Environmental Audit

of the Existing Desalination Plant and Powerhouse in Medhufushi Island Resort, Meemu Atoll

Proposed by:
Medhufushi Island Resort

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Environmental audit of the existing desalination plant and powerhouse in Medhufushi Island Resort

Executive Summary

This report has been prepared in order to assess the environmental performance of the existing desalination plant and powerhouse in Medhufushi island resort for the purpose of registration of the plants according to the requirements of the Environmental Protection Agency of Maldives. This report focuses only on the desalination plant and powerhouse of the resort development and associated areas of impact.

The major effects the existing plants may have on the environment include the following impacts;

- Impact on energy and water resources
- Impact on coral cover in the reef
- Impact on marine life in the lagoon
- Impact on ground water quality
- Impact on marine water quality
- Visual impacts
- Impact due to noise pollution

Such significant environmental issues can be resolved by implementing mitigation measures outlined in the document.

The audited facility at Medhufushi Island can be regarded as being in compliance, despite few issues that require mitigation. The plant site is among the better sites observed in the Maldives. There were minimum leaks and maintenance had been undertaken on a regular basis, while appropriate safety measures were also taken. General operations and maintenance was up to standards as experienced staff was given the responsibilities of maintaining the plant. The resort management and staff should do their utmost to maintain the water quality standards and follow the environmental monitoring program outlined in this report for the sustainable use of the plants.
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1. **Introduction**

This report is based on the audit of the existing desalination plant and powerhouse in Medhufushi Island Resort and an assessment of the impact they may have on the environment. The report outlines the environmental compliance of the plants, and identifies possible environmental impacts due to the operation of the plants under existing conditions. Subsequently, this report will provide mitigation measures and a monitoring plan to improve existing conditions of the environment and for the sustainable use of the desalination plant and powerhouse.

1.1 **Need for the project**

The Ministry of Housing and Environment requires all desalination plants and powerhouses in the Maldives to be registered. In order to carry out the registration process, environmental approval from EPA is mandatory. This approval is obtained through the formulation of an Environmental Audit/Assessment of the desalination plant under the Desalination Regulation of the Maldives and the powerhouse according to the requirements by the Maldives Energy Authority.

Moreover, it is the need of the proponent that the existing plants are in compliance and does not result in any significant negative impact on the environment, to which the development is heavily dependent upon. If any such impacts do currently occur, the need exists to rectify any issues by putting in place effective mitigation measures on the short term, and following a comprehensive monitoring plan to prevent any such impacts on the long term.

1.2 **Aims and Objectives**

The objectives of the report are:

- To assess the performance of the desalination plant and powerhouse.
- To assess the environmental compliance of the desalination plant and powerhouse and associated facilities
- To identify environmental impacts due to the plants.
- To provide mitigation measures for current and future impacts from the plants
- To outline an effective and feasible monitoring plan for the sustainable functioning of the plants
- To get all the clearance necessary to register the desalination plant and powerhouse according to the requirements of the Environmental Protection Agency.
- To fulfil the obligations of the proponent to undertake an EIA under Clause 5 of the Environmental Protection and Preservation Act of the Maldives and the requirements of the tourism regulations.

1.3 **Audit and Assessment team**

This assessment has been undertaken by a multidisciplinary team of engineers and consultants led by Mr. Ahmed Jameel. The team was chosen by the proponent as the environmental consultants for this project.

The team members were:
- Ahmed Jameel, Environmental Engineer (EIA Registration No: EIA 07/07)
- Amir Musthafa, Environmental Engineer
- Abdullah Wahid, Electrical Engineer
1.4 Audit and Assessment Methodology

Standard methodologies were employed in assessing the existing environmental conditions and also in identifying the environmental compliance and performance of the audited facilities. The methodology is mainly divided into 3 parts including; literature review, field observations and analysis, and consultations.

There were no known previous environmental studies undertaken for Medhufushi island and therefore, environmental studies undertaken for similar islands were used as references.

Two field visits were undertaken, one during April and another one on the 8th July 2011, on the request of the proponent. The senior onsite engineer from the proponent’s side accompanied the consultant throughout the field trips. Details of the methodologies used for field data collection are given in the following.

The consultations that were carried out during the scoping meeting and during the field visits were useful in identifying the problem areas and in the determination of standard of current facilities and possible impacts.

1.4.1 Location Identification

Locations were identified using a handheld GPS device, which included locations of the sample collection points, the RO plant, powerhouse, water intake, brine discharge, and sewage outfall locations.

1.4.2 Water Quality

All water quality measurements, including groundwater quality, marine water quality, desalinated water quality were undertaken in the National Health Laboratory in the capital Male’. Water samples were taken on the field trips to the Island. Marine samples were taken 1m below mean sea level at deep waters, and at mid water level at shallow waters. Water samples were collected in 500ml water bottles, and sample to be tested for microbiology were taken in glass bottles, which were previously sterilised at the National Health Laboratory. The samples were stored in a Styrofoam box with ice to keep the samples cool at a constant temperature and all the samples were tested in the laboratory within 24 hours of sample collection.

1.4.3 Marine environment surveys

This environmental audit does not require a complex marine survey to be undertaken. Therefore, a qualitative marine survey was conducted through visual observations and photographs, using a Sony CyberShot underwater camera, at the outfall and especially the intake locations and associated areas. The surveys were conducted to collect data on key environmental components that were impacted especially due to the change in water quality at the outfall location and the existing environment at the intake location and along the pipe.

1.4.4 Noise

The noise levels were measured using Sound Meter 1.6 on the Android 2.2 platform. Sound levels were measured at the plant site, within the back of the house facilities, and outside the facilities at the guest area.
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1.5 Consultation

A scoping meeting was held between the major stakeholders of the project at EPA to highlight the important issues that need to be covered in the environmental audit and assessment.

Furthermore, consultation was held with the responsible people for the operation and management of the desalination plant and powerhouse during the field visits to Medhufushi Island and through meetings with the responsible people in the proponents Male’ office.

The resort staff met during the consultation were;

- Amjad Mohamed (Engineer)
- Ganesh (Senior Plumber)
- Santos (Civil Engineer)
- Johir (Powerhouse and RO plant operator)

1.6 Terms of Reference

The terms of reference have been attached in the Annex. This report has been prepared based on these terms of references. The scope for this audit focuses on the environmental compliance and performance of the existing desalination plant and powerhouse in Medhufushi Island.
2. Project Description

2.1 Facility locations and Study Area
Medhufushi is located on the eastern rim of Meemu Atoll. It is approximately 145 km away from Male’ international airport and travelling to the island requires approximately 40 minutes by a sea plane. The island is at latitude 2°53’ N and longitude 73°34’ E. This study focuses on the existing desalination plant and powerhouse in Medhufushi Island and associated areas.

The island has a land area of approximately 90,000 sqm. The island is elongated in shape as can be seen in Figure 1 and has the typical Maldivian island environment with lush green natural flora, and an abundance of vegetation spread throughout the island. The island is a medium sized island which is over 1000m long and 200m wide. There is significant beach surface area around the island, with relatively minimum signs of major erosion taking place. The island also has water villas structures to the south of the island in addition to the facilities available in land.

2.2 Facility Description
There is currently one main RO plant on Medhufushi Island, with water production capacity at 220m³/day. The product water is stored in one main storage tank of capacity 200m³ in addition to 4 extra tanks with a capacity of 10m³ each. More details of the RO plants are given on Section 3.

There are 4 generator sets in the power plant with capacities of 800 kVA, 450 kVA, 450kVA and 350kVA. The usage of the gen-sets is determined by the peak loading schedules. Diesel is used to run the power plant, and the fuel is stored in a 50m³ tank, with an 8.2m³ tank used as the day tank. More details of the power plant are given in Section 4.
2.3 Need for the facilities

Desalination plants are required for each tourist island in the Maldives in order to provide safe utility water for the guests and staff of the island. As mentioned in Section 5, in 6.1 of the Regulation on the protection and conservation of environment in tourism industry, it requires a desalination plant on each resort in the Maldives for the purpose of provision of clean and safe water sufficient for use in the resort. Other means of obtaining clean water for resort islands such as Medhufushi is not as cost effective and efficient as that of desalination, especially since all islands are surrounded by a vast supply of saline water which can be easily obtained for the desalination process.

Decentralised power plants are a requirement for each resort island in the Maldives to provide energy for the various activities undertaken in resort islands. There is no central power grid which caters for these islands, and establishment of such a grid will require a huge economic commitment and may not be feasible due to logistic issues in the country. Such a system may even have deteriorating impacts on the environment on the long term, while decentralised systems enable the environmental impacts to be largely localised and therefore mitigation of the impacts are much more convenient and practical.

3. Water Supply Infrastructure

3.1 Water Demand

There are 170 staffs on the island catering for 112 villas. During peak seasons, it is estimated that 240 guests reside on the island. Off peak season estimates are on average 80 guests at any given time. On average water consumption is at 180m$^3$/day. However this amount would rise considerably during the peak season. The water usage amount can be regarded as high considering other resorts of similar status.

There are currently no plans for expansion of the resort capacity and subsequently no plans exist to upgrade the water facilities.

3.2 Water utilization

Desalinated water is used for most purposes in the island, including for gardening in addition to washing and laundry purposes, bathing, cooking and for staff drinking. It is used for the free distribution among the staff and guests at Medhufushi Island. Bottled water is used as tourists’ drinking water and is also provided to staff on a limited basis. Currently groundwater is not used for any important activity in the island. Treated waste water is used for toilet flushing.

3.3 RO plant

There is one main RO plant in the island. The plants each have a capacity of 220 m$^3$/day. The plants were installed by the locally based ‘Island Engineering’ company. A specific plant is not dedicated to be used as a back-up. An information sheet on the RO plant is attached in the Annex.
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Figure 2 Reverse Osmosis module

3.4 Desalination Process
Desalination is carried out by a regular Reverse Osmosis plant. In a simple osmotic system the less concentrated solution attempts to equalize the concentrations of both solutions by migrating across the semi permeable membrane. When enough pure solution migrates across the membrane such that the potential difference between the solutions is no longer higher than the osmotic pressure of the membrane, the purer solution will stop flowing.

Reverse osmosis works by increasing the pressure on the concentrated solution to above the osmotic pressure, thereby reversing the fluid flow, which subsequently causes the reverse osmosis effect. High pressure is established in the RO plant by artificially pressurizing the more concentrated solution using a high pressure pump. In this type of system, the concentrated solution will become more concentrated as pure water flows out of solution and across the membrane to the permeate side. Discounting the effects of feed water temperature and salinity, the operating pressure is at least twice the osmotic pressure of the membrane used to produce significant amounts of pure water.

3.5 Sedimentation tank
The sedimentation tank is located within the plant house. Water from the intake flows direct to the sedimentation tank where the particulates are separated from the water. The tank consists of three chambers of differing sizes, with the largest chamber being the final chamber from which water is taken to the RO modules. The total size of the chamber is approximately 40m$^3$. The sedimentation tank is of good size and is capable of meeting the capacity of the RO plant.
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3.6 Filtration and Disinfection
The seawater initially undergoes sedimentation in dedicated tanks to separate the larger particles and then subsequently flows through a sand filter with filter capacity of approximately 15 microns by the filtration pump after being stored in the sedimentation tank. The two sand filters have a capacity of approximately 1800 Litres.

The filtered water is then passed through the reverse osmosis system. The reverse osmosis membrane reduces the salt content producing freshwater. Freshwater is pumped into a temporary 150L tank which is located outside the plant house. Here, chlorine dosage of 1L/100L of water is undertaken. Water pumped into the storage tank is disinfected using chlorine solution for distribution via underground distribution network to all guest rooms and public areas.

Additionally, cartridge filters are installed in all important areas of water consumption such as the staff and guest kitchen, and common staff drinking facilities.

3.7 Water intake and outfall
Source water is taken from the lagoon/sea near the house reef at about 150m away from the shoreline. GPS coordinates of the location are 2°53’19”N, 73°34’26”E. The pipe is located at about 1m deep. The location of the intake is shown in Error! Reference source not found.

