



3.2 FRESHWATER RESOURCES

The water resources of the Maldives comprise of fresh groundwater that occurs in the porous coral sediments on many islands of the Maldives. The population of Maldives has traditionally been dependent on groundwater from shallow well dug in the ground. It has been estimated that currently 25% of the population depends on groundwater for drinking while the rest of the population uses rainwater and desalinated water for drinking and groundwater for other purposes.

The quality of groundwater varies seasonally and across the islands. The superficial hydrogeology of the groundwater aquifers result in ease of pollution by sewage, chemicals and pathogens. Water quality testing carried out to date shows that bacterial contamination of point source water supplies (dug wells) is widespread and that faecal contamination exists in many of these sources on the inhabited islands. The level of faecal contamination is higher on the more densely populated islands, Malé being regarded as having the highest level of bacterial contamination of the groundwater aquifer. However, the controlling factor is not the size of the

population of the island, but the house plot size in combination with the presence of cesspits and their interaction with the groundwater aquifer. On the basis of WHO drinking water guidelines there are few groundwater sources in the Maldives fit for potable use without disinfection.

The microbiological quality of well water in many growth centres of the Maldives is usually above 50 coliforms per 100ml which renders the water even unfit for bathing under World Health Organisation recreational or bathing water quality guidelines. Improper sewage disposal facilities are the major cause of poor groundwater quality in these islands.

Chloride and electrical conductivity varies both from island to island and within an island. On a few islands chloride exceeds the WHO guideline of 250mg/l. Data collected in the past points to the fact that the chloride concentration is not necessarily related to the level of extraction or population density, but also to underlying hydro geological aspects of the aquifer. Islands without wetland areas show low chloride levels than those with wetlands, as wetlands contribute to the increased chloride levels of the true groundwater lens of the

island. Generally, however, the greater the extraction, the higher is the chloride from island to island and within an island. Chloride levels of the groundwater aquifer may not be particularly important in many islands because well water is hardly used for potable needs. During early 2000 about 60% of the wells in the country were reported to have freshwater (MWSA).



The groundwater in Malé is severely depleted. The 5600 household wells have been supplying the water needs of the population of Malé, in the past. At present the water provided by these wells is so saline that it is not fit even for bathing and washing purposes. The situation is further aggravated by the amount of chemicals in the water such as hydrogen sulphide and hydrocarbons. A recent chemical analysis of ground water in Malé shows that it contains high amounts of nitrates and sulphates. In a few wells ammonia was detected at elevated levels (0.4 - 0.6 mg/l) indicative of sewage pollution and raised pH levels (7.5 - 8.0) tended to confirm that the results were significant (WHO, 1995). Hydrogen sulphide or sewer gas has also been a major threat to well water users in Malé resulting in acute poisoning of two and death of one person in 1997. Hydrogen sulphide makes the water stink and poses different health risks at different levels of exposure. Many household wells have shown elevated levels (0.5 to 3.5 ppm in water and above 100 ppm in the air) of hydrogen sulphide. Hydrogen sulphide in the sewers has also been a major problem for people living near pumping stations around Malé. The situation has improved in many areas since household venting started in 1999.

Hydrogen sulphide has also been detected in some wells in Kulhudhuffushi and Hithadhoo, the designated growth centres under the first Regional Development Project.

The quality of groundwater in Gan, Addu Atoll has also rapidly declined in the past few years. Gan has a few garment factories and a regional airport. However, as almost all general purpose water used on Gan originates from two boreholes located on the western side of the island, there is excessive extraction above the demand. Leakages in the distribution network also contribute to the problem in Gan.

Increased extraction exceeding natural recharge through rainfall has dramatically depleted the freshwater lens in Malé and other populated islands. This increased extraction is linked with technology and lifestyle. Although, many households in Malé and in other islands of the Maldives use low flush toilets and other water saving devices, water conserving lifestyles can be said to be rare.

3.2.1 Rainwater



In many islands, rainwater is mainly used for drinking and cooking purposes. Recent and past water quality tests on rainwater have shown that rainwater in the Maldives is of acceptable potable quality. However, a full analysis of rainwater may be required before impacts of trans-boundary air pollution can be assessed.

