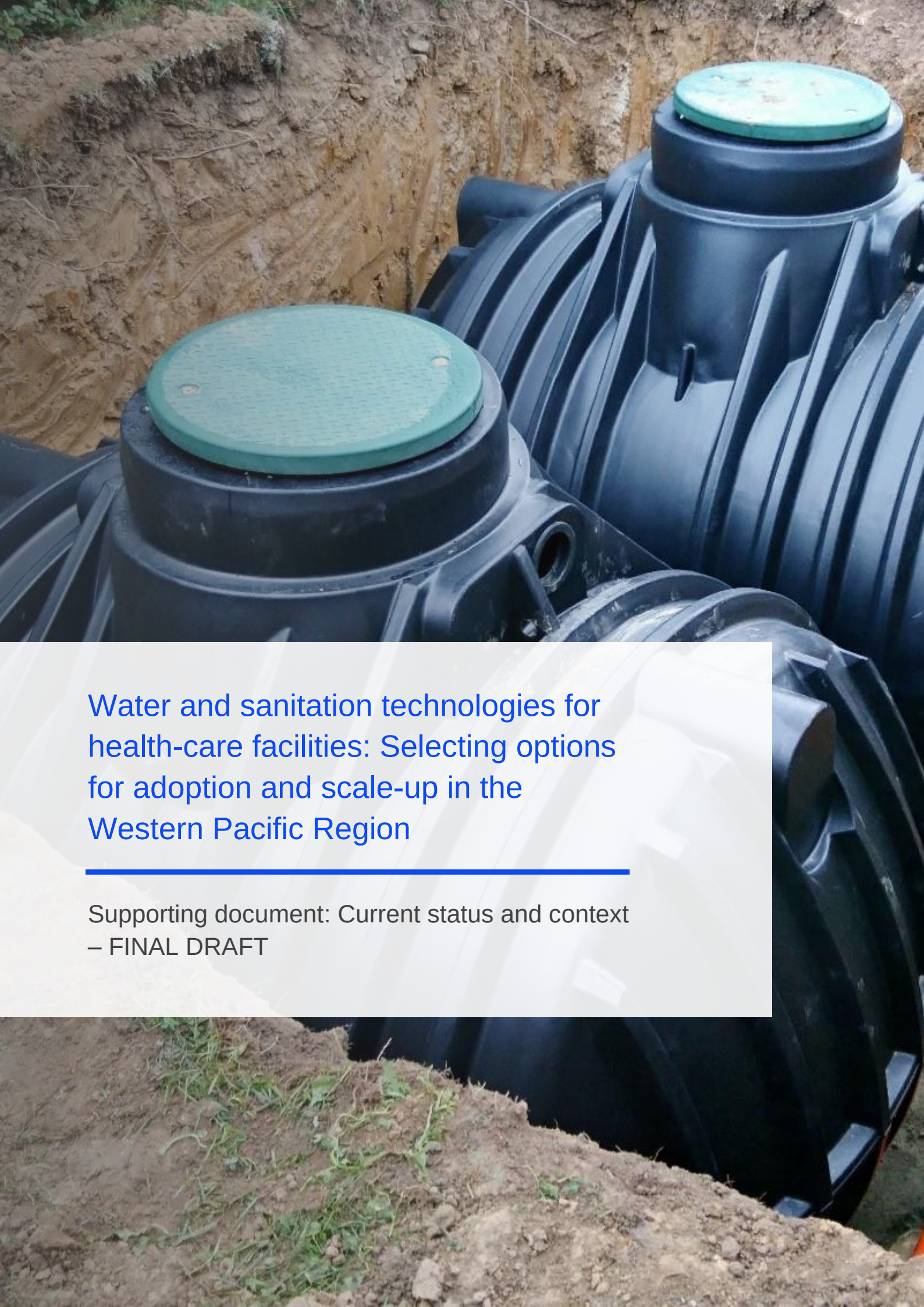


Water and sanitation technologies for health-care facilities: Selecting options for adoption and scale-up in the Western Pacific Region

Supporting document: Current status and context – FINAL DRAFT

Acknowledgements

This document was authored by Dr Benny Zuse Rousso, Professor Juliet Willetts, Dr Tim Foster and Dr Nuhu Amin of University of Technology Sydney, Institute for Sustainable Futures (UTS-ISF): www.isf.uts.edu.au

The document benefited from the participation of and key contributions from Dr Oyuntogos Lkhasuren and Ms Souvanaly Thammavong of WHO Lao Health and Environment office, Ms Nellie Ham of Vanuatu's Ministry of Health and Ms Altazangas Badrakh of WHO Mongolia Health and Environment office, as well as inputs from staff of the WHO Regional Office for the Western Pacific including Genandrialine Peralta, Sally Edwards, Bonifacio Magtibay and Ton Tuan Nghia.

Review was provided by Kencho Namgyal and James Robertson from UNICEF; Bilal Akbar from the Australian Department of Foreign Affairs and Trade; Ed Ramsay, Madeleine Edgeworth and Ruth Kennedy-Walker from the WASH in Institutions team, Water Global Practice, World Bank Group; and Professor Kyoung-Woong Kim from Gwangju Institute of Science and Technology in the Republic of Korea. Review was also provided by WHO headquarters staff Margaret Montgomery and Arabella Hayter.

JinWon Yi and Akeem Ali of WHO Asia-Pacific Centre for Environment and Health in the Western Pacific Region provided overall guidance, direction and technical oversight in the preparation of this report: www.who.int/westernpacific/centreforenvironment

Images: Adobe Stock Images and Juliet Willetts

Executive summary

Water and sanitation are critical for public health, economic development and quality health care, since they prevent infections and avoidable deaths in health-care facilities (HCFs). To meet the demands of maintaining a safe and sterile environment in HCFs and to address complex wastewater streams, specific water supply and wastewater treatment technologies are required that are tailored to the local context. The World Health Organization (WHO) recognizes the need to improve water and sanitation services in HCFs, especially in low- and middle-income countries and areas (LMICs) within the Western Pacific Region (WPR).

Progress in water and sanitation in the WPR is highly varied. Of the countries with available data, eight LMICs (American Samoa, Cambodia, Kiribati, the Lao People's Democratic Republic, Mongolia, Papua New Guinea, Solomon Islands and Vanuatu) have yet to achieve the WHO target of an 80% coverage rate for basic water and sanitation by 2025. As a result, they have been identified as priority countries for improved water and sanitation services in HCFs. Furthermore, the limited data on water and sanitation in HCFs available across the 37 countries and territories in the WPR indicate significant data gaps which need to be addressed.

This document outlines the **regional context of the WPR with respect to water and sanitation technologies** in HCFs, including those technologies currently in use in selected countries; the broader geographic, climatic and funding contexts; and factors considered in decisions about technology choice. This document is a supporting document to *Guidance for informed selection of water and sanitation technologies for healthcare care facilities in the Western Pacific Region*. It was developed through collation of secondary data, and interviews with key stakeholders in three countries (the Lao People's Democratic Republic, Mongolia and Vanuatu) on HCF types and classification systems, existing water supply and wastewater technologies, and relevant regulations and decision-making processes.

The WPR includes diverse geographic, climatic and hydrological contexts. Its geographical composition includes mountains, plains, islands and coastal regions, each with unique characteristics. Furthermore, the WPR has a pronounced climatic heterogeneity that influences the availability of water resources and, ultimately, the associated services of water and sanitation.

In the three countries where interviews with stakeholders were conducted, HCFs are categorized based on the type of medical services provided and their capacity, size and geographical location. Ensuring adequate water and sanitation services in these facilities has proved to be challenging due to various factors. Human resource constraints, budget limitations and a lack of local expertise hinder the proper functioning of water and sanitation systems in HCFs, thereby creating barriers to accessing safe and reliable services.

Each country to date has shown different preferences and technology choices. In Mongolia, centralized solutions like piped water and co-treatment in sewerage systems are preferred, complemented by on-site systems using groundwater pumping or truck delivery or disposal. Vanuatu primarily relies on on-site systems, with rainwater harvesting being common. Wastewater is usually treated using septic tanks, with limited segregation of different wastewaters. In the Lao People's Democratic Republic, water supply varies with piped and on-site solutions, depending on HCF type and location. Wastewater treatment is always on-site, mostly using septic tanks since the country does not possess any centralized wastewater treatment systems.