Brine is discharged into the lagoon approximately 45m from the shoreline. The brine discharge is located on the west of the island, similar to the water intake. It has GPS coordinates 2°53’21”N, 73°34’28”E. The outfall is located relatively closer to the shoreline. The locations are shown on Error! Reference source not found.. More details on the intake and outfall (the brine discharge) water quality are given in Section 7.
3.8 Storage
The water storage facility is outside the plant house. The water is stored in 1 huge steel tank, with a capacity of 120 m³ and 4 smaller HDPE tanks of 10 m³ capacity each. Therefore the total water storing capacity of the island is 160 m³. In case of maintenance or damage to the plant, the stored water can only be used for 1 day or less depending on the season. The water storage tanks in the island are shown in Figure 5.
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3.9 Staff
There are 3 people totally in charge of the daily operation of the plant. Among these, 2 are expatriate workers while there is one local. The management reported that the staff are highly experienced with everyone having been involved with similar work for over 5 years. At night, a security guard is placed to monitor the site.

The schematic flow diagram for the RO plant is shown in the following figure:

Sea water Intake

Intake Pump

Sedimentation Tank

Filter Pump

Sand Filter + Check Filter Pump

Temporary Storage

Brine Discharge

Reverse Osmosis

Chlorination

water storage tank
3.10 Plant Site
The RO plant is located in a standard structure used for warehouses and storage of industrial equipment. However, the structure is made to be more sound proof to reduce noise pollution. The land area of the water plant is 90 m². The RO plant is located on the same site as the power plant, with the control room dividing the two facilities. The plant site is located deep in the staff area north of the island and is significantly separated from the guest area.

3.11 Crystal water bottling plant
Although not strictly a part of the water desalination plant network in the island, the “Crystal water bottling plant” is an important infrastructure which produces drinking water for both tourists and staff on the island in a limited basis. Water from the desalination plant is further filtered in the Crystal plant using a cartridge filter, which is regularly renewed, and a UV filter. Glass bottles are cleaned using industrial based detergents and the water is bottled at the site to be distributed throughout the resort. In addition to making economic sense in the long term, the establishment of the plant enabled the resort to cut down on the import of plastic water bottles into the island, and subsequently reduced the amount of waste plastic generated in the island considerably. Therefore the plant had a positive environmental impact on the island. However, it is recommended that the bottling procedure be automated to prevent any hazard points existing in the procedure, such contamination from human contact during bottling. Furthermore, it is also recommended that more frequent water quality monitoring be carried out on the water produced, preferably on a weekly basis. This report would not further delve into the crystal plant facility as it is not within the scope of this project.

Figure 5 'Crystal' water bottling plant
4. Energy Infrastructure

4.1 Powerhouse
There are 4 generator sets in the power plant with capacities of 800 kVA, 450 kVA, 450kVA and 350kVA. The use of the gen-sets is determined by the peak loading schedules, which has been formulated by the engineering department. Therefore, all the generators are not run at the same time, and at least one is always on back up in case a generator fails. Radiators are used to cool the generators by passing water based coolant through the engine block. Dedicated coolants are used to keep the generators at optimum running temperature. Attenuators are also associated with each generator in order to reduce the amount of noise generated.

![Figure 6 Powerhouse generator sets](image)

4.2 Emissions
There are four emission stacks, one for each generator. The design of the stacks is the typical steel designs observed in most resort islands. Height of the stacks are 1m above roof level. Total height of the stacks are approximately 5-6m above ground level. The emissions are not filtered and there is no real chimney structure in the island to minimise the carbon content of the emissions.

![Figure 7 Powerhouse emission stacks](image)


4.3 Fuel Storage
Diesel is used as fuel for the operation of the plant and it is stored in a large 50m³ capacity steel tank. The tank is properly enclosed within a bund of size approximately 50m³. The bund walls are about 5 feet high. Fuel from this tank goes to the daily reserve tank. This day tank has a capacity of 8.2m³. The storage is elevated and there is a very small bund created at the bottom of the tank which will be able to contain small leaks from the tank.

![Figure 8 Diesel fuel storage](image)

4.4 Disposal of waste
The main waste generated in the powerhouse is that of the waste oil. The waste oil is collected in barrels as shown in the figure 9. They are temporarily stored in the island and transported to other nearby islands. Excess oil is used as fuel for the incinerator.

![Figure 9 Waste oil barrels](image)

4.5 Plant Site
The plant is located almost adjacent to the RO plant with the control room in between. This is a typical design used in most of the resort islands in the Maldives. The site is far away from the guest area, with plenty of vegetation surrounding the location. Such vegetation would help to reduce the effect of noise from the plant reaching the guest area. The site is not completely enclosed with a boundary wall as is done in some islands. Enclosing the area is not necessary since there is a significant distance from plant site to both the guest area and to the staff quarters to a lesser extent.
5. Legal and Policy Requirements

The legal and policy requirements that are relevant to the assessment or audit of desalination and power plants and their registration areas are as follows:

- Environmental Protection and Preservation Act,
- EIA Regulations,
- Regulation on the Protection and Conservation of the Environment in the Tourism Industry,
- Desalination Regulation of the Maldives,
- National Energy Policy

These legal as well policy instruments and their relevance to the desalination infrastructure in Medhufushi are discussed below.

5.1 Environmental Protection and Preservation Act

The main legal Act that enforces the protection and preservation of the environment for sustainable development in the Maldives is the Environmental Protection and Preservation Act (Law No. 4/93) passed by the Citizen’s Majlis in April 1993. The following clauses of the Environmental Protection and Preservation Act (Law No. 4/93) are relevant to the project:

Clause 5a: An impact assessment study shall be submitted to the Ministry of Environment, Energy and Water (now Ministry of Housing and Environment - MHE) before implementing any development project that may have potentially negative effects on the environment.

Clause 5b: The Ministry of Environment, Energy and Water shall formulate the guidelines for EIA and shall determine the projects that need such assessment as mentioned in paragraph (a) of this clause.

Clause 6: The Ministry of Environment, Energy and Water has the authority to terminate any project that has an undesirable impact on the environment. A project so terminated shall not receive any compensation.

Clause 10: The government of the Maldives reserves the right to claim compensation for all damages that are caused by activities that are detrimental to the environment. This includes all activities mentioned in Clause No. 7 of this law as well as those activities that take place outside the projects that are identified here as environmentally damaging.

5.2 EIA Regulations

The EIA Regulations, which came into force in May 2007, has been developed based on the Act as mentioned above. Since 2007, the EIA Regulations have been the basis for Environmental Impact Assessment in the Maldives. EIAs are required to be signed by registered consultants and reviewed by two independent reviewers and a final decision is made based on these reviews. As with all assessments, this audit would also be subject to these requirements and review criteria. The different environmental projects that require an EIA are listed under Section D of the EIA Regulations and desalination plants have been included in this list.

An assessment in the form of an Audit was needed for the registration of the facilities as no EIAs had been done specifically for the said developments in Medhufushi. The EIA Regulations do not directly indicate the requirements for environmental audits. However, the contents of environmental impact
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assessments have been defined in Schedule E and the format for monitoring reports can be found in Schedule M. These requirements and formats have consequently been taken into consideration in preparing this Audit Report.

### 5.3 Regulation on the Protection and Conservation of the Environment in the Tourism Industry

The Regulation on the Protection and Conservation of the Environment in the Tourism Industry came into effect on 2006. Section 6 of the Regulation deals with the supply of water in tourist facilities. It requires every resort to have a desalination plant registered according to the Desalination Regulation and requires that water quality to be monitored properly by recording and maintaining daily logs of water quality. The regulation also gives a guideline for the provision of water storage sufficient for 5 days supply.

The regulation further states that groundwater shall not be used for drinking by guests or staff, and shall not be supplied to guest rooms or toilets or for use by staff. Furthermore, any type of oil or any other chemical which may damage the environment shall not be drained to the ground.

Clause 2.4 of the regulation requires an Environment Impact Assessment to be prepared before commencing any construction project or activity listed in clause 2.1 of the regulation, which covers coastal protection, dredging, reclamation, vegetation clearance, demolition of existing structures, import and export of living species, conducting research of land, sea and lagoon and anything that may adversely affect the vegetation and freshwater lens of the island.

### 5.4 Desalination Regulation of the Maldives

The Desalination Regulation of the Maldives came into effect on the year 2002. The Desalination Regulation states the requirements for plant capacity, intake and source water, storage capacity, plant operation and maintenance, brine discharge as well as water quality monitoring requirements.

The Environmental Protection Agency is currently in the process of reviewing the Desalination Regulation to incorporate the current regulatory requirements as well as an administrative framework. This regulation is the only regulation currently in force for the water and sanitation sector and has been established with their main goal being the safeguarding of public water supplies, the environment as well as the interest of service provider.

### 5.5 National Energy Policy

The Maldives National Energy Policy is focussed on the goal of Maldives becoming the world’s first carbon neutral country by 2020. The policy looks at existing issues, constraints and emerging issues the island nation faces. It addresses issues of energy supply, consumption, environment, renewable energy, energy efficiency and sustainability. Sustainable supply and consumption of energy is the main focus of the policy, and use of alternative green energy is encouraged.
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The key policies outlined in the National Energy Policy are:
Policy 1: Provide all citizens with access to affordable and reliable supply of electricity
Policy 2: Achieve carbon neutrality by Year 2020
Policy 3: Promote energy conservation and energy efficiency to reduce costs
Policy 4: Increase national energy security by diversifying energy sources
Policy 5: Promote Renewable Energy Technologies
Policy 6: Strengthen the institutional and legal framework of the energy sector

6. Exiting Environment

Existing environment was determined based on the findings of field trip that has been undertaken and also from any previous environmental studies and reports generated based on any environmental components of the island. Unfortunately no previous environmental impact assessments were conducted on the island, which therefore would lead to uncertainties in determining the accuracy of some parameters. The areas of significance are the existing conditions of ground water, marine water and the marine environment.

6.1 Ground water

There is currently only one location on the island from which ground water can be obtained from without any further deterioration to the environment. Therefore groundwater was collected from this well near the power plant. The ground water quality results are shown on Table 1. The well that was used to obtain ground water is shown in Figure 10.

The ground water had good quality compared to most inhabited islands on the Maldives. The pH was slightly more alkaline, and TDS was greater in the water sample collected. However this is not a major cause for concern. The bare minimum usage of groundwater resource in the island and due to the fact that sewage is treated in the island is discharged to the sea via sewage outfall means there is minimum impact on the groundwater.

<table>
<thead>
<tr>
<th>Sample</th>
<th>Ground water</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPS coordinates</td>
<td>3°52’35.96”N, 73°22’00.15”E</td>
</tr>
<tr>
<td>Physical Appearance</td>
<td>Pale yellow with suspended solids</td>
</tr>
<tr>
<td>Total Dissolved Solids (mg/L)</td>
<td>7150</td>
</tr>
<tr>
<td>Electrical Conductivity (µs/cm)</td>
<td>1424</td>
</tr>
<tr>
<td>pH</td>
<td>8.8</td>
</tr>
</tbody>
</table>
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Figure 10 Groundwater well

6.2 Marine Water
The marine water quality test results are shown in Table 2. The results show the overall Total Dissolved Solids (TDS) and Electrical conductivity (EC) in the marine water from all samples near the island is greater compared to most islands, while the pH is relatively similar. The brine discharge had 1.5 times greater TDS and EC than intake water.

Table 2 Marine water quality test results (National Health Laboratory)

<table>
<thead>
<tr>
<th>Sample</th>
<th>Intake Water</th>
<th>Sedimentation Tank</th>
<th>Brine Discharge</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPS location</td>
<td>2°53'19&quot;N, 73°34'26&quot;E</td>
<td>2°53'20&quot;N, 73°34'31&quot;E</td>
<td>2°53'21&quot;N, 73°34'28&quot;E</td>
</tr>
<tr>
<td>Appearance</td>
<td>Clear</td>
<td>Clear</td>
<td>Clear</td>
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<tr>
<td>pH</td>
<td>8.5</td>
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</tr>
<tr>
<td>TDS (mg/L)</td>
<td>33200</td>
<td>33100</td>
<td>49600</td>
</tr>
<tr>
<td>EC (µs/cm)</td>
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<td>65400</td>
<td>98500</td>
</tr>
<tr>
<td>BOD (mg/L)</td>
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<td>22</td>
<td>14</td>
</tr>
</tbody>
</table>

6.3 Marine environment
The marine environment was surveyed at both the water intake and the outfall location. Baseline conditions at the brine discharge location are important to assess the impact the high density salty water may have on the existing marine life.

