Maldives National Water Accounts

2018 & 2019

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Utility Regulatory Authority

Ministry of Fisheries, Marine Resource and Agriculture

Ministry of Tourism

National Disaster Management Authority

Maldives Meteorological Services

Atoll Councils

Male' Water and Sewerage Company

Fenaka Corporation Limited

State Electric Company Limited

Handy Holdings

Maldives Aerated Water Company Pvt Ltd

Happy Market Trading Company Pte Ltd

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ABBREVIATIONS

CGS	Conventional Gravity System
EIA	Environmental Impact Assessment
Fenaka	Fenaka Corporation Limited
GCF	Green Climate Fund
ISIC	International Standard Industrial Classification
MAWC	Maldives Aerated Water Company (PVT) LTD
MCS	Maldives Customs Services
MoE	Ministry of Environment
MWSC	Male' Water & Sewerage Company
NBS	National Bureau of Statistics
PSUT	Physical Supply and Use Tables
SBS	Small Bore System
SDGs	Sustainable Development Goals
SEEA	System of Environmental-Economic Accounts
SEEA-Water	System of Environmental-Economic Accounts for Water
Stelco	State Electric Company Limited
STP	Sewerage Treatment Plant
UNDESA	United Nations Department of Economic and Social Affairs
UNDP	United Nations Development Programme
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
URA	Utility Regulatory Authority
VCS	Vacuum Sewerage System

EXECUTIVE SUMMARY

Maldives has secured water supply systems for 41 per cent of the population and sanitation services for 48 per cent of the population. Although this is nearly half of the population for both water and sanitation services, water supply system is in 40 islands and sanitation services is in 66 out of the total 187 inhabited islands. Therefore, to secure water and sanitation services for the remaining population, investments and service provisions need to continue for most of the inhabited islands.

Given that the only freshwater resource inland is the groundwater aquifer, Maldives is highly dependent on desalination of seawater for producing safe water for the Maldivian people. Groundwater is vulnerable to saltwater intrusion as well as seepage from poor sewerage systems. Groundwater is mostly used in the atolls for non-potable purposes. Similarly, rainwater is also used mostly in the atolls for both non-potable and drinking purposes. However, more people are opting for bottled water for drinking as rainwater harvested from roof tops is deemed unsafe for drinking. The water situation of industrial islands need to be studied further for better understanding and data requirements for the Water Accounts.

The compilation of the Water Accounts considers flows of water: (1) from the environment to the economy; (2) exchanges of water within the economy among the different industries and households and; (3) the return flow of water from the economy to the environment. The Water Account is presented as Physical Supply and Use Tables (PSUT). The Use Table consists of water abstracted from the environment and the use of water received from other economic units by industry. The Supply Table includes the supply of water to other economic units and to the environment.

Water Accounts for 2018 and 2019 was prepared with limited data available and using estimations based on existing studies. The data and analysis from the Water Accounts must be used with caution as the Water Accounts were prepared with significant limitations in data. Below are the totals from the PSUT for both 2018 and 2019.

PSUT component	2018 (tons)	2019 (tons)
Total Use	627,088,694	793,392,116
Total Supply	479,249,681	665,381,366
Total consumption	147,839,013	128,010,750

According to the Water Accounts of 2018 and 2019, the main use of water was from the abstraction of seawater for desalination by the Water Supply industry while the main supply of water was the discharge of brine as reject water from the desalination process. Supply of water is under-estimated as there was no data on the flow of wastewater from the different industries and households to the

sewerage system and the discharge of wastewater from the sewerage systems to the environment. The total consumption of water is considered over-estimated as there was no data available on the wastewater discharged through the sewerage systems. With improved data, the results in the PSUT is likely to change considerably.

From the process of compilation of the Water Accounts, it was evident that there are opportunities to improve the Water Accounts for 2018 and 2019. The main service providers related to water and sanitation have established data systems for their billing purposes. Although the customer registration is by residential, commercial and government institutes, through collaboration with the service providers data could be obtained and assessed for classification by industries for a representative sample size by the geographic locations where they operate. In addition, some of the service providers indicated that wastewater discharge could be estimated based on the pumping hours at some of their pumping stations. As the information was not readily available from the stakeholders, this data could not be accessed during the project period.

With the Water Accounts improved with further data, the country level progress on the relevant Sustainable Development Goals (SDGs) can also be monitored for some of the targets using the Water Accounts. Upon assessing the usefulness of the Water Accounts for the evaluation of the national policies related to water and sanitation, it was found that the current policies are on infrastructure and service provisions. The Water Accounts can be used for policy discussions related to features such as preservation of water resources and efficiency of water use.

The next steps in the compilation of the Water Accounts need to focus on establishing institutional mechanisms to undertake the data collection regularly and efficiently and optimizing the existing opportunities to improve the Water Accounts for 2018 and 2019. In addition, the National Bureau of Statistics (NBS) should work with the Utility Regulatory Authority (URA) and the Ministry of Environment (MoE) to develop the Water Accounts further to serve the purposes of all the agencies. This includes understanding and identifying the data needs of the key agencies in order to ensure the protection and preservation of the natural water resources, minimization of pollution of the environment from the water and sanitation services and adaptation to climate change to secure safe water for the people of the Maldives.

1 INTRODUCTION

1.1 Purpose

In 2017, the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) commissioned a system-wide review of the National Statistical System of the Maldives. In line with the recommendations of the review, UNESCAP supported the Maldives in conducting an assessment of the priorities, opportunities, constraints and feasibility for strengthening environment statistics with the goal of improved monitoring of the SDGs. The assessment recommended to identify the data compilation priorities as a foundation towards developing a national mechanism for compilation of environment statistics.

Building on the initial assessment in 2017, Water and Waste were identified as the first step to focus on strengthening environmental statistics. During 2018 UNESCAP conducted a review on the current data availability and guided the working group on environment statistics to develop waste and water accounts by a local expert. It reviewed the available data through all sources and obtained data available on waste and water for 2017 and prepared test accounts for waste and water.

Based on the recommendations of the review and pilot accounts, UNESCAP is assisting the NBS and the Working Group in progressing the work on water accounting, with an aim to compile and publish water accounts for 2018 and 2019 according to the System of Environmental-Economic Accounts (SEEA).

The purpose of this report is to present the national Water Accounts for the Maldives for the years 2018 and 2019. The specific objectives are to:

- Introduce a framework that serves as a basis in data collection and preparation of the water accounts;
- Bring together different information sources into a holistic picture of water flows using an accounting framework;
- Develop a multi-purpose data system which serves user needs - government, service providers, Non-Governmental Organizations, citizens;
- Identify key indicators and proxy indicators on water for evaluating effectiveness of national policy and planning, as well as progress on SDGs;
- Identify data gaps and propose activities that will help improve data collection and dissemination.

Hence, this work has looked at the water sector in-depth for the purpose of obtaining data that can be used in the compilation of the national water accounts for 2018 and 2019.

1.2 Scope

This report focuses on abstraction of water from the environment, flow of water within the economy and flow of water from the economy to the environment within the Maldives as per SEEA-Water published by United Nations Department of Economic and Social Affairs (UNDESA) (2012).

Data used is from existing data provided by the different stakeholders.

All data are presented as metric tons.

Geographic coverage of data sought was country-wide.

Period of data is time-bound to 2018 and 2019 unless otherwise specified.

1.3 Report structure

This report consists of eight chapters as follows:

Chapter 1 Introduction

Chapter 2 Background and context

Chapter 3 Framework for Water Account

Chapter 4 Water Accounts 2018 & 2019

Chapter 5 Methodology

Chapter 6 Conclusion

Chapter 7 Recommendations

Chapter 8 References

2 BACKGROUND AND CONTEXT

Maldives is a coral archipelago made up of about 1192 islands and sandbanks (Stevens & Froman, 2018), each located in one of the 26 atolls that lies in the Indian Ocean between Latitude 7° North 6 minutes to Latitude 0° 42 minutes South and between Longitude 72° 33 minutes and 73° 44 minutes East (Maniku, 1990).

The population of the Maldives is distributed over 187 inhabited islands, 109 resorts and 128 industrial/other use islands (National Bureau of Statistics, 2016). The projected population of the Maldives for 2018 and 2019 was 512,038 and 533,941 respectively.

This chapter provides describes the existing water situation in the Maldives and makes the case for data collection and analysis related to water.

2.1 Existing situation of water and sanitation

2.1.1 Water resources & availability

The only natural freshwater resource in the islands of the Maldives is a groundwater aquifer, which consists of a freshwater lens that floats on top of a dense saline water layer (Wickramagamage, 2017). The freshwater lens is formed and recharged by rainfall that infiltrates and percolates through the islands' soil layer. The thickness of the freshwater lens depends on multiple factors such as the geology of the island; size, porosity and permeability of soil; the amount of rainfall; the sea level and the groundwater extraction rate (MoEnv, 2020). This freshwater lens is highly susceptible to contamination from sewage seepage and saltwater intrusion.

High permeability of soil in the Maldives prevents the formation of inland water bodies (Deng & Bailey, 2017). However, some islands do have small brackish water ponds (locally called Kulhi/Kilhi) formed in swampy wetland and/or mangrove areas.

Rainwater is captured from roofs and collected into tanks in households and/or in communal tanks in the majority of the inhabited islands. Rainwater harvesting was not widely practiced in the Maldives, until late 20th century (Ministry of Environment and Energy, 2017).

