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Maldives Country Paper

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Introduction

The Maldives is formed into 1190 small low lying coral islands in the Indian Ocean stretched into north-south direction. The total area of the largest island is 5.2 sq.km and that of the smallest 0.037 sq.km. The elevation from MSL is 1.5 m and the highest natural point from MSL is 2 m. Among these islands 194 are inhabited with a total population of 350,759 people (Census 2015 Results). These islands are grouped into 21 administrative atolls of that majority are with land area below 500 m^2. Nearly half of the total population is living in Male'- capital of Maldives of total land area less than 1.4 sq.km.

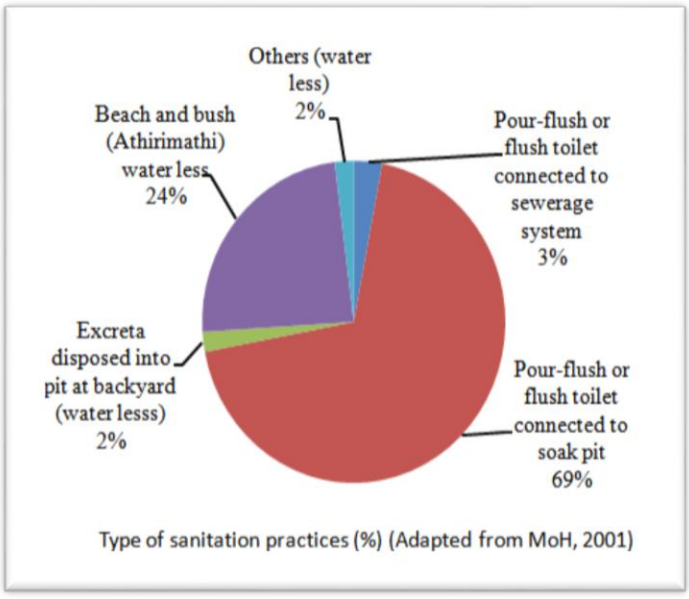
Overview of Sanitation in Maldives

The sanitation sector is arbitrarily divided into two segments namely the inhabited islands and industrial sector. The capital of Maldives (Male City) is with island wide conventional sewerage system that is operational since 1985. Island wide sewerage work in outer islands for the first time has begun in early 90's. The major industry where sanitation is widely covered is tourism industry. In tourist resorts the resort developer build and operate sewerage and sanitation facilities in each of the resort island on their own.

Traditionally Maldivians used bush/beach or Athirimathi for their excreta discharge. A designated area in the backyard of the house is also used for shallow burial of faeces. The backyard in most of the houses is isolated with either thatched or a masonry wall where a hole is made on the ground using thick iron rod for defecation. Once defecation is over the hole is covered with a portion of soil.

It has been an environmentally sound and zero cost method widely used across the country for human excreta disposal. Other past practices included Dhivehi Faakhaanaa, a form of oversee latrine. Brief but unsuccessful trials of other systems including ash latrines and sealed pit toilets were also constructed in the 1980s. Following the diarrheal epidemics in 1970's and 1980's, people started in building water based onsite sanitation systems.

Until the introduction of small bore sewerage (simplified shallow gravity) systems in early 90's defecation on beach//bush or Athirimathi and Gifili has been widely practiced among island communities. Vulnerability and Poverty Assessment survey carried out in 1998 indicated 33% and 26% population used Athirimathi and Gifili for defecation respectively. Athirimathi and Gifili systems although gradually are replaced with water based sewerage on systems, the incidence of diarrhoea and other water borne diseases still continue to cause illness to children and adults, indicating inadequate access to safe water and basic sanitation in outer atolls.



Type of sanitation practices (%) (Adapted from MoH, 2001)

Water-based Sewerage Systems

Water-based sewerage systems built in several islands across Maldives consist of a toilet flushed by water either from a fixed cistern or by pour-flush manually using a bucket or a dhani. The toilet is connected to some form of piped system leading to an on-site septic tank and effluent soak-pit, or to an island wide piped sewerage system. The first water supply and sewerage project in Maldives was launched in 1985 in Male mainly due to the diarrhoeal epidemics in 1970's and 1980's. In outer islands the first sewerage project was launched in early 1992 in V.Rakeedhoo. At present nearly 56% of total population have access to sewerage services with pour flush or flush toilets connected to sewerage systems with or without treatment (MEE, 2011). These various types of sewerage technologies in use as shown in Box 1 include small bore sewerage, conventional deep sewer gravity sewerage and vacuum sewerage systems etc. The rest (44%) of the population depend on on-site sanitation through septic tanks and infiltration systems.