In Medhufushi, water is discharged considerably away from the shoreline in the lagoon. However minimum marine life was observed at the region. Fish population was in very small quantities, and as can be seen from Figure 11, there were virtually no corals or other such life present in the area. For the purpose of a marine survey, the discharge location was almost negligible. As shown in the figure, the area only consists of sand and few rocks and is devoid of any significant marine life.
Environmental audit of the existing desalination plant and powerhouse in Medhufushi Island Resort

**Figure 11 Brine Discharge Area**

A small marine survey at the water intake location was also important to assess the existing conditions. Although the area would not be usually as vulnerable as the brine discharge, it is important to observe whether the pipe has provided a support for more coral growth in the region. Furthermore, observation was necessary to investigate if the intake pose any threat to marine life in the area as there have been instances where small marine organisms were sucked into the water plant via the intake.

**Figure 12 Water Intake Area**

As can be seen from figure 12, the area does not consist of a significant amount of corals and other similar marine life. However, plenty of seaweed patches can be observed. There are no coral growth observed along the pipe as was seen in investigations carried out in other islands. Most importantly, the foot valve installed in the inlet could be observed. This is important to prevent the intake of any significant marine life in the water plant from the area.
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6.4 Uncertainties in data collection
A sufficient amount of uncertainties will be met during the determination of the existing environmental conditions in Medhufushi Island. Due to lack of previous environmental data on the island, it is difficult to determine the accuracy of the data collected. The accuracy of the data would be low compared to an island which has a long history of information gathered on the environment. Furthermore, definite predictions of the possible impacts on the environment cannot be made, as significant differences are apparent with minor differences in ecological, geomorphological or social conditions in the given location.

In general, the major factor for the uncertainties is the lack of long-term data and information about the site under consideration, making it rather difficult to predict impacts by direct means. However, similar studies have been undertaken in the Maldives for similar facilities and therefore, the level of uncertainty will be expected to be at a moderate level.

7. Environmental Compliance and Mitigation
The following are identified as to having an impact on the environment due to the operation of the desalination plant and powerhouse. Initially general impacts caused by the operation of both powerhouse and desalination plant are discussed. Subsequently, impacts specific for each plant is highlighted and discussed with respect to their environmental compliance and mitigation.

The impacts are identified based on literature and from past studies that have been undertaken on desalination plants and powerhouses in other similar islands in the Maldives. The impacts include;

- Impact on energy and water resources
- Impact on coral cover in the reef
- Impact on marine life in the lagoon
- Impact on ground water quality
- Impact on marine water quality
- Visual impacts
- Impact due to noise pollution

It should be ensured that all the components of the desalination plant and powerhouse including waste handling, emission control, water intake and outfall does not have a significant consequence on the environment and that the existing plants are in compliance with the expected standards of desalination plants and powerhouses respectively.

7.1 Energy Conservation
The energy usage in Medhufushi Island can be regarded as high. On average, the powerhouse produces 12,207 Kwh electricity per day. To reduce the energy demand, more natural lighting and ventilation in rooms can be implemented. Awareness campaigns targeting both staff and guests can be carried out separately which would highlight on environment friendly practices such as turning of lights and ACs while not using their respective rooms.
Environmental audit of the existing desalination plant and powerhouse in Medhufushi Island Resort

Desalination itself is generally an energy intensive process. Alternative methods of desalination can be employed to reduce energy consumption. Use of energy recovery equipment can be employed. As it is currently available in the country, it is recommended that such equipment be installed in the future. The possibility of using a renewable energy source, at least to partially power the power plant should be further investigated to reduce energy usage and also to reduce emissions from the plant. Implementation of environment friendly, best available technology is an important factor in the sustainable use of the plants.

7.2 Impact on ground water
There is minimum impact on the ground water due to the desalination plant as water is taken the sea. However there is a small possibility of leakage of the brine discharge pipe contaminating the groundwater system of the island. Leak detectors can be used throughout the water distribution network. However this is not recommended as the feasibility of implementing this for such a small island is low, and the impact of small leakages on the ground water will also be minimum.

Additionally, water used to wash powerhouse equipments can lead to deterioration in the groundwater quality if not disposed properly. Mitigation measures are highlighted in Section 7.7.3

7.3 Noise
Noise will only have a minimum impact on the staff, as minimum no. of staff would work in close proximity to, or inside the plant. For those that do, ear muffs are provided. As such, 3 ear muffs were observed during the field visit. Noise attenuators were also present at the site. Negligible impact would be observed by the guests, since it is located within the back of the house facilities. Noise levels within and around the plant are given in Table 5.

The noise levels within the island away from the plant were in compliance. It was observed that staff did not use the ear muffs when the field trip was undertaken. It is highly recommended that these protection measures be used when inside the plant site at all times.

<table>
<thead>
<tr>
<th>Location</th>
<th>Noise levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inside RO plant house</td>
<td>79 dB(A)</td>
</tr>
<tr>
<td>Inside control room</td>
<td>71 dB(A)</td>
</tr>
<tr>
<td>Outside plant house</td>
<td>73 dB(A)</td>
</tr>
<tr>
<td>20ft away from the plant</td>
<td>67 dB(A)</td>
</tr>
<tr>
<td>Outside back of the house facility area</td>
<td>60 dB(A)</td>
</tr>
</tbody>
</table>

7.4 Safety
Fire protection and prevention measures had been taken at the plant facility and the surrounding areas. In order to protect the plants from fire accidents the proponent has installed fire fighting equipment at the plant site as shown in Figure 133. However, a fire alarm was not observed. Since the plant is located on the ground, there is no need for a dedicated fire escape. There is a dedicated assembly area in case of any emergencies. ‘Safety Services Maldives’ have provided all the fire fighting equipment to the site.
Environmental audit of the existing desalination plant and powerhouse in Medhufushi Island Resort

Figure 13 Fire extinguishers and ear muffs

7.5 Visual Impact
The plant will have negligible impact on the aesthetics of the island as it is located within the back of the house facilities, which is clearly separated from the guest area. The plant is constructed in a properly built structure and would not cause any visual obstruction to the staff. It was observed that regular housekeeping has been undertaken within the plant boundary, and thus cleanliness of the plant was satisfactory. However, the diesel fuel bund required some more maintenance as leaves and other such vulnerable material to fire was observed on the site. Likewise, more attention was also required at the sedimentation tank location.

Frequency of plant housekeeping can be increased to improve the cleanliness and general conditions inside and around the plant. Since the area just outside the plant was unkempt and it is recommended to clean the area in a more organised manner to improve the overall visual amenity of the plant.

7.6 Operation and Maintenance
There are no major temperature variances during the flow of water through the RO plant. There have been continuous water quality monitoring in the island for over 3 years. Although the monitoring was observed to be quite regular, there is still room for improvement and it is recommended that regular field testing be carried out weekly and major water quality tests carried out monthly, with reports generated at least once a month. More details on monitoring are given in Section 8. Some water quality tests already undertaken in the current water quality monitoring tests in the island are given in the Annex.
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It was observed that an operations manual was present for the desalination plant in Medhufushi. Presence of the manual was important for proper operation and maintenance of the plant. It is highly recommended that the manual be easily accessible to all relevant staff.

![Operation manual cover](image)

Figure 14 Operation manual cover

The resort has trained staff to carry out day to day activities at the powerhouse and desalination plant. All work is supervised by an experienced on site engineer who reports back to an offsite chief engineer. The management also employs a highly experienced electrical engineer as a consultant and therefore operation and maintenance issues at the resort were at a minimum.

### 7.7 Power plant

#### 7.7.1 Emission handling

The powerhouse in Medhufushi does not employ any sophisticated emission control methods. It is recommended that best available technology should be investigated and implemented at the resort. As such, methods such as activated carbon purification systems can be considered after undertaking a feasibility study whether any new technology will be suitable for a resort of this size. From this study, it was found that such a system may not be feasible, however an in depth study is recommended. Currently, there are four emission stacks in the island, one for each generator, and all of which are approximately 1m above roof level, which emits the smoke into the atmosphere. The smoke is only partially visible which means the tuned generators are able to filter some of the harmful emissions. The height is the bare minimum of the recommended values and therefore on the short term, care must be taken that staff and guests are not within the vicinity for long periods. On the long term, aforementioned technology should be implemented to reduce the global warming potential of the powerhouses.
7.7.2 Fuel Storage
Main fuel storage is in a 50m$^3$ steel tank. There is also an 8m$^3$ rectangular steel tank dedicated as a day tank. The bund size around the main storage is at acceptable levels with depth greater than 5 feet. It is recommended that the bund be able to store 110% of the contents in the fuel storage tank in case of a major leak from the tank. The bund in Medhufushi will be able to contain atleast 100% of the contents and therefore is regarded as satisfactory. However the bund dedicated for the day storage tank needs further work as it is too small to contain any major leaks within the tank. It is recommended that the walls are lifted approximately 1-2 feet higher to produce an acceptable mitigation measure.

7.7.3 Waste Management
Management of waste generated by the powerhouse, namely waste oil is crucial for the environmental compliance of the power plant. In Medhufushi Island, waste is collected in barrels as discussed is Section 5 and disposed accordingly. Waste oil is transported to nearby island for the islanders to be mainly use as lubricants in boat building works. This is a good example of reuse of the waste product and is a recommended environmental practice. Excess waste oil is then used for the incinerator as fuel to incinerate waste generated in the island. Therefore the management of waste oil is in compliance.

However, there is no dedicated confined area in the island where engine parts are washed. It is recommended such activities to be carried out inside concrete bunds or similar structure near the powerhouse so that the waste water will not seep to the ground causing potential degrading impact on the groundwater system. Additionally the liquid coolant should be properly disposed and it should be ensured that the water does not affect the groundwater system.

7.8 Desalination plant
7.8.1 Water Conservation
Water consumption in the resort is quite high as was discussed in Section 4 with water consumption averaged to be 400L/person/day. This due to the production of desalinated water for most drinking purposes rather than importing water and also due to the usage of desalinated water for all water related purposes in the island, excluding toilet flushing.

Finding alternate water sources for activities such as gardening and as coolant for the radiators is highly recommended. One such option is to have rainwater tanks dedicated for these purposes. Importing plastic bottled water to reduce water production in the resort is not recommended, as the current practice of producing own drinking water is much more eco friendly if undertaken properly and lead to water efficiency on a regional scale.

Water conservation can be further improved upon by implementing an efficient monitoring program as given in Section 8.

7.8.2 Brine outfall
Although the brine contains materials originated from sea (source water), its high salinity per volume and the potential presence of chemicals introduced in disinfection may harm the marine environment in the area in which the water is discharged. This would be a significant issue if the
Environmental audit of the existing desalination plant and powerhouse in Medhufushi Island Resort

discharge was close to the shoreline or is close to the reef. However, in Medhufushi, brine is discharged within a considerable distance to both the shoreline and the reef. Furthermore, there is no significant marine life observed in the discharge region as discussed in Section 6. Therefore, the brine outfall is in compliance.

7.8.3 Source water intake
The trapping of marine organisms against the intake screens by the velocity and force of water flowing to it and smaller marine organisms passing through the intake screens and getting into process equipment are two key impacts that may be caused due to the water intake. Also the source water should not be subject to any anthropogenic pollution, which would lead to the eventual decrease in the quality of the desalinated water.

For mitigation, currently the intake is capped with a proper foot valve, which generally prevents entry of marine organisms. Alternatively, a submerged water tank can be used with a mesh filter membrane inside with a separate inlet. In such a case water will be further filtered before reaching the main inlet for the RO plant. Furthermore, low intake velocity should be considered. However, use of the foot valve is considered as good practise and if maintenance of the valve and the pipe in general is carried out on a set basis, the intake can be regarded as being in compliance.

7.8.4 Sedimentation tank
Upon observation, the water from the intake is clear with very few sediments and does not possess any significant foul odour, although there was a hint of the typical odour of sea water. It is expected that the membranes and filters will be more durable due to the clearness water especially after sedimentation. The size of the tank is adequate and is well capable of handling the input of water.

![Figure 15 Sedimentation tank](image)

7.8.5 Processed Water
The processed water does consist of a small number of total coliform bacteria and thus is a cause for concern. However, faecal coliform is completely absent. Total coliform, although not directly harmful to humans, do indicate poor water quality and thus has to be reduced by suitable mitigation measures. The high total coliform no. could potentially be due to a fault in the functioning of the RO membranes and/or due to poorly sterilised water collection bottles. It should be noted that total coliform was previously at negligible levels in Medhufushi as can be seen from the water quality monitoring tests undertaken in the island. Some previous water quality monitoring reports are
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attached in Annex. Therefore, this issue of high total coliform has not been a persistent problem and is only occurring currently.