The study revealed key factors influencing technology selection in HCFs. These factors encompassed various aspects, such as HCF characteristics, environmental considerations, sector capacity, standards, regulations and sociocultural acceptance, which are further described below.

While the relative importance of these factors varied among the countries, common themes emerged. Notably, expertise and budget availability for the design, construction, operation and maintenance of such systems were invariably crucial. In addition, enforcement of technical standards

and regulations were commonly cited as influential factors. Planning for climate resilience was often overlooked in the current decision-making processes and requires greater attention in future.

This report offers a summary of the regional context for water and sanitation technologies in HCFs in the WPR. It supports the development of a decision-support framework for assessment and informed selection of water and sanitation service technologies in HCFs, not least those in priority countries in the WPR aiming to increase progress on water and sanitation.

Contents

Abbreviations

˚C	degrees Celsius
GLAAS	Global Analysis and Assessment of Sanitation and Drinking-Water
HCF	health-care facility
LMICs	low- and middle-income countries and areas
m^3	cubic metres
OECD	Organisation for Economic Co-operation and Development
UNICEF	United Nations Children's Fund
WASH	water, sanitation and hygiene
WHO	World Health Organization
WPR	Western Pacific Region

1. Introduction

Water and sanitation play a crucial role in promoting public health, driving economic development and maintaining the quality of health-care services. Access to clean water and proper sanitation within health-care facilities (HCFs) is essential for ensuring the delivery of high-quality care, preventing the transmission of infections and reducing avoidable deaths. HCFs have distinct water and sanitation needs, and specific challenges may arise in different contexts, including those within the Western Pacific Region (WPR).

Ensuring appropriate access to water and sanitation in HCFs is still a global challenge. One in five HCFs worldwide lacks basic water services, and one in 10 does not have access to sanitation services, leaving approximately 1.7 billion people attending HCFs without proper water services and 800 million people without toilet facilities (WHO, 2023).

Low- and middle-income countries and areas (LMICs) face an even greater challenge, with half of their HCFs lacking basic water services and 60% lacking sanitation services. As a result, they are identified as priorities for intervention and improvements. The lack of comprehensive monitoring data further complicates the issue, as there is limited understanding of the actual water and sanitation situation in HCFs in many LMICs, including those in the WPR (WHO, 2023).

1.1 Challenges of water and sanitation in health-care facilities in the Western Pacific Region

According to data from the World Health Organization (WHO)/United Nations Children's Fund (UNICEF) Joint Monitoring Programme, most (27 out of 32) countries in the WPR lack data on water and sanitation coverage in HCFs. Available data suggest that 60% and 85% of countries have not reached the target of achieving 80% coverage of basic water services and sanitation services, respectively (WHO, 2023).

Of the 37 Member States in the WPR, eight Member States of low- and middle- income status have not yet met the 80% coverage target for households (WHO, 2023), with a corresponding need to improve water and sanitation services in HCFs. These are American Samoa, Cambodia, Kiribati, the Lao People's Democratic Republic, Mongolia, Papua New Guinea, Solomon Islands and Vanuatu.

1.2 Objective, scope and methods

This document is a supporting document to the main output from a study to support informed decision-making on water and sanitation technologies in HCFs: *Water and sanitation technologies for health care facilities: Selecting options for adoption and scale-up in the Western Pacific Region*.

The objective of this document is to **outline the regional context of the WPR in relation to water and sanitation technologies in HCFs**, illustrating the technologies currently implemented in selected countries and the broader geographic, climatic and funding contexts.

This document reviews the WPR in relation to three subregions with distinct hydrological and geographical characteristics: Northern Asia, South-East Asia and the Pacific islands. One country from each subregion was selected based on: (i) the current level of water and sanitation coverage compared to other countries, and (ii) availability of key stakeholders to collaborate with for this project. The Lao People's Democratic Republic, Mongolia and Vanuatu and were selected on this basis as example countries for the assessment of water and sanitation services in HCFs.

The information presented about these three countries was compiled on the basis of semi-structured interviews with local stakeholders with expertise and experience in water and sanitation in HCFs, including WHO technical officers and ministry of health representatives. Interviews covered: (i) types, classification factors and distribution of HCFs; (ii) in-place water supply, wastewater and faecal sludge technologies and existing regulations; and (iii) practices and factors driving the selection of water and sanitation technologies.

2 Status of water and sanitation in HCFs in the WPR

The WPR comprises countries at different stages of economic development, resulting in variations in the quality of HCFs. Developed economies in the region have greater resources to invest in advanced technologies and infrastructure for water supply and wastewater treatment in HCFs. LMICs, however, face challenges in funding and maintaining health-care infrastructure, leading to limited water and sanitation services. Addressing this disparity is crucial to ensure equitable access to quality health care, water and sanitation across the Region.

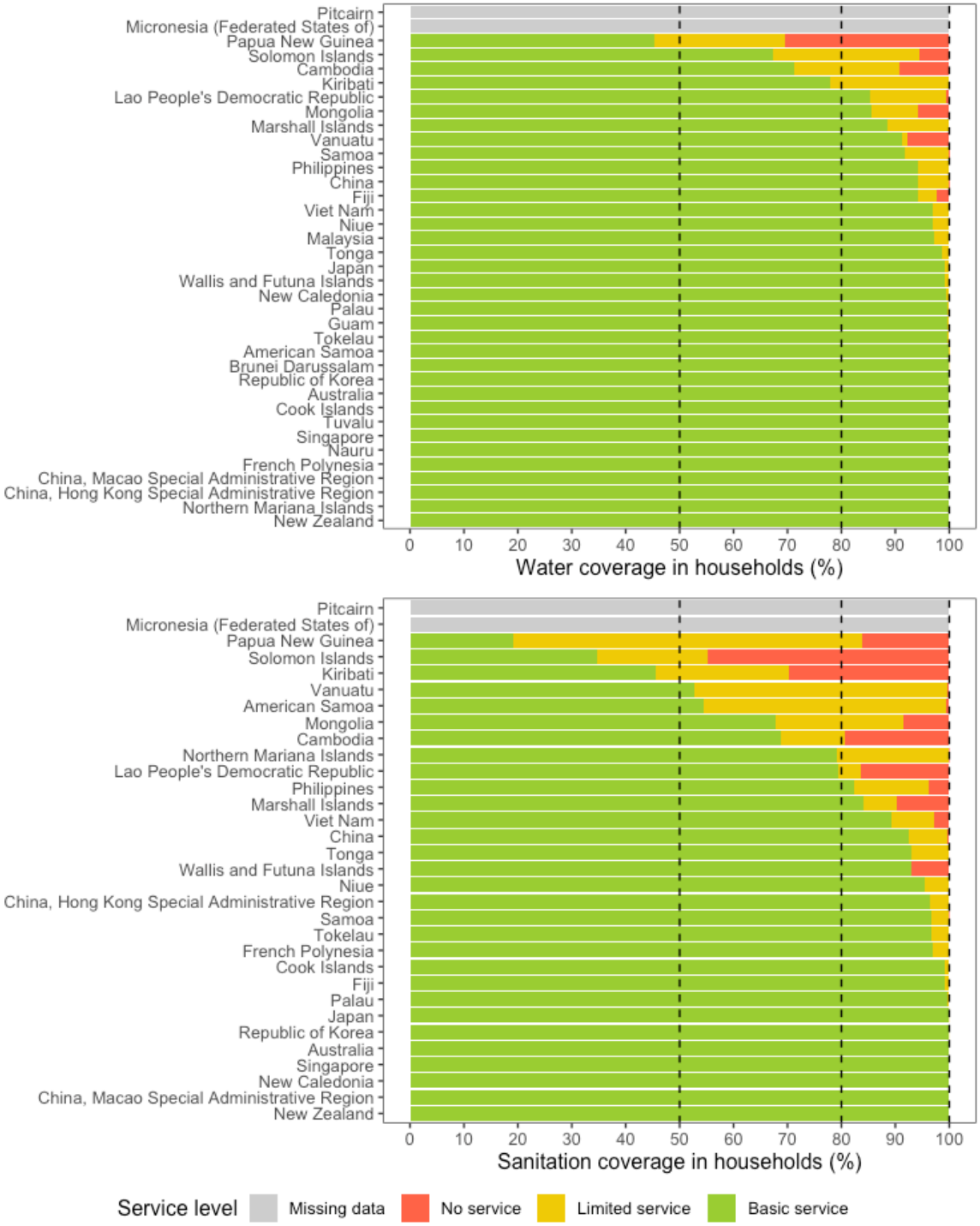
According to data from the Joint Monitoring Programme (Fig. 1), most WPR countries (27 of 37) lack data on water and sanitation coverage in HCFs. Based on the available data, 60% and 85% of countries have not reached the target of 80% coverage of basic water services and sanitation services, respectively.