Many people practice safe collection and storage of rainwater. However, there have been a few incidents when rainwater has been tested positive for faecal coliforms. Rainwater is hardly disinfected, and very few people boil it.

Rainwater collection is also encouraged in resorts islands by the Ministry of Tourism to reduce the need for desalination.



3.2.2 Desalinated water

Desalination or desalting became necessary when the sustainable yield of the existing groundwater aquifer on some islands was exceeded. Desalinated water is now supplied to almost all households in Malé and Villingilli, the fifth ward of Malé. Malé produces about 4,000 tonnes of desalinated water everyday using the reverse osmosis (RO) process to serve a population of about 74,000 people (figure 3.1).

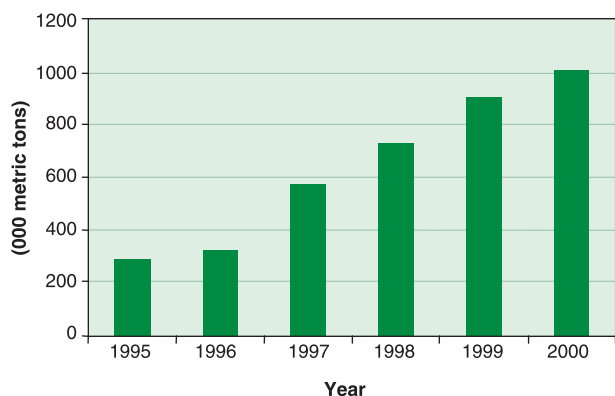


Figure 3.1: Annual Supply of Desalinated Water in Malé



At present, Kandholhudhoo is the only other inhabited island that is served with desalinated water via taps in standbays. The need for desalination arose during the dry season of 1998 when the inhabitants of Kandholhudhoo had to fetch water from nearby islands. Kandholhudhoo, the most densely populated island in the Maldives, is served by a reverse osmosis desalination plant with a capacity of 50 cubic meters. The island community operates and maintains the plant. When the population of Kandholhudhoo was served by desalinated water in May 1999, about 28% of the population of the Maldives had access to desalinated water and over 20% of the population almost entirely depended on desalinated water.

All tourist resorts rely on desalination to cater for their water needs as the island aquifers could not be tapped and also would not provide sufficient yield. In most resorts, a total production capacity based on 250 litres per capita per day is established.

3.2.3 Fresh or brackish water ponds

Surface freshwater is generally lacking throughout the archipelago with the exception of a few swampy areas, shallow freshwater lagoons, and some fresh or brackish water ponds in some of the islands in the northern and southern atolls (Table 3.3). In heavily



Table 3.3: Islands with wetlands in the Maldives

Island	Atoll	Size of Wetland (hectares)
Filladhoo	Haa Alifu	3.6
Thakandhoo	Haa Alifu	1.8
Baarah	Haa Alifu	5
Mulhadhoo	Haa Alifu	-
Maafari	Haa Alifu	0.8
Nolhivaranfaru	Haa Dhaalu	0.35
Neykurendhoo	Haa Dhaalu	-
Finey	Haa Dhaalu	-
Nolhivaramu	Haa Dhaalu	4
Kulhudhuffushi	Haa Dhaalu	16.1
Maakandoodhoo	Shaviyani	8.28
Feydhoo	Shaviyani	-
Funadhoo	Shaviyani	-
Maroshi	Shaviyani	-
Nalandhoo	Shaviyani	2.49
Milandhoo	Shaviyani	1.6
Medhukuburudhoo	Shaviyani	7.88
Farukolhu	Shaviyani	1.3
Eriadhoo	Shaviyani	1.1
Eskasdhoo	Shaviyani	29
Bomasdhoo	Noon	2.3
Kedhikolhudhoo	Noon	31.1
Tholhendhoo	Noon	3.7
Medufaru	Noon	5.9
Karinmavattaru	Noon	0.3
Kuredhdhoo	Lhaviyani	2.4
Kolhufushi	Meemu	5.3
Gan	Laamu	-
Isdhoo	Laamu	-
Gaadhoo	Laamu	-
Viligili	Gaafu Alifu	-
Kadulhudhoo	Gaafu Alifu	-
Madaveli	Gaafu Dhaalu	4
Nadallaa	Gaafu Dhaalu	3.7
Thinadhoo	Gaafu Dhaalu	3
Fuvahmulah	Gnaviyani	8.5
Hithadhoo	Seenu	11.9
Hulhudhoo	Seenu	2.8
Meedhoo	Seenu	-
Herethere	Seenu	4.7
Viligili	Seenu	2.3