Given the limited natural freshwater resources and the susceptibility of the freshwater lens to contamination, Maldives relies primarily on desalinated water, and bottled water to meet the increasing water demand.

With stricter regulations restricting usage of groundwater in tourist resort islands, some of the resorts use treated wastewater for landscaping and non-potable uses (e.g., toilet flushing).

Table 1 provides a summary of current situation of these water resources in the Maldives.

Table 1 Water resources and their current situation

Type of water	Existing situation
Groundwater	- Groundwater is abstracted via wells and is mainly used for non-potable needs such as bathing, washing and toilet flushing (Ministry of Environment and Energy, 2017). - Recently groundwater aquifer volume has been estimated by the MoE in 13 community islands across the Maldives (MoEnv, 2020), the study shows that size of the island and population density are key factors that affect the quality and quantity of freshwater lens. - Increased extraction exceeding natural recharge through rainfall has depleted groundwater lens of Male' and other densely populated islands.
Surface water	- Wetlands and/or mangrove areas are recorded in about 75 islands of the Maldives (Ministry of Environment and Energy, 2015). These wetlands or mangrove areas support brackish water ponds of varying sizes. The largest wetland area is located in Fuvahmulah island measuring 1.41 km^2 area (Ministry of Environment and Energy, 2017). - This surface water is not used as a water source because it is brackish and current regulation does not allow abstraction of surface water for desalination.
Rainwater	- There are regional variations in average annual rainfall. The average annual rainfall from 1978 to 2012 in the southern atoll was 2,218 mm, central atolls 1,966 mm and northern atolls 1,790 mm (Ministry of Environment and Energy, 2017). - Rainwater is used for drinking by almost 40 per cent of households across the country (NBS, 2019) - There is a significant difference between Malé and the rest of Maldives in harvesting and usage of rainwater. Rainwater is the main source of drinking water for 75.9 per cent of households in the atolls while in Male' it is 0.4 per cent (NBS, 2019).
Desalinated Water	- All desalination plants in the Maldives abstract seawater directly via sea or boreholes drilled below the groundwater lens, and brine (by-product of desalination process) is directly disposed to the sea via an outfall pipeline. - Currently there are 39 community islands that have desalinated water supply systems (Ministry of Environment). This accounts for about 70 per cent of the population. - Desalinated water supply systems are currently under construction at 67 community islands and is planned for another 81 islands (Ministry of Environment). On completion these projects will cover all the community islands of the Maldives. - All operational tourist resorts have their own desalination plants. - Households that use desalinated water for drinking is 12.3 per cent (NBS, 2019). - In Male', 20.8 per cent of households use desalinated water for drinking while in atolls it is 4.6 per cent of households (NBS, 2019).
Bottled Water	- Bottled water is used for drinking in 47.6 per cent of households in the Maldives (NBS, 2019). - In Male', 78.9 per cent of households use bottled water for drinking while in the atolls 19.1 per cent of households use bottled water as drinking water (NBS, 2019). - Most of the bottled water comes from bottle water companies in the Maldives. Some of these bottling plants also produce soft drinks (carbonated and non-carbonated).

2.1.2 Sanitation

There are three types of sewerage systems used in the Maldives:

(1) Conventional Gravity System (CGS)
(2) Vacuum Sewerage System (VCS)

(3) Small Bore System (SBS)

Sewerage systems have been established in 72 islands, of which 59 islands have CGS, five islands have VCS and eight islands use SBS (Ministry of Environment). Only 26 of these islands have sewerage treatment plants (STP) installed and only 10 of these STPs are in use.

Sewerage systems are under construction at 69 islands, and MoE has plans to construct sewerage systems in 46 other islands. On completion these projects will cover of all inhabited islands of the Maldives.

2.1.3 Access to water and sewerage

By the end of 2016, 41 per cent of the population had access to water supply systems (Ministry of Environment and Energy, 2017).

By the end of 2016, 48 per cent of the population had access to sewerage networks (Ministry of Environment and Energy, 2017).

2.1.4 Service providers

There are state-owned, public and private organizations involved in the provision of water and sanitation services in the Maldives. Table 2 provides a summary of water suppliers and number of community islands and populations to which they provide water supply services. Based on the data received from MoE, URA and the different service providers, out of the 187 inhabited islands, water supply network is established in 40 islands, covering 70 percent of the population. Water supply systems are under development or planned in the remaining islands.

Table 2 Water service providers in inhabited islands

Water Supplier	Number of islands	Projected Population	
		2018	2019
Fenaka Corporation Limited (Fenaka)	28	79,748	81,313
State Electric Company Limited	4	7,436	7,643
Malé Water and Sewerage Company	4*	218,773	229,992
Villa Utilities Maamigili	1	2,885	2,985
ALTEC Maldives Pvt Ltd	1	1,216	1,247
Ungoofaaru Council	1	1,698	1,738
Huraa Council	1	1,730	1,810

Total	**40**	**306,050**	**326,728**

**Includes Malé City which consists of Malé, Villingili and Hulhumalé*

Table 3 is a summary of sewerage system operators and the number of islands and populations for which they provide sewerage services. Data available from MoE, URA and service providers shows that 66 islands out of the 187 inhabited islands have sewerage systems, covering about 77% of the population. Sewerage systems are under development or planned in the remaining islands.

Table 3 Sewerage system operators in inhabited islands

Sewerage service provider	Number of islands	Projected Population	
		2018	2019
Fenaka Corporation Limited	56	112,930	115,163
State Electric Company Limited	4	7,347	7,621
Villa Utilities Maamigili	1	2,885	2,985
Malé Water and Sewerage Company	4	218,773	229,992
ALTEC Maldives Pvt Ltd	1	1,216	1,247
Total	**66**	**343,151**	**357,008**

2.1.5 Water shortage

Communities in the Maldives experience water shortage during the northeast monsoon which extends from January to April. In addition to the dry season, one of the main reasons for the shortage of water is the inadequate storage of rainwater combined with the absence of water production mechanisms such as desalination. Inadequate storage of rainwater relates both to insufficient storage capacity as well as small roof catchment areas within these islands.

In 2018, a total of 48 inhabited islands representing 10 per cent of the total population (45,798) experienced water shortage. The islands were supplied with emergency water of 1,460 metric tons. The government expenditure to supply emergency water was a total of MVR3,345,509 at a rate of MVRMVR2292 per metric ton of water.

The number of islands that needed emergency water in 2019 increased to 82 which was 16 per cent of the total population (73,622). A total of 3,887 tons of water being supplied to these islands. A total MVR11,043,280 was spent on the supply of emergency water at a rate of MVR2,841 per ton.

2.2 Case for improving and combining water-related data

Water and sewerage resources and services are governed by several policies and legislation. The National Water & Sewerage Policy 2017 and the Strategic Action Plan 2019-2023 are the key policy documents related to the water and sanitation sector. The Water and Sewerage Act (8/2020) enacted in 2020 is the main legislation. These policies and laws include provisions that need data to assess progress and evaluate effectiveness.

2.2.1 Policy and legislation

Table 4, Table 5 and Table 6 provide summaries of policies and legislation relevant to water and sanitation in the Maldives.

There are requirements for maintaining data related to water and sanitation under the Regulation on providing water and sewerage services in the Maldives (2021/R-23). The responsible agency to collect and maintain information on water and sanitation is the URA.

Table 4 Key policies on water and sanitation

#	Name	Summary	Goals/Objectives/Targets	Stakeholder(s)
1	National Water and Sewerage Policy 2017	National Water and Sewerage Policy sets out the government's plans for water and sewerage services in the future and steps that will be taken to ensure provision of appropriate and sustainable water and sewerage services for all.	- Ensure access to safe water and adequate sewerage services - Adopting cost effective, environment friendly and appropriate technologies - Strengthening legal framework - Encourage private sector investments - Building institutional capacity - Maintain financial and environmental sustainability - Strengthen advocacy and awareness - Promote research and development - Protect and conserve water resources	- Ministry of Environment
2	Strategic Action Plan 2019 – 2023 2019	- Policy 1: Ensure access to safe water supply and adequate sewerage services. - Policy 2: Adopt cost-effective and environment-friendly, water infrastructure - Policy 3: Build sector capacity in water resources, water supply and sewerage services. - Policy 4: Strengthen advocacy and awareness programmes in water resources, water supply and sewerage	- By 2020, Utility Regulatory Authority for integrated utility services is functional; - By 2023, all water and sewerage utility providers have an operating license; - By 2023, all inhabited islands will have access to safe water supply and sewerage facilities; - By 2023, 30% of energy consumption for water and sewerage facilities across the Maldives will be met with renewable energy;	- Ministry of Environment - Local Councils - Local Government Authority - Utilities Regulatory Authority - Environmental Protection Agency - Ministry of Economic Development - Ministry of Higher Education - Ministry of Education

		- Policy 5: Protect and conserve natural water resources	- By 2020, a standard mechanism to foster private sector investment in the water and sanitation sector will be in effect; - By 2023, at least 60% of technical staff in utility service providers are licensed; - By 2023, at least 40 engineers will be trained in water and sanitation related field; - By 2020, public perception on safe water and sanitation practices improved by 33% compared to 2018 levels; - By 2023, at least 40% of households phased out bottled water use; - By 2023, water resource conservation and management plans are implemented in all islands.	- Maldives Energy Authority (now URA) - Malé Water and Sewerage Company - State Electric Company Limited - Fenaka Corporation Limited - Ministry of National Planning, Housing and Infrastructure - Ministry of Health - Ministry of Tourism - Maldives Metrological Services - National Disaster Management Authority - Media outlets - Non-Governmental Organizations - Colleges/Universities - Maldives Qualification Authority - Technical and Vocational Education and Training Authority.