Fig. 1. Water and sanitation coverage in health-care facilities categorized by service level for all countries and territories in the Western Pacific Region

This scenario is not limited to the WPR. According to the latest report on the global status of water, sanitation and hygiene (WASH) in HCFs (WHO, 2023), despite the improvements in data reporting among many countries that have strengthened their national monitoring systems, limited reporting of WASH data in HCFs is still a major bottleneck for proper assessment of its current status in HCFs globally.

Because of the limited reporting on water and sanitation services in HCFs, even among developed economies such as Australia, Japan, New Zealand and the Republic of Korea, this analysis in priority countries of improvements in water and sanitation services was performed using coverage data for households (WHO, 2023). To allow a comparison with HCF data, categories of service levels were modified: “safely managed” and “at least basic” were categorized as “basic service”; and “surface water” and “open defecation” were categorized as “no service” (Fig. 2).

Fig. 2. Water and sanitation coverage in households categorized by service level for all countries and territories in the Western Pacific Region



Of the 37 countries and territories that make up the WPR, eight have yet to meet the 80% coverage rate for households, set as a target for 2025 by WHO. They were therefore identified as priority countries for improvements in water and sanitation services in HCFs (Table 1). It may be noted that the Commonwealth of the Northern Mariana Islands has also yet to meet the 2025 target for basic sanitation services but was not included in the list of priority countries because it is not classified as a LMIC (World Bank, 2023).

Table 1. Priority countries for each Western Pacific subregion, their performance against the 2025 target, and World Bank classification by income

Western Pacific subregion	Priority countries	≥ 80% coverage for basic water service	≥ 80% coverage for sanitation service	World Bank income classification (FY 2021–2022)
Northern Asia	Mongolia	Y	N	Lower-middle-income
Pacific Islands	Vanuatu	Y	N	Lower-middle-income
	Papua New Guinea	N	N	Lower-middle-income
	Kiribati	N	N	Lower-middle-income
	American Samoa	Y	N	Lower-middle-income
	Solomon Islands	N	N	Lower-middle-income
South-East Asia	Lao People's Democratic Republic	Y	N	Lower-middle-income
	Cambodia	N	N	Lower-middle-income

3 Western Pacific Region geographic context

The WPR is one of the six regions of WHO and encompasses a diverse group of countries and territories. Encompassing the western part of the Pacific Ocean and Asia, the WPR covers a large area which includes different landscapes, climates, cultures and economies. Consideration of this diversity is crucial to understand how different water and sanitation technologies for HCFs are suited to specific country contexts.

3.1 Key characteristics of the Western Pacific subregions

The WPR has diverse geographic, climatic and hydrological contexts. Its geographical composition includes mountains, plains, islands and coastal regions, each with unique characteristics. Furthermore, the WPR has a pronounced climatic heterogeneity that influences the availability of water resources and, ultimately, the associated services of water and sanitation. In light of this diversity, it can be categorized into three subregions: Northern Asia, South-East Asia and the Pacific islands (Table 2).

- *Northern Asia:* Dry, cold, reliant on key rivers and groundwater, with low availability of water resources per capita.
- *Pacific Islands:* Wet, tropical, reliant on rainwater and ephemeral rivers due to run-off, with the largest availability of water resources per capita but highly susceptible to climate change impacts (e.g. rising sea level). Variation across islands including atolls, larger and smaller islands.
- *South-East Asia:* Tropical, with monsoons, abundance of rivers and groundwater and largest population but with the lowest use of freshwater for domestic and industrial uses, being mostly used for agriculture.

This classification serves as a framework for the subsequent analysis conducted in this report.

Because of its geographical characteristics, the WPR is particularly susceptible to the impacts of climate change and extreme weather events such as prolonged droughts, sea level rise, storm surges and flooding.

Table 2. Climatic and water resource characteristics of the three Western Pacific subregions

Environmental indicator	Western Pacific subregion	Average (1990 to 2022)
Air temperature *(degrees Celsius)*	Northern Asia	–0.5 (–20.6 – 17.2)
	Pacific Islands	24.9 (22.2 – 26.3)
	South-East Asia	25.1 (18.7 – 28.9)
Average precipitation *(mm per year)*	Northern Asia	241.0
	Pacific Islands	2723.3
	South-East Asia	1869.0
Renewable internal freshwater resources *(cubic metres per capita)*	Northern Asia	12 131.2
	Pacific Islands	75 669.7
	South-East Asia	19 176.2
Domestic freshwater withdrawals *(% of total freshwater withdrawal)*	Northern Asia	13.0
	Pacific Islands	57.0
	South-East Asia	3.1
Agriculture freshwater withdrawals *(% of total freshwater withdrawal)*	Northern Asia	54.6
	Pacific Islands	0.3
	South-East Asia	95.0
Industry freshwater withdrawals *(% of total freshwater withdrawal)*	Northern Asia	32.3
	Pacific Islands	42.7
	South-East Asia	1.9
Water stress *(proportion of total freshwater withdrawal and available resources)*	Northern Asia	3.4
	Pacific Islands	0.1
	South-East Asia	2.9

Source: World Bank (2023)

3.2 Overview of climatic, hydrological and water and sanitation contexts

Varied climatic, hydrological and socioeconomic contexts characterize each subregion of the WPR. The sections below outline relevant characteristics for each of these subregions, including water and sanitation service provision and, where available, information about water and sanitation in HCFs.

3.2.1 Northern Asia

Climate and hydrological systems: Mongolia, as a country representative of the Northern Asia subregion, displays distinct characteristics in terms of climate and hydrological systems. The country experiences a continental climate, with significant variations in temperature throughout the year. Winters are harsh and frigid with the temperature dropping to –20 degrees Celsius (˚C), while summers are relatively short and warm (up to 17.2 ˚C) (World Bank, 2023).

Precipitation in Mongolia is generally low, with an average of 241 millimetres per year (mm/yr) (World Bank 2023) mostly occurring during the summer months as sporadic rainfall or thunderstorms. The country's hydrological systems primarily rely on the limited water resources from rivers, lakes and underground sources, as well as seasonal snowmelt. The diverse geography of Mongolia encompasses vast steppes, rugged mountains and the expansive Gobi Desert, which significantly influence its hydrological patterns. Rivers such as the Orkhon and Selenge, originating from the Mongolian Altai Mountains and Khentii Range, respectively, are important water sources for the country.

However, the arid and semi-arid nature of Mongolia's climate poses challenges related to water availability and management, particularly in the context of sustaining agricultural activities and ensuring the well-being of local communities. Agricultural activities are responsible for around 55% of freshwater withdrawal, while domestic use is limited to 13% of the total freshwater resources available (World Bank, 2023).

These unique climate and hydrological conditions shape the landscape and water resources of Mongolia, emphasizing the need for prudent management and conservation strategies in the Northern Asia subregion, which presents the largest water stress level (3.4) in terms of the proportion between total freshwater withdrawal and available resources in any country of the WPR subregions (World Bank, 2023).

Water and sanitation coverage: There is limited reporting on water and sanitation coverage in HCFs in Mongolia. In terms of water and sanitation coverage in households, Mongolia already exceeds the 2025 target for basic water services (30.6% safely managed + 55.43% basic service) but does not yet meet the 2025 target for basic sanitation services (55.5% safely managed + 12.2% basic service). As is the case in most countries, rural settings have considerably lower coverage than urban settings, with 50.6% of basic sanitation services (48.7% safely managed + 1.9% basic service) and 61.1% of basic water services (11.4 % safely managed + 49.7% basic service) in rural areas compared to 75.6% of basic sanitation services (58.7% safely managed + 16.9% basic service) and 96.7% of basic water services (38.6% safely managed + 58.1% basic service) in urban areas.