It is recommended that further testing be carried out on the processed water. The resort staff can collect the samples from sterilised water bottles provided by the National Health Laboratory. If the problem persists, which is unlikely the case, then it is recommended that existing RO membrane be replaced and ensure proper chlorination and mixing of the produce water before it is distributed to the storage tanks. Results of the tests undertaken from the field trip in April are attached in the annex. As can be observed, there were no issues with regards to the quality of the water from these tests. The most recent test results are shown in Table 3 and Table 4.

Table 4 Microbiological test results for process water

<table>
<thead>
<tr>
<th>Sample</th>
<th>Staff Area</th>
<th>Guest Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total coliform count /100ml</td>
<td>06</td>
<td>10</td>
</tr>
<tr>
<td>Faecal Coliform Count (E.coli)/100ml</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 5 Water quality tests for other parameters for process water

<table>
<thead>
<tr>
<th>Sample</th>
<th>Processed water</th>
<th>Staff area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>Clear</td>
<td>Clear</td>
</tr>
<tr>
<td>pH</td>
<td>6.7</td>
<td>7.0</td>
</tr>
<tr>
<td>TDS (mg/L)</td>
<td>384</td>
<td>386</td>
</tr>
<tr>
<td>EC (µs/cm)</td>
<td>770</td>
<td>752</td>
</tr>
</tbody>
</table>

7.8.6 Storage tanks

Storage capacity of the existing tanks is not in compliance. The water storage will not be able to cater for even 2 days in case of plant failure. The resort staff explained there was no need for excessive storage since it would only lead to possibilities of more contamination. However, in a sustainable system, proper back up facilities should be available. Additionally, the tanks were all opaque which prevents any algal growth and regular maintenance of the tanks is necessary to minimise any impacts on the water during storage. The resort staff reported that the tanks are maintained yearly. Therefore, apart from the storage capacity, the tanks were in compliance.
### 7.9 Environmental audit summary for existing plants

<table>
<thead>
<tr>
<th>Environmental and Social Aspects</th>
<th>Compliance</th>
<th>Performance</th>
<th>Comments</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water quality monitoring</td>
<td>X</td>
<td>Low</td>
<td>X</td>
<td>Water quality monitoring is undertaken, monthly</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>To follow the set procedure diligently of undertaking monitoring regularly</td>
</tr>
<tr>
<td>Exhaust emissions</td>
<td>X</td>
<td></td>
<td>X</td>
<td>Exhaust stacks are in compliance and emissions will not have any significant local impact</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Implement a chimney system to reduce carbon emissions</td>
</tr>
<tr>
<td>Waste handling</td>
<td>X</td>
<td>Low</td>
<td>X</td>
<td>Waste oil handling is good, however wash water handling is not</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Wash industrial equipments in a confined space and dispose water properly</td>
</tr>
<tr>
<td>Noise</td>
<td>X</td>
<td></td>
<td>X</td>
<td>Plant housing well insulated from noise pollution</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Use of ear muffs for the staff at the RO plant.</td>
</tr>
<tr>
<td>Visual impact</td>
<td>X</td>
<td></td>
<td>X</td>
<td>Facilities clearly away from residential area and the plants are housed within their dedicated structure</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>To engage in more regular housekeeping to keep the area clean, especially the fuel storage bund.</td>
</tr>
<tr>
<td>Water storage</td>
<td>X</td>
<td>Low</td>
<td>X</td>
<td>Water storage capacity too low. Structure is satisfactory</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Can increase the storage to be able to cater for 5 days.</td>
</tr>
<tr>
<td>Fuel Storage</td>
<td>X</td>
<td></td>
<td></td>
<td>Main storage is good with appropriate bund.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Day storage bund capacity need to be larger</td>
</tr>
<tr>
<td>Water intake</td>
<td>X</td>
<td></td>
<td>X</td>
<td>Any pollution at intake area should be prevented.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Include marine water quality testing as part of the monitoring program.</td>
</tr>
<tr>
<td>Brine discharge</td>
<td>X</td>
<td>Low</td>
<td>X</td>
<td>Location of the discharge is appropriate.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Ensure chemicals are removed before being</td>
</tr>
</tbody>
</table>
Environmental audit of the existing desalination plant and powerhouse in Medhufushi Island Resort

<table>
<thead>
<tr>
<th>Section</th>
<th>X</th>
<th></th>
<th>X</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Produce water quality</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td>Total coliform slightly above recommended value. Undertake frequent monitoring. Test water after changing RO membrane.</td>
</tr>
<tr>
<td>Groundwater impact</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td>Minimum impact on groundwater as no leakage currently. Potential wash water impacts exist. Periodically check for leakage along the water distribution network and ensure washing in confined area.</td>
</tr>
<tr>
<td>Energy usage</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td>Peak load times were organised, although overall energy usage is high. Can implement innovative technology to reduce energy. Can implement best available technology for heat recovery. Create more energy friendly awareness campaigns.</td>
</tr>
<tr>
<td>Water conservation</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td>Good ideas in place for water conservation. However need to investigate alternative sources More methods need to be employed for water conservation, and alternative water sources should be used especially for irrigation.</td>
</tr>
<tr>
<td>Operation and Maintenance</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td>Operations manual present. Highly experienced staff present. Need to have operations manual easily accessible to all staff and daily routines understood by all staff.</td>
</tr>
<tr>
<td>Safety</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td>Fire fighting equipment visible and easily accessible Need to also include a fire warning system.</td>
</tr>
</tbody>
</table>
8. Environmental Management and Monitoring

This section deals with the Environmental Management and Monitoring plan for Medhufushi Island. The data collected for this assessment and previous assessments will be used as baseline data while undertaking the monitoring plan. The monitoring program will try to assess the changes in quality of desalinated water, groundwater and marine water, especially at intake and outfall locations over a course of period in addition to other factors as outlined in the monitoring program. Monitoring should be undertaken quarterly, while summary monitoring reports should be submitted to the EPA annually. In house water quality monitoring of processed water should take place on a more frequent basis to ensure water is provided to the users at the best possible quality.

The proponent is fully committed to carry out the monitoring program outlined in this report. The proponent’s declaration of commitment is given in the Annex.

8.1 Monitoring Methodology and Costs

The methodology used for monitoring will be similar if not the same as those used in this environmental assessment. However, field water quality testing equipment can be employed to decrease the uncertainties of the results as they can be compared to those obtained from the National Health Laboratory.

The costs given in Table 6 are calculated for monitoring to be undertaken quarterly throughout the year by hiring environmental consultants. However, field data collected for the proposed environmental monitoring program can be carried out by an in house team of engineers and/or technical assistants since most of the parameters are to be investigated monthly and quarterly, and therefore hiring a consultant for each occasion may not be feasible. Nevertheless, if the resort does not employ an environmental expert among its staff, it is highly recommended that an arrangement is made with an environmental consultant on a long term basis to carry out and supervise the execution of the monitoring program. Moreover, environmental expertise will be required for compiling the data and generating the annual environmental monitoring report.

Table 6 Summary of information required for environmental monitoring

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Indicator</th>
<th>Location</th>
<th>Frequency</th>
<th>Estimated Cost/quarter*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marine water quality</td>
<td>DO, COD, BOD, pH, EC/Salinity</td>
<td>At water intake and brine discharge location, 1 m below sea level.</td>
<td>Quarterly</td>
<td>USD 150</td>
</tr>
<tr>
<td>Ground water quality</td>
<td>DO, TDS, COD, BOD, EC/Salinity, pH, nitrate, phosphate.</td>
<td>From the well that already exists in the island in close proximity to the plants</td>
<td>Quarterly</td>
<td>USD 150</td>
</tr>
<tr>
<td>RO processed water quality</td>
<td>pH, EC, DO, free and residual chlorine, total coliform, fecal</td>
<td>From RO plants, guest area, kitchen area and staff quarters.</td>
<td>Monthly</td>
<td>USD 200</td>
</tr>
</tbody>
</table>
Environmental audit of the existing desalination plant and powerhouse in Medhufushi Island Resort

<table>
<thead>
<tr>
<th></th>
<th>coliform.</th>
<th>Locations where water meters are set up.</th>
<th>Monthly</th>
<th>-</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Water Demand</strong></td>
<td>Daily production of water</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Energy Demand</strong></td>
<td>Daily energy use and fuel consumption at the resort and peak load times</td>
<td>At powerhouse facility</td>
<td>Monthly</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Atmospheric Emissions</strong></td>
<td>Estimated from energy consumption data</td>
<td>At powerhouse facility</td>
<td>Quarterly</td>
<td>USD 100</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Leakages and spills</strong></td>
<td>Visual inspection of any water or fuel leakages and scale of leaks</td>
<td>At the desalination facility and powerhouse</td>
<td>Monthly</td>
<td>USD 150</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Noise</strong></td>
<td>Noise levels measured in dBA</td>
<td>Around the proximity of the plant and at staff quarters and guest area.</td>
<td>Quarterly</td>
<td>USD 150</td>
</tr>
<tr>
<td><strong>Marine Environment</strong></td>
<td>Qualitative assessment of coral cover in identified locations</td>
<td>Around the proximity of the intake and outfall pipes.</td>
<td>Quarterly</td>
<td>USD 300</td>
</tr>
</tbody>
</table>

*Note: The costs include field allowances for consultants, monitoring equipment depreciation and other charges. They do not include data compiling and report generation charges. No additional costs are bared to monitor the water demand and energy demand as this segment is carried out by resort staff with existing equipment at the resort. The costs are approximations made at the time of making this report and are subject to change.

### 8.2 Monitoring Report

Monitoring report should be compiled based on the baseline data collected. This report should be submitted to the EPA and any other relevant government agencies for compliance, if requested. The report structure may include but not limited to;

- Introduction
- Details of the site at the time of investigation,
- Data collection and analysis,
- Details of methodologies and protocols followed
- Quality control measures,
- Sampling frequency and monitoring analysis
- Conclusion and recommendations
Environmental audit of the existing desalination plant and powerhouse in Medhufushi Island Resort

9. References


Water Solutions Pvt. Ltd., 2011 Environmental audit at Bandos Island Resort for the registration of existing desalination plant and powerhouse and in Bandos Island Resort.
10. Declaration of the consultant

This Environment Audit has been prepared according to the EIA Regulations 2007, issued by the Ministry of Environment, Energy and Water. The EIA was carried out by a multidisciplinary consulting team.

I certify that the statements in this Environmental Impact Assessment study are true, complete and correct, to the best of my knowledge and ability.

Name: Ahmed Jameel (EIA 07/07)

Signature:
Environmental audit of the existing desalination plant and powerhouse in Medhufushi Island Resort

ANNEX
Terms of Reference for the Environmental Audit on existing Desalination plant, Power Plant and related infrastructure at Medhufushi Resort, Meemu Atoll Maldives.

The following is the Terms of Reference for preparing an Environmental Audit report for the existing desalination plant, power plant and related infrastructure at Medhufushi Resort, Meemu Atoll, Maldives. This Environmental Audit is carried out for the purpose of registering the desalination plant and power plant on the island. While every attempt has been made to ensure that this TOR addresses all of the major issues associated with development proposal, they are not necessarily exhaustive. They should not be interpreted as excluding from consideration matters deemed to be significant but not incorporated in them, or matters currently unforeseen, that emerge as important or significant from environmental studies, or otherwise, during the course of preparation of the audit report.

1. **Introduction** - The Ministry of Housing and Environment requires that desalination and Power plants in the Maldives to be registered. In order to carry out the registration process, environmental clearance is required from the EPA, i.e. a Decision Statement regarding the environmental impact assessment of the water infrastructure. In order to provide such clearance the EPA requires that an Environmental Impact Assessment be done for proposed new or upgrading projects and an Environmental Audit be done for existing facilities. Since there are no upgrading or additional components at Medhufushi, Maldives it was decided that an Environmental Audit will be done for the purpose of registering the desalination infrastructure.

2. **Study Area** - The study will be focused on the power and desalination infrastructure existing on the island. The specific areas include power generator set with stacks and immediate vicinity affected by noise and emissions and oil handling areas, the desalination plant including the seawater intake and brine discharge locations.

3. **Scope of Work** - The following tasks will be performed:

   **Task 1. Description of the Project Components** - Provide a brief description of the proponent, full description of the relevant parts of the project, using clearly labeled maps, scaled site plan including location of existing desalination plant, outfalls and saltwater intake. In addition provide a process flow diagram of the desalination plant.

   For the power generator set provide details of the area of power generator set, number of and capacity of generator sets, height of smoke stack, method of generator sets cooling water discharge outfall if any, emissions.

