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Briefing Note

Regional Fellowship Program

Overview of Wastewater Management in Phnom Penh City

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Acronyms

ADB	Asia Development Bank
PPWSA	Phnom Penh Water Authority
GPPWSS	the Greater Phnom Penh Water Supply System
JICA	the Japan International Cooperation Agency
MPWT	Ministry of Public Works and Transport
MoE	Ministry of Environment
GOC	the Government of Cambodia
MDG	the Millennium Development Goal
NIS	National Institute of Statistic
CDS	City Development Strategy
PPGCSP	Phnom Penh Green City Strategic Plan

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1. Introduction

In Cambodia, urbanization, including the ability to offer adequate and basic public services, has not kept pace with its fast growing economy, averaging 7 percent GDP growth per year[1]. Uneven economic development has occurred, and resulted in an increasing flow of people from rural areas to main cities in search of employment and resettlement. This phenomenon has created considerable challenges for the government to provide adequate basic services such as drainage, wastewater treatment, public transport and solid waste management [1].

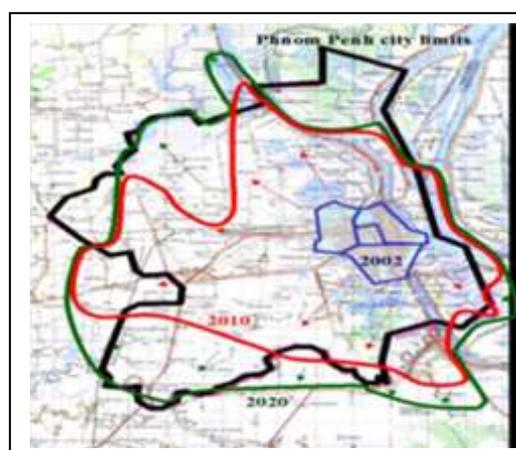
This briefing note reviews the current capacity and challenges related to wastewater, to try to identify the best next steps for strengthening effective wastewater management for a healthy living environment in Phnom Penh through the following questions:

1. Why is wastewater management an issue as part of the urbanization in Phnom Penh?
2. What are the current efforts to address the wastewater issues in Phnom Penh?
3. Are there any best practices to help manage wastewater more effectively in Phnom Penh?

2. Urbanization in Phnom Penh

Phnom Penh, the capital of the Kingdom of Cambodia with a population of approximately 2 million people in 2019, is experiencing the fastest urbanization of all the cities in the country. Its size has increased from 300 to 700 square kilometers in the last ten years (Figure 1)[2]. As Cambodia's gateway to the global economy, it has attracted an increasing flow of foreign investment in trade, production for export and service sectors, including the real estate and construction sectors, in the past decade[1]. In 2014, Phnom Penh had a total of 97,200 established enterprises, an increase of 1.4 percent[3] from 2011, and provided 552,625 jobs, an increase from 17,625 jobs in 2011[4]. This expansion has created thousands

Figure 1: Phnom Penh Map



Source: Research Gate 2018

of jobs every year resulting in increasing demand for basic public services including water security including an adequate supply of clean water and a proper waste management system.

3. Supply of Clean Water

Phnom Penh has almost doubled its capacity to supply clean-water over the past 6 years (Figure 2), reaching 580,000 m³ per day (Table 1). However, the Phnom Penh Water Supply Authority (PPWSA) states about 85 percent of its residents[5] have accessed to water mains. One out of four clean water plants is being upgraded for expansion of its capacity and, which will be put back in operation at the end of 2019. Moreover, with the recent impacts of climate change¹ and El Niño effects there has been increased concern regarding the unreliable supply of water mains for domestic consumption in Phnom Penh[6].

Table 2: Drinking Water Production in 2019

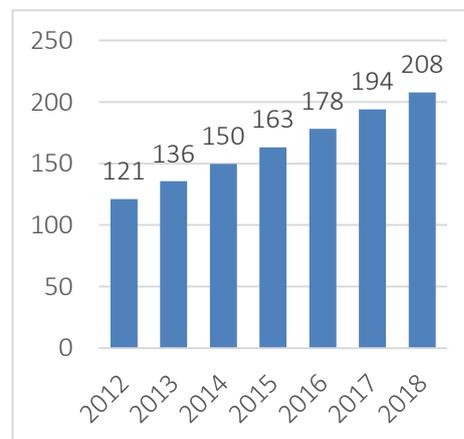
Clean water plants	M ³ per day
Phum Prek Water Treatment	150,000
Chroy Chongvar Water Treatment	130,000
Niroth Water Treatment	260,000
Chamkarmon Water Treatment (in restoration and will be in operation by the end of 2019)	52,000
Total capacity of dirking water production per day (18/03/19)	592,000
Expansions of new Clean Water Production more capacity	
Bakheng Water Plant (new) *	400,000
Chamkarmon Water Plant restoration and expansion**	52,000