3.2.2 Pacific islands

Climate and hydrological systems. The Pacific islands subregion has a tropical climate, with warm, humid and consistent temperature throughout the year (average of 24.9 ˚C, with a minimum of 22.2 ˚C and maximum of 26.3 ˚C). Abundant rainfall, often in the form of heavy tropical showers and occasional cyclones, is a prominent feature with a yearly average of 2723.3 mm/yr (World Bank, 2023). The proportional impact of these cyclones on the population is much higher than in other regions. Given their insular nature, the hydrological systems of the Pacific islands rely heavily on rainfall and surface run-off. However, limited land area and irregular topography result in challenges related to freshwater resources, including water scarcity and susceptibility to saltwater intrusion. The islands' topography, characterized by mountains and volcanic activity, contributes to the presence of rivers, streams and waterfalls. These climatic and hydrological conditions significantly influence water resources and management approaches in the Pacific islands subregion. The highest risks are in the atoll countries where there are effectively no rivers or streams.

The identified priority countries in the Pacific islands subregion (American Samoa, Kiribati, Papua New Guinea, Solomon Islands and Vanuatu) have the highest average renewable internal freshwater per capita (75 670 cubic metres per capita [m^3/capita]) when compared to priority countries from the Northern (12 131

m^3/capita) and South-East Asia (19 176 m^3/capita) subregions (Table 2). Most freshwater withdrawals (57%) are used for domestic end uses, followed by 42.7% for industry and less than 0.5% for agriculture (World Bank, 2023).

Water and sanitation coverage: Most of the countries in the Pacific islands subregion do not report data on water and sanitation in HCFs. Kiribati, Solomon Islands and Vanuatu have yet to meet the 80% target coverage for basic water and sanitation in HCFs. On the other hand, Cook Islands, Tokelau and Tonga have all met the 80% target of basic water coverage in HCFs, while Tokelau alone has exceeded the 80% target for basic sanitation services in HCFs.

In terms of household water coverage, several countries in the Pacific islands subregion meet the 80% target for basic water services. However, Kiribati, Papua New Guinea and Solomon Islands do not, and they account for a large proportion of the Pacific population. In terms of household sanitation coverage, there is variation across countries in the subregion, including in those that meet and those that do not meet the 80% basic service mark.

Of the five priority countries in this subregion, American Samoa and Vanuatu are the two countries that meet the 80% basic water service target but not the 80% basic sanitation target, which represents the average for all the countries in this subregion. American Samoa has no reported data for rural and urban settings. Vanuatu's data for rural and urban settings include: water and sanitation coverage in urban settings was higher than in rural settings, with 48.6% of basic sanitation services (0% safely managed + 48.6% basic service) and 88.4% of basic water services (0% safely managed + 88.4% basic service) in rural areas compared to 64.6% of basic sanitation services (0% safely managed + 64.6% basic service) and 99.5% of basic water services (56.6% safely managed + 42.9% basic service) in urban areas.

3.2.3 South-East Asia

Climate and hydrological context: The South-East Asia subregion, like the Pacific islands subregion, has a tropical climate characterized by warm and humid conditions, with slightly larger variabilities of temperature and rainfall (average of 25.1 ˚C, with a minimum of 18.1 ˚C and maximum of 28.9 ˚C). The region receives significant rainfall (average of 1869 mm/yr), mostly in the form of heavy tropical showers during the wet monsoon season. This rainfall plays a crucial role in sustaining the hydrological systems of countries in the South-East Asia region, including the identified priority countries Cambodia and the Lao People's Democratic Republic.

The topography of these two countries is characterized by a mixture of low-lying plains and mountain ranges such as the Cardamom and Dangrek mountains in Cambodia, and the highlands of the Lao People's Democratic Republic. These geographical features contribute to the presence of significant rivers such as the Mekong, which flows through both countries, as well as an abundance of other water bodies such as lakes, wetlands and waterfalls. The rugged terrain and intense rainfall patterns in both countries require careful consideration and management of potential risks, such as flooding and its associated impacts.

Compared with the priority countries in the Pacific islands and Northern Asia subregions, priority countries in the South-East Asia subregion have a considerably larger population. Because of this, the per capita water resource availability is relatively low (19 176.2 m^3/capita) despite the subregion's large abundance of water resources. Compounded by the fact that most available freshwater resources are used for agriculture (95% of the total on average for both countries), water scarcity is in fact an issue for many communities in those countries. Despite the more humid climate, the water stress level of the South-East Asia subregion (2.9) is similar to the much drier Northern Asia subregion (3.4).

Water and sanitation coverage: The Lao People's Democratic Republic is the only country in South-East Asia that reports on water and sanitation coverage in HCFs. While basic water services in HCFs comfortably meet the 80% target for 2025, basic sanitation services are found in only 4% of HCFs, with the vast majority (96%) having only limited services.

Regarding household coverage, Cambodia and the Lao People's Democratic Republic share similar water and sanitation coverage levels in both rural and urban settings, with a slightly higher coverage in the Lao People's Democratic Republic. Basic water coverage in urban areas of the Lao People's Democratic Republic amounts to 97% (27% safely managed + 70% basic service) and in urban areas of Cambodia to 90.4% (57% safely managed + 33.4% basic service). In comparison, basic water coverage is 78.5% in rural areas of the Lao People's Democratic Republic (12.4% safely managed + 66.1% basic service) and 65.1% in rural areas of Cambodia (18.4% safely managed + 46.7% basic service).

4 Financing for water, sanitation and hygiene in health-care facilities in the Western Pacific Region

International and national funding are important factors impacting the development of essential services in LMICs − they enable the construction of critical infrastructure and the development of financial mechanisms to ensure continued operation and maintenance of the delivered services.

According to estimates (Chaitkin et al., 2022), achieving full coverage of basic WASH services in HCFs across the 46 United Nations least developed countries would require a total investment in the range of US$ 6.5−9.6 billion, with significant investment needed for both capital expenditure and recurrent costs.

These estimates highlight the need for increased investments in WASH services in HCFs, both at the national level through the allocation of a higher proportion of national budgets to WASH, and at the international level through enhanced international funding mechanisms and donations.

The United Nations Water Global Analysis and Assessment of Sanitation and Drinking Water (GLAAS) report (UN-Water and WHO, 2022) reveals that of the 118 countries assessed, a mere 3% have sufficient financial and human resources (defined as greater than 75% of required resources) to fund approved policies for WASH in HCFs. This figure excludes countries – such as some of the Pacific island countries and areas – where GLAAS is mostly incomplete. Although approximately 52% of countries have formally approved policies, more than half (54%) lack approved costed plans. Additionally, around 15% of countries are still in the process of revising or developing their policies, indicating that significant work remains to be done.

> GLAAS reveals that of the 118 countries assessed, only 3% had sufficient financial and human resources to fund approved policies for WASH in HCFs (UN-Water and WHO, 2022).

The Creditor Reporting System devised by the Organisation for Economic Co-operation and Development allows a mapping of funded sectors and key international funding donors for most LMICs. According to the Creditor Reporting System, among the identified priority countries, the largest portion of water and sanitation funding is generally allocated to infrastructure, particularly large water supply and sanitation systems (see Annex A). Very limited information is available regarding international investments in water and sanitation in HCFs.

Key international donors within the WPR are the Japan International Cooperation Agency and Japan Ministry of Foreign Affairs; the Australian Government; New Zealand's Ministry of Foreign Affairs and Trade; Korea International Cooperation Agency, Korea Ministry of Economy and Finance and Export-Import Bank of the Republic of Korea.

External to the WPR, key donors are the French Development Agency and Development Co-operation Commission/Ministry of Foreign Affairs of France; Swiss Agency for Development and Cooperation; Germany's Federal Ministry for Economic Cooperation and Development; Hungary's Ministry of Affairs and Trade; the Czech Republic's Ministry of Industry and Trade; United Stated Millennium Challenge Corporation and the United States Agency for International Development (USAID).