Sewer outfall of small bore sewerage system, K. Gulhi (Photo: Mustafa, 2006)

Sanitation and pollution

Groundwater is the main water source for the outer islands. The leaky septic tanks, infiltration wells and soak away pits etc. directly discharge untreated effluent into groundwater led direct contamination of groundwater causing serious concerns. Groundwater quality tests indicate bacterial contamination of the groundwater. The shallow depth of the groundwater lenses of the islands makes this freshwater source vulnerable to land based such pollutions.

Box 1: Water borne sewerage systems introduced in the period 1990 - 2012

No	Type sewerage systems
1	Simplified sewerage with shallow sewers without septic tanks effluent discharged into a beach well or near shore lagoon
2	Septic tanks with effluent draining to on-plot soak-pits generally made from coral rocks.
3	Small-bore sewerage systems with septic tanks where effluent under gravity draining into lagoon through near-shore outfalls or into beach through beach soakage wells

4	Sewage consisting of solids and liquids draining through ‘simplified’ sewerage systems pumped into outfalls at the edge of the island. Some of these systems drain only ‘black-water’ (i.e. water from toilets) whiles others drain both black-waters and ‘grey-water’ (i.e. water from other discharge points including bathrooms and kitchens).
5	Conventional deep sewer gravity sewerage systems draining black-water and grey-water to lift stations + pump stations which pump the ‘raw sewage’ to the sea (untreated) through a series of outfalls outside the house reef
6	Conventional deep sewer gravity sewerage systems draining black-water and grey-water to pump stations which pump the ‘raw sewage’ to sewage treatment plant and effluent is used for irrigation, treated sludge is used as fertilizers
7	Sewerage draining or pumped to package treatment plants and from there to effluent reuse schemes (e.g. irrigation of plants) and discharge to soak-pits.
8	Sewerage connected to vacuum valve pit/holding tank (Vacuum Sewerage) + effluent (solid+ liquid) pumped into sea via ocean outfall

Table 1 Type of sewerage/sanitation practices and capital cost per person

Sn	Type of sewerage and sanitation practices	Average capital cost in US$ per person	Period
1	Gifili and Athirimathi (beach, bush and pit at house backyards)	0	Before 1980's
2	Gravity small bore sewerage system built in 90's with and without household septic tanks+beach collection tanks+ near shore gravity outfalls	85-150	In 1990's
3	Small bore sewerage (SBS) systems **without treatment**+ household septic tanks+with pump stations+ sea outfalls	849	After 2004
4	Small bore sewerage (SBS) systems **with treatment** household septic tanks+ with pump stations+ sea outfalls	858	
5	Conventional gravity sewerage (CGS) **without treatment**+ pump stations+ sea outfalls	727	
6	Conventional gravity sewerage (CGS) **with treatment**+ pump stations+ sea outfalls	965	

The per capita capital cost for SBSS (shallow sewer gravity) in Table 1 No.2 is estimated through personnel communication with Mr. Hussen Shaheed (engineer who built SBSS in V. Rakeedhoo) and Mr. Farooq Mohamed Hassan (Head of MWSA in 90's) on 14 October 2013. The first SBS system was built in early 1990's in V. Rakeedhoo Island of size 4 ha. The population of the island in 90's was estimated to be below 300. The capital cost per capita for SBSS in 1990's was found to be USD85-150 which is extremely low compare to sewerage systems implemented after 2004 as shown in Table 1. Those CGS systems are deep sewer gravity systems without and with household septic tanks. For future CGS projects the estimated capital (for planning purpose) cost per capita is USD1000 and 1500 (MEE, 2013)

