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## **SECTION 6**

# **EMPLOYER'S REQUIREMENT**

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## SECTION 6 – EMPLOYER’S REQUIREMENT

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This section provides the requirements of the project including preliminary and detailed Surveys, Preparation of Concept Design, preparation of Environmental Impact Assessment (EIA), Detailed Design and execution of Construction works. The basic design requirements of the project will be governed by the technical specifications/guidelines of Environmental Protection Agency (EPA) of Maldives. Where there is a conflict between EPA guidelines and this Employers requirement, the higher requirement should prevail.

The section is divided into the following sub-sections:

- 6.1 Employer’s Requirement: Survey and Design Requirements,
- 6.2 Employer’s Requirement: Construction Part 1: General Works
- 6.3 Employer’s Requirement: Construction Part 2: Water Supply System Works
- 6.4 Employer’s Requirement: Construction Part 3: Sewerage System Works
- 6.5 Employer’s Requirement: Typical Drawings
- 6.6 Land use plan of the islands

*Note 1: This Employers requirement is prepared as a combined requirement for the Contracts (lots) specified under Invitation to Bid bearing reference (IUL)13-K/13/2020/51. The bidder may disregard the requirements which is not relevant to the Lot(s) for which the bidder is submitting Bids.*

*Note 2: The following EPA guidelines/regulations will be available for download from the link <http://www.epa.gov.mv/regulations>*

*Water Supply: Design criteria and technical specifications – Design and Construction of water Treatment and Supply System*

*Sewerage system: Design criteria and technical specifications for conventional gravity sewerage systems.*