* 350 million USD for investment to be in operation in 2022 with 3 year 9 months for construction

** 15 million USD for investment to be in operation by October/November 2019

***Clean water supply up to 1 million m³ in 2025

Figure 2: Quantity of Clean Water Supply in Phnom Penh (million m³)



Source: Phnom Penh Water Supply Authority, 2019

The PPWSA plans to increase clean water production to 1 million m³ per day by 2025 in order to accommodate the growing population, expanding construction sector and other economic activities in Phnom Penh (Table 1) [6]. With this commitment, access to clean water will be

¹ <https://www.accuweather.com/en/weather-news/what-is-el-nino/70005474>

less of no a concern for all residents and businesses in Phnom Penh, as noted in PPWSA's third Master Plan period 2015[7].

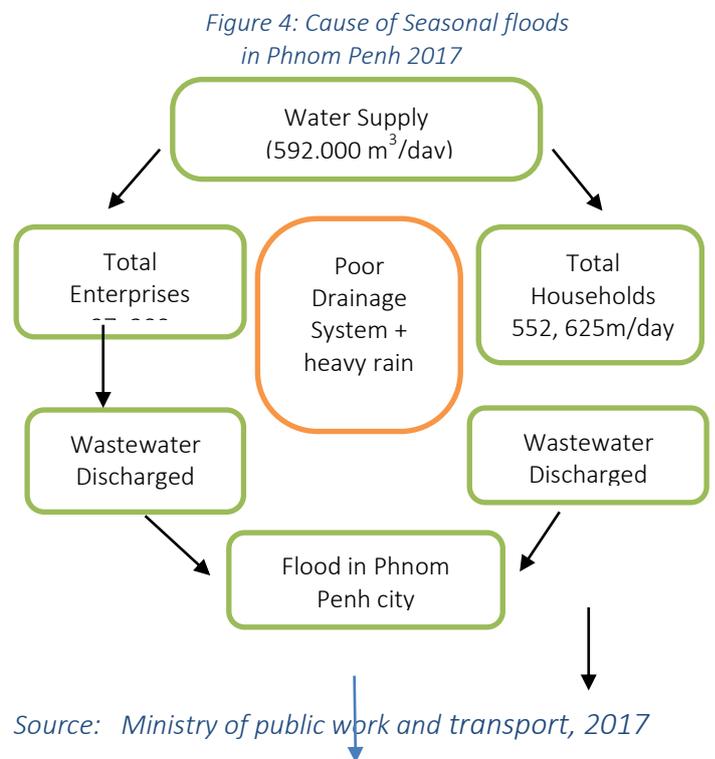
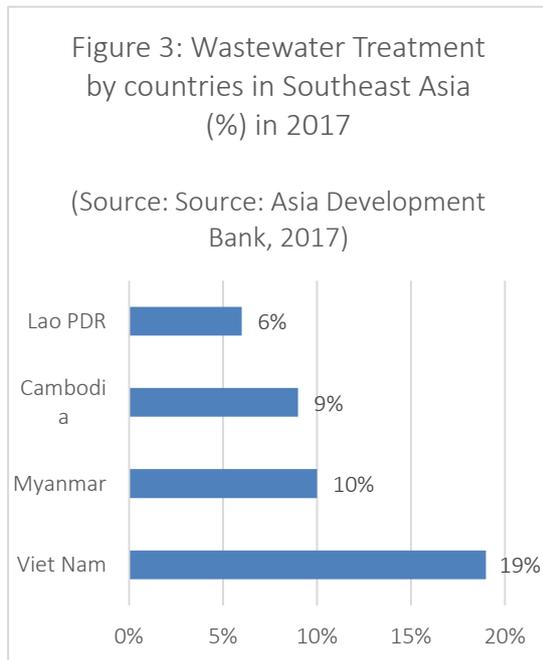
More progress and a strong commitment to increase clean water production and supply will eventually increase the volume of wastewater discharged to the main water-bodies. Issues regarding the current capacity of wastewater management in Phnom Penh relate to the many roads that are often blocked after a big monsoon rain² as well as the affects experienced by the 15 percent of people who do not have access to clean water[7].

