

Water Security in Malaysia – Issues and Challenges

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Abstract— For mankind, water is not just used for drinking purpose, but also served as an important resource for social, economic, cultural and environmental activities. Malaysia is a country in Southeast Asia. It is considered a water-rich country. Despite being blessed with abundance of water resource, Malaysia is not free from water supply issue. This paper discusses four of the common issues and challenges facing the Malaysian in ensuring water security. This paper is written largely based on literature review and extensive experience of the authors in the field of water management. Four of the challenges discussed are flood, water pollution, aging water infrastructure, and financial deficit of water supply sector. Finally, the paper suggests that a more integrated approach is required to enhance water security in Malaysia.

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I. INTRODUCTION

Water is naturally one of the most important nature resources to the earthlings. For mankind, water is not just used for drinking purpose, but also served as an important resource for social, economic, cultural and environmental activities [1]. In Asia, demand for water is growing due to population explosion, rapid urbanization, economic growth, and agricultural expansion. In the light of global warming, one of the biggest challenges facing the governments in Asian countries is to ensure water security, particularly the developing countries [2].

Malaysia is a country in Southeast Asia. It is considered a water-rich country as the country is blessed with more than 3,000 mm of average annual rainfall with more than 556 billion cubic meter of annual renewable surface water [3]. According to World Bank, Malaysian enjoys an annual renewable internal freshwater resource of 19,420 cubic meter per capita per year. This volume of renewable freshwater resource per capita is about 263 % and 327% more than the Nepal and global average of 7,366 and 5,932 cubic meter per capita per year [4]. Despite being blessed with abundance of water resource, Malaysia is not free from water supply issue [5]. Scholars worry that the fast-changing climate will further threaten water security of the country [6]. This paper discusses four of the common issues and challenges facing by Malaysia in ensuring water security of the country.

Four of the issues discussed are: flood, water pollution, aging water infrastructure, and financial issue of water supply sector in Malaysia. This paper is written based on literature, government report, research reports, and extensive of the authors in the field of water management.

II. FLOOD DISASTER IN MALAYSIA

As a tropical country in Southeast Asia, Malaysia is a flood-prone country. Due to the combination of natural and man-made factors, such as monsoon winds, heavy seasonal rainfall, low-lying topography, river characteristic, rapid urbanization and land-use change, flood has caused socio-economic losses to the people in Malaysia [7]. Annually, the country is hit by monsoon flood, flash flood, and tidal flood. The total number of reported floods per annum has seen a surge in past five years. On average, there were about 134 floods reported annually from 2002 to 2010 (Figure 1). From 2011 – 2017, the average number of reported floods per annual increased to 240. In 2015 and 2017, the number of reported floods per annum had increased to historic highs of 323 and 498 per annum. By simply observing these numbers, flood events have become more frequent if comparing with the first decade of 21st century. In addition, from 2015 to 2017, the total number of flood victims were 141,940 people, and the total estimated economic losses were 83 million Malaysian Ringgit (about 20 million US dollar) [8].

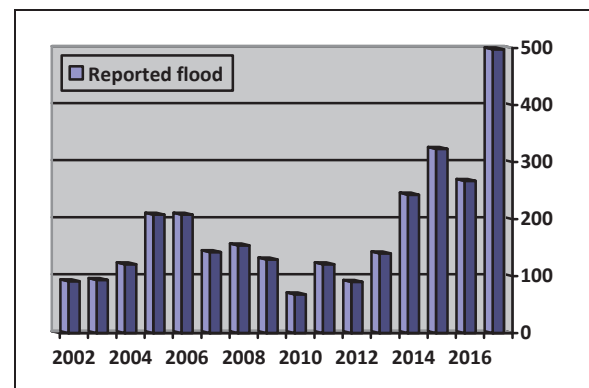


Fig. 1. Number of reported floods in Malaysia (2002 – 2017).
 (Source: Compendium 2018, Department of Irrigation and Drainage, Malaysia)

According to the Annual Flood Report published by the Department of Irrigation and Drainage, Malaysia [8], the other common factors of flood in Malaysia are:

- i. Sistem saliran tidak dapat menampung air larian permukaan kerana tersumbat dengan sampah sarap dan kelodak hasil dari pembinaan atau kerja tanah di kawasan sekitar;
- ii. Ketidakupayaan sistem saliran sediaada untuk menampung peningkatan air larian permukaan yang mendadak akibat hujan lebat berkeamatan yang tinggi dalam masa yang singkat;
- iii. Limpahan air sungai yang disebabkan oleh hujan berterusan dan menyeluruh serta pelepasan air dari empangan;
- iv. Pemendapan dasar sungai yang mengakibatkan sungai-sungai menjadi cetek dan sempit;
- v. Perubahan corak gunatanah hasil daripada pembangunan setempat yang tinggi dan pesat menyebabkan kurangnya kawasan telap air;
- vi. Pembinaan dalam kawasan rizab sungai;
- vii. Pengaruh pasang-surut air laut. Masalah banjir berlaku apabila air laut pasang tinggi dan hujan lebat berlaku pada masa yang sama. Akibatnya air daripada sistem saliran samada sungai semulajadi atau saliran perparitan mengambil masa yang lama untuk menyalirkan air; dan
- viii. Kawasan rendah dan berisiko untuk banjir.

III. WATER RESOURCE POLLUTION IN MALAYSIA

In Malaysia, water pollution is among the major threats to water supply security of the country. In the country, 95 % of the people are served by tap water. More than 80% of the tap water supplied are produced with water resource extracted from rivers [9]. Notwithstanding the importance of river, the number of clean rivers decreased significantly in the past decade (2008 – 2017). As shown in Table 1, the number of clean rivers decreased from 336 in 2008 to 219 in 2017. In contrast, the number of slightly polluted rivers and polluted rivers increased from 197 and 46 in 2008 to 205 and 52 in 2018.

TABLE 1. River Water Quality Trend in Malaysia, 2008 - 2017

Year	Cleanliness of monitored rivers			Total rivers monitored
	Clean	Slightly Polluted	Polluted	
2008	336	197	46	579
2009	306	219	52	577
2010	291	205	74	570
2011	274	148	42	464
2012	277	162	38	477
2013	277	172	29	477
2014	243	186	48	477
2015	277	167	33	477
2016	224	205	48	477

2017	219	205	52	477
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Source: Environmental Quality Report 2017 [10]

According to the Environmental Quality Report 2017, high Biochemical Oxygen Demand (BOD), Ammoniacal Nitrogen (NH₃-N) and Suspended Solids (SS) contributed significantly to the river pollution in Malaysia. High BOD is usually caused by inadequate sewerage treatment or effluent discharged by manufacturing industries. NH₃-N were found from animal farming and domestic sewerage, and SS were mainly due to improper earthworks and land clearing activities [10].

IV. AGING WATER SUPPLY INFRASTRUCTURE

Since the country independent in 1957, Malaysia's water supply infrastructure has been developed rapidly to cater the increasing domestic and commercial water demand. In 1981, total length of water pipe in Malaysia was 31,089 kilometers (km) and the total capacity of water treatment plant was only 2,542 million liters per day (MLD). Ten years after, total length of pipe increased by 57% to 48,762 km and the capacity of water treatment plant grew by 136% to 6,103 MLD in 1990. From 1990 to 2000, additional 38,328 km (increase of 78%) of pipe were laid and the capacity of water treatment plant had been expanded to 11,911 MLD, nearly a double of the capacity comparing with the year of 1990. Since 2001, the length of pipe and capacity of water treatment plant grew significantly. By 2017, the length of pipe was recorded at 152,121 km and the capacity of water treatment plant was 19,706 MLD.

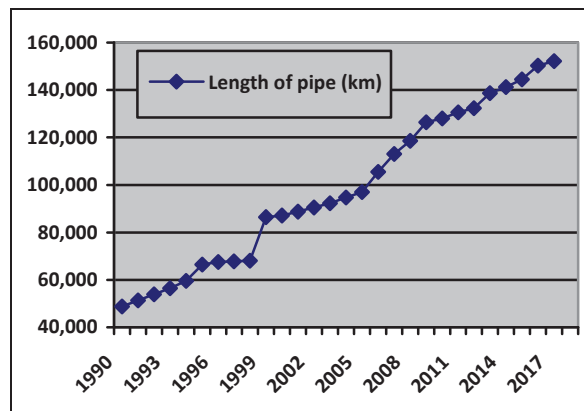


Fig 2. Length of Pipes (km), 1990 - 2017 [11]

With a significant increase of pipes, the volume of water leakage increased along with the grow of pipes laid. Non-revenue water (NRW) is commonly used worldwide as an indicator of water loss in a water supply system. NRW is measured by deducting the volume of water supplied with the volume of water billed to the water users. According to available record, 43% (about 2043 MLD) of the treated water produced by Malaysia's water treatment plant in 1990 were lost because of NRW. In 2000, NRW rate of the country was recorded at 40 %, which was about 4,112 MLD of loss. In 2017, NRW rate in Malaysia had been reduced to 35.3%, but the volume of NRW

increased to 5,929 MLD [11]. NRW rates vary across Malaysian States (Table 2). Five of the states recorded NRW rate of higher than 40%; another five states' NRW rates were ranged between 31% - 40%; and there were only three states' NRW rate were recorded below than 25%.