Records of national investments in WASH in HCFs are also limited, with only sporadic reports available. For instance, Kiribati was one of the few countries in the WPR which explicitly referred to investments in WASH in HCFs, which amounted to approximately US$ 4.3 million in hospital water and sanitation infrastructure from 2014 to 2020.

Besides its enabling role in implementing infrastructure, international and national funding plays a significant role in the selection of technologies which are perceived to be suitable. Similarly, national and international guidelines, standards and institutional frameworks are pivotal in narrowing down alternatives and selecting technologies suitable for water and sanitation provision.

5 Health-care systems

The main goal of health-care systems is to ensure the well-being and optimal health of individuals within a population. These systems aim to prevent, diagnose, treat and manage illnesses and injuries, promote overall public health and reduce mortality rates. Different types of HCFs exist to cater to diverse medical needs and provide specialized services in an efficient manner, ranging from primary care clinics for routine check-ups and basic treatments to specialized hospitals and tertiary care centres for complex medical interventions and critical care.

The varied nature of HCFs also impacts their water and sanitation needs, leading to the adoption of different technologies and budget allocations for implementation and maintenance. The classification and distribution of HCFs can differ among countries, making it crucial to understand these variations when weighing up the implications of selecting appropriate water and sanitation technologies for specific contexts. This section compiles key information regarding the health-care system structure and corresponding types of HCFs in each representative country.

5.1 Mongolia

As of 2022, Mongolia had 4652 registered HCFs, including both public and private establishments. These facilities are further categorized into two main types: primary care and referral level centres. Along with these primary and referral HCFs, dispensaries are also considered part of the health-care infrastructure in Mongolia.

- **Primary care health centres:** At the primary care level, health centres are responsible for serving communities in both rural and urban areas, with a primary focus on providing outpatient care services. These health centres are distributed throughout the country to ensure accessibility for all citizens. Depending on their location, health centres can be further classified into family health centres, village health centres or *soum* health centres. The term “soum” refers to an administrative unit in Mongolia, which falls below the provincial and district levels. Health centres make up approximately 56% of public HCFs in Mongolia, with a total of more than 500 establishments. On the other hand, the number of private clinics is significantly higher, amounting to roughly three times the number of public health centres.
- **Referral hospitals:** Referral hospitals are specialized HCFs that offer a wide range of medical services including, in some instances, inpatient care. These hospitals are further categorized into *soum* general hospitals, provincial general hospitals and district general hospitals, of which there are a total of 36 establishments. In addition to these, specialized professional hospitals, such as diagnostic and treatment, cancer, maternity, and army hospitals, along with other referral public hospitals, account for another 54 establishments. Like health centres, the number of private hospitals far exceeds the number of public establishments, totalling 215 establishments.

Water provided to HCFs in Mongolia should correspond to drinking standards imposed for other uses (e.g. domestic), although minimum flows based on the type of activity (e.g. outpatient examination, inpatient care, surgery and delivery, hospital kitchen, etc.) are set out in the Mongolian National Standards (Ministry of Health of Mongolia, 2013). The same document recommends co-treatment of HCF effluents in existing centralized wastewater treatment systems, and where this is not possible stipulates a local liquid waste treatment system or pit, followed by safe disposition in the environment.

5.2 Vanuatu

The health-care system in Vanuatu is structured into four main HCF categories, each serving specific roles and providing essential services to the population.

- **Aid posts:** Aid posts are health units located at the community level. These units are not formal public institutions but are managed and run by the local community. Locally elected villagers receive training to provide basic care and support to community members. While there are no trained professionals at these facilities, volunteers are selected by the community to dedicate their time to

the well-being of their neighbours. Approximately 200 aid posts are scattered across Vanuatu's urban and rural areas, focusing on community care.

- **Dispensaries:** Dispensaries cover catchment areas and are staffed with registered nurses, providing primary care services to the local population. Equipped with trained nurses, these facilities offer more comprehensive medical assistance compared to aid posts.
- **Health centres:** Health centres are strategically located in areas where there are no hospitals. Due to long distances and limited accessibility, these centres often provide maternity and inpatient services. There are 16 health centres throughout Vanuatu which are designed to offer both primary and secondary care, and to bridge the gap between dispensaries and hospitals.
- **Hospitals:** The top tier of the health-care system is made up of hospitals, which range from provincial to regional and national referral facilities. Provincial hospitals deliver primary and secondary care services to their catchment communities. Referral hospitals focus on providing secondary and tertiary care, handling more complex medical needs. Vanuatu has only six referral hospitals, emphasizing their significance within the health-care network.

In addition to these main categories, there are further categories of HCFs in remote locations (remote dispensaries) or providing specialized services (enhanced health centres). To ensure the provision of adequate health care, Vanuatu's Role Delineation Policy (Ministry of Health Vanuatu, 2018) sets out essential requirements before establishing or upgrading any HCF, which include access to a reliable water supply, adequate solid and waste management, and access to a power supply. The policy also emphasizes the importance of assessing the facility's vulnerability to climate change and natural disasters. However, it is worth noting that some facilities may not fully comply with the requisite standards and recommendations outlined in the Role Delineation document; for example, some facilities may lack expert professionals such as midwives, or may not be fully equipped with reliable water supply and adequate wastewater treatment.

5.3 Lao People's Democratic Republic

In the Lao People's Democratic Republic, the health system is organized into four types of HCFs, each serving specific functions and varying in service capacity.

- **Central hospitals:** There are 10 central hospitals in the country located exclusively in urban areas, which serve as the highest level of medical facility. These hospitals have the capacity to handle complex medical cases and offer specialized services, and have access to treated chlorinated piped water to ensure safe water supply.
- **Provincial hospitals types A and B:** The Lao People's Democratic Republic has 17 provincial hospitals, which are further categorized into types A and B. These hospitals serve their respective provinces and provide a range of medical services. Type A provincial hospitals have more extensive service capacity than type B.
- **District hospitals types A and B:** The district hospitals are also categorized into types A and B, with a total of 135 establishments. These hospitals cater to the health-care needs of specific districts and offer essential medical services. Like provincial hospitals, type A district hospitals may perform surgical procedures, whereas type B district hospitals may lack this capability.
- **Community health centres types A and B:** The largest category of HCFs in the country is community health centres, with a total of 1075 facilities. These health centres, further divided into types A and B, play a crucial role in providing primary care services to communities across the country. Type A community health centres may offer a broader range of services and capacity than type B centres.

The classification of HCFs in the Lao People's Democratic Republic is primarily based on the type of service they provide and their capacity to handle various medical procedures. Central hospitals are the pinnacle of the health system, catering to complex medical needs in urban areas. Provincial and district hospitals serve specific regions and offer varying levels of medical care. Lastly, the extensive network of community health centres focuses on delivering primary care services to communities throughout the country.

6 In-place water and sanitation technologies

Water and sanitation services in HCFs can be delivered through diverse technologies, arrangements and systems. Common practices often vary within countries and subregions, influenced by factors such as local regulations, the capacity and expertise of public and private sectors, natural environment attributes and cultural preferences. This section presents the prevalent practices identified concerning water supply and sanitation systems in HCFs in the selected countries.

6.1 Mongolia

6.1.1 Water supply systems

The water supply in Mongolia's HCFs varies based on whether they are in urban or rural areas. HCFs in urban areas, such as the capital Ulaanbaatar, are all connected to piped water, while most rural HCFs rely on on-site water supply systems. Approximately 19% of rural health centres are connected to centralized water supply systems.

National legislation mandates that HCFs should be connected to centralized or local water supply systems, with government incentives to support centralized solutions reported during interviews. Water quality standards follow national drinking-water standards, with no specific considerations for medical activities.

To ensure continuous water supply for medical activities, 87% of HCFs have water storage tanks. Mongolian National Standard MNS 6392 (Ministry of Health of Mongolia, 2013) sets out minimum water requirements for different medical activities such as outpatient examinations, inpatient cases, surgeries and delivery wards. Point-of-use treatment is commonly present in surgery and maternity delivery wards. Weekly chlorination and cleaning of storage tanks is reported in more than 90% of HCFs. During water shortages, some HCFs may rely on water trucks or wells. These trucks can be provided by the community or water utility, or be owned by the HCF.