   Provide details of area of the plant room, number of and capacity of desalination plants, method of saltwater intake and, location and length of brine discharge outfall and its reject arrangements, and disinfection and reticulation mechanism and existing safety measures in place in case of an emergency.
Task 2. Description of the Environment - Assemble, evaluate and present baseline data on the relevant environmental characteristics of the audit area, including the following:

a) Physical environment: brief description of groundwater quality at the desalination plant location. Marine water quality at the location of intake and brine discharge locations. Marine water quality parameters shall include pH, dissolved oxygen, COD, BOD, E- Conductivity, salinity and pH. Groundwater quality shall include TFC, dissolved oxygen, TDS or E-Conductivity, COD, BOD, nitrate and phosphate. Quality of the product water from desalination plant shall also be assessed, especially for pH, E-Conductivity, free chlorine and coliform bacteria (E-coli and Total coliforms).

b) Biological environment: brief description of the marine environment especially the coral cover along the both outfall and intake pipe if found.

c) Human environment: Identify the noise levels in the vicinity and how they affect recreational quality and public and occupational health.

Characterize the extent and quality of the available data, indicating significant information deficiencies and any uncertainties associated with the prediction of impacts. All available data from previous studies of the island, if available should be presented. Geographical coordinates of all sampling locations should be provided. All water samples shall be taken at a depth of 1m from the mean sea level or mid water depth for shallow areas. Absence of facilities in the country to carry out the water quality tests will not exempt the proponent from the obligation to provide necessary data. The report should outline the detailed methodology of data collection utilized to describe the existing environment. Baseline conditions should be presented for the marine environment. An average of at least 5 measurements must be given for each parameter tested and analyzed from a certified laboratory. Provide details of calibration for any onsite data analysis.

Task 3. Legislative and Regulatory Considerations - Describe the pertinent national legislation, regulations and standards, and environmental policies that are relevant and applicable to the audit, and identify the appropriate authority jurisdictions that will specifically apply to the audit.

Task 4. Determine the Environmental Performance, compliance, Mitigation and Recommendations - Identify impacts related to operation and maintenance desalination plant and power plant. Distinguish between significant impacts that are positive and negative, direct and indirect, and short and long term. Identify impacts that are cumulative, unavoidable or irreversible. Identify any information gaps and evaluate their importance for decision-making. Identify Determine how well the existing infrastructure complies with existing environmental policies and regulations.

Give details of all mitigation measures currently implemented to minimize any adverse impacts. Are these mitigation measures sufficient, provide recommendations to improve the existing operations. Commitment of the proponent to implement any required additional mitigation measures and cost, equipment, resources required to implement these measures shall also be given.

Task 5. Environmental Management Plan and Monitoring - Identify the critical issues requiring monitoring to ensure compliance to mitigation measures and present impact management and monitoring plan.
Details of the monitoring programme including the physical and biological parameters for monitoring, frequency, duration and cost commitment from responsible person, detailed reporting time table and ways and means of undertaking the monitoring programme must be provided. A general guideline for monitoring is provided in appendix 1. Relevant components of this guideline must be followed when preparing the audit report.

**Task 7. Methodology** - Explain clearly the methodologies used for data collection, making predictions and data gaps and also the information on the uncertainties and assumptions involved in interpreting the data.

**Appendix** - Operational manuals (if not maintained shall be recommended), layout of the desalination plant and power plant, site specific process flow diagrams, an A-3 site plan showing location of power plant and desalination plant.

**Presentation** - The Environmental Audit, to be presented in digital format, will be concise and focus on significant environmental issues. It will contain the findings, conclusions and recommended actions supported by summaries of the data collected and citations for any references used in interpreting the data. The Environmental Audit report will be organized according to, but not necessarily limited by, the outline given for Initial Environmental Examination in the Environmental Impact Assessment Regulations, 2007.

**Timeframe for submitting the EIA report** - The developer must submit the completed Environmental Audit report within 3 months from the date of this Term of Reference.

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**Appendix 1**

4th Floor, Jameeludeen Complex
Nikagas Magu
Male’, Republic of Maldives
Tel: 333 5949 / 333 5951
Fax: 333 5951

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3rd April 2011
Mr. Ibrahim Naeem  
Director  
Environmental Protection Agency  
Male', Maldives  

03rd August 2011  

Dear Mr. Naeem,  

Sub: Commitment to undertake the mitigation and environmental monitoring proposed in the Environment Audit report developed for the registration of the existing desalination plant and powerhouse in Medhufushi Island resort  

An environmental assessment and audit has been undertaken to obtain the required permit for the registration of the existing desalination plant in Medhufushi Island Resort.  

Hence we would like to confirm our commitment to the proposed mitigation measures and monitoring program that has been outlined in this report.  

Thanking you  

Yours Sincerely  

Ali Shiyam  
Director
**National Health Laboratory**

Maldives Food and Drug Authority,
Sosun Magu, Male' 200590, Republic of Maldives
Telephone # 3014310, Fax # 3014307

**WATER CHEMISTRY ANALYTICAL RESULTS**

**REPORT NUMBER:** NHL/WR-WC/RC0816

**NAME AND ADDRESS OF CLIENT:** WATER SOLUTION
MA. SHAH, DHIDI GOALHI
TEL: (+960) 9636131, FAX: (+960) 3331643

**LOCATION OF SAMPLE**

<table>
<thead>
<tr>
<th>MEDHUFUSHI ISLAND RESORT</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEDIMENTATION TANK</td>
</tr>
<tr>
<td>BRINE</td>
</tr>
<tr>
<td>OUT FALL</td>
</tr>
<tr>
<td>INTANK</td>
</tr>
<tr>
<td>SEWAGE OUT FALL</td>
</tr>
<tr>
<td>GROUND WATER</td>
</tr>
</tbody>
</table>

**Requisition Form No.:** NHL/WR-WC-2011/R0645

**Date sampled:** 10/07/2011

**Time Sampled:** -

**Type of water:** SEA

**Date tested:** 10/07/2011

**Sample ID:** 1007t11WC60 1007t11WC65

**PARAMETER TESTED**

<table>
<thead>
<tr>
<th>Physical Appearance</th>
<th>Clear</th>
<th>Clear</th>
<th>Clear</th>
<th>Clear</th>
<th>Pale yellow with suspended particles</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>8.2</td>
<td>6.2</td>
<td>8.5</td>
<td>8.5</td>
<td>8.5</td>
</tr>
<tr>
<td><em>Total Dissolved Solids</em></td>
<td>33100 mg/L</td>
<td>49600 mg/L</td>
<td>33400 mg/L</td>
<td>33200 mg/L</td>
<td>33200 mg/L 7150 mg/L</td>
</tr>
<tr>
<td>Electrical Conductivity</td>
<td>65400 μs/cm</td>
<td>98500 μs/cm</td>
<td>66200 μs/cm</td>
<td>65800 μs/cm</td>
<td>66800 μs/cm 1424 μs/cm</td>
</tr>
</tbody>
</table>

**COMMENT:**

Authorized by

[Signature]

Technical Manager
Khaadeja Nashwa

Date: 11th July 2011

NOTE: *information supplied by the client
This laboratory is not accredited for the test marked by *

This Result is valid only for this sample. This report is not for duplicate or advertisement without prior approval from NHL.
**WATER MICROBIOLOGY ANALYTICAL RESULTS**

**REPORT NUMBER:** NHL/TR-WM/RC0780

**NAME AND ADDRESS OF CLIENT:** Water Solutions, Ma. Shah, Dhidhi Goaithi  
Tel: +960 9636131, Fax: +960 3331543

**LOCATION OF SAMPLE**  
- Guest Room  
- Staff Room

**Requisition Form No:** NHLWM-2011/RQ0652

**Date Sampled/Processed:** 10/07/11  
**Time Sampled:** -

**Type of water:** Desalinated water in sterilized bottles

**Date Tested:** 10/07/11  
**Sample ID:** 100711WM48

**Parameter Tested:**  
- Total Coliform Count (c/ml): 10  
- Faecal Coliform Count (E.coli)/100ml: 0

**Test Method:**  
- HPA std method, 2007, W2 issue 4.1

**Reference Range:**  
- 0/100ml

**COMMENT:**

---

**Authorized by:**  
**Technical Manager:** Mariyam Nisha

**Date:** 11th July 2011

---

**NOTE:** Information supplied by the client.  
This Laboratory is not accredited for the test marked by "

This Result is valid only for this sample. This report is not for duplicate or advertisement without prior approval from NHL.
# WATER CHEMISTRY ANALYTICAL RESULTS

**REPORT NUMBER:** NHL/TR-WC/RC0815

**NAME AND ADDRESS OF CLIENT:** WATER SOLUTIONS
MA. SHAH, DHIDHI GODHI
TEL: (+960) 903351, FAX: (+960) 3331543

**PURPOSE OF TESTING:** Quality Monitoring

<table>
<thead>
<tr>
<th>LOCATION OF SAMPLE</th>
<th>MEDHUFUSHI ISLAND RESORT</th>
<th>PROCESSED WATER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Requisition Form No.</td>
<td>NHL/WC-2011/RQ0645</td>
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<tr>
<td><strong>Date sampled</strong></td>
<td>10/07/2011</td>
<td>10/07/2011</td>
</tr>
<tr>
<td><strong>Time Sampled</strong></td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Type of water</strong></td>
<td>Desalinated</td>
<td>Desalinated</td>
</tr>
<tr>
<td><strong>Date tested</strong></td>
<td>10/07/2011</td>
<td>10/07/2011</td>
</tr>
<tr>
<td><strong>Sample ID</strong></td>
<td>100711WC58</td>
<td>100711WC59</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PARAMETER TESTED</th>
<th>CRYSTAL PLANT</th>
<th>PROCESSED WATER</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Physical Appearance</strong></td>
<td>Clear</td>
<td>Clear</td>
</tr>
<tr>
<td><strong>pH</strong></td>
<td>7.0</td>
<td>6.7</td>
</tr>
<tr>
<td><strong>Total Dissolved Solids</strong></td>
<td>366 mg/L</td>
<td>384 mg/L</td>
</tr>
<tr>
<td><strong>Electrical Conductivity</strong></td>
<td>770 µS/cm</td>
<td>752 µS/cm</td>
</tr>
</tbody>
</table>

**COMMENT:**

Authorized by

Technical Manager
Khadeeja Nashwa

Date: 11th July 2011

**NOTE:** Information supplied by the client
This laboratory is not accredited for the test marked by *

*This Result is valid only for this sample. This report is not for duplicate or advertisement without prior approval from NHL.*
### 1. DESCRIPTION OF RO DESALINATION PLANT

**Water boy**

MODEL: SO-KQD220 type 400

#### Item  | Description | Remarks
---|---|---
1. **Model** | SO-KQD220 | Seawater application
2. **Capacity** | Max 220 m$^3$/D/24hrs | 4.6 m$^3$/H x 2trains
3. **Seawater Conditions** | Typical seawater | 35,000 ppm
4. **Seawater Intake Volume** | 303.0 m$^3$/D x 2trains | 12.6 m$^3$/H x 2trains
5. **Brine Discharge Volume** | 193.0 m$^3$/D x 2trains | 8.0 m$^3$/H x 2trains
6. **Recovery** | 36% | Product vol/seawater
7. **Product Water Quality** | WHO drinking water standard (Guaranteed quality) | E8S/SP-5W
8. **RO Pressure Vessel** | 4 pcs (5 membrane/PV) | AWT-SW8040-H
9. **RO Membrane** | 20 pcs | at 25 deg. C
10. **Operating Pressure** | 5.3 MPa | FBK21-6P-30
11. **Water Boy Control Panel** | | MW6761DX
12. **Main Motor** | 6P-30.0 kW x 2sets | 5 pcs x 2Trains
13. **Electric Power** | 415 V x 3 ø x 50 Hz | 3 micrometer
14. **Electric Circuit** | 100 V x 1 ø x 50 Hz | 500mmL 9pcs x 2
15. **High Pressure Pump** | Plunger-type | Direct
16. **Material** | Duplex stainless steel | 
17. **Drive Belt** | V-belt (C-108) | 
18. **Flow Meter (Brine)** | Digital | 
19. **Flow Meter (Product)** | Digital | 
20. **Operating Pressure Gage** | 0-0.5 MPa | 
21. **Check Filter** | Cartridge filter | 

KQD220 T-651 12.99
**Report Number:** NHL/TR-WC/RC0468  
**Date:** 12th April 2011  
**Authorised by:** Technical Manager Khadeeja Nashwa

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**Purpose of Testing:** Quality Monitoring  