Table 5 Laws related to the protection of water resources and provision of water and sanitation services

#	Name	Description	Requirements/Constraints	Stakeholder(s)
1	Environmental Protection and Preservation Act (4/93) 19 April 1993	This is the framework law related to environment protection in the Maldives. It aims at improving the legal and administrative co-ordination of the	1. Protection and preservation of water resources.	- Ministry of Environment

#	Name	Description	Requirements/Constraints	Stakeholder(s)
	Amendment 1 (12/2014) 24 Apr 2014	initiatives in the field of environment with the objective of integrating environmental considerations into the country's overall economic and social development.		
2	Public Services Act (4/96) 15 Nov 1996	This is the framework law for providing electricity, telephone, water and sewerage services to the public.	3. All utility providers are required to register with the relevant authority and obtain all permits prior to commencement of utilities services.	- Ministry of Environment
3	Water and Sewerage Act (8/2020) 5 Aug 2020	This Act mandates the development of guidelines and procedures for the protection of water resources, and to enable the establishment of a suitable water & sewerage network for all inhabited islands, along with other relevant guidelines.	35. Water supply and sewerage systems, including desalination plants must be operated after registration at the authority.	- Ministry of Environment - Environmental Protection Agency - Utilities Regulatory Authority - Utility service providers
4	Decentralization Act (7/2010) 17 May 2010	The Decentralization Act establishes the local councils as the highest political authority in the locality and who shall have executive powers to be exercised in accordance with the Act. The Act establishes Atoll Councils, Island Councils and City Councils.	24. (e) Island Council is responsible for providing electricity, water, sewerage and other utilities in their jurisdiction. 42. (e). City Council is responsible for providing electricity, water, sewerage and other utilities in their jurisdiction.	- Island Councils - City Councils

Table 6 Regulations on the provision of water and sanitation services

#	Name	Description	Requirements/Constraints	Stakeholder(s)
1	Regulation on providing water and sewerage services in the Maldives (2021/R-23) 11 Feb 2021	The objectives of this regulation are to set guidelines and steps in: Designing water and sewerage systems Providing water and sewerage services Certification of equipment and tools used in water and sewerage services Protection of water and sewerage systems	12. a. Water and sewerage systems, desalination plants, rainwater collection with treatment systems must be registered at Utilities Regulatory Authority. 13. Utilities Regulatory Authority is required to maintain the following information a. Water production systems established to supply water in islands (Water production plants in the water supply system with their production capacity); b. Sewerage system established to provide sewerage services in islands (Number of people the system provides service, capacity of Sewage Treatment Plant); c. Desalination plants established in the islands that are not in the water supply network; d. Rainwater collection and storage with treatment systems.	- Utilities Regulatory Authority - Utilities services providers - Local councils
2	Desalination Plant Regulation 17 Oct 2002 *Note: this Regulation is void upon Water and Sanitation Act 8/2020 coming into force.*	Desalination Plant Regulation provides requirements for registration, development and operation of Desalination Plants.	<u>Plant Registration</u> 1. All desalination plants operated in Maldives shall be registered at Maldives Water and Sanitation Authority (now EPA). 2. Following information shall be submitted with Applications for desalination plant registration: a. Existing condition of water at the project location	- Ministry of Environment - Environmental Protection Agency - Desalination Plant Operators

#	Name	Description	Requirements/Constraints	Stakeholder(s)
			b. Rationale for desalination plant c. Quantity and use of product water d. Source and method of water intake e. Brine outfall method and location f. Approval from sewerage system operator if brine is to be discharged via sewerage system h. Plant design and drawings i. Capacity of party designing and installing the plant j. Mechanism for monitoring and reporting product water quality k. Capacity of plant operator	
2	Dewatering Regulation (2013/R-1697) 31 Dec 2013 Amendment 1 (2014/R-6) 30 Jan 2014 Amendment 2 (2020/R-42)7 Jun 2020 *Note: this Regulation and its subsequent amendments are void upon Dewatering Regulation for building construction and industrial*	Dewatering Regulation provides measures to minimize adverse environmental impacts related to dewatering.	7(a) Dewatering permit shall be obtained from EPA prior to undertaking any dewatering activities. 9. Applications for dewatering permit shall include results of water tested for parameters listed in the regulation (9d). The Tests shall be done no longer than 45 days prior to application submission and shall be done at a laboratory approved by the relevant government authority (EPA)	- Ministry of Environment - Environmental Protection Agency - Developers - Contractors

#	Name	Description	Requirements/Constraints	Stakeholder(s)
	projects 2021/R-29 coming into force.			
3	Dewatering Regulation for building construction and industrial projects (2021/R-21) 3 Feb 2021	Dewatering Regulation provides procedures/steps to minimize adverse environmental impacts from dewatering groundwater and pumping it into the ground or sea for building construction or industrial projects.	14. b. The authority issuing dewatering permits is required to maintain the volume of water that is pumped out.	- Utilities Regulatory Authority
4	Environmental Impact Assessment Regulation 2012 (2012/R-27) 8 May 2012 Amendment 1 (2013/R-18) 9 Apr 2013 Amendment 2 (2015/R-174) 30 Aug 2015 Amendment 3 (2016/R-66) 11 Aug 2016 Amendment 4 (2017/R-7) 19 Jan 2017 Amendment 5 (2018/R-131) 27 Dec 2018	Regulates the Environmental Impact Assessment (EIA) process.	8. (c). If a proponent plans to undertake a development activity listed in Appendix D of the Regulation, proponent must submit EIA application form as per Appendix C in the regulation along with a project brief not exceeding 3 pages and Approvals from respective government authority to the Ministry. Establishing water supply networks (no. 28) is listed as an activity that requires and EIA under Appendix D under the Amendment 2 of the EIA regulation.	- Ministry of Environment - Environmental Protection Agency - Water service providers
4	Regulation for providing subsidies for water and sanitation services (2021/R-17) 3 Feb 2021	Provides guideline for providing subsidies for water and sewerage services.	-	- Ministry of Environment - Utilities Regulatory Authority
5	Regulation on setting floor price for water and sanitation	Provides for setting floor price for water and sanitation services	-	- Ministry of Environment - Utilities Regulatory Authority

#	Name	Description	Requirements/Constraints	Stakeholder(s)
	services (2021/R-21) 4 Feb 2021			
6	Regulation on water resources management (2012/R-22) 11 Feb 2021	The aim of this regulation is to ensure sustainable usage of available water resources.	-	- Ministry of Environment - Utilities Regulatory Authority

2.2.2 Ongoing projects

MoE with assistance from the Green Climate Fund (GCF) and United Nations Development Programme (UNDP) is implementing the project 'Supporting vulnerable communities in Maldives to manage climate change-induced water shortages' (UNDP, 2021). The project is being implemented in 49 islands across 13 atolls of Maldives. The targeted islands are those that experience water shortages during the northeast monsoon. The aim of the project is to provide safe and reliable freshwater to 105,000 people representing 30 percent of the population.

The project will develop a 90-day reserve of clean water that will help reduce exposure to health risks from untreated water establishing desalination operations on four islands in the North, which are the most vulnerable to water shortages in during the dry season. The four islands with the desalination plants will then serve as water production and distribution hubs for the northern seven atolls during the dry season, reducing their dependency on Male' for emergency water supply. The benefits of the activities will also reach the remaining 45 islands of the northern atolls through improved rainwater collection infrastructure, combined with groundwater protection and improvements.

The expected outcomes of the project are: (1) Scaling up an integrated water supply system to provide safe water to 105,000 people; (2) Dry season water production and distribution and; (3) Aquifers recharged and protected.

The project has a total budget of USD28.2 million and is planned from 2017 to 2021.

Under the project, a baseline assessment of 13 islands in 13 atolls, one island in each atoll, has been completed (MoEnv, 2020). Findings of the study has been used in the Water Accounts.

3 FRAMEWORK FOR WATER ACCOUNT

This chapter presents the framework for the Water Account of the Maldives based on the System of Environmental-Economic Accounts for Water (SEEA-Water) and the current situation of water and sanitation data in the country.

Water Account Framework is then presented as PSUTs per SEEA-Water.

3.1 Water types

The natural resources of water identified for the Water Account of the Maldives are as follows:

Groundwater – Groundwater abstracted from the groundwater aquifer.

Rainwater – Collection of precipitation.

Seawater – Seawater abstracted from the sea using intake pipelines placed directly to the ocean or seawater abstracted using boreholes.

Surface water – natural water bodies such as wetlands.

In addition to the natural water resources, water produced is also included, mainly:

Desalinated water – Freshwater produced from the process of seawater desalination.

Bottled water – Water that is bottled for consumption following desalination and purification processes as well as bottled water that is imported.

Treated water – Wastewater that is from septic tanks and from wastewater treated in Sewage Treatment Plants to tertiary level of treatment.

There is also residuals that are discharged to the environment following use by different industries. These include:

Brine – reject water of the desalination process.

Wastewater – untreated wastewater or wastewater treated to secondary level e.g. in septic tanks.