In rural areas, approximately 80% of facilities do not have access to centralized piped water. In cases where centralized water systems are unavailable, on-site water supply relies on motorized pumping of groundwater, or water provided by trucks. The use of surface water as a source is not frequent due to a limited capacity to install and maintain the necessary technology for treating it. Challenges related to water freezing and pipe damage have been reported, necessitating effective winterizing of pipes, which may not always be feasible due to limited resources.

6.1.2 Wastewater systems

Wastewater treatment of HCF effluents in Mongolia is closely tied to the availability of surrounding infrastructure. According to Mongolian National Standard MNS 6392 (Ministry of Health of Mongolia, 2013), where a centralized sewerage system exists, HCFs are mandated to co-treat their effluents by disinfection prior to disposal in the sewers. However, in the absence of a sewerage system, HCFs must rely on on-site wastewater treatment. The specific technologies to be used are not stipulated other than mention of a pit system followed by disinfection. The final treated effluent and sludge should not be eliminated in the environment but transported to a designated treatment plant.

In practice, many HCFs in Mongolia opt for septic tank systems for wastewater treatment. However, there are challenges to operate and maintain such systems, particularly in terms of emptying, treating and disposing of the generated faecal sludge. In addition, wastewater streams in HCFs are often not segregated.

In some rural areas, *soum* health-care units have both indoor and outdoor toilets, but outdoor latrines are predominantly used for cultural reasons − for example, in the male preference for external pit latrines. Technological limitations, such as occasional blockages or freezing, may also contribute to the preference for outdoor latrines. Some *soum* health-care establishments lack indoor toilets; those that provide maternity delivery services rely on biotoilets as an alternative solution for mothers who are unable to go outside.

An HCF survey is planned in 2023, and an implementation guideline expected to be prepared by the Ministry of Construction and Urban Development that will extend existing laws.

6.2 Vanuatu

6.2.1 Water supply systems

In Vanuatu, water supply systems in HCFs mainly rely on rainwater and piped water, depending on the type of HCF and its location. The Role Delineation Policy (Ministry of Health Vanuatu, 2018) sets minimum standards for water supply infrastructure based on the type of HCF.

For provincial, regional and national hospitals, the policy dictates that water supply should include dedicated storage, potential treatment and reticulation to all essential services. Central hospitals primarily use piped water with backup water tanks, while regional and provincial hospitals often rely more on on-site water supply systems, primarily based on rainwater. However, groundwater or trucked water may be used depending on the location. Point-of-use treatment inside hospitals and water treatment in storage tanks are not common practices, despite periodic monitoring.

Vanuatu's main hospitals in Port Vila and Luganville rely on chlorinated piped water. In contrast, other provincial hospitals, farther from the main centres, often primarily rely on rainwater because either piped water supply is not available or, if it is, water losses in distribution networks due to leakages − among other issues − can lead to unreliability of the service.

For HCFs responsible for primary care, such as aid posts, dispensaries and health centres, the Role Delineation Policy specifies as a minimum requirement that handwashing facilities should be provided within the facilities using running water. In practice, aid posts and dispensaries often rely on rainwater catchment and may use piped water if available. Groundwater is used to a lesser extent and perceived as of lower quality compared to rainwater. Most HCFs offering primary care pump roof-harvested rainwater to storage tanks for distribution. In some cases, water from HCFs is shared with the community owing to water shortages and the fact that HCFs have a larger rainwater catchment than households. In dispensaries and health centres, disinfection is commonly performed on untreated water.

Certain regions like the atoll islands (e.g. Aniwa in Tafea) and other locations in the north of Vanuatu rely exclusively on rainwater systems, but drought poses a challenge. Water utility trucks provide water during water shortages, especially in dry periods, with recent years experiencing more severe dry seasons and cyclones. Some regions, such as the central region of Tafea, have recently implemented centralized piped water systems, while others have no reliable water sources other than rainwater, and face water shortages.

The national water quality standard for drinking-water applies for all communities, including HCFs, but does not impose further water quality requirements for medical activities. In practice, regular monitoring and enforcement of national drinking-water standards are not commonly performed, particularly in rural areas, due to resource constraints such as lack of laboratories, trained staff and reagents.

6.2.2 Wastewater systems

In Vanuatu, HCFs predominantly manage wastewater using on-site systems, and co-treatment with sewage networks is not commonly practised. On-site treatment primarily involves septic tanks or other form of wastewater containment, with limited consideration given to sludge management. Only the central hospital in Port Vila has a dedicated wastewater treatment plant including faecal sludge treatment. However, issues in its operation and severe contamination of the surrounding environment have been reported.

According to Section 5.4.2 of the Role Delineation Policy, hospitals should have waste management practices that include contained treatment for medical waste, a separate septic or waste treatment system, and facilities for hazardous biomedical waste disposal. The policy refers to different types of waste streams (blackwater, surgery, biohazardous effluents, greywater), but segregation is not commonly reported in practice. While the policy does not prescribe standardized designs or suitable technologies for hospital wastewater treatment, it states that site-specific assessments to determine necessary additional infrastructure are required to support the overall effectiveness of HCFs.

The wastewater treatment plant at Port Vila hospital comprises a treatment train including primary sedimentation, trickling filters, secondary sedimentation, fine filters and chlorination. The sludge generated during treatment is pumped to drying sand beds before final disposal in landfills. However, issues with the operation and maintenance of the wastewater treatment plant have resulted in overspill and contamination of the receiving water body during prolonged periods. Major rehabilitation work is required, necessitating external funding from international donors due to limited budget allocation. In situations where chlorination is not operational, effluent may directly flow into the lagoon without adequate surveillance or enforcement of penalties for non-compliance.

On the other hand, other hospitals mainly rely on on-site septic tanks or holding tanks for wastewater management. Wastewater segregation, specifically between blackwater and greywater, is not commonly practised in these facilities.

Section 5.4.1 of the Role Delineation Policy outlines the minimum facilities necessary for primary care facilities, including aid posts, dispensaries and health centres. The policy mandates waste management practices that enable on-site management of various waste types or access to suitable disposal sites. In addition, it specifies appropriate sanitation facilities, such as pits for the disposal of specific biomaterials like placentas, where required.

In practice, health centres usually have toilets followed by septic tanks or other forms of containment. Challenges related to emptying septic tanks and managing sludge are not reported, which may indicate that they are not becoming full and requiring emptying because they have not been properly constructed and are leaking directly from the containment system. Information on the destination of sludge from septic tanks in provinces is lacking, and most provinces do not have the necessary infrastructure to manage sludge.

Aid posts and dispensaries do not always have toilets, although the Role Delineation Policy requires at least one, such as a ventilated improved latrine. In some cases, the toilet may be external to the aid post and shared with the community. Wastewater from these facilities often goes to soak pits, especially in areas with sandy soil, near the sea or a water source, thereby polluting these sources.

6.3 Lao People's Democratic Republic

6.3.1 Water supply systems

In the Lao People's Democratic Republic, commonly employed water supply systems vary for different types of HCFs based on their locations and infrastructure capabilities:

- **Central hospitals**, found only in urban areas, commonly rely on treated chlorinated piped water. To prepare for recurrent disruptions in centralized water supply systems, these hospitals often have boreholes as a backup water source and include additional storage tanks.
- **Provincial hospitals**, serving a mix of urban and rural regions, also adopt mixed water supply systems, combining piped water, when available, with other sources which vary according to the locality.

- **District hospitals**, mainly situated in rural areas, often rely on on-site water supply systems. Groundwater, particularly from borewells and deep wells, serves as the primary water source for these facilities.
    - When **district, provincial and central hospitals** are connected to piped water, they commonly have backup systems in place to handle any supply disruptions. Central hospitals typically use elevated tanks for water storage, but some have started implementing underground tanks with pumps to ensure steady water pressure.
- **Community health centres** face the challenge of limited access to treated piped water. Their water supply systems usually vary depending on the region of the country in which they are located.