Cost recovery of sanitation services

The sanitation practice using Gifili and Athirimathi is at no cost and not required for a cost recovery. When it comes to water based sewerage systems (simplified or conventional) a capital and operation, maintenance and management (OMM) cost is involved in each case. The average capital cost for CGS system is at USD2.6 million, for SBSS system is at USD1.8million and for vacuum system the average capital cost is USD1.4million (MEE, 2013). The average monthly OMM cost for CGS is at USD8000 (with STP), for SBSS system USD1000 (without STP) and for Vacuum system the cost is at USD8000 (with STP). It has

been a tough task in setting a reasonable user tariff on water and sewerage in islands outside Male' due to high cost anticipated for building sewerage systems, mixed technologies, absence of both water/sewerage systems built simultaneously, low population in islands (EPA, 2013). EPA (2013) also reports, islands where both water and sewerage systems are installed demand for a tariff not exceeding the tariff collected in Male' where the population is more than 120000. The population in outer islands is in the range 500 – 10000.

Institutional Roles and Responsibilities

Several government agencies at different levels are involved in managing water and sanitation sector in Maldives both at a central and local level. The water and sewerage sector until 2005 was under Ministry of Health regulated by Maldives Water and Sanitation Authority (MWSA). The water and sewerage mandate between 2005 and 2008 was at Ministry of Environment Energy and Water (MEEW) regulated by MWSA, which in 2009 changed into Ministry of Housing Transport and Environment (MHTE) regulated by water and sewerage unit merged with a newly formed Environmental Protection Agency (EPA).

In 2012 MHTE was split into Ministry of Housing and Infrastructure (MHI) and Ministry of Environment and Energy (MEE). Water and Sanitation Department (WSD) is formed within MEE is one of the key departments responsible for the water and sanitation sector. It is responsible for (a) formulating policies, regulations, and standards relating to water and sanitation. MEE does not have responsibility for emergency transportation of water to islands. Emergency water transportation task is held by the NDMC. Water supply, sewerage system design, tariff approval and water quality monitoring are the responsibility of the Environmental Protection Agency (EPA). EPA is functioning as a semi autonomous institute under MEE. Under the current setup policy making and construction of sewerage and water supply system is a responsibility of MEE. There are three water and sewerage utility companies in the country that provides these basic services in the islands. The Male' water and sewerage Company (MWSC) has been providing services to the urban population for 20 years while for the outer islands the services are being provided by the recently formed utility company FENAKA Corporation. The recently formed company has taken over the responsibilities of operation and maintenance of sewerage facilities in the Atolls. State Electric Company (STELCO) has also brought in to the water and sewerage sector in the year 2015.

Achievement (2003- 2015)

The government of Maldives attaches a high priority to the Health and well-being of all Maldivians. To this end, the Government is committed to improving access to safe drinking water and sanitation to all

Maldivians. The provision of safe drinking water supply and sanitation is regarded as a basic right for all Maldivians in the new constitution of the country that came into force in 2008

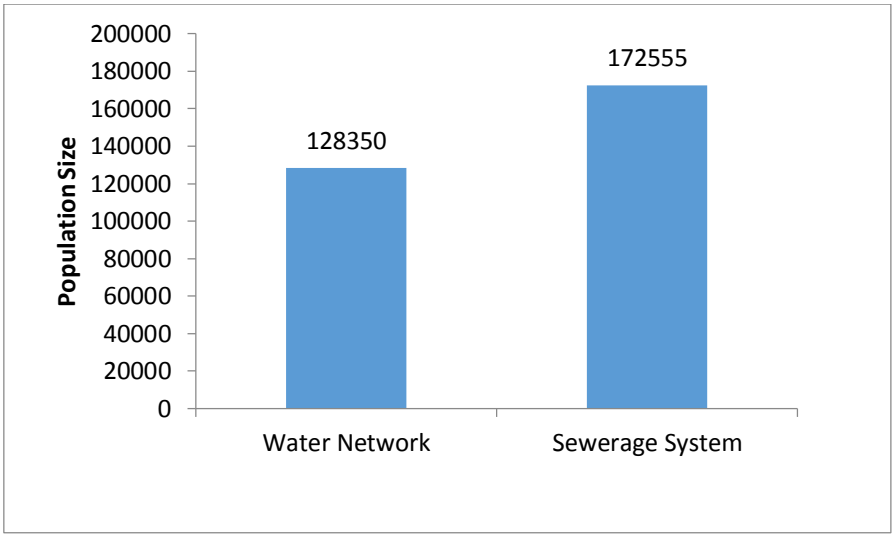


Figure 1 Population with safe water supply and improved sewerage facility-2014

Provision of appropriate water supply and sewerage services is one of the top priorities for the Government with the main task being to protect the island aquifers from fecal contamination and thus improve health and well-being of the people. Over the years the increased groundwater pollution and salinization, along with the socioeconomic development, raised the need for action to improve sanitation services in the atolls and higher levels of services.