*Regulation on preparation of Environmental Impact Assessment*

*Borehole drilling: Technical Specifications and guidelines*

*Supply Water Quality Standard*

## 6.1 EMPLOYER’S REQUIREMENT: SURVEY AND DESIGN REQUIREMENTS

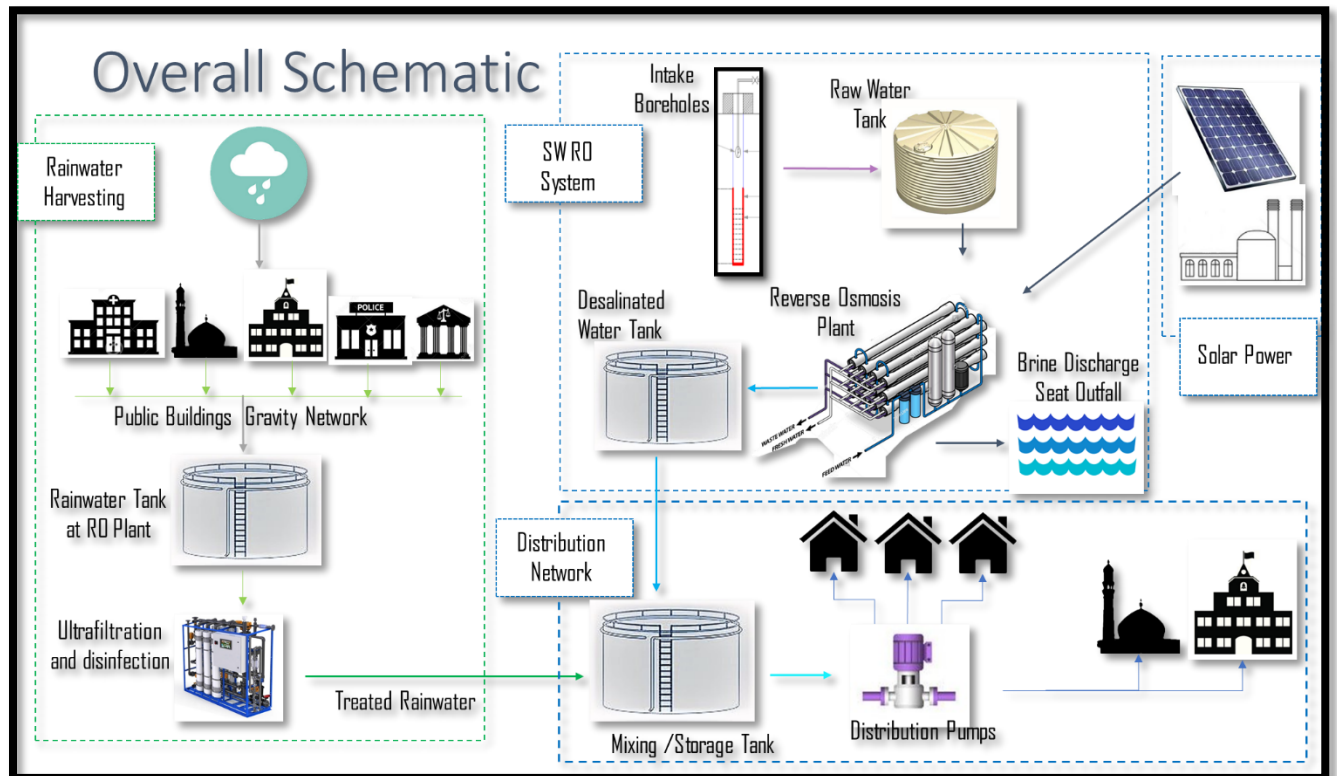
### 6.1.1 ISLAND INFORMATION

#	Atoll	Island	Type of System	Population (2017) *	Land Use Plan
1	Ha	Utheemu	Water Supply	950	Approved
2	Ha	Molhadhoo	Water Supply and Sewerage	381	NA
3	Hdh	Naivaadhoo	Sewerage	849	Approved
4	R	Rasmaadhoo	Water Supply	869	Draft Plan
5	R	Maakurathu	Water Supply	1,318	NA
6	Aa	Bodufulhadhoo	Water Supply and Sewerage	801	Approved
7	M	Veyvah	Water Supply and Sewerage	316	NA
8	F	Feeali	Water Supply	1,263	NA
9	Dh	Hulhudheli	Water Supply	937	Approved
10	Dh	Maaen'boodhoo	Water Supply	1,006	NA
11	Dh	Rin'budhoo	Water Supply and Sewerage	429	Approved
12	Th	Burunee	Water Supply	607	NA
13	Th	Omadhoo	Water Supply and Sewerage	777	NA
14	Th	Veymandoo	Water Supply	1,305	Draft Plan
15	L	Dhan'bidhoo	Water Supply	1,041	NA
16	L	Mundoo	Water Supply and Sewerage	305	NA
17	Ga	Kon'dey	Water Supply and Sewerage	547	Approved
18	Gdh	Rathafandhoo	Water Supply and Sewerage	1,385	Approved