In the northern region of the Lao People's Democratic Republic, characterized by mountainous topography, gravity-fed systems are often combined with piped water when available. In the south, where main district towns are situated, HCFs commonly adopt a combination of boreholes and piped chlorinated water. However, in rural southern regions, groundwater remains the primary water source.

While some HCFs may utilize surface waters, it is less common than other water sources. Water supply interruptions are frequent, prompting the use of water trucks to bring additional water during shortages and fill water tanks in hospitals. Additional storage, such as elevated tanks, is also implemented to ensure a continuous supply for patient care.

While considerations about water quantity are essential, water quality assessments are limited. A recent plan to add chlorine boosters in hospitals is yet to be fully implemented. Point-of-use treatment is present in laboratories and surgery/delivery wards in provincial and district hospitals. In cases where a reliable water supply is absent, point-of-use treatment is supplied on demand for specific medical activities. In extreme situations, bottled water may be used for surgeries and newborn deliveries in rural areas.

Challenges arise in certain regions, particularly in southern provinces where arsenic contamination in groundwater poses a concern. The absence of established standards for monitoring arsenic in the environment adds to the complexity. Additionally, regions with hard water experience issues such as mineral precipitation and accumulation in pipes, potentially leading to blockages and system failure, and affecting water quality perception among the population. High concentrations of iron in natural sources of water have also been reported as a recurrent issue affecting the water supply in the country.

6.3.2 Wastewater systems

HCFs in the Lao People's Democratic Republic typically have on-site wastewater treatment systems because sewage networks are not common in the country. The technology used for on-site wastewater treatment varies according to the type of HCF and its location.

In central hospitals located in urban areas, there is a prevailing practice of segregating wastewater streams for dedicated treatment. Blackwater from toilets is primarily managed using septic tanks, while other wastewater streams, including greywater and laboratory wastewater, may undergo activated sludge treatment. Notably, three hospitals have implemented activated sludge treatment for greywater combined with other wastewater streams, excluding blackwater from toilets. This approach aims to optimize the targeted treatment of various wastewater types. However, operational challenges were identified as limiting factors for system efficacy.

Septic tanks managing wastewater from toilets require regular emptying by trucks to remove sludge. However, limited hospital resources often hinder adequate outsourcing of this task, which is performed by private contractors. Operational challenges are also observed in activated sludge systems treating greywater and other wastewater streams, primarily due to insufficient staff and resources exclusively dedicated to their operation and maintenance. Frequent monitoring of the system and electricity costs for recirculation pumping and aeration results in high operational costs, leading to intermittent operation and persistent interruption during system failure. The lack of any enforcement of minimum standards for wastewater disposal and associated penalties often cause delays in taking corrective actions to restore system efficacy after failures.

In urban provincial hospitals, septic tanks or soak pits are mostly used. Wastewater from surgery rooms and laboratories are directed to soak pits or septic tanks. In rural provincial hospitals, direct disposal of

wastewater into the environment is common, with soil saturation becoming an issue, particularly during the rainy season.

Community health centres usually have pour-flush toilets followed by pits. Some type A health centres have septic tanks but lack proper sludge management; some toilets have never been de-sludged, which potentially indicates design flaws. In delivery rooms, waste is often washed into trenches that lead directly to the environment.

While the Ministry of Environment has minimum standards for wastewater disposal from households, tools for effective implementation and enforcement are lacking. In addition, hospital effluents and the specific risks associated with emerging compounds they contain are not adequately considered in the existing standards. Improvements in wastewater management and enforcement of standards were identified as crucial to safeguarding water quality and environmental health in HCFs across the Lao People's Democratic Republic.

7 Criteria for technology selection

The decision-making process for determining the technological arrangement of water and sanitation services in HCFs is complex, involving numerous factors. Moreover, the relevance of these factors varies based on local circumstances.

This section compiles the criteria identified as important to decision-making processes for each of the three countries, including perceived gaps that should be addressed to improve the uptake and sustainability of appropriate technologies in HCFs. Factors considered important by interviewees are shown in bold below.

7.1 Mongolia

In Mongolia, **overall city planning** has been identified as crucial given the current government emphasis on promoting centralized water and sanitation solutions, including piped water and sewer systems, or transporting effluents to nearby wastewater and faecal sludge management facilities.

Access to existing centralized infrastructure is another key decision-making consideration. The strategic positioning of HCFs in areas covered by sewers and piped water, or alternatively with clean water sources and external wastewater treatment plants, is the prioritized procedure in Mongolia. Similarly, expansion of existing piped or sewerage systems to HCF locations is prioritized. For locations where centralized solutions are currently unfeasible, key factors highlighted in the technology selection process included water source and wastewater disposal site characteristics that would ensure their compatibility with the chosen technologies.

The suitability of **operation and maintenance requirements** of the chosen technologies, along with the **availability of skilled local staff** − particularly engineers − were other factors identified as crucial in ensuring the long-term sustainability of the implemented systems.

Mongolia's scarcity of skilled and dedicated water and sanitation professionals directly affects the design, operation and maintenance of advanced water and sanitation technologies. For instance, the challenging low temperatures prevalent across the country entail continuous maintenance and operation, which are often lacking, in order to avoid damage caused by water freezing within pipes during winter months.

The absence of **national guidelines and standards** governing appropriate water and sanitation technologies for HCFs has been identified as a critical gap, impeding the widespread adoption of suitable technologies that are tailored to Mongolia's unique needs and conditions.

The importance of **climate resilience** in water and sanitation technologies was emphasized, considering the potential impacts of climate change and natural disasters. To enhance overall resilience of water and sanitation systems, prioritizing the integration of climate-resilient features into technology selection by establishing a legal norm was suggested as a central factor that is currently not receiving enough attention in Mongolia. Implementing such a guideline would support proactive planning and preparedness, effectively supporting the mitigation of climate change risks and strengthening responses to natural disasters.

7.2 Vanuatu

In Vanuatu, most HCFs rely either entirely or partially on on-site water supply systems. The selection of suitable water technologies is heavily influenced by the **local availability and characteristics of water resources**, which are in turn contingent upon **topography and soil characteristics**. Drilling and utilizing groundwater in mountainous regions can be expensive and unfeasible, while lowland areas are more favourable for this purpose. The country's considerable rainfall supports its widespread adoption as the main water source for backup systems during intermittent piped water supply, noting that an increasingly long dry season also presents the risk of water shortages, particularly with climate change; water quality has also been found to be variable.

Regarding sanitation in Vanuatu's HCFs, **local expertise** and **affordability** were identified as key factors, resulting in the predominant utilization of septic tanks. Another significant considerations are the cost associated with retrofitting infrastructure, and changing cultural behaviour. There is limited availability of

resources to build comprehensive wastewater treatment plants (existing plants were built by the French during the colonial era) and limited ability to allocate dedicated personnel to operate and maintain such systems.

Availability of international donor funding thus becomes vital for implementing advanced wastewater treatment technologies in Vanuatu. For instance, the Port Vila hospital is the only HCF in Vanuatu that benefits from a dedicated wastewater treatment plant, being funded through external sources, in this case the French Government.

Sanitation services in the country rely heavily on **private sector capacity**, which remains constrained at the national level. However, tourism development in Port Vila has introduced new wastewater treatment technologies, with several recently constructed hotels featuring dedicated wastewater treatment plants equipped with advanced processes. Due to the limited budget and staff capacity in public hospitals, the maintenance and operation of systems demand the involvement of public−private consortiums to address the scarcity of expert personnel within the public sector.

In Vanuatu's current decision-making process for water and sanitation in HCFs, **climate resilience** and the prioritization of **green energy sources**, particularly the solar energy that is abundantly available throughout the year, have been identified as not receiving enough attention.

7.3 Lao People's Democratic Republic

In the Lao People's Democratic Republic, the selection of water supply technologies in HCFs primarily depends on the **type of water source available** in the area and the **Government's familiarity** with water and sanitation technologies, as approval from the Ministry of Health is necessary for implementation. Prioritization is usually given to piped water systems, and their provision is dependent mainly on **budgetary** and **technical and economic feasibility** to implement and **operate** such systems.

The implementation of advanced sanitation technologies in HCFs in the country relies heavily on **external support** for both the initial set-up and ongoing **operation and maintenance**. However, the episodic nature of international funding presents challenges, and the national public budget allocated to HCFs is limited.