Treated wastewater – wastewater from septic tanks or from STPs.

Waste cooling water – water used for cooling purposes in generator sets.

Waste seawater – waste seawater from ice plants.

The water types are presented in the PSUT adapted for the Maldives based on SEEA-Water.

3.2 Water producers, suppliers & users

The main economic agents identified for the Water Account are of four main categories:

1. Water production and supply industry
2. Sewage collection, treatment and discharge industry
3. Other industries
4. Households

In the Maldives, water and sanitation services are provided by the same service provider in the specific geographic locations where a service provider operates.

The industries included in the PSUT are given in Table 7.

Table 7 ISIC categories of industries used in PSUT

ISIC Broad categories	ISIC codes	Sub-categories	
A: Agriculture	01	Agriculture	
A: Fisheries	03	Fisheries	
C: Manufacturing	10-33	Manufacturing industries	1020 Fish processing 1104 Bottling plants Other manufacturing
D: Electricity	35	Electricity	
E: Water	36	Water Supply	
	37	Sewerage	
All Other industries	38, 39, 41-43 45-99	All other industries	55 Accommodation 56 Food & beverage services 84 Public administration
			All other
Households			
Rest of the world = imports			

3.3 Water flow

According to SEEA-Water, there are three types of flows of water in the Water Account and the definitions are given below.

Flows from the environment to the economy: "The abstraction/removal of water from the environment by economic units in the territory of reference for production and consumption activities."

Flows within the economy: "Water exchanges between economic units."

Flows from the economy to the environment: "Discharges of water by the economy into the environment (residual flows)."

Using the SEEA-Water as a basis, flows of water within the Maldives are depicted in Figure 1. The water flow diagram is further explained using the water types and water producers, suppliers and users defined in Sections 3.1 and 3.2 respectively.

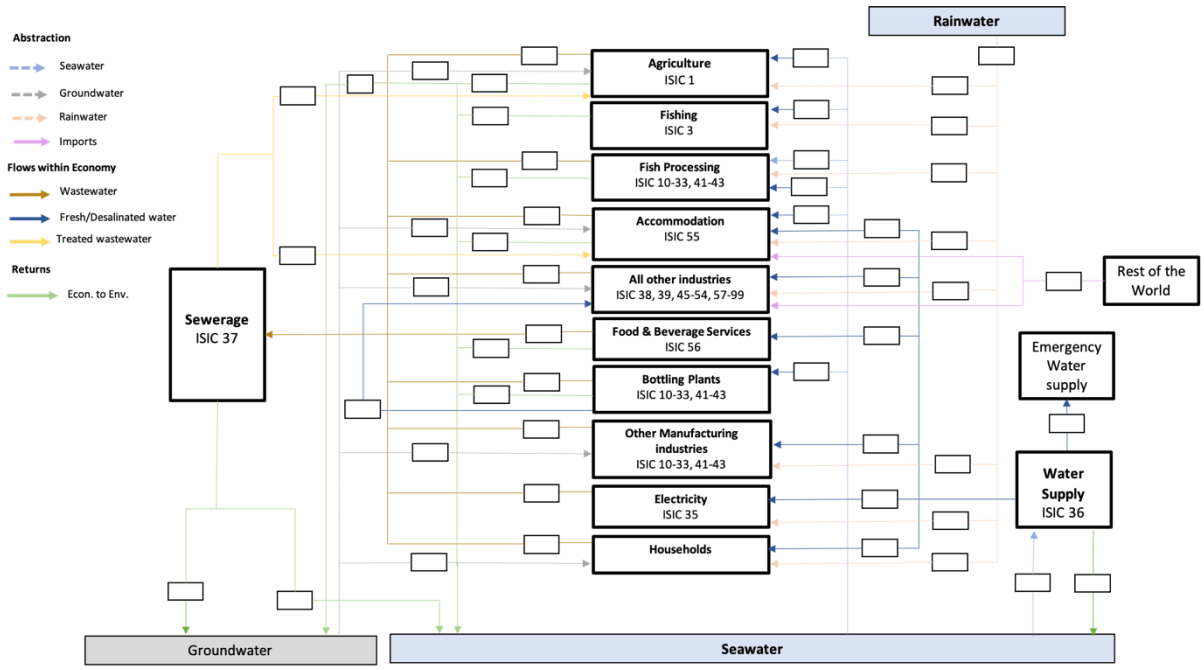

Figure 1 Water flow diagram for the Maldives Water Account Framework

Flows from the environment to the economy (Abstraction)

- The main types of water abstracted are groundwater, seawater and rainwater.
- Groundwater and rainwater are the main sources of freshwater available in the Maldives.
- Seawater is abstracted for desalination as well as for other uses such as for ice plants and generator cooling.
- Seawater abstracted is desalinated before it is supplied to the households and other industries by the main Water Supply (ISIC 36) industry.

Flows within economy

- Desalinated water is directly supplied to households and other industries by the Water Supply industry.

- Establishments such as tourist resorts/guesthouses, agricultural islands, fish processing factories, and bottling plants mainly use their own desalination plants. The flows would be abstraction of seawater to own-use desalination plants which then supply fresh water only to the economic unit that owns and operates these desalination plants (own-use).
- Wastewater generated by industries and households are collected to the sewerage system (e.g. Septic tanks, Sewer networks).
- Some commercial establishments in inhabited islands are not connected to the main sewer and have their own septic tanks and outfalls to the sea.
- Commercial establishments such as resorts have their own sewerage systems and some also have STPs.
- Treated water is available where STP are installed, mainly resorts and some inhabited islands.
- Resorts reuse treated water primarily for landscaping mainly.
- Bottled water manufactured by bottling plants is distributed through wholesale and retail traders.
- Emergency water supply is the supply of desalinated water by the Government to islands experiencing with water shortages during the dry season. The desalinated water is procured by the Government through a bidding process. The water is transported in boats with in-built water tanks approved by relevant Government agencies. Upon reaching the islands the water is then pumped to community water tanks. The water is then obtained directly from the storage tanks by households and others on the islands (there is no distribution network leading from these tanks).

Flows from economy to the environment (Return flows)

- Return flow of water from the economy to the environment include groundwater, brine, wastewater, treated water, cooling water and waste seawater.
- Groundwater flow is considered mainly back to the groundwater aquifer from agricultural activities.
- Treated water also may flow to the groundwater aquifer from use of treated water for landscaping maintenance and from septic tanks.
- Brine, wastewater, treated water, cooling water and waste seawater flow mainly to the sea.
- Brine is produced as a by-product from the desalination process and is discharged directly into sea.
- In islands with sewer networks wastewater from the sewerage system is discharged directly to the sea. In islands with septic tanks, secondary level treated wastewater returns to the groundwater. Where there is an STP in operation the wastewater is treated before discharging to the sea or reused for purposes such as landscaping.

The understanding from the Water Flow Diagram was used to adapt the PSUT of the SEEA-Water to the context of Maldives.

3.4 Physical Supply and Use Table

In the SEEA-Water, the Supply Table and the Use Table are described as below.

Use Table is divided into two parts: flows from the environment to the economy and the flows within the economy. The definitions of the components of the Use Table as given in SEAA-Water (UNDESA, 2012) are below.

Abstraction: The amount of water that is removed from any source, either permanently or temporarily, in a given period of time for consumption and production activities.

> **Abstraction for own use:** Water abstracted for use by the same economic unit which abstracts it.
>
> **Abstraction for distribution:** Water abstracted for supply to other economic units, possibly after some treatment.

Abstraction for own use and abstraction for distribution are also presented as below.

> **Abstraction from inland water sources:** Abstraction from inland water resources for production and consumption activities.
>
> **Abstraction from other sources:** Abstraction of sea water and the direct collection of precipitation for production and consumption activities.

Use of water received from other economic units: The amount of water that is delivered to an industry, household or the rest of the world by another economic unit. The use of water received from other economic units by the rest of the world corresponds to the export of water.

Total water use of an industry: The sum of the amount of water directly abstracted and the amount of water received from other economic units.

Similarly, the Supply Table is divided into two parts: the flows of water within the economy, and the flows from the economy to the environment. SEEA-Water explains the elements of the Supply Table as below.

Supply of water to other economic units: The amount of water that is supplied by one economic unit to another. The supply of water is recorded net of losses in distribution. Supply of water by the rest of the world corresponds to the **import** of water.

Total returns: Water that is returned into the environment. Total returns can be classified according to (*a*) the receiving media, that is, inland water resources and sea water, and (*b*) the type of water, such as treated water and cooling water.

Total water supply: The sum of the amount of water supplied to other economic units and the amount of water returned to the environment.

Use of water and supply of water are disaggregated in the Water Account of Maldives by types of water.

3.5 Availability of data

A list of key indicators and proxy indicators by industry was developed to obtain data for the Water Accounts. The indicators are given in Annex A.

In Table 8 and Table 9, the cells marked with 'X' are where the water data was considered relevant for each industry. Where the 'X' is in red is where data was available through data records provided by the stakeholders and using estimations based on assumptions. The blank cells indicate that the water type and flow were considered to be irrelevant to the industries. Light grey cells are where total and sub-total will be computed using the data available. Dark grey cells indicate that by definition, no entries should be made.