4. Wastewater Management

Currently, wastewater released from households contains 234 tons of feces, 2,335 m³ of urine and 8,154 m³ of grey water per day. Moreover, wastewater discharged from 3000 small enterprises amounts to more than 1 million m³ daily[8].

There are 14 pumping stations in Phnom Penh's 732 kilometer drainage system and 44,807 converted-holds in Phnom Penh for wastewater management. This sewer system is mostly narrow and has old settings remaining from the colonial period [6]. Well-functioning sewers increased from 7 percent of the total in 2011 to 11 percent in 2015, while the rest need further improvement[9]. Consequently, only 9 percent of discharged water in Cambodia is properly treated before being released into the main water bodies, the second lowest capacity after Lao PDR in Southeast Asia (Figure 3). Phnom Penh, in particular, often experiences flooding during the rainy season[10] due to its fragile sewage and drainage system (Figure 4).

² <https://www.khmertimeskh.com/504609/flash-floods-hit-phnom-penh/>



Current efforts to construct sewage systems and centralized wastewater treatment facilities in several locations has not yet been adequately addressed. There are small sized natural lagoons that receive wastewater from the drainage system but they are not sufficient to address the wastewater management issues in Phnom Penh. To help address this issue, construction of a wastewater treatment plant in Dangkor District, (a USD 27 million investment), with technical assistance from the Japan International Cooperation Agency (JICA), will begin in 2019[9].

5. Impact on Water Source

Most of the wastewater in Phnom Penh runs off directly to public receiving sources including the Tonle Sab and Mekong water streams though public sewers and open canals/drainage systems. This the main cause of water pollution in Phnom Penh. According to the Ministry of Environment (MOE), while chemicals are currently used by the industrial sector to boost production, only 5 percent of the run off is properly treated before discharging. This raw

sewage smells bad and is poisonous because it contains bacteria, and parasites, making the affected water unsafe for humans and animals[11].

Only 41 percent of Cambodians have secure access to sanitation facilities, the lowest among all countries in the Southeast Asia, and was ranked as one of the slowest to make progress in wastewater management in the region (Table 2). In Cambodia, almost 13 percent of children under five years of age are at high risk of getting diarrhea as a result being exposed to contaminated water and unhygienic and poor sanitation practices (Table 3).

Table2: Water Supply in Southeast Asia in 2016

Countries	Water Supply	Wastewater	Sanitation Access	Diarrhea
Scale	5-Jan	5-Jan	%	#
1.Laos	2	2	70	2,621
2.Cambodia	3	1	41	970
3.Viet Nam	2	1	76	414
4.Thailand	3	2	93	233
5.Philippines	1	1	73	718
6.Myanmar	1	1	80	1,295
7.Malaysia	5	5	96	150
8.Brunei	5	5	96	125
9.Indonesia	1	1	61	675
10.Singapore	5	5	100	82

Source: Asia Development Bank, 2016

Table 3: Demographic and Health Survey on Diarrhea in 2014

Background	All Diarrhea (%)	Diarrhea with Blood (%)	Number of Children
Characteristic			
Age in Months			
6	12.8	0.5	736
11-Jun	20	2.3	761
23-Dec	19	2.4	1,460
24-35	13.7	2	1,368
36-47	7.4	1.3	1,343
48-59	6.6	0.6	1,376
Sex			
Male	13.4	1.7	3,522
Female	12.2	1.4	3,523
Residence			
Urban	12.5	1.4	1,033
Rural	12.9	1.6	6,011

Source: National Institute of Statistic, 2014

In 2010, the 40 percent mortality of children under five was significantly higher than in neighboring countries, with 88 per 1,000 dying before their fifth birthday. It is estimated that 32,000 children under five die each year in Cambodia, including 9,000 as a result of pneumonia and 2,250 from diarrhea [12]. The Number of children brought to health facilities for diarrhea treatment showed a slight reduction from 59 percent in 2010 to 56 percent in

2014. Out of those affected by diarrhea, 2 percent suffered severe illness, having diarrhea with blood (Table 3) [13].

6. Legal Framework and Regulations

The Ministry of Public Works and Transport (MPWT) is responsible for implementing urban sanitation projects and other urban services (e.g., sewage/drainage pipes). The Ministry of Rural Development is responsible for rural sanitation, while the Ministry of Environment (MOE) is responsible for setting water quality standards for effluents discharging into water bodies as well as monitoring compliance with 7 regulations (Annex 1). In practice, however, the MOE has monitored industrial wastewater treatment facilities while leaving domestic and/or public wastewater discharges unmonitored and unregulated [9].