The **type of HCF** plays a significant role in the type of sanitation technology installed, with larger facilities like central hospitals having the capacity to afford more complex systems while rural HCFs prioritize simple yet robust technologies with low operation and maintenance requirements.

As a result, **ongoing costs**, particularly for electricity and imported chemicals such as reagents and chlorine, limit the effectiveness of advanced wastewater systems. The lack of local skills to maintain and operate such systems further favours the adoption of simpler alternatives. **Cultural factors**, including a preference for traditional water-based toilets and a reluctance to adopt non-water-based solutions such as dry/composting toilets, also influence technology choices.

Furthermore, the lack of enforcement owing to resource constraints within regulatory agencies results in minimal penalties for non-compliance with **wastewater treatment regulations** and unsafe disposal practices in the environment. Despite shortcomings in their wastewater treatment, HCFs are typically not shut down, since priority is given to provision of care for the local population.

A key factor highlighted as currently lacking and deserving greater emphasis in the decision-making process in the country is the establishment of **technical standards** to guide the budget allocation and approval process for designing advanced water and sanitation technologies applicable to the specific requirements of HCFs.

8 Conclusions

This document provides a summary of findings about water and sanitation technologies in the WPR − including the underlying hydrological, climatic and service contexts − as well as of information obtained through interviews with stakeholders involved in water and sanitation practices in HCFs in three countries in the Region. The information gathered on health-care system structures, prevalent water and sanitation technologies, existing regulations and decision-making factors provide a useful basis for improving WASH in HCFs in the Region.

Health-care systems commonly categorize HCFs based on the type of medical services offered, their capacity or size, and their geographic location within the country. Although the structure of health-care systems is generally well defined, there are notable challenges in implementing and maintaining adequate water and sanitation services, particularly in rural and remote areas.

These challenges are often attributed to limited resources, which include budget constraints, a lack of local expertise and insufficient human resources to sustain the proper functioning of water and sanitation systems in HCFs. These factors are frequently reported as significant barriers to ensuring access to safe and reliable water and sanitation services for HCFs, and are therefore a critical area for improvement and attention.

The diverse contexts of the three countries studied in this document offer valuable insights into how decision-making processes differ and which factors are more consequential depending on context. Owing to the complexity of factors and local backgrounds, individually tailored and case-by-case analysis is necessary to determine the most suitable technologies for a particular country or area. To facilitate this process, a decision-support framework outlining key factors and processes has been developed on the strength of this document and the accompanying literature review, to ensure informed assessment and sustainable water and sanitation service delivery in HCFs in the WPR.

9 References

Chaitkin M, McCormick S, Torreano JAS, Amongin I, Gaya S, Hanssen ON, et al. (2022). Estimating the cost of achieving basic water, sanitation, hygiene, and waste management services in public health-care facilities in the 46 UN designated least-developed countries: a modelling study. Lancet Glob Health. 2022;10(6):e840–9.

Ministry of Health of Mongolia (2013). Environmental and hygienic requirements for health facilities. Mongolia 2016. MNS 6392 : 2013. Ulaanbaatar: Ministry of Health of Mongolia (https://www.washinhcf.org/wp-content/uploads/2021/07/Environmental-hygienic-requirements-for-health-facilities-Mongolia-2016.pdf, accessed 28 November 2023).

Ministry of Health, Vanuatu (2018). Role Delineation Policy. Port Vila: Ministry of Health, Vanuatu (https://moh.gov.vu/images/health_policies/policies/Role_Delineation_Policy-_Final.pdf, accessed 28 November 2023).

UN-Water, World Health Organization (2022). Strong systems and sound investments: evidence on and key insights into accelerating progress on sanitation, drinking-water and hygiene. UN-Water global analysis and assessment of sanitation and drinking-water GLASS 2022 report. Geneva: World Health Organization (https://www.unwater.org/sites/default/files/2022-12/GLAAS_2022_REPORT.pdf, accessed 14 December 2023)

World Bank Group (2023). World Development Data [online database]. Washington (DC): The World Bank Group (https://databank.worldbank.org/, accessed 14 December 2023).

World Health Organization (2023). Water, sanitation, hygiene, waste and electricity services in health care facilities: progress on the fundamentals. 2023 Global Report. Geneva; World Health Organization (https://www.who.int/publications/i/item/9789240075085, accessed 28 November 2023).

Annex 1

Fig. A1.. International funding in key water, sanitation and health care sectors for the identified priority countries in three Western Pacific subregions

Table A1. Average international funding disbursements per year (2012–2021 data) for the Western Pacific Region priority countries in key water, sanitation and health care sectors (cases denoted with − indicate missing data)

Funding sector	Western Pacific subregion	Country	Average yearly international funding (US$ millions)
Water supply *Large systems*	Northern Asia	Mongolia	7.16
	Pacific Islands	Vanuatu	0.01
		Papua New Guinea	0.04
		Kiribati	0.02
		Solomon Islands	0.37
	South-East Asia	Lao People's Democratic Republic	5.53
		Cambodia	47.60
Sanitation *Large systems*	Northern Asia	Mongolia	0.07
	Pacific Islands	Vanuatu	−
		Papua New Guinea	0.85
		Kiribati	−
		Solomon Islands	−
	South-East Asia	Lao People's Democratic Republic	1.04
		Cambodia	7.46
Basic drinking-water supply	Northern Asia	Mongolia	0.26
	Pacific Islands	Vanuatu	0.10
		Papua New Guinea	0.42
		Kiribati	0.10
		Solomon Islands	0.09
	South-East Asia	Lao People's Democratic Republic	1.88
		Cambodia	0.48
Basic sanitation	Northern Asia	Mongolia	0.06
	Pacific Islands	Vanuatu	0.04
		Papua New Guinea	7.54
		Kiribati	0.14
		Solomon Islands	0.02
	South-East Asia	Lao People's Democratic Republic	0.16
		Cambodia	0.19
Total water supply and sanitation	Northern Asia	Mongolia	13.40
	Pacific Islands	Vanuatu	2.83
		Papua New Guinea	13.05
		Kiribati	2.18
		Solomon Islands	4.71
	South-East Asia	Lao People's Democratic Republic	23.22
		Cambodia	76.26
Basic health infrastructure	Northern Asia	Mongolia	6.22
	Pacific Islands	Vanuatu	0.21
		Papua New Guinea	20.39
		Kiribati	0.52
		Solomon Islands	0.12
	South-East Asia	Lao People's Democratic Republic	3.24
		Cambodia	3.67

Table A2. Rank of fund donors according to funding percentage of total disbursements (2017–2021 data) per funding sector for priority countries in Western Pacific subregions

Funding sector	Western Pacific subregion	Country	Fund Donor Countr	Funding percentage
Water supply *Large systems*	Northern Asia	Mongolia	United States of America	99
			Others	5
	Pacific Islands	Vanuatu	Japan	100
		Papua New Guinea	Japan	100
		Kiribati	Korea	100
		Solomon Islands	Japan	77
			Australia	23
	South-East Asia	Lao People's Democratic Republic	Japan	50
			Hungary	45
			Others	5
		Cambodia	France	65
			Japan	28
			Australia	6
Sanitation *Large systems*	Northern Asia	Mongolia	Japan	86
			Czech Republic	14
	Pacific Islands	Vanuatu	–	-
		Papua New Guinea	Japan	100
		Kiribati	–	-
		Solomon Islands	–	-
	South-East Asia	Lao People's Democratic Republic	Korea	74
			France	19
			Japan	4
			Korea	3
		Cambodia	France	66
			Japan	28
			Japan	5
Basic drinking water supply	Northern Asia	Mongolia	Korea	74
			France	14
			Others	3
	Pacific Islands	Vanuatu	New Zealand	73
			Japan	15
			Australia	11
		Papua New Guinea	Australia	94
			New Zealand	6
		Kiribati	New Zealand	100
		Solomon Islands	Australia	74
			New Zealand	25
	South-East Asia	Lao People's Democratic Republic	Hungary	83
			Japan	11
			Others	6
		Cambodia	United States of America	32
			France	29
			France	22
			France	7
			Australia	6
			Others	4