Source: MHAHE : 2002

populated islands such as Thinadhoo and Kulhudhuffushi, the marshy area has been used for waste disposal and to create land. In Baarah, the wetland or brackishwater ponds became a nuisance by being a breeding ground for certain mosquitoes. Freshwater ponds like the one in Fuvahmulah could serve as an important reservoir for freshwater supply.

3.2.4 Major Policy Responses and Initiatives

To face the challenges, an integrated national water resources management master plan is to be developed, in addition to the development and strengthening of monitoring and assessment capabilities. However, this process is currently in its draft stages. Draft regulations on water supply, plumbing, waste disposal, sewerage systems, etc. have been developed. Desalination plants cannot be installed and operated in the country without written permission from MWSA. Therefore, a draft standard for the operation and maintenance of desalination systems has been developed. Strict measures are in places to reduce the amount of pumping for excavation and foundation works. As such, dewatering guidelines have been developed. The tourism regulations have ensured that the groundwater lens of newly developed resort islands are truly conserved and protected. All restaurants and cafes are required to have grease/oil traps according to MWSC specifications.

Optimizing rainwater catchment is a priority policy of the government. Rainwater collection tanks are procured and delivered at public and household levels. Household/private tanks are sold on monthly installment basis. The programme is carried out under a revolving fund generated with the assistance of UNICEF.

In 1995, the Government of Maldives transferred the water supply and sewerage management of the city of Malé from the Maldives Water and Sanitation Authority (MWSA) to a private company, Malé Water and Sewerage Company Ltd., which was set up for this purpose. MWSC is a joint venture company with Government majority shareholding. In order to protect the interests of consumers as well as the environment, the Maldives Water and Sanitation Authority was given the mandate to act as a regulatory body for the company. The regulatory body is responsible for setting standards and regulations for water quality in the Maldives and to monitor and enforce them.

MWSC is improving the performance of the existing sewerage system in Malé. Efforts are underway to reduce the level of hydrogen sulphide gas in sewers by sewer ventilation. Leaking catchpits are being replaced by plastic (HDPE) ones to ensure strength and longevity and to virtually eliminate leaks and reduce groundwater contamination.

Local traders are introducing different water saving devices into the country. Energy efficient technologies are also being introduced. However, currently there are no tax cuts on environment safe or environmentally friendly products.

Inappropriate selection of excreta disposal methods coupled with lack of management skills at community level has resulted in ill-health or other related problems. Small bore sewerage systems installed on 7 islands have had several problems related to design, construction and maintenance. Consequently, a study to find practical options and develop selection and management criteria is now underway. The study is being developed by National Development Consultants of Pakistan and would be completed in early 2002.

Water quality surveillance is given special focus by the Maldives Water and Sanitation Authority. The Public Health Laboratory carries out daily tests on desalinated water produced in Malé and Villingilli by MWSC.

Water test kits have also been provided to regional hospitals. Appropriate training on how to use these test kits have also been given to concerned persons at the Regional Hospitals.

Bathing water quality in Malé Swimming Track (or fathaa sarahaddu) is tested regularly to protect swimmers who swim in the area, which is close to sewer outfalls for PS2 and PS9 behind Dharubaaruge. At times when faecal contamination exceeds 100 per 100ml, notice has been given.

Water quality monitoring is also carried out for 64 groundwater wells in Malé and water resources of selected islands of selected atolls are assessed every year.

A storm water management system is being developed by the Ministry of Home Affairs, Housing and Environment. However, the health concerns of such a plan have not been adequately addressed.

Water and sanitation component of the Regional Development Project would provide the venue and forum for detailed investigation and understanding of appropriate technologies and means of water supply and sanitation.