**Location of Sample:**  
- **Requisition Form No.:** NHL/WC-2011/RQ0376  
- **Date Sampled:** 11/04/2011  
- **Time Sampled:** 05.29  
- **Type of Water:** Desalinated  
- **Date Tested:** 04/04/2011  
- **Sample ID:** 11041IFC100, 11041IFC102, 11041IFC103

<table>
<thead>
<tr>
<th>Location</th>
<th>Staff Kitchen</th>
<th>Crystal Plant</th>
<th>Desalination Plant</th>
<th>Dispense Bar Ice Cube</th>
<th>Main Kitchen</th>
<th>Guest Room</th>
</tr>
</thead>
<tbody>
<tr>
<td>Requisition Form No.</td>
<td>NHL/WC-2011/RQ0376</td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Time Sampled</td>
<td>05.29</td>
<td>05.15</td>
<td>05.15</td>
<td>-</td>
<td>06.25</td>
<td>06.20</td>
</tr>
<tr>
<td>Type of Water</td>
<td>Desalinated</td>
<td>Desalinated</td>
<td>Desalinated</td>
<td>Desalinated</td>
<td>Desalinated</td>
<td>Desalinated</td>
</tr>
<tr>
<td>Date Tested</td>
<td>04/04/2011</td>
<td>04/04/2011</td>
<td>04/04/2011</td>
<td>04/04/2011</td>
<td>04/04/2011</td>
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</tr>
<tr>
<td>Sample ID</td>
<td>11041IFC100, 11041IFC102, 11041IFC103</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Parameter Tested:**  
- **Physical Appearance:** Clear & colorless  
- **pH:** 6.5  
- **Electrical Conductivity:** 253 μS/cm, 308 μS/cm, 7.7 μS/cm, 250 μS/cm, 248 μS/cm

**Test Method:**  
- Method 4500-B ch4 page 65 spectrophotometric method Adapted from standard method 19P edition for the examination of water and wastewater by AHPA  
- Adapted from corning electrode meter instruction manual

**Reference Range:**  
- W.H.O. Guideline for Drinking Water

**Comment:**

---

**Note:** This Result is valid only for this sample. This report is not for duplicate or advertisement without prior approval from NHL.
# Water Microbiology Analytical Results

**Client:** Madhulushi Island Resort  
**Report Number:** NHL/TR-WM/RC0437

**Time Tested:** 13:30  
**Collected By:**

### Madhulushi Island Resort

<table>
<thead>
<tr>
<th></th>
<th>Staff Kitchen</th>
<th>Crystall Plant</th>
<th>Desalination Plant</th>
<th>Dispense Bar Ice Cube</th>
<th>Main Kitchen</th>
<th>Guest Room</th>
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<tbody>
<tr>
<td>Time</td>
<td>06:20</td>
<td>05:15</td>
<td>05:15</td>
<td>06:22</td>
<td>06:20</td>
<td>-</td>
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</tbody>
</table>

**Test Method:**

- **HPLC**
- **WHO Guideline for Drinking Water**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Limit</th>
<th>Result</th>
<th>Reference Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>E. coli</td>
<td>0/100ml</td>
<td>0</td>
<td>HPA std method, 2007, W2 issue 4.1</td>
</tr>
<tr>
<td>Total Coli</td>
<td>0/100ml</td>
<td>0</td>
<td>HPA std method, 2007, W2 issue 4.1</td>
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</tbody>
</table>

**Date:** 12th April 2011

*By the client

*Note: This report is not for duplicate or advertisement without prior approval from NHL.*
**REPORT NUMBER: NHL/TR-WC/RC1561**

**TIME TESTED:** 11:15

**PURPOSE OF TESTING:** Quality Monitoring

**LOCATION OF SAMPLE:** MEDHUFUSHI ISLAND RESORT

<table>
<thead>
<tr>
<th>LOCATION OF SAMPLE</th>
<th>VILI BAR ICE CUBE</th>
<th>DESALINATION PLANT</th>
<th>GUEST ROOM</th>
<th>MAIN KITCHEN</th>
<th>CRYSTAL PLANT</th>
<th>STAFF KITCHEN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Requisition Form No.</td>
<td>NHL/WC-2010/RQ/1236</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date Sampled/Processed</td>
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<td>19/12/2010</td>
<td>19/12/2010</td>
<td>19/12/2010</td>
<td>19/12/2010</td>
<td>19/12/2010</td>
</tr>
<tr>
<td>Time Sampled</td>
<td>0500</td>
<td>0500</td>
<td>0500</td>
<td>0500</td>
<td>0500</td>
<td>0500</td>
</tr>
<tr>
<td>Type of Water</td>
<td>Desalinated</td>
<td>Desalinated</td>
<td>Desalinated</td>
<td>Desalinated</td>
<td>Desalinated</td>
<td>Desalinated</td>
</tr>
<tr>
<td>Date Tested</td>
<td>19/12/2010</td>
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<td></td>
<td></td>
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</table>

**PARAMETER TESTED**

<table>
<thead>
<tr>
<th>Parameter Tested</th>
<th>Physical Appearance</th>
<th>pH</th>
<th>Electrical Conductivity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Clear</td>
<td>7.3</td>
<td>518 μS/cm</td>
</tr>
<tr>
<td></td>
<td>Clear</td>
<td>7.4</td>
<td>518 μS/cm</td>
</tr>
<tr>
<td></td>
<td>Clear</td>
<td>7.2</td>
<td>518 μS/cm</td>
</tr>
<tr>
<td></td>
<td>Clear</td>
<td>7.3</td>
<td>519 μS/cm</td>
</tr>
<tr>
<td></td>
<td>Clear</td>
<td>7.4</td>
<td>519 μS/cm</td>
</tr>
<tr>
<td></td>
<td>Clear &amp; colorless</td>
<td>7.2</td>
<td>491 μS/cm</td>
</tr>
</tbody>
</table>

**NOTE:** Information supplied by the client

*This Result is valid only for this sample. This report is not for duplicate or advertisement without prior approval from NHL.*
National Health Laboratory
Maldives Food and Drug Authority,
Soasun Magu, Male' 200500, Republic of Maldives
Telephone # 301 4310, Fax # 301 4307

WATER MICROBIOLOGY ANALYTICAL RESULTS
REPORT NUMBER: NHL/TR-WM/RC0437

• NAME AND ADDRESS OF CLIENT: Medhufushi Island Resort,
  M. Atoll, Tel: +960 672 0079,
  AAA & Trading Company, Majeedhe Magu
  Tel: +960 333 7707 Fax: +960 331 4942

• PURPOSE OF TESTING: Quality Monitoring

<table>
<thead>
<tr>
<th>LOCATION OF SAMPLE</th>
<th>Medhufushi Island Resort</th>
</tr>
</thead>
<tbody>
<tr>
<td>Requisition Form No:</td>
<td>NHL/MMM-2011/RC0366</td>
</tr>
<tr>
<td>Date sampled/processed</td>
<td>Staff Kitchen 11/04/11, Crystal Plant 11/04/11, Desalination Plant 11/04/11, Dispense Bar Ice Cube 11/04/11, Main Kitchen 11/04/11, Guest Room 11/04/11</td>
</tr>
<tr>
<td>Time Sampled</td>
<td>06:20, 05:15, 05:15, -, 06:25, 06:20</td>
</tr>
<tr>
<td>Type of water</td>
<td>Desalinated Water in sterilized Bottle</td>
</tr>
<tr>
<td>Date Tested</td>
<td>Staff Kitchen 11/04/11, Crystal Plant 11/04/11, Desalination Plant 11/04/11, Dispense Bar Ice Cube 11/04/11, Main Kitchen 11/04/11, Guest Room 11/04/11</td>
</tr>
<tr>
<td>Sample ID</td>
<td>110411WM 71, 110411WM 72, 110411WM 73, 110411WM 74, 110411WM 75, 110411WM 76</td>
</tr>
</tbody>
</table>

PARAMETER TESTED

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Staff Kitchen</th>
<th>Crystal Plant</th>
<th>Desalination Plant</th>
<th>Dispense Bar Ice Cube</th>
<th>Main Kitchen</th>
<th>Guest Room</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Coliform Count (/100ml)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Faecal Coliform Count (E.coli)/100ml</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

TEST METHOD | REFERENCE | RANGE | WHO Guideline for Drinking Water |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>HPA std method, 2007, W2 issue 4.1</td>
<td>0/100ml</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

COMMENT:

[Signature]
Technical Manager
Fatihmath Liusha Hussain

Date: 12th April 2011

NOTE: This report is not for duplicate or advertisement without prior approval from NHL.
**NAME AND ADDRESS OF CLIENT**: MEDHUFUSHI ISLAND RESORT, M. ATOLL, Male' 200500, Republic of Maldives
**TEL**: (960) 6720079, AAA & TRADING COMPANY, MAJEEDHEE MAGU, Male', Priority 1000, FAX: (960) 3337707, FAX: (+960) 3314942
**WATER CHEMISTRY ANALYTICAL RESULTS**
**REPORT NUMBER**: NHL/TR-WG/RC0468

**LOCATION OF SAMPLE**

<table>
<thead>
<tr>
<th>STAFF</th>
<th>CRYSTAL PLANT</th>
<th>DESALINATION PLANT</th>
<th>DISPENSE BAR ICE CUBE</th>
<th>MAIN KITCHEN</th>
<th>GUEST ROOM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of water: Desalinated</td>
<td>Type of water: Desalinated</td>
<td>Type of water: Desalinated</td>
<td>Type of water: Desalinated</td>
<td>Type of water: Desalinated</td>
<td>Type of water: Desalinated</td>
</tr>
<tr>
<td>Date tested: 04/04/2011</td>
<td>Date tested: 04/04/2011</td>
<td>Date tested: 04/04/2011</td>
<td>Date tested: 04/04/2011</td>
<td>Date tested: 04/04/2011</td>
<td></td>
</tr>
<tr>
<td>Sample ID: 110411WC038</td>
<td>Sample ID: 110411WC038</td>
<td>Sample ID: 110411WC0100</td>
<td>Sample ID: 110411WC101</td>
<td>Sample ID: 110411WC102</td>
<td>Sample ID: 110411WC103</td>
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</table>

**PARAMETER TESTED**

<table>
<thead>
<tr>
<th>Physical Appearance</th>
<th>pH</th>
<th>Electrical Conductivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clear</td>
<td>6.5</td>
<td>253 μS/cm</td>
</tr>
<tr>
<td>Clear</td>
<td>7.4</td>
<td>308 μS/cm</td>
</tr>
<tr>
<td>Clear</td>
<td>7.6</td>
<td>7.7 μS/cm</td>
</tr>
<tr>
<td>Clear</td>
<td>7.8</td>
<td>250 μS/cm</td>
</tr>
<tr>
<td>Clear</td>
<td>7.8</td>
<td>248 μS/cm</td>
</tr>
</tbody>
</table>

**COMMENT:**

Authorized by

Technical Manager
Khadeeja Nashwa

Date: 12th April 2011

**NOTE:** Information supplied by the client
This laboratory is not accredited for the test marked by

This result is valid only for this sample. This report is not for duplicate or advertisement without prior approval from NHL.
National Health Laboratory  
Maldives Food and Drug Authority,  
Soasun Magu, Male' 200500, Republic of Maldives  
Telephone # 334 3537, Fax # 330 4570

WATER MICROBIOLOGY ANALYTICAL RESULTS  
REPORT NUMBER: NHL/TR-WM/RC0110

**NAME AND ADDRESS OF CLIENT:** Medhufushi Island Resort,  
M. Atoll, Tel: +960 672 0079,  
AAABA Trading Company, Male' 20000, Republic of Maldives  
Tel: +960 333 7707, FAX: +960 331 4942

**PURPOSE OF TESTING:** Quality Monitoring

<table>
<thead>
<tr>
<th>LOCATION OF SAMPLE</th>
<th>Crestel Plant</th>
<th>Guest Room</th>
<th>Desalination Plant</th>
<th>Staff Kitchen</th>
<th>Viu Bar</th>
<th>Main Kitchen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reguilation Form No:</td>
<td>NHL/WM-2011/RQ094</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date Sampled/Processed</td>
<td>26/01/2011</td>
<td>26/01/2011</td>
<td>26/01/2011</td>
<td>26/01/2011</td>
<td>26/01/2011</td>
<td>26/01/2011</td>
</tr>
<tr>
<td>Time Sampled</td>
<td>05:10</td>
<td>05:10</td>
<td>05:10</td>
<td>05:10</td>
<td>05:10</td>
<td>05:10</td>
</tr>
<tr>
<td>Type of Water</td>
<td>Desalinated Water in sterilized Bottles</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date Tested</td>
<td>26/01/2011</td>
<td>26/01/2011</td>
<td>26/01/2011</td>
<td>26/01/2011</td>
<td>26/01/2011</td>
<td>26/01/2011</td>
</tr>
<tr>
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<td>260111WM 273</td>
<td>260111WM 274</td>
<td>260111WM 275</td>
<td>260111WM 276</td>
<td>260111WM 277</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PARAMETER TESTED</th>
<th>Total Coliform Count /100ml</th>
<th>Fecal Coliform Count(E.coli) /100ml</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>0/100ml</td>
<td>0/100ml</td>
</tr>
</tbody>
</table>