Table 8 Data availability for Use Table

	Categories	ISIC 1-3		ISIC 10-33, 41-43 Manufacturing industries			35 Electricity industry	36 Water supply	37 Sewerage	38, 39, 45-99 All other industries				Households	Rest of the world	Total
		1 Agriculture	3 Fisheries	Fish processing	Bottling plants	Other manufacturing				55 Accomodation	56 Food and beverage service	84 Public administration	All other			
From the environment	**1 - Total abstraction** (=1.a+1.b = 1.i+1.ii)															
	1.a Abstraction for own use															
	1.a.i Groundwater	X		X	X	X	X		X	X	X	X	X	X		
	1.a.ii Seawater	X	X	X	X		X	X		X			X			
	1.a.iii Rainwater	X		X	X		X	X	X	X	X	X	X	X		
	1.b Abstraction for distribution (=1.b.1+1.b.2+1.b.3)															
	1.b.1Groundwater															
	1.c.2 Seawater				X											
	1.c.3 Rainwater				X							X				
	1.i From inland water resources (=1.i.1+1.i.2+1.i.3)															
	1.i.1 Surface water															
	1.i.2 Groundwater (=1.i.2.1+1.i.2.2)	X		X	X	X	X		X		X	X	X	X		
	1.i.3 Soil water									X						
	1.ii From other sources (=1.ii.1+1.ii.2)															
	1.ii.1 Collection of precipitation	X		X	X		X	X	X	X	X	X	X	X		
	1.ii.2 Abstraction from the sea	X	X	X	X		X	X		X		X	X	X		
Within the economy	**2. Use of water received from other economic units and own use desalinated water** (=2.a+2.b +2.c)															
	2.a Own use desalinated water				X	X		X		X			X			
	2.b Wastewater								X	X						
	2.c Distributed water - fresh/desalinated water (2.c.i + 2.c.ii)															
	2.c.i Distributed water through mains	X	X	X	X	X	X		X	X	X	X	X	X		
	2.c.ii Distributed water via public collection point									X				X		
	2.d Distributed water - bottled water	X		X		X	X	X	X	X	X	X	X	X		
	2.e Distributed water - emergency supply					X				X	X	X	X	X		
3. Total use of water (=1+2)																

Table 9 Data availability for Supply Table

	Categories	ISIC 1-3		ISIC 10-33, 41-43 Manufacturing industries			35 Electricity industry	36 Water supply	37 Sewerage	38, 39, 45-99 All other industries				Households	Rest of the world	Total
		1 Agriculture	3 Fisheries	Fish processing	Bottling plants	Other manufacturing				55 Accomodation	56 Food and beverage service	84 Public administration	All other			
Within the economy	**4. Supply of water to other economic units and own use desalinated water**															
	4.a Own use desalinated water									X						
	4.b Wastewater	X			X	X	X			X	X	X	X	X		
	4.c Distributed water - fresh/desalinated water (4.c.i + 4.c.ii)				X											
	4.c.i Distributed water through mains				X			X								
	4.c.ii Distributed water via public collection point							X								
	4.d Distributed water - bottled water				X										X	
	4.e Distributed water - emergency supply											X				
To the environment	**5. Total returns** (= 5.a+5.b+5.c)															
	5.a To inland water resources															
	5.a.1 Surface water															
	5.a.2 Groundwater	X				X	X		X	X	X	X	X	X		
	5.a.3 Soil water															
	5.b To seawater															
	5.b.1 Brine	X			X			X		X			X			
	5.b.2 Wastewater	X			X				X	X			X	X		
	5.b.3 Treated wastewater								X							
	5.b.4 Waste cooling water	X			X		X	X		X			X			
	5.b.5 Waste seawater		X							X						
	5.c Losses in distribution	X						X	X	X						
6. Total supply of water (= 4+5)																
7. Consumption (3-6)																

4 WATER ACCOUNTS

This chapter presents the Water Accounts compiled for 2018 and 2019 and the possible results and analysis using the Water Accounts. In addition, estimation methodologies and assumptions are described in detail. The issues with the data available and the gaps are also discussed. As the last section of the chapter, linkages between the Water Accounts and national policies are briefly explained.

4.1 Water accounts for 2018 and 2019

The Water Accounts compiled for 2018 and 2019 are presented in Table 10 to Table 13. The PSUTs here show the most relevant sections for the Maldives based on available information. The complete PSUTs are available in Annex B.

Table 10 Use Table 2018: Preliminary estimates in tons

	Categories	ISIC 1-3		ISIC 10-33, 41-43 Manufacturing industries			35 Electricity industry	36 Water supply	37 Sewerage	38, 39, 45-99 All other industries				Households	Rest of the world	Total
		1 Agriculture	3 Fisheries	Fish processing	Bottling plants	Other manufacturing				55 Accommodation	56 Food and beverage service	84 Public administration	All other			
From the environment	**1 - Total abstraction** (=1.a+1.b = 1.i+1.ii)	0	0	0	151,313	0	0	359,819,809	0	76,762,785	0	0	0	30,141,470		466,875,377
	1.a Abstraction for own use	0	0	0	151,313	0	0	359,819,809	0	76,762,785	0	0	0	30,141,470		466,875,377
	1.a.i Groundwater				0			0		0				29,344,425		29,344,425
	1.a.ii Seawater (as saltwater and as input to desalination plants)				150,975			359,815,216		76,762,785				0		436,728,976
	1.a.iii Collection of precipitation				338			4,593		0				797,045		801,976
	1.b Abstraction for distribution (=1.b.1+1.b.2+1.b.3)	0	0	0	0	0	0	0	0	0	0	0	0	0		0
	1.b.1Groundwater				0			0		0				0		0
	1.c.3 Collection of precipitation				0			0		0				0		0
	1.i From inland water resources (=1.i.1+1.i.2+1.i.3)	0	0	0	0	0	0	0	0	0	0	0	0	0		0
	1.i.1 Surface water				0			0		0				0		0
	1.i.2 Groundwater (=1.i.2.1+1.i.2.2)				0			0		0				0		0
	1.i.3 Soil water				0			0		0				0		0
Within the economy	**2. Use of water received from other economic units and own use desalinated water** (=2.a+2.b +2.c)	0	1,447,653	771,626	9,600	1,826,638	563,356	0	0	25,588,350	755,310	5,855,484	54,362,108	69,033,192	0	160,213,317
	2.a Own use desalinated water water from own desalination plants				0			0		25,587,595				0		25,587,595
	2.b Wastewater				0			0		0				0		0
	2.c Distributed water - fresh/desalinated water (2.c.i + 2.c.ii)	0	1,447,653	771,626	9,600	1,826,638	563,356	0	0	0	754,555	5,855,484	54,362,108	69,031,732	0	134,622,752
	2.c.i Distributed water through mains	0	1,447,653	771,626	9,600	1,826,638	563,356	0		0	754,555	5,855,484	54,362,108	69,031,732		134,622,752
	2.c.ii Distributed water via public collection point				0			0		0				0		0
	2.d Imported bottled water				0			0		755	755			0		1,511
	2.e Distributed water - emergency supply				0			0		0				1,459.52		1,460
3. **Total use of water** (=1+2)		0	1,447,653	771,626	160,913	1,826,638	563,356	359,819,809	0	102,351,135	755,310	5,855,484	54,362,108	99,174,662	0	627,088,694

Note: grey cells indicate zero entries by definition.

Table 11 Supply Table 2018: Preliminary estimates in tons

	Categories	ISIC 1-3		ISIC 10-33, 41-43 Manufacturing industries			35 Electricity industry	36 Water supply	37 Sewerage	38, 39, 45-99 All other industries				Households	Rest of the world	Total
		1 Agriculture	3 Fisheries	Fish processing	Bottling plants	Other manufacturing				55 Accomodation	56 Food and beverage service	84 Public administration	All other			
Within the economy	**4. Supply of water to other economic units and own use desalinated water**	0	0	0	23,765	0	0	121,899,430	0	25,587,595	0	0	0	0	1,511	147,512,301
	4.a Own use desalinated water				0			0		25,587,595				0		25,587,595
	4.b Wastewater				0			0		0				0		0
	4.c Distributed water - fresh/desalinated water (4.c.i + 4.c.ii)	0	0	0	0	0	0	121,899,430	0	0	0	0	0	0	0	121,899,430
	4.c.i Distributed water through mains				0			121,899,430		0				0		121,899,430
	4.c.ii Distributed water via public collection point				0			0		0				0		0
	4.d Distributed water - bottled water				23,765			0		0				0	1,511	25,276
	4.e Distributed water - emergency supply				0			0		0				0		0
To the environment	**5. Total returns** (= 5.a+5.b+5.c)	0	0	0	105,702	0	0	237,919,467	0	69,086,507	0	0	0	24,625,704		331,737,380
	5.a To inland water resources	0	0	0	0	0	0	0	0	0	0	0	0	0		0
	5.a.1 Surface water				0			0		0				0		0
	5.a.2 Groundwater				0			0		0				0		0
	5.a.3 Soil water				0			0		0				0		0
	5.b To seawater	0	0	0	105,702	0	0	237,089,946	0	69,086,507	0	0	0	24,625,704		330,907,859
	5.b.1 Brine				98,134			237,089,946		51,175,190				0		288,363,270
	5.b.2 Wastewater				7,568			0		17,911,317				24,625,704		42,544,589
	5.b.3 Treated wastewater				0			0		0				0		0
	5.b.4 Cooling water				0			0		0				0		0
	5.b.5 Waste seawater				0			0		0				0		0
	5.c Losses in distribution				0			829,521		0				0.00		829,521
6. Total supply of water (= 4+5)		0	0	0	129,467	0	0	359,818,897	0	94,674,102	0	0	0	24,625,704	1,511	479,249,681
7. Consumption (3-6)		0	1,447,653	771,626	31,446	1,826,638	563,356	912	0	7,677,034	755,310	5,855,484	54,362,108	74,548,957	-1,511	147,839,013

Note: grey cells indicate zero entries by definition.