In outer islands where sewerage system exists - a wide range of technologies have been chosen. The different technologies in place include, vacuum sewerage, RBC, conventional deep sewer gravity, shallow sewer gravity all with pump stations etc. while the treatment technologies are based on conventional activated sludge process, rotating biological contactors etc.

As the islands with water shortages has been increasing each year and as such supply of emergency water to the dispersed populations has continued to be a challenge. At the moment population greater than 1500 are provided with water supply network with household connections. Medium populations of 1000-1500 are provided with reverse osmosis plants and storage tanks with a community tap bay system. In addition, enhancement of community level rain water storage systems are being provided to the populations below 1000.

Efforts have been made by the Government in increasing financial assistance in providing more islands with improved water and sanitation services. Presently throughout the country, 31 islands have improved sewerage systems and 06 islands have desalinated piped water supply system with household connections.

More water and sanitation projects are underway across the country for the development of the sector. Over $100 Million Loan has been secured for the provision of adequate water supply and sanitation facilities to all Maldivians. Under the loan aid, 18 islands have been proposed for adequate sewerage facilities.Whilst 21 islands have ongoing projects for the provision of safe water supply facilities under the loan and grant aid. In addition around USD27.5 million is budgeted under 2015 Public Sector Investment Program (PSIP) Government Budget, 49 islands are targeted for adequate sewerage facilities and 21 islands are targeted for safe water supply facilities.

The Government seeks out to involve the private sector in developing, managing as well as providing the services in a sustainable manner. Efforts are being made to improve the sector governance and to provide more opportunities for the private sector. Creating an investor friendly environment is a key priority and the government policy is to take on the role of a facilitator and regulator rather than the service provider of these services.

Gaps, Challenges and Future Plan

The Government is working to improve access to water and sanitation services and to develop sustainable infrastructure based on cost effective, environment friendly, appropriate technology. The services will be developed in line with the Government Manifesto and strategies, taking into account the needs of the country.

The draft Water and Sanitation policy of 2015 takes note of the constitution and emphasis to improve governance by developing human resource capacity, promoting awareness, strengthening monitoring and evaluation, research, and learning at all levels.

The policy further aims to use the available resources efficiently and therefore encourage integrated and multi-disciplinary approach to the planning, formulation and implementation of projects. It will further utilize alternative methods of financing, including user fees, involvement of private sector and, public private partnerships and other methods of cost sharing. It also recognizes the critical role of broad stakeholder participation including non-governmental organizations (NGOs), civil society organizations (CSOs), multilateral agencies and other development partners in ensuring success and effectiveness of water supply and sanitation programs in the country.

Additionally the policy will emphasize the need to ensure autonomy and accountability in service delivery in a manner that enhances equity and access. This will ensure that appropriate legal measures are taken to improve and expand the delivery of water and sanitation services.

Key policy principles:

1. Universal access to safe water supply and adequate sewerage services.

2. Adopt cost effective, environment friendly, appropriate technologies in developing water and sewerage systems

3. Strengthen legal framework

4. Introduce innovative financial Mechanisms

5. Maintain financial and environmental sustainability of water and sewerage services

6. Strengthen institutional capacity of the sector

7. Strengthen advocacy and awareness programs in water and sewerage

8. Enhance Research and development for sustainable water and sewerage services

The major challenges in water and sanitation sector include;

- The Maldives geography is characterized by small and scattered islands which make it difficult to provide, monitor and manage services effectively.
- Limited technical expertise to manage and implement sector programs and projects
- Existing financial resources are insufficient to meet the target of ensuring that all densely populated and development focused islands have adequate supplementary water sources and sewerage systems.
- Sanitation technologies that will provide sustainable protection of groundwater are costly and this is limiting their applications in small islands where the groundwater table is high.
- In many islands, extraction of groundwater exceeds the sustainable yield, which is accelerating saline water intrusion into freshwater aquifer.
- The existing cost-recovery mechanisms do not ensure the sustainability of services in the outer islands. Where desalination plants are provided, the high costs of producing safe water prevent full cost-recovery, thus requiring government subsidies.
- Lack of regulatory framework, guidelines/standards and tariff system.