\*source: isles.gov.mv

*The bidder should verify the accuracy of the population data provided above.*

## A- WATER SUPPLY SYSTEM

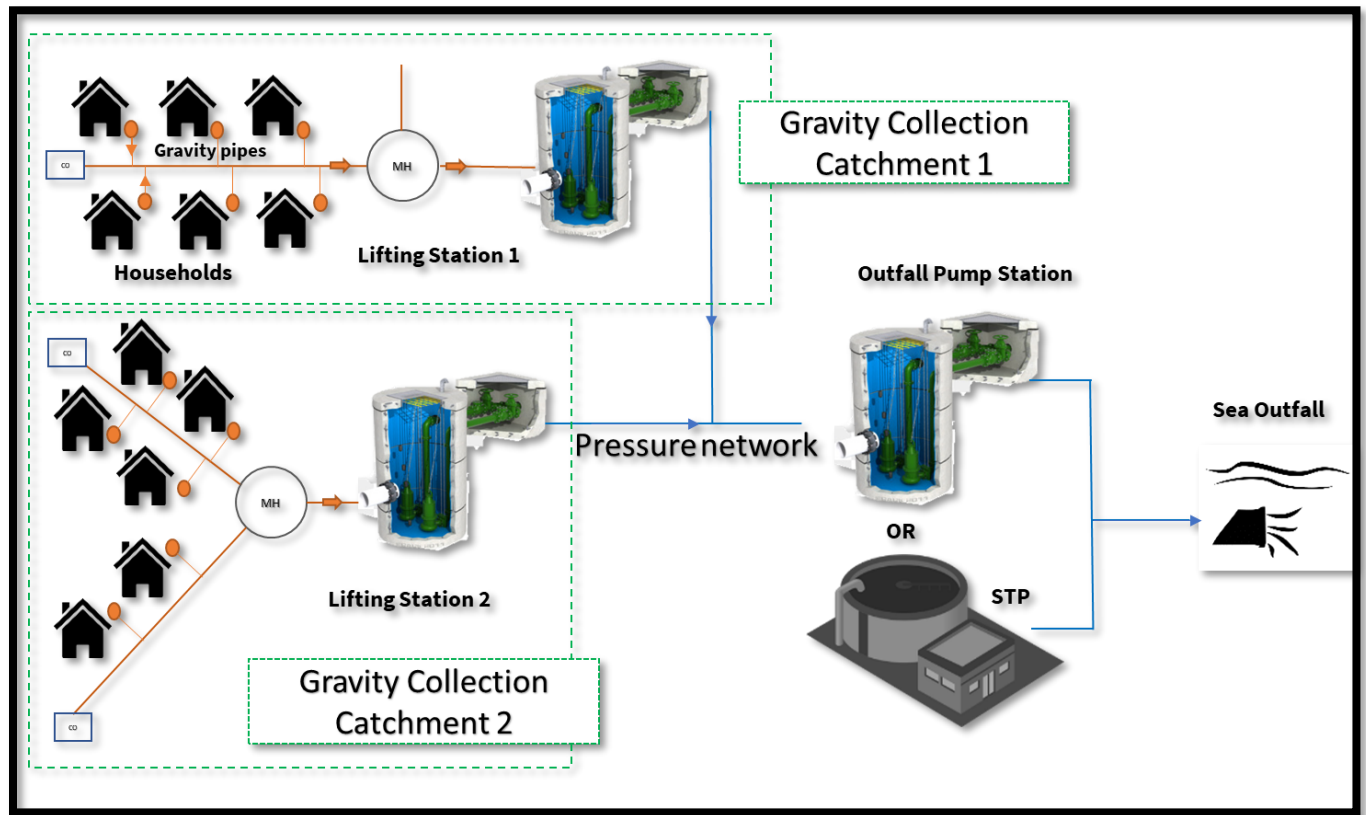


The Water Supply System design should be based on IWRM systems which include the following components (Where one of these components are available in the island the system should be designed after discounting that component from the overall sizing)

- **RO Plant** - Sea Water RO treatment with pretreatment and post treatments. The RO plant should be compact and sized based on the island specific requirements. The RO plant should be sized to cater the projected water demand of **15 years**. As a minimum requirement, domestic consumption of **50 LPCD** should be assumed to size the plant. Additional institutional/commercial demand should be calculated based on island specific surveys.
- **Distribution Network:** The network should be designed to cover the entire inhabited area of the island and the proposed development areas shown in the land use plan of the islands. The of distribution network should be designed to cater the 35-year peak demand of the island.
- **Rainwater Collection Network:** Rain water collection and treatment system should be incorporated into the water supply system. Rainwater should be collected from public building roofs and should be collected through a gravity network. It is expected that rainwater component will be able to cater **15-25%** of total water demand of the island.

- **Rainwater Treatment:** Ultrafiltration and UV/Chlorine disinfection treatment
- **Solar power:** Photovoltaic modules in plant building roof top should be used to either provide a grid connection or it should be provided with inverters and a standalone system where energy can be utilized for RO plant operation
- **Storage Tanks, Feed Water Tanks and Brine Tanks** should be provided as deemed necessary. As a minimum requirement, 02 product water storage tanks, with combined capacity of **7 days** water demand should be provided,
- **RO/Administration building** – Facility building should be provided to house the RO facilities and rainwater treatment plant. The building should also include adequately sized administrative office, control room, laboratory, storage room and vehicle parking area. Plot boundary walls (Combination of masonry and steel railings) should be provided around the building.
- **Household Connections:** each household and institutional/commercial facility should be provided with a metered connection.
- **Provision of Water Quality Testing Equipment:** As Specified under Section 6.2 Employers requirements, Scope of works for water distribution system.

## B- SEWERAGE SYSTEM



The Gravity Sewer System should be provided with the following components

- **Gravity Network/Catchment:**

- The minimum slope for the sewer mains is 1:250 and is preferred to be maintained between 1:250 to 1:200.
- The maximum excavation depth for the sewer main is 2.5m.
- Each Household should be provided with 315-400mm dia Household catch pit, which will transfer the sewage through lateral connections (110mm dia) leading to sewer mains (160mm dia).
- At starting point of each sewer main section Maintenance shaft (MS) or cleanouts (CO) can be used
- The sewer main should have a minimum cover of 600mm (From ground level to the top/crown of the pipe) at all starting MS
- The network should have 600mm manholes at all junctions or at maximum intervals of 60m. The last manhole or the final manhole leading up to PS/LS could be provided as 1000mm dia.

- The gravity network should cover the entire island (if approved or draft land use plans are available) and should facilitate the immediate implementation of selected catchments for the inhabited area of the island. The additional catchments required to cover the entire island should be designed to facilitate the phasing out of the works.

- **Pump Stations (PS)/Lift Stations (LS):**

- The Sewer mains will discharge sewage into lift Stations (LS)/Pump Stations (PS)
- Estimation of size of catchment for each PS/LS should be made to utilize the maximum coverage area within the trench excavation restriction of 2.5 m set by EPA.
- The PS/LS should include, sump, valve chamber, vent structures and control panel
- PS/LS should be provided for each gravity catchment with TWO submersible pumps controlled based on the level sensors/Float switches.
- Based on the sewage levels within the PS/ LS sump, the pumps should operate automatically to discharge the sewer into pressure network.
- Sewage pumped into pressure network from LS/PS located at each catchment should be discharged to sea via sea outfall.
- The discharge will be directly into sea away from the reef edge and into a minimum depth of 6m.
- The sea outfall should be protected with ballast block and diffusers at the discharge point should be provided.