**COMMENT:**

Authorized by  
[Signature]

Technical Manager  
Marilyam Nisha

Date: 27th January 2011

NOTE: *Information supplied by the client,  
This Laboratory is not accredited for the test marked by *  
This Result is valid only for this sample,  
This result is not for duplicate or advertisement without prior approval from NHL.
# Water Chemistry Analytical Results

**Report Number:** NHL/TR-WC/RC0113

**Name and Address of Client:** Medhufushi Island Resort, M. Atoll,
Tel.: +960 0720079, AAA & Trading Company, Maheedhee Magu,
Tel.: +960 3337707 Fax: +960 3314842

**Purpose of Testing:** Quality Monitoring

<table>
<thead>
<tr>
<th>LOCATION OF SAMPLE</th>
<th>CRESTEL PLANT</th>
<th>GUEST ROOM</th>
<th>DESALINATION PLANT</th>
<th>STAFF KITCHEN</th>
<th>VILU BAR</th>
<th>MAIN KITCHEN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Requisition Form No</td>
<td>NHL/WC-2011/PQ0088</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date Sampled/Processed</td>
<td>26/01/2011</td>
<td>26/01/2011</td>
<td>26/01/2011</td>
<td>26/01/2011</td>
<td>26/01/2011</td>
<td>26/01/2011</td>
</tr>
<tr>
<td>Time Sampled</td>
<td>05:10</td>
<td>05:10</td>
<td>05:19</td>
<td>05:10</td>
<td>05:10</td>
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<td>Type of Water</td>
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<td>Desalinated</td>
<td>Desalinated</td>
<td>Desalinated</td>
<td>Desalinated</td>
<td>Desalinated</td>
</tr>
<tr>
<td>Date Tested</td>
<td>26/01/201</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Sample ID</td>
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<td>260111WC241</td>
<td>260111WC242</td>
<td>260111WC243</td>
<td>260111WC244</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Parameter Tested</th>
<th>Physical Appearance</th>
<th>pH</th>
<th>Electrical Conductivity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Clear</td>
<td>6.5</td>
<td>517 µS/cm</td>
</tr>
<tr>
<td></td>
<td>Clear</td>
<td>6.6</td>
<td>514 µS/cm</td>
</tr>
<tr>
<td></td>
<td>Clear</td>
<td>6.7</td>
<td>507 µS/cm</td>
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<tr>
<td></td>
<td>Clear</td>
<td>6.7</td>
<td>544 µS/cm</td>
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<tr>
<td></td>
<td>Clear</td>
<td>6.7</td>
<td>542 µS/cm</td>
</tr>
<tr>
<td></td>
<td>Clear</td>
<td>6.7</td>
<td>546 µS/cm</td>
</tr>
</tbody>
</table>

**Test Method:**
- Physical Appearance: Clear & colorless
- pH
- Electrical Conductivity

**Comment:**

Authorized by

[Signature]

Technical Manager
Khadheera Nashwa

Date: 27th January 2011
# WATER CHEMISTRY ANALYTICAL RESULTS

**REPORT NUMBER:** NHL/TR-WC/RC1561

**NAME AND ADDRESS OF CLIENT:** MEDHUFUSHI ISLAND RESORT, M. ATOLL,
TEL: (+960) 9720079, AAA & TRADING COMPANY, MAJEEDHEE MAGU,
TEL: (+960) 3327707 FAX: (+960) 3314942

**PURPOSE OF TESTING:** Quality Monitoring

<table>
<thead>
<tr>
<th>LOCATION OF SAMPLE</th>
<th>MEDHUFUSHI ISLAND RESORT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>VILU BAR ICE CUBE</td>
</tr>
<tr>
<td></td>
<td>DESALINATION PLANT</td>
</tr>
<tr>
<td></td>
<td>GUEST ROOM</td>
</tr>
<tr>
<td></td>
<td>MAIN KITCHEN</td>
</tr>
<tr>
<td></td>
<td>CRYSTAL PLANT</td>
</tr>
<tr>
<td></td>
<td>STAFF KITCHEN</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Regulation Form No:</th>
<th>NHL/TR-WC-2010/RC138</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Date sampled/processed</strong></td>
<td>19/12/2010</td>
</tr>
<tr>
<td><strong>Date Sampled</strong></td>
<td>0500</td>
</tr>
<tr>
<td><strong>Type of water</strong></td>
<td>Desalinated</td>
</tr>
<tr>
<td><strong>Date Tested</strong></td>
<td>19/12/2010</td>
</tr>
<tr>
<td><strong>Sample ID</strong></td>
<td>191210WC129 191210WC130 191210WC131 191210WC132 191210WC133 191210WC134</td>
</tr>
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</table>

**PARAMETER TESTED**

<table>
<thead>
<tr>
<th>Parameter Tested</th>
<th>VILU BAR ICE CUBE</th>
<th>DESALINATION PLANT</th>
<th>GUEST ROOM</th>
<th>MAIN KITCHEN</th>
<th>CRYSTAL PLANT</th>
<th>STAFF KITCHEN</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Physical Appearance</strong></td>
<td>Clear</td>
<td>Clear</td>
<td>Clear</td>
<td>Clear</td>
<td>Clear</td>
<td>Clear</td>
</tr>
<tr>
<td><strong>pH</strong></td>
<td>7.3</td>
<td>7.4</td>
<td>7.2</td>
<td>7.3</td>
<td>7.4</td>
<td>7.2</td>
</tr>
<tr>
<td><strong>Electrical Conductivity</strong></td>
<td>518 µS/cm</td>
<td>518 µS/cm</td>
<td>518 µS/cm</td>
<td>519 µS/cm</td>
<td>491 µS/cm</td>
<td>3</td>
</tr>
</tbody>
</table>

**COMMENT:**

Authorized by

Technical Manager
Khadeeja Nashwa

Date: 20th December 2010

**NOTE:** Information supplied by the client

This Result is valid only for this sample. This report is not for duplicate or advertisement without prior approval from NHL.
# Water Chemistry Analytical Results

**Report Number:** NHL/ TR-WC/RC1561

**Name and Address of Client:** Medhufushi Island Resort, Az. Atoll.
- **Tel:** (+960) 6720076, AAA Trading Company, Majeeedh H Magu,
- **Tel:** (+960) 3337777, FAX: (+960) 3314842

**Purpose of Testing:** Quality Monitoring

<table>
<thead>
<tr>
<th>LOCATION OF SAMPLE</th>
<th>MEDHUFUSHI ISLAND RESORT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>VILU BAR ICE CUBE</td>
</tr>
<tr>
<td>Regulation Form No.</td>
<td>NHL/ WC-2010/RQ1239</td>
</tr>
<tr>
<td>Date sampled/processed</td>
<td>19/12/2010</td>
</tr>
<tr>
<td>Time Sampled</td>
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<tr>
<td>Type of water</td>
<td>Desalinated</td>
</tr>
<tr>
<td>Date Tested</td>
<td>19/12/2010</td>
</tr>
</tbody>
</table>

**Parameter Tested**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Clear</th>
<th>Clear</th>
<th>Clear</th>
<th>Clear</th>
<th>Clear</th>
<th>Clear</th>
</tr>
</thead>
</table>

- **pH:** 7.3, 7.4, 7.2, 7.3, 7.4, 7.2
- **Electrical Conductivity:** 518 µS/cm, 518 µS/cm, 519 µS/cm, 519 µS/cm, 4911 µS/cm

**Comment:**

- Clear & colorless

Method: APHA 2140-B.45

**Authorized by:**

Technical Manager
Khadeeja Nashwa

Date: 20th December 2010

**Note:** Information supplied by the client.

This report is valid only for this sample. This report is not for duplicate or advertisement without prior approval from NIH.

Page 1 of 1
National Health Laboratory  
Maldive Food and Drug Authority,  
Soasun Magu, Male' 200500, Republic of Maldives  
Telephone # 301 4310, Fax # 301 4307

WATER MICROBIOLOGY ANALYTICAL RESULTS  
REPORT NUMBER: NHL/TR-WM/RC0437

**NAME AND ADDRESS OF CLIENT:** Medhufushi Island Resort,  
M. Atoll, Tel: +960 872 0079,  
AAA & Trading Company, Majeedhee Magu  
Tel: +960 333 7707 Fax: +960 331 4942

**PURPOSE OF TESTING:** Quality Monitoring

<table>
<thead>
<tr>
<th>LOCATION OF SAMPLE</th>
<th>Medhufushi Island Resort</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Staff Kitchen</td>
</tr>
<tr>
<td>Requisition Form No:</td>
<td>NHL/WM-2011/RG0366</td>
</tr>
<tr>
<td>Date sampled/processed</td>
<td>11/04/11</td>
</tr>
<tr>
<td>Time Sampled</td>
<td>06:20</td>
</tr>
<tr>
<td>Type of Water</td>
<td>Desalinated Water in sterilized Bottle</td>
</tr>
<tr>
<td>Date Tested</td>
<td>11/04/11</td>
</tr>
<tr>
<td>Sample ID</td>
<td>110411WM 71</td>
</tr>
</tbody>
</table>

**PARAMETER TESTED**

<table>
<thead>
<tr>
<th>Test</th>
<th>Result (cfu/100ml)</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Coliform Count</td>
<td>0</td>
<td>HPA std method, 2007, W2 issue 4.1</td>
</tr>
<tr>
<td>Faecal Coliform Count (E.coli)</td>
<td>0</td>
<td>HPA std method, 2007, W2 issue 4.1</td>
</tr>
</tbody>
</table>

**COMMENT:**

*Note: the method is supplied by the client. This laboratory is not accredited for the test marked by *.

This Result is valid only for this sample. This report is not for duplicate or advertisement without prior approval from NHL.

**DATE TESTED:** 13:30

**COLLECTED BY:**

**AUTHOR:**

Technical Manager  
Fathimath Luihsia Hussain

**DATE:** 12th April 2011
**National Health Laboratory**

**Maldives Food and Drug Authority,**
Sosun Magu, Male' 200500, Republic of Maldives

**Telephone #: 3014310, Fax #: 3014307**

**WATER CHEMISTRY ANALYTICAL RESULTS**

**REPORT NUMBER:** NHL/TR-WC/RC0468

---

**NAME AND ADDRESS OF CLIENT:** MEDHUFUSIII ISLAND RESORT, M. ATOLL,

TEL: (+960) 6720079, A&A TRADING COMPANY, MAJEEDEE MAGU,

TEL: (+960) 3337797, FAX: (+960) 3314942

**TIME TESTED: 11:45**

**COLLECTED BY:**

**PURPOSE OF TESTING:** Quality Monitoring

**LOCATION OF TESTING:** Quality Monitoring

<table>
<thead>
<tr>
<th>LOCATION OF SAMPLE</th>
<th>STAFF KITCHEN</th>
<th>CRYSTAL PLANT</th>
<th>DESALINATION PLANT</th>
<th>DISPENSE BAR I CUBE</th>
<th>MAIN KITCHEN</th>
<th>GUEST ROOM</th>
</tr>
</thead>
<tbody>
<tr>
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<tr>
<td>Time Sampled</td>
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<td>05:15</td>
<td>05:15</td>
<td>-</td>
<td>06:25</td>
<td>06:20</td>
</tr>
<tr>
<td>Type of water</td>
<td>Desalinated</td>
<td>Desalinated</td>
<td>Desalinated</td>
<td>Desalinated</td>
<td>Desalinated</td>
<td>Desalinated</td>
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<td>04/04/2011</td>
<td>04/04/2011</td>
<td>04/04/2011</td>
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<td>110411/W/39</td>
<td>110411/W/101</td>
<td>110411/W/101</td>
<td>110411/W/102</td>
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<td>Physical Appearance</td>
<td>Clear</td>
<td>Clear</td>
<td>Clear</td>
<td>Clear</td>
<td>Clear</td>
<td>Clear</td>
</tr>
<tr>
<td>pH</td>
<td>6.5</td>
<td>7.4</td>
<td>7.4</td>
<td>7.6</td>
<td>7.8</td>
<td>7.8</td>
</tr>
<tr>
<td>Electrical Conductivity</td>
<td>253 µs/cm</td>
<td>306 µs/cm</td>
<td>308 µs/cm</td>
<td>7.7 µs/cm</td>
<td>250 µs/cm</td>
<td>248 µs/cm</td>
</tr>
</tbody>
</table>