Progress has been made on the development of a relevant legal framework and regulations. Since June 2007, for example, the Water Resources Management Law in Cambodia is a tool for regulating, managing and monitoring the use of water resources on land and underground [10]. The Sub-decree on water pollution control aims to minimize and phase out various polluting activities connected to public water areas, including the improvement of wastewater management for sustaining good water quality suitable to human needs[8].

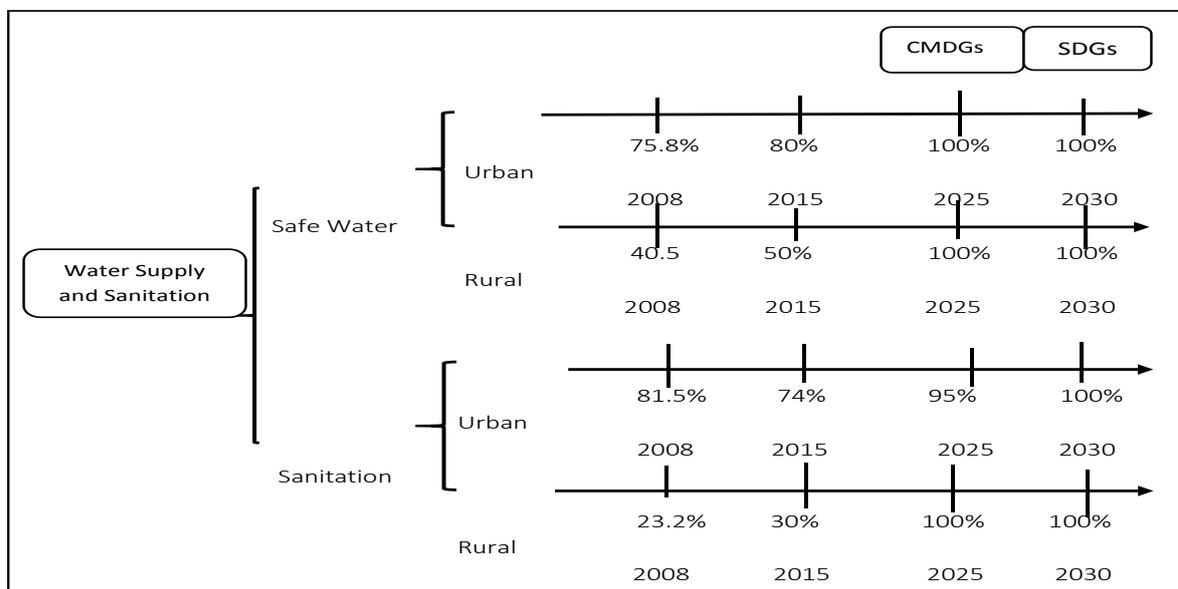
The Royal Government of Cambodia has just endorsed a new set of environmental regulations stipulating that dischargers of wastewater, such as small and medium enterprises and housing estates, will be held responsible for wastewater pollution [ibid]. Therefore, these entities should treat wastewater adequately on-site before it is discharged or released into the environment. Wastewater must be treated to abide by the environmental legal instruments before discharging into receiving water; otherwise, a penalty will be levied according to the law[8].

The Phnom Penh Green City Strategic Plan 2017-2026 is in the drafting stage. The implementation of this Strategic Plan will be aligned with the enforcement of the Master Plan on Drainage and Sewerage Improvement 2035, Phnom Penh’s Master Plan for Land Use 2035, and the Urban Transport Master Plan 2035[14].

The Royal Government of Cambodia has shown a commitment to improve the institutional framework and laws aimed at promoting effective and sustainable sanitation and wastewater management. The road maps for further wastewater treatment development and improving the sanitation services in the major cities and urban areas (Figure 5) can be grouped[10] into:

- Short Term: (a) MPWT needs to develop the Sewerage Law 2015, (b) Septic tanks/DEWATS will be expanded in scale for households by 2025.
- Medium Term: Septic tanks/DEWATS from households will be connected to centralized septic tanks by 2030.
- Long Term: Wastewater management and sanitation services will be provided for all by 2050 (Figure 5).