Table 12 Use Table 2019: Preliminary estimates in tons

	Categories	ISIC 1-3		ISIC 10-33, 41-43 Manufacturing industries			35 Electricity industry	36 Water supply	37 Sewerage	38, 39, 45-99 All other industries				Households	Rest of the world	Total
		1 Agriculture	3 Fisheries	Fish processing	Bottling plants	Other manufacturing				55 Accomodation	56 Food and beverage service	84 Public administration	All other			
From the environment	**1 - Total abstraction** (=1.a+1.b = 1.i+1.ii)	0	0	0	156,791	0	0	553,289,620	0	76,762,785	0	0	0	23,464,270		653,673,466
	1.a Abstraction for own use	0	0	0	156,791	0	0	553,289,620	0	76,762,785	0	0	0	23,464,270		653,673,466
	1.a.i Groundwater				156,465			0		0				22,914,473		23,070,938
	1.a.ii Seawater (as saltwater and as input to desalination plants)				0			553,285,209		76,762,785				0		630,047,994
	1.a.iii Collection of precipitation				326			4,411		0				549,797		554,534
	1.b Abstraction for distribution (=1.b.1+1.b.2+1.b.3)	0	0	0	0	0	0	0	0	0	0	0	0	0		0
	1.b.1Groundwater				0			0		0				0		0
	1.b.iii Collection of precipitation				0			0		0				0		0
	1.i From inland water resources (=1.i.1+1.i.2+1.i.3)	0	0	0	0	0	0	0	0	0	0	0	0	0		0
	1.i.1 Surface water				0			0		0				0		0
	1.i.2 Groundwater (=1.i.2.1+1.i.2.2)				0			0		0				0		0
	1.i.3 Soil water				0			0		0				0		0
Within the economy	**2. Use of water received from other economic units and own use desalinated water** (=2.a+2.b +2.c)	0	995,251	530,488	9,600	1,255,800	387,303	0	0	25,588,350	519,506	4,025,603	37,373,557	69,033,192	0	139,718,650
	2.a Own use desalinated water				0			0		25,587,595				0		25,587,595
	2.b Wastewater				0			0		0				0		0
	2.c Distributed water - fresh/desalinated water (2.c.i + 2.c.ii)	0	995,251	530,488	9,600	1,255,800	387,303	0	0	0	518,751	4,025,603	37,373,557	69,031,732	0	114,128,085
	2.c.i Distributed water through mains	*0*	*995,251*	*530,488*	9,600	*1,255,800*	*387,303*	0		0	*518,751*	*4,025,603*	*37,373,557*	69,031,732		114,128,085
	2.c.ii Distributed water via public collection point				0			0		0				0		0
	2.d Distributed water - bottled water				0			0		*755*	*755*			0		1,511
	2.e Distributed water - emergency supply				0			0		0				1,459.52		1,460
3. **Total use of water** (=1+2)		0	995,251	530,488	166,391	1,255,800	387,303	553,289,620	0	102,351,135	519,506	4,025,603	37,373,557	92,497,461	0	793,392,116

Note: grey cells indicate zero entries by definition.

Table 13 Supply Table 2019: Preliminary estimates in tons

	Categories	ISIC 1-3		ISIC 10-33, 41-43 Manufacturing industries			35 Electricity industry	36 Water supply	37 Sewerage	38, 39, 45-99 All other industries				Households	Rest of the world	Total
		1 Agriculture	3 Fisheries	Fish processing	Bottling plants	Other manufacturing				55 Accomodation	56 Food and beverage service	84 Public administration	All other			
Within the economy	**4. Supply of water to other economic units and own use desalinated water**	0	0	0	24,239	0	0	192,133,839	0	25,587,595	0	0	0	0	1,511	217,747,184
	4.a Own use desalinated water				0			0		25,587,595				0		25,587,595
	4.b Wastewater				0			0		0				0		0
	4.c Distributed water - fresh/desalinated water (4.c.i + 4.c.ii)	0	0	0	0	0	0	192,133,839	0	0	0	0	0	0	0	192,133,839
	4.c.i Distributed water through mains				0			192,133,839		0				0		192,133,839
	4.c.ii Distributed water via public collection point				0			0		0				0		0
	4.d Distributed water - bottled water				24,239			0		0				0	1,511	25,750
	4.e Distributed water - emergency supply				0			0		0				0		0
To the environment	**5. Total returns** (= 5.a+5.b+5.c)	0	0	0	109,375	0	0	361,154,869	0	69,086,507	0	0	0	17,283,431		447,634,182
	5.a To inland water resources	0	0	0	0	0	0	0	0	0	0	0	0	0		0
	5.a.1 Surface water				0			0		0				0		0
	5.a.2 Groundwater				0			0		0				0		0
	5.a.3 Soil water				0			0		0				0		0
	5.b To seawater	0	0	0	109,375	0	0	359,874,660	0	69,086,507	0	0	0	17,283,431		446,353,973
	5.b.1 Brine				101,702			359,874,660		51,175,190				0		411,151,552
	5.b.2 Wastewater				7,673			0		17,911,317				17,283,431		35,202,421
	5.b.3 Treated wastewater				0			0		0				0		0
	5.b.4 Cooling water				0			0		0				0		0
	5.b.5 Waste seawater				0			0		0				0		0
	5.c Losses in distribution				0			1,280,209		0				0.00		1,280,209
6. Total supply of water (= 4+5)		0	0	0	133,614	0	0	553,288,708	0	94,674,102	0	0	0	17,283,431	1,511	665,381,366
7. Consumption (3-6)		0	995,251	530,488	32,777	1,255,800	387,303	912	0	7,677,034	519,506	4,025,603	37,373,557	75,214,030	-1,511	128,010,750

Note: grey cells indicate zero entries by definition.

4.2 Results and analysis

The Use and Supply Tables in Section 4.1 show the preliminary results for water accounts for the years 2018 and 2019. There were serious issues on data availability; the data available was not always accurate, for some sectors there were no data available; and some of the data were estimated using assumptions regarding prices, distribution structure and other types of assumptions. Hence it is likely that the data in the total columns are not accurate. These figures should be considered very preliminary and should not be used for more than illustrative purposes.

Main sectors where data were available include Bottling plants, Water supply, Accommodation and household sector. Among these, the most accurate information was available from the water supply sector. Accommodation and households sector values were estimated using different assumption (details given in the methodology section).

According to the available data, the total use of water in the Maldivian economy is 627,088,694 tonnes water in 2018 and 793,392,116 tonnes of water in 2019. The main use of water is from abstraction of seawater for own use and for further distribution by the water supply sector (ISIC 36). About 70-80 percent of water use is abstraction of sea water for this purpose.

According to the available data, total supply of water in the Maldivian economy is 479,249,681 tonnes and 665,381,366 tonnes in 2018 and 2019, respectively. Main supply of water is returns to the environment as brine from the desalination processing plants. The total consumption of water is significantly high in both years. This is an over estimation of water consumption because data on waste water was not included, as it was not available. No adequate estimation method was identified. This makes the supply and use picture for water to be incomplete.

Note that all analysis given in this section must be used with caution as a significant amount of data is not available. It is highly likely that the results shown in the PSUT will change significantly when more data are received. Most importantly, data on sewerage industry and wastewater is not available hence, results for supply table are significantly underestimated and water consumption is over estimated. Furthermore, several results in the PSUT were estimated using some substantial assumptions and it is likely that these estimates may not be accurate compare to the actual data. The main areas that were estimated using assumptions include household sector, accommodation sector and data for water use. These estimates are marked in the PSUT in pink.

4.3 Estimation methodology and assumptions

The methodologies for each of the industry in the Water Accounts is explained below. Information for each ISIC category, households and import exports were derived separately for both Supply and Use tables.

4.3.1 Water supply industry

The data for PSUT includes information from the three major utility service providers producing desalinated water for water supply in the Maldives: Male' Water & Sewerage Company (MWSC), Fenaka and State Electric Company Limited (Stelco). The seawater abstraction in the Use Table is the sum of data acquired directly from the establishment, where available, and estimates using water production data. The assumption for seawater abstracted using the water production data is 3:1, i.e., one-third of the total volume of seawater abstracted can be recovered as desalinated water. Similarly, brine discharged is a combination of both actual reported data and estimates where the assumption is that two-thirds of the seawater abstracted is discharged as brine.

Where data is available for rainwater collected it is presented as water abstracted for own use. Whether the rainwater is used in the desalination process or mixed with desalinated water before distribution or is used only in-house is not clear.

The losses in distribution is an estimate using the assumption that loss is seven per cent of water distributed as stated by one of the service providers.

Where it is indicated that desalinated water is used by the producer itself, the data is presented as water consumption.