Such a significant volume of water loss is caused by aging water infrastructure. In Malaysia, Asbestos Cement (AC) pipe is an indication of old piping that is prone to leakage. If a water supply network comprise of high proportion of AC pipe, the network tends to have higher volume of water leakage. On average, 27 % of the water pipe in the country are AC pipe. However, this number varies across the States. Currently, many of the Malaysian State still consists of significant proportion of AC pipe in their water supply system. To replace these aging pipes, a huge amount of fund is required.

TABLE 2. Volume and rate of NRW of Malaysian State, 2017
(Source: Malaysian Water Industry Guide 2018)

State	Volume of NRW (MLD)	NRW Rate (%)
Johor	433	24.7
Kedah	651	47.5
Kelantan	234	49.3
Melaka	101	19.6
N. Sembilan	245	32.6
Penang	231	21.9
Pahang	528	47.5
Perak	406	30.9
Perlis	152	63.1
Sabah	679	53.8
Sarawak	529	37.8
Selangor	1,526	31.5
Terengganu	186	30.4
Malaysia	5,929	35.3

V. FINANCIAL DEFICIT OF WATER SUPPLY SECTOR

Financial issue has been a major threat to Malaysia's water security. From 1990 to 2000, total revenue collected by Malaysia's water sector can only barely covered total expenditure of the sector. However, from 2001 to 2010, total revenue collected by Malaysia's water sector was less than the total expenditure. Since 2011, Malaysia's water sector has been in operating deficit, averaging 567 Million Malaysian Ringgit (about 137 million USD) loss per annum. In 2017, total revenue collected by Malaysia's water sector was 5,875 million Malaysian Ringgit, but the total expenditure of the sector was 7,694 million Malaysian Ringgit, which represents a loss of 1,819 billion Malaysian Ringgit per annum.

Low water tariff is recognized as the main cause of Malaysia's water sector deficit. Malaysia average

domestic water tariff for the first 20 cubic meter of water consumed is only 0.13 USD per cubic meter. It is the cheapest in the region of Southeast Asia. However, the average cost for producing clean water is 0.43 USD per cubic meter. The Malaysian water sector loss about 0.30 USD for every cubic meter of water sold to the domestic water consumer for the first 20 cubic meter of water consumed. With increasing personal, energy and chemical costs of producing clean water, the low water tariff in Malaysia cannot sustain the water supply expenditure in the long run. The country has started to reform its water sector, and the issue of low water tariff is expected to be resolved after the reform is completed [12].

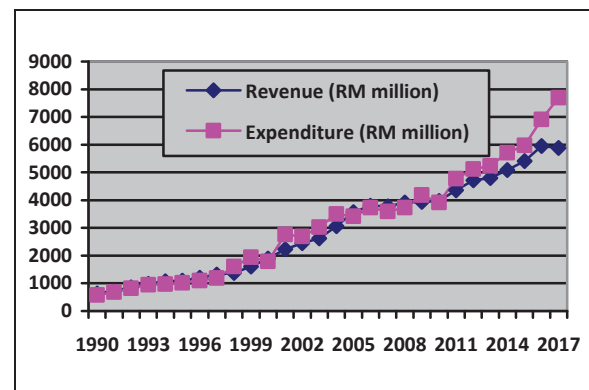


Fig 3. Total revenue vs total expenditure of water supply sector in Malaysia, 1990 – 2017 [11]

VI. CONCLUSION

In summary, four of the water issues discussed in this article show that ensuring water security in Malaysia is getting more and more challenging. In particular, when the regional climate is getting more extreme, the country will face more extreme rainfall and drought events in the future. Flood disaster can be more severe and frequent. With the increasing trend of economic development, river pollution will be more serious because of rapid urbanization and industrial development. Without increasing revenue for the water sector, there will not be enough money to invest in developing more effective water infrastructure. Finally, the water solutions have been widely applied in the past cannot effectively solve the water issues facing the world in 21st century. Therefore, a more integrated and sustainable approach for water management is required to enhance water security in Malaysia. In addition, the public who used to be a passive role when comes to water management, must play a pro-active role to manage water resource of the country.

ACKNOWLEDGMENT

The preferred spelling of the word "acknowledgment" in America is without an "e" after the "g". Avoid the stilted expression "one of us (R. B. G.) thanks ...". Instead, try "R. B. G. thanks...". Put sponsor acknowledgments in the unnumbered footnote on the first page.

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