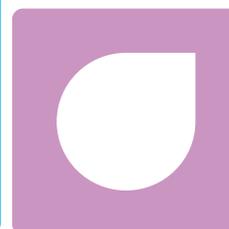


Troubled wastewaters

Policy brief



A review of the functionality of wastewater treatment plants in low- and middle-income countries

Highlights

Over one billion USD in official development assistance (ODA) is spent each year on wastewater treatment plants (WWTPs). This is more than twice what is spent on basic sanitation.

Many of these WWTPs are not functional or only partially functional. There is not enough publicly available evidence to establish how many.

The poor record of functionality of WWTPs is caused by problems with their design and operations and maintenance (O&M) – including poor technology choices, weak capacity, insufficient funding for O&M, and upstream issues – and underpinned by institutional constraints.

Perverse incentives in the system – including the donors' infrastructure-centred approach – favour the construction of expensive WWTPs, but don't help ensure they are properly operated and maintained.

Governments and donors need to radically rethink their investments in WWTPs by making service sustainability central to the design and technologies chosen, prioritising capacity strengthening, promoting institutional reforms and adopting a holistic approach to urban sanitation.

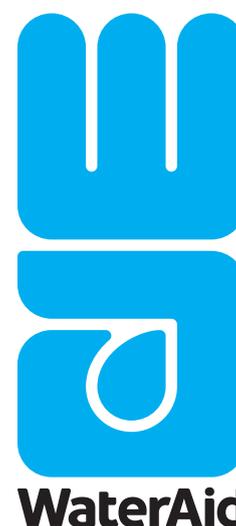
Bilateral donors and development banks could play a catalytic role by:

- reviewing the sustainability of WWTPs in their portfolios;
- systematically monitoring the sustainability of the plants they fund;
- rebalancing their investment in basic sanitation vs large systems;
- making capacity building and institutional reform central to their operations;
- reviewing how they design