4.3.2 Manufacturing industry

In the manufacturing industry, the main contribution to the accounts is from the bottling industry that manufactures bottles of water by desalinating water abstracted from the sea combined with the collection of rainwater. The data in the Water Accounts is using data from three bottling plants out of six major producers of bottled water. All three producers provided data on production of bottled water which is assumed as distribution in the Supply Table. Of the three manufacturers, water abstracted and returned to the environment was provided by one of the manufacturers. The figures were not grossed up to cover all six major producers, so the figures in the PSUTs are lower than if all units reported. No information regarding production was available which would allow for grossing up from the 3 units to cover the whole population of all 6 units.

4.3.3 Sewerage Industry

In the sewerage industry, there are three main service providers. However, the data provided is from only one of the service providers and the data is only an estimate of the wastewater that is discharged to the sea via outfalls. The quantity of water that is discharged is an estimate based on the pumping hours of the pumping stations. The uncertainty of this calculation, as well as the lack of coverage for the

other service providers, makes this data unusable in this context. Therefore, no data on sewerage was used in the PSUT.

4.3.4 Accommodation

Under accommodation, the number of desalination plants and their production capacity is available for resorts. The total capacity of all the desalination plants across all resorts is 70,103 cbm/day. This is used to calculate an annual total in tons per day as production, which is assumed to be the quantity of water that is distributed. This estimation method assumes that all resort desalination plants are operating every day at full capacity. This assumption will lead to an over estimation since running at maximum capacity every day is unlikely, but gives an upper boundary to the amounts of sea water abstracted and desalinated water produced. To calculate the amount of water abstracted and brine discharged, the same assumptions used for the water supply industry were applied which uses a 1:3 ratio. This assumption was used for both 2018 and 2019.

4.3.5 Imports

Imports of bottled water received from Maldives Customs Services (MCS) are included in the Supply Table as imported bottled water distributed to economic units. It is assumed that 50 percent of imported water goes to the resorts (accommodation sector) and 50 percent goes to restaurants. The type of imported bottled water is of the high-end brands, so would be purchased mostly by tourists and not by households. Households purchase primarily locally produced desalinated bottled water.

4.3.6 Households

Estimates for water abstraction and returns to the environment for the household are estimated using data from a baseline assessment report for ground water developed by the Ministry of Environment. The report was based on survey results in selected islands in the country. One island from each atoll was included in the survey. This survey data was used to extrapolate the total abstraction of ground water and rainwater harvested by the population living in the Atolls. It was assumed that households in Male' region do not use rainwater and ground water for household use in the Male' region is not available.

Use of water received from other economic units include water use billed to households by Fenaka and MWSC. Even though data for water distributed was available, those data were lower than the amounts of billed water. It was decided that the amounts of water billed for were better figures than the data for water distributed. It appears that the amount of water distributed is underestimated.

Use of water received from other economic units for household also includes emergency water received. This data was provided by water and sanitation department of Ministry of Environment.

4.3.7 Water use

No data was available on extraction and use of water by other sectors not mentioned above. Hence water use for all other sectors in the PSUT was estimated using the National Accounts Monetary Supply and Use table for 2014. Estimates of the purchases of water found in the monetary Use Table were used to develop a distribution key to estimate water use for different sectors. The payments for water by the different industries categorized by ISIC were used to develop a proportion of the total for each industry group in the PSUT use table. Total water provided for commercial and industrial use was apportioned using the ratios of monetary Use Table of the national accounts.

4.4 Data gaps and quality issues

Below are outlined some the of limitations in the data that was used in the compilation of the Water Accounts for both 2018 and 2019.

- Data on water abstraction, water use and returns to the environment are not available for all the industries included in the PSUT. This data is available mainly for bottling plants and water supply industry. These missing data result in not full coverage of the economy in the PSUT system.
- For water abstraction for own use, data are available mostly for seawater. There is no data on groundwater abstraction for any of the industries and households. Estimates for abstraction of household water was calculated using data provided in the baseline assessment report for ground water use. This report was compiled using data from 12 islands and there maybe issues with representativeness of the data when used for extrapolation.
- Some of the water producers harvest rainwater. However, it is not confirmed whether the rainwater is used only in-house or is used in the desalination process or is added to desalinated water for distribution.
- There are no data available on the use of any types of water received from other economic units by the industries.
- Data on the supply of wastewater by the industries to the Sewerage industry is not obtainable as there are no systems in place to measure incoming wastewater.
- The quantity of desalinated water distributed by Fenaka is almost ten times that of MWSC according to the data received. However, MWSC serves a population twice that of Fenaka and is the water supplier in the Greater Male' Area. This data needs to be checked for errors.
- The seawater abstracted and the brine discharged consists of values estimated using a ratio 3:1 of seawater abstracted to desalinated water recovered. The efficiency of the desalination plant is not taken into account. This estimation approach needs to be revised using experts from the desalination plants.
- Data were provided as monthly averages in some cases, and hence estimates are equal for both 2018 and 2019. Obtaining actual monthly data would be helpful to make a more nuanced and accurate picture of water use and production.

- Assumptions used did not change for 2018 and 2019. There is not enough data to change the assumptions. Some assumptions such as water use based on reports are assumptions for years before 2018. The estimations based on these types of assumptions need to be reviewed and updated as new information become available.

4.5 SDGs and national policies

One of the purposes of the Water Accounts is to use the accounts for evaluation of progress with achieving the SDGs. Similarly, Water Accounts can also be useful for the evaluation of the national policies on water and sanitation. Table 14 shows linkages of the Water Account with the SDGs where the targets are relevant and the detailed table is in Annex C.

Table 14 Summary of Water Accounts linkages to SDGs

Targets	Indicator as per SDG Metadata sheets	Data from Water Accounts 2018 & 2019
Target 6.1: By 2030, achieve universal and equitable access to safe and affordable drinking water for all.	Indicator 6.1.1: Proportion of population using safely managed drinking water services. Defined as proportion of population using an improved basic drinking water source which is located on premises, available when needed and free of faecal (and priority chemical) contamination.	Related data inlcudes: 1.a.iii. Rainwater abstraction by households; 2.c.i. Use of distributed water - freshwater/desalinated water by households; 2.e. Use of distributed water - emergency supply by households;
Target 6.3: By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally.	Indicator 6.3.1: Proportion of domestic and industrial wastewater flows safely treated	No data available on sewerage.
Target 6.4: By 2030, substantially increase water-use efficiency across	Indicator 6.4.1: Change in water-use efficiency over time	Water use by industry;

Targets	Indicator as per SDG Metadata sheets	Data from Water Accounts 2018 & 2019
all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity. Water Use Efficiency is defined as the value added of a given major sector divided by the volume of water used.	Indicator 6.4.2: Level of water stress: freshwater withdrawal as a proportion of available freshwater resources	1 - Total abstraction: 1.a. Abstraction for own use - groundwater by households; rainwater by industry & households; 2. Use of water received from other economic units and own use desalinated water by industry & households; 4. Supply of water to other economic units and own use desalinated water: 4.c Distributed water - fresh/desalinated water. 7.Consumption by industry;

An evaluation of the national policies on water and sanitation using the Water Accounts was also attempted. However, it was found that the Water Accounts is not useful for appraising the current national policies on water and sanitation. This shows that firstly, additional tools are needed for policy evaluation and secondly, that the national policies need to consider other aspects such as protection and preservation of water resources, reducing costs of desalinated water production and distribution and minimizing pollution from the water and sanitation sector.

5 METHODOLOGY

This chapter details the work undertaken for the preparation of the Water Accounts including data sources, assumptions and challenges in data. Water Accounts was prepared through five key actions:

1. Preparing a framework for Water Accounts in the Maldives
2. Consultations with key stakeholders
3. Documentation of data and data sources
4. Water Accounts compilation
5. Making recommendations

Each of the key activities are described below.

5.1 Development of framework for Water Account

The framework for the Water Account was developed based on the SEEA-Water framework and national reports. The methodology in the SEEA-Water was first reviewed in order to understand how it can be applied to the circumstances of the water sector in the Maldives. The components in the SEEA-Water framework were further refined for the country context using published reports and findings from stakeholder consultations.

The types of water most relevant to for the Water Account of Maldives was identified using existing studies and guidance from MoE and URA.

Water producers, suppliers and users were identified based on the ISIC categories given in the SEEA-Water and then, further detailed with the most relevant industries for the Maldives.

A flow diagram was constructed based on the country situation to understand the flows of the different types of water. The flow diagram was then used to adapt the standard PSUT in the SEEA-Water to reflect the existing situation of water in the Maldives.

In addition, key indicators and proxy indicators were identified using the water flow diagram and the PSUT to obtain data from stakeholders.

5.2 Stakeholder consultations

A list of stakeholders was identified for consultation based on key policies and legislations and the draft water flow diagram. Stakeholder meetings were conducted with the stakeholders listed in Table 9. During the meetings, stakeholders were presented with the water flow diagram to discuss the existing situation of water, the data needs for the Water Account and their roles in the providing data.

Table 15 Stakeholders consulted and their role

#	Name of organization	Role
1	Ministry of Environment -Water and Sanitation Department	Policy-maker
2	Utilities Regulatory Authority	Regulator
3	Ministry of Fisheries, Marine Resource and Agriculture - Agriculture Department - Fisheries Department	Policy maker
4	Ministry of Tourism	Policy maker
5	National Disaster Management Authority	Emergency relief response
6	Maldives Meteorological Services	Rainfall data
7	Atoll Councils	Local governance
8	Male' Water and Sewerage Company	Service provider; Bottled water producer
9	Fenaka Corporation Limited	Service provider; Bottled water producer
10	State Electric Company Limited	Service provider; Bottled water producer
11	Handy Holdings	Bottled water producer
12	Maldives Aerated Water Company (MAWC) Pvt Ltd	Bottled water producer
13	Happy Market Trading Company Pte Ltd	Bottled water producer

Based on findings of the consultation, data that could be useful for the assignment was requested from each stakeholder. It is noted that no data was requested from the Atoll Councils as they are not involved in the provision of water and sanitation services at the island level. The service providers given in Table 14 above, provide water services at island level.