Figure 5: Cambodian Strategy and Goals (Water Supply and Sanitation) by 2025 & 2030



Source: Ministry of Public Works and Transport

7. Best Practices of Wastewater Management Learned from Other Countries

Lessons from current wastewater management highlight the importance of a proper set of urban planning guidelines and legislation, awareness raising and enforcement of policies, laws and the development plan. Harmonized and coordinated planning for restoration, reconstruction and expansion of urban infrastructure development, including sewage and/or drainage system is an important requirement for wastewater management.

Retaining natural wastewater treatment systems is cost effective as experiences in other countries show³. Such potential is getting less feasible in the current state of urbanization in Phnom Penh due to increasing demand for land with high prices along with rapid growth of construction activities. While there is a need for better institutional and community coordination and participation in waste management in general, some lessons from the waste management technology and systems employed by different industries in ASEAN countries to treat wastewater are:

- a) releasing wastewater into the sewer for further treatment with municipal wastewater (e.g. in Singapore); or
- b) discharging wastewater into waterways but in compliance with regulated water discharge standards.

Another critical issue in wastewater management is sludge management which is the disposal of organic sludge which is usually not regulated since it can be easily disposed of in landfills or recycled in composting. The problem is disposal of chemical or inorganic sludge. In Malaysia, sludge is considered a scheduled (or hazardous) waste, which has to be further treated before being approved for disposal. In Singapore, chemical sludge can be easily disposed of in landfills after treatment.

³ <https://greentumble.com/natural-wastewater-treatment-systems/>

8. Conclusion

In Phnom Penh, improvement of wastewater management has not kept pace with urbanization and the responsible ministries are now dealing with this challenge.

The negative impact of the discharge of untreated wastewater into water bodies on humans and animals is being addressed in the future urbanization plan for Phnom Penh.

Progress on wastewater management has been made through the development of a number of legal frameworks and regulations including, for example, water resource management law in 2007 and decrees and sub-decrees related on control of household and industrial wastes as well as pollution control. In order to speed up the process of improving sewage/drainage the MPWT and the MoE is mandated to develop and enforce legal frameworks and regulations. The MPWT is mandated to responsible for upgrading the drainage system. The MoE is responsible for developing and enforcing legal frameworks and regulations.

A number of projects are being implemented to improve drainage system in Phnom Penh to support the implementation of the Master Plan on Drainage and Sewage Improvement 2035. And, the Phnom Penh Green City Strategic Plan 2017-2026 which is in the drafting stage is expected to align with the Master Plan on Drainage. Lessons learned from other ASEAN countries can help to inform regarding wastewater treatment systems and may serve as a good model for effective wastewater management in Cambodia.

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Annex 1: Chapter Summary of Title 6 (Water Pollution Control) under Book 6 of the Environment and Natural Resources Code of Cambodia (Final Draft 2017)

Chapter	Articles	Major contents
Chapter 1: Measures to Prevent Water Pollution	1–5	Prohibition of discharge of point source pollutants
Chapter 2: Water Pollution Point Source Control	6–10	Responsibility for treatment and discharge, discharge permits and their requirements, additional conditions and standard limits
Chapter 3: Water Pollution Nonpoint Source Control	11,12	Categories, best management practices and responsibilities for implementing best land use management practices
Chapter 4: Monitoring	13–20	Monitoring responsibility for a point source discharge permit, sampling, certification, orders, surface water and groundwater monitoring and their sampling, analysis and inspections.
Chapter 5: Treatment and Reuse of Wastewater and Remains	21,22	Sludge and bio-solids, wastewater reuse
Chapter 6: Operator Certification	23,24	Criteria and certification for the operator of point sources
Chapter 7: Marine Pollution Control	25–28	Sources of marine pollution from inland discharges, sea and ships, implementation of international agreements

Source: Water Environmental Partnership in Asia (WEPA), Ministry of the Environment-Japan and Institute for Global Environmental Strategies (IGES), (2018). Outlook on water environmental management in Asia 2018. Japan, Available at: http://wepa-db.net/3rd/en/publication/2018_outlook/wepa_outlook_report_2018_en.pdf [Accessed 5 May 2019].