**COMMENT:**

**Authorized by:**

[Signature: Technical Manager, Khadeeja Nashwa]

**Date:** 12th April 2011

---

**NOTE:**
- Information supplied by the client
- This laboratory is not accredited for the test marked by *
- This Result is valid only for this sample. This report is not for duplicate or advertisement without prior approval from NHL.
# WATER MICROBIOLOGY ANALYTICAL RESULTS

**REPORT NUMBER:** NHL/TR-WM/RC0110

**NAME AND ADDRESS OF CLIENT:** Medhufushi Island Resort, M. Atoll, Tel: +960 672 0079, AAA& Trading Company, Majeddin Magu, Tel: +960 333 7707 FAX: +960 331 4842

**LOCATION OF SAMPLE**

<table>
<thead>
<tr>
<th>Location</th>
<th>Crestel Plant</th>
<th>Guest Room</th>
<th>Desalination Plant</th>
<th>Staff Kitchen</th>
<th>Vilu Bar</th>
<th>Main Kitchen</th>
</tr>
</thead>
<tbody>
<tr>
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<td>26/01/2011</td>
<td>26/01/2011</td>
<td>26/01/2011</td>
<td>26/01/2011</td>
</tr>
<tr>
<td>Time Sampled</td>
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<td>05:10</td>
<td>05:10</td>
<td>05:10</td>
<td>05:10</td>
<td>05:10</td>
</tr>
<tr>
<td>Type of Water</td>
<td>Desalinated Water in sterilized bottle</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date Tested</td>
<td>26/01/2011</td>
<td>26/01/2011</td>
<td>26/01/2011</td>
<td>26/01/2011</td>
<td>26/01/2011</td>
<td>26/01/2011</td>
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<td>260111WM 274</td>
<td>260111WM 275</td>
<td>260111WM 276</td>
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</tbody>
</table>

**PARAMETER TESTED**

<table>
<thead>
<tr>
<th>Parameter Tested</th>
<th>Total Coliform Count (100ml)</th>
<th>Fecal Coliform Count (E. coli) (100ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**COMMENT:**

Authorized by

[Signature]

Technical Manager
Mariyam Nisha

Date: 27th January 2011

**NOTE:** Information supplied by the client. This Laboratory is not accredited for the test marked by *.
This result is valid only for this sample. This result is not for duplicate or advertisement without prior approval from NHL.
**National Health Laboratory**  
**Maldives Food and Drug Authority,**  
**Sosun Magu, Male' 200500, Republic of Maldives**  
**Telephone # 3343538, Fax # 3304570**  
**WATER CHEMISTRY ANALYTICAL RESULTS**

**REPORT NUMBER:** NHL/TR-WC/RC0113

**NAME AND ADDRESS OF CLIENT:** MEDHUFUSHI ISLAND RESORT, M. ATOLL,  
**TEL:** (+960) 6720079, AAA TRADING COMPANY, MAJEEDHEE MAGU,  
**TEL:** (+960) 3337707 , **FAX:** (+960) 3314842

**PURPOSE OF TESTING:** Quality Monitoring

<table>
<thead>
<tr>
<th>LOCATION OF SAMPLE</th>
<th>MEHFUSHI ISLAND RESORT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CRESTEL PLANT</td>
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<tr>
<td>Requisition Form No.</td>
<td>NHL:WC-2011/RQ088</td>
</tr>
<tr>
<td>Date sampled/processed</td>
<td>26/01/2011</td>
</tr>
<tr>
<td>Time Sampled</td>
<td>05.10</td>
</tr>
<tr>
<td>Type of water</td>
<td>Desalinated</td>
</tr>
<tr>
<td>Date Tested</td>
<td>26/01/2011</td>
</tr>
<tr>
<td>Sample ID</td>
<td>260111WC240</td>
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**PARAMETER TESTED**

<table>
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<tr>
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<th>Clear</th>
<th>Clear</th>
<th>Clear</th>
<th>Clear</th>
<th>Clear</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>6.5</td>
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<td>6.7</td>
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<td>6.7</td>
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</tr>
<tr>
<td>Electrical Conductivity</td>
<td>517 µS/cm</td>
<td>514 µS/cm</td>
<td>507 µS/cm</td>
<td>544 µS/cm</td>
<td>542 µS/cm</td>
<td>546 µS/cm</td>
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</tbody>
</table>

**COMMENT:**

Method 4500-B-24 page 65 electrometric method 4500-B-24 page 65 electrometric method adapted from standard methods 19th edition for the examination of water and waste water by AMF

Authorized by:  

Technical Manager  
Khadheefa Nashwa  
Date: 27th January 2011
**National Health Laboratory**  
Maldives Food and Drug Authority,  
Sosun Magu, Male' 200500, Republic of Maldives  
Telephone #: 3343538, Fax #: 3304570  
WATER CHEMISTRY ANALYTICAL RESULTS  
REPORT NUMBER: NHL/TR-WC/RC1561  

**NAME AND ADDRESS OF CLIENT:** MEDHUFUSHI ISLAND RESORT, M. ATOLL,  
TEL: (+960) 6720079, AAA & TRADING COMPANY, MAJEEDHEE MAGU,  
TEL: (+960) 3337707  FAX: (+960) 3314842  

**PURPOSE OF TESTING:** Quality Monitoring  
**LOCATION OF TESTING:**  

<table>
<thead>
<tr>
<th>LOCATION OF SAMPLE</th>
<th>VILU BAR ICE CUBE</th>
<th>DESALINATION PLANT</th>
<th>GUEST ROOM</th>
<th>MAIN KITCHEN</th>
<th>CRYSTEL PLANT</th>
<th>STAFF KITCHEN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date Sampled/Processed</td>
<td>19/12/2010</td>
<td>19/12/2010</td>
<td>19/12/2010</td>
<td>19/12/2010</td>
<td>19/12/2010</td>
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</tr>
<tr>
<td>Time Sampled</td>
<td>0500</td>
<td>0500</td>
<td>0500</td>
<td>0500</td>
<td>0500</td>
<td>0500</td>
</tr>
<tr>
<td>Type of Water</td>
<td>Desalinated</td>
<td>Desalinated</td>
<td>Desalinated</td>
<td>Desalinated</td>
<td>Desalinated</td>
<td>Desalinated</td>
</tr>
<tr>
<td>Data Tested</td>
<td>19/12/2010</td>
<td></td>
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</tr>
<tr>
<td>Sample ID</td>
<td>191210WC128</td>
<td>191210WC130</td>
<td>191210WC131</td>
<td>191210WC132</td>
<td>191210WC133</td>
<td>191210WC134</td>
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</tbody>
</table>

**PARAMETER TESTED**  

<table>
<thead>
<tr>
<th>Parameter Tested</th>
<th>Physical Appearance</th>
<th>pH</th>
<th>Electrical Conductivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>Clear</td>
<td>7.3</td>
<td>518 µs/cm</td>
</tr>
</tbody>
</table>

**COMMENT:**  

Authorized by  

[Signature]  

Date: 20th December 2010  

**NOTE:** Information supplied by the client  

This Result is valid only for this sample. This report is not for duplicate or advertisement without prior approval from NHL.
### NATIONAL HEALTH LABORATORY

**Maldives Food and Drug Authority, Sosun Magu, Male' 200500, Republic of Maldives**

**Telephone #: 3343538, Fax #: 3304570**

**WATER CHEMISTRY ANALYTICAL RESULTS**

**REPORT NUMBER:** NHL/TR-WC/RC1561

---

**NAME AND ADDRESS OF CLIENT:** MEDHUFUSHI ISLAND RESORT, M. ATOLL, TEL: (+960) 6720076, AAA TRADING COMPANY, MAJEEDHEE MAGU, TEL: (+960) 3337707, FAX: (+960) 3314842

**PURPOSE OF TESTING:** Quality Monitoring

**COLLECTED BY:**

**TIME TESTED:** 11.15

---

**LOCATION OF SAMPLE**

<table>
<thead>
<tr>
<th>VILU BAR ICE CUBE</th>
<th>DESALINATION PLANT</th>
<th>GUEST ROOM</th>
<th>MAIN KITCHEN</th>
<th>CRYSTEL PLANT</th>
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</thead>
<tbody>
<tr>
<td>Requisition Form No.</td>
<td>NHL/WC: 2010/RG1236</td>
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</tr>
<tr>
<td>Time Sampled</td>
<td>0500</td>
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</tr>
<tr>
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<td>Desalinated</td>
<td>Desalinated</td>
<td>Desalinated</td>
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</tr>
</tbody>
</table>

**Date Tested:** 19/12/2010

**Sample ID:** 191210/WC129 191210/WC130 191210/WC131 191210/WC132 191210/WC133 191210/WC134

**PARAMETER TESTED**

<table>
<thead>
<tr>
<th>Physical Appearance</th>
<th>Clear</th>
<th>Clear</th>
<th>Clear</th>
<th>Clear</th>
<th>Clear</th>
<th>Clear</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>7.3</td>
<td>7.4</td>
<td>7.2</td>
<td>7.3</td>
<td>7.4</td>
<td>7.2</td>
</tr>
<tr>
<td>Electrical Conductivity</td>
<td>518 μS/cm</td>
<td>518 μS/cm</td>
<td>518 μS/cm</td>
<td>519 μS/cm</td>
<td>519 μS/cm</td>
<td>491 μS/cm</td>
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</tbody>
</table>

**REFERENCE RANGE**

W.H.O. Guideline for Drinking Water

**TEST METHOD**

Method: 5006 B and 51 page 65 photometric method. Adapted from standard methods 19th edition for the examination of water and waste water by EPA.

Adapted from owning spectrometer brand instruction manual.

---

**COMMENT:**

Authorized by:

Technical Manager
Khadeja Naseema

Date: 20th December 2010

**NOTE:** Information supplied by the client

This Result is valid only for this sample. This report is not for duplicate or advertisement without prior approval from NHL.
National Health Laboratory
Maldives Food and Drug Authority,
Soasun Magu, Male 200500, Republic of Maldives
Telephone # 334 3537, Fax # 330 4570
WATER MICROBIOLOGY ANALYTICAL RESULTS
REPORT NUMBER: NHL/TR-WM/RC1417

NAME AND ADDRESS OF CLIENT: Medhufushi Island Resort,
M. Atoll, Tel: +960 672 0079,
AAA Trading Company, Maafushi Magu
Tel: +960 333 7707, FAX: +960 331 4942

PURPOSE OF TESTING: Quality Monitoring

<table>
<thead>
<tr>
<th>LOCATION OF SAMPLE</th>
<th>Medhufushi Island Resort</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Villu Bar Ice Cube</td>
</tr>
<tr>
<td></td>
<td>Desalination Plant</td>
</tr>
<tr>
<td></td>
<td>Guest Room</td>
</tr>
<tr>
<td></td>
<td>Main Kitchen</td>
</tr>
<tr>
<td></td>
<td>Crystal Plant</td>
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<tr>
<td></td>
<td>Staff Kitchen</td>
</tr>
<tr>
<td>Requisition Form No:</td>
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<tr>
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<tr>
<td>Time Sampled</td>
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<tr>
<td>Type of water</td>
<td>Desalinated Water in sterilized Bottles</td>
</tr>
<tr>
<td>Date Tested</td>
<td>19/12/10</td>
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<tr>
<td>Sample ID</td>
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<td>191210WM 125</td>
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<td>191210WM 126</td>
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TEST METHOD
REFERENCE RANGE
WHO Guideline for Drinking Water

<table>
<thead>
<tr>
<th>PARARMETER TESTED</th>
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</thead>
<tbody>
<tr>
<td>Total Coliform Count (/100ml)</td>
<td>0</td>
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<tr>
<td>Fecal Coliform Count (E.coli) (/100ml)</td>
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</table>

NOTE: Information supplied by the client.
This Laboratory is not accredited for the test marked by "*".
This Result is valid only for this sample. This report is not for duplicate or advertisement without prior approval from NHL.

Authorized by:
Technical Manager
Marilyam Nisha

Date: 20th December 2010

Page 1 of 1