5.3 Documentation of data sources

Data used in the compilation of Water Accounts are from data records maintained by some of the stakeholders and the NBS, including data obtained following the pilot Water Account in 2017. The data that was made available was documented according to the organizations.

5.4 Compilation of the Water Accounts

The Water Accounts for 2018 and 2019 were compiled using the Water Accounts Framework and the PSUT adapted for the Maldives. Both data records from stakeholders and estimations based on

assumptions were used in compiling the Water Accounts. Estimation methodologies are detailed in Section 4.1.

5.5 Devising recommendations

The recommendations are based on the findings from the review of literature, stakeholder consultations and the lessons learned in the compilation exercise of the Water Accounts for 2018 and 2019.

6 CONCLUSION

The Water Accounts of Maldives for the years 2018 and 2019 have been compiled based on the SEEA-Water methodology using available data. The Water Account Framework developed for the compilation of the Water Accounts helps to understand the flows of water from the environment to the economy, within the economy and flows back to the environment from the economy. The Water Account Framework for the Maldives takes into account the geography and the unique challenges related to water and sanitation in the Maldives. The SEEA-Water PSUTs have been adapted for the compilation of the Water Accounts based on the flows of water in the existing situation of the Maldives. The PSUTs will serve as a tool for improving the Water Accounts and developing new accounts in the future by the Government agencies and others.

Through the Water Account Framework, several organizations were identified as sources of information for the compilation of the Water Accounts. There are three major service providers of water and sanitation that can provide a significant amount of data. The list of key indicators and industry-wise proxy indicators drafted in accordance with the Water Account Framework can be used for discussions with industries in obtaining data.

The Water Account for the Maldives was prepared with significant limitations in data. The preliminary results for water accounts for the years 2018 and 2019 show that the main sectors where data were available include Bottling plants, Water supply, Accommodation and household sector. The data available from records maintained by agencies was limited, thus, most of the data presented in the PSUTs had to be estimates. The total consumption for both 2018 and 2019 were significantly high due to unavailability of data on wastewater. Hence, the supply and use depicted in the PSUTs is not considered a true picture of the water situation in the Maldives.

The newly established URA has the mandate to collect and maintain information on water and sanitation. However, the information is not sufficiently detailed to meet the needs of compilation of the Water Accounts. As the URA is currently reviewing existing regulatory framework, this provides an opportunity for NBS to collaborate with the organization to improve data collection. Although data could not be obtained industry-wise from MWSC, Fenaka and Stelco during this project, the data is available with these service providers and . can be used to further improve the PSUTs.

The assessment of linkages between the Water Accounts and the SDGs show that useful data can be extracted from the Water Accounts to monitor the progress of the SDGs. In contrast, the attempt to evaluate the national policies using the Water Account illustrated that the national policies are focused on regulations, infrastructure and human resources while the Water Accounts is a tool for assessing policies related to the water system. The findings from the Water Accounts can also help to understand the policy needs for a more holistic water sector.

7 RECOMMENDATIONS

This chapter provides the recommendations that have been developed with the objective to establish a harmonized and reliable water data account for the Maldives using the Water Accounts.

Recommendation 1: Establish the necessary institutional arrangements for implementation of the compilation of Water Account.

1.1 Establish a unit within NBS dedicated to water and sanitation and, environmental accounts and, assign staff.

1.2 Conduct training for the staff of NBS on water and sewerage services in the Maldives and linkages to the Water Account.

1.3 Form a committee to coordinate the compilation of water data. The committee shall include focal points from MoE, MED, LGA, URA and NBS.

1.4 Identify staff who will compile water data according to existing legislation, policies and SDGs.

1.5 Mobilise funding for immediate and long-term activities related to compilation of water account through sources such as the ongoing donor-funded projects, national government budget as well as other sources such as CSR components of SOEs and grant programmes of the Government and donor agencies.

Recommendation 2: Introduce the new Water Account Framework to stakeholders and seek their understanding and commitment.

2.1 Identify and map policy and industry-specific stakeholders using the draft Water Account Framework that includes water and sanitation.

2.2 Carry out consultations with key stakeholders to educate and agree on the purpose of the Water Accounts and their roles and responsibilities including budget allocation and the opportunities for collaboration through ongoing and planned work.

2.3 Prepare a stakeholder engagement strategy for stakeholders to work in partnership with NBS for future water audits and other data collection activities.

Recommendation 3: Address the data gaps and quality issues in the existing data from MWSC, Fenaka, Stelco and other service providers about their water production and supply process to improve the PSUT for 2018 and 2019.

3.1 Conduct meetings with the service providers to discuss the gaps and issues with the data that have been provided.

3.2 Prepare questionnaires for the service providers to collect information on the operations of the service providers including use of water in the generation of electricity as needed for the Water Account.

3.3 Obtain information using questionnaires, site visits and meetings if necessary.

3.4 Improve the PSUT for 2018 and 2019 using the data that is collected.

Recommendation 4: Continue to work with MWSC, Fenaka and Stelco and, other water service providers in inhabited islands to obtain data in accordance with the Water Account Framework to include use of water by the different industries in the PSUT for 2018 and 2019.

4.1 Obtain existing number of customer registration by customer types and locations from each of the service providers.

4.2 Define sample size for top consumers by customer type, where applicable, and for each geographic location where the service providers operate.

4.3 Obtain list of top consumers and annual billed water quantity for each customer from the service providers.

4.4 Identify industry type of the top consumers in collaboration with Local Councils, MED and MIRA and other relevant agencies.

4.5 Improve the Supply Table using the top consumers data obtained from the service providers.

4.6 Document and share the issues faced in obtaining data, identifying industries for customers and data quality with the respective organizations.

Recommendation 5: Collaborate with the newly established URA to integrate the Water Account Framework with the Authority's plans and programmes.

5.1 Evaluate the Water Account Framework with the URA to assess whether the information needed by regulators are included in the Water Accounts.

5.2 Consult URA on the existing and upcoming regulations and guidelines related to service providers to incorporate data collection and reporting in conformity with the Water Account Framework.

5.3 Discuss with URA to incorporate the Water Account Framework and the necessary reporting to their regulatory requirements for commercial establishments.

5.4 Revise the indicators used in the Water Account Framework for data collection from the industries and households in consultation with URA.

5.5 Discuss with URA to conduct a stock-taking of water and sanitation services related infrastructure and resources across the country.

Recommendation 6: Collaborate with the water and sanitation service providers to harmonise their data with the Water Account Framework.

6.1 Review customer registration and billing information used by the different service providers to enable sorting of existing data according to the Water Account Framework.

6.2 Consult with the service providers to revise their billing system to enable billed water data by ISIC industries in the future. NBS will assist in connecting entities to their officially assigned ISIC industry code. Including the ISIC code into the billing system of the service providers would facilitate the implementation of these assignments.

Recommendation 7: Assess the existing water and sanitation situation of the different economic agents identified in the Water Account Framework.

7.1 Develop industry-specific questionnaires to assess current water and sanitation situations of different organizations and establishments from each industry and introduce them to existing NBS surveys.

7.2 Gather qualitative and quantitative industry-specific information on water abstraction, use, supply and discharge to prepare baseline for each industry through on-going and planned surveys of NBS and line ministries.

7.3 Review data collected for the groundwater assessment of inhabited islands by MoE under the Green Climate Fund to improve the data presented in the Water Accounts.

7.4 Prepare estimation methodologies for the different components of the Water Account Framework with the assistance of experts in the respective government agencies and industry experts.

Recommendation 8: Endorse the proposed Water Account Framework as one of the key tools for future data collection and reporting related to water and sanitation.

8.1 Conduct workshops to review and revise the Water Account Framework with suggestions from stakeholders, findings of industry-specific water and sanitation situation assessments and pilot water audits, with the objective to get the Framework endorsed by all stakeholders.

8.2 Review the ongoing and planned data collection activities and ensure conformity with the new Water Account Framework.

8.3 Collaborate with URA to incorporate data collection needs related to the Water Accounts to their data collection requirements.

Recommendation 9: Develop a water data system that serves the needs for the Water Accounts as well as that of policy-makers and regulators.

9.1 Evaluate the current water and sewerage policies and the Water Account Framework to identify policy gaps based on the findings of the Water Accounts as well as data gaps in the Framework to address policy needs.

9.2 Review the SEEA-Water to identify additional components that can be used to expand the Water Accounts with more relevance to existing policies.

9.3 Prepare additional tools based on SEEA-Water that can be developed for evaluation of SDGs and national policies.

Disseminate the results and findings on the water and sanitation situation of the Maldives based on the Water Account.

10.1 Establish a window on the NBS website to share information on the Water Account processes and results.

10.2 Conduct workshop with stakeholders to present the findings of the Water Account and the policy evaluation.

10.3 Publish the Water Accounts annually on the NBS website.

10.4 Periodically report water data to the UN statistical division when requested.

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