- The urban areas of Maldives are experiencing a rapid population growth. Long-term investment planning will be required to keep the current level of services.
- Lack of environmental awareness and water conservation
- Lack of stakeholder participation in the design and monitoring of water and sewerage systems
- Limited water resources. There is practically no surface water sources. Rainwater and groundwater is the only conventional resources available and desalinated water and bottled water available as non-conventional sources
- Lack of capacity to respond in an emergency and in mitigating the impacts of climate change (water shortages during dry periods). Over 50% of the inhabited islands have reported acute water shortages due to the prolonged dry period every year and the National Disaster Management Center (NDMC) has transported desalinated water to these islands.
- Lack of capacity (financial, technical and human) in the private sector for a solid engagement in public-private partnership for the provision and management of water and sanitation services.

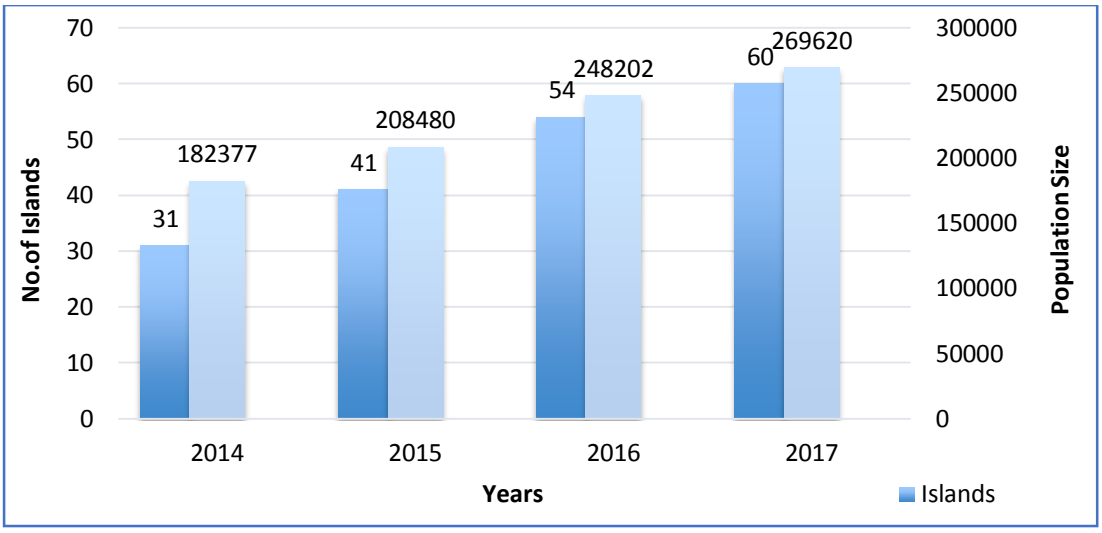


Figure 2 Number of Islands and Population with improved sewerage systems, current trend and future projections.

Conclusion

The water less sanitation systems such as defecation on beach, bush (Athirimathi) and pits at house backyard (Gifili) practiced by Maldivians until early 70's have gradually changed into water based onsite sanitation practices. In 1985 in Male' (capital of Maldives) government launched first major water supply and sewerage project mainly due to diarrhoeal epidemics in 1970's and 1980's. In early 90's government

launched first outer island sewerage project in V. Rakeedhoo island, where first small bore sewerage system (SBSS) was built. SBS systems were replicated to 7 more islands with design modification. The 2004 Asia tsunami that was hit on part of Maldives has been the bench mark that shifted into the modern sewerage infrastructure in Maldives. Island wide sewerage systems that began with per capita capital cost USD85-150 in early 1990's is now over USD900. Absence of a stable institutional setup, lack of technical people and comprehensive mechanism for sustainable operation and management of water supply and sewerage systems in islands are some of the key challenge. The 46% population who are using septic tanks and infiltration wells for sewage disposal also happens to pollute the freshwater lens due to direct discharge of effluent into groundwater

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