- **Sewage Treatment Plant (STP)**

- The Contractor shall carry out a detailed analysis of different types of STP's in respect to Operation and Maintenance Costs, Investment Cost, foot print, complexity etc and shall propose to the Employer for selection of the type of STP to be implemented. The contractor shall then carry out the detailed design as per the approved concept.
- As a minimum requirement, the Sewage Treatment Plant (STP) shall be designed to cater for the 30 year Peak Wet Weather Flow (PWWF) and should achieve the following effluent standards;

BOD5	20 mg/L
COD	50 mg/L
TSS	30 mg/L

**Provision of Equipment for O&M and Spare parts:** Providing spare parts and Equipment required for operation and maintenance of the system including O&M Manuals etc. as specified under Section 6.2 Employers requirements, Scope of works for sewerage system.

### 6.1.2 DELIVERABLES

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The following Survey and design deliverables should be completed within 04 months of commencement.

#### 1. Preliminary surveys

- a) As part of stakeholder engagement, meetings with all relevant stakeholders and public should be carried.
- b) Locations including alternatives for water supply facilities and/or sewerage facilities should be identified in consultation with island councils and based on approved land use plans of the island.
- c) Locations for Pump stations (PS) /Lift stations (LS) should be selected to maximize the coverage area and to minimize the number of PS/LS.
- d) Where there is limited land area, the pump station/lift stations can be located at the center of road junctions.
- e) In locating any PS/LS on roads care should be taken to avoid placement of vent structures near households and to locate the vents next to open lands such as football grounds and cemeteries.

#### 2. Topographic Survey:

The survey should be carried out in accordance with the guidelines set out from Maldives Land Survey Authority (MLSA). The following aspects should be covered in the survey.

- a) Three bench mark should be placed as per Control Survey Guideline of MLSA standards and should be registered with MLSA
- b) The land use plan of the islands
- c) Topographic survey for the entire island at plot levels should be carried
- d) Names and details of roads should be properly marked
- e) Public buildings should be taken with internal layouts to demarcate the exact position of the building and roof areas.
- f) High tide line, low tide line, and vegetation lines should be taken.
- g) Harbor basin and any revetment should be mapped in the drawing
- h) Significant trees, electric distribution boxes, electric light poles should be marked in the survey map.
- i) Where possible type of vegetation should be provided and any trees falling on immediate network coverage area or on facility locations should be properly mapped in the survey.



- j) The levels on all existing roads should be taken at 10m intervals from the center of the road and at all junctions
- k) Proposed facility locations and alternative locations should be mapped with existing ground levels.
- l) Bathymetry for proposed outfall locations and alternatives should be taken.
- m) All survey files, including editable copies should be provided to the employer along with land allocation maps for approval.

### 3. Geotechnical Investigations:

- a) Preliminary Geotechnical survey should be carried and can be restricted to inspection pits or scalar penetrometer tests.
- b) Inspection pits up to a depth of 1.5m with the log of soil conditions should be provided.
- c) Inspection pits at all facility locations should be carried out and any requirement for ground improvement should be identified

### 4. Concept Design:

The Overall Concept of the System should be based on the schematic diagram(s) provided above and should include the following information/documents as a minimum requirement.

- Background of the project: Geographical setting, Existing Water and Sewerage facilities, details of the surveys conducted.
- Demographic data: Detailed assessment of existing population and housing including future projections
- Water Demand calculation for current, 15 year and 30-year horizons, based on the surveys.
- Sizing of RO plant and storage tanks
- Floor plan/layout of the RO/Administration building.
- Wastewater flow calculation for current, 15 year and 30-year design horizons (sewer)
- Pump Stations and catchment boundaries (sewer)
- Comparative analysis of different STPs considering factors such as but not limited to, long term operational costs, footprint, investment cost, complexity and propose the best option for implementation.
- Land allocation Map
- Meeting minutes of stakeholder consultation meetings.
- Household willingness to pay survey for a minimum of 30% of the households should be carried.

### 5. Environmental Impact Assessment (EIA)

After finalization of land allocation and concept design, EIA works should be initiated and reported in accordance to EPA guidelines and regulations.

## 6. Detailed Design

Detailed design of water supply and/or sewerage facilities should be carried out based on the approved concept design and should provide detailed engineering calculations of the proposed water supply and/or sewerage facilities. Design should be carried out in accordance with the design guidelines of EPA and the requirements stated herein. If the aforementioned documents are silent on any aspect of the system, International Design Standards and best engineering practices should be followed.

The detailed design report should include the following;

- a) Detailed engineering calculations and design of civil, electrical and mechanical components of water supply and/or sewerage facilities including detailed calculation and analysis of water distribution network, rainwater network and gravity sewerage network
- b) Construction Drawings
- c) All the gravity profiles should be provided.
- d) All Electrical drawings should be stamped by an Engineer licensed from Maldives Energy Authority (MEA). If required, the drawings should be approved by MEA.
- e) All structural components of the design including buildings, pump stations, STP components, foundations, plinths etc should be stamped by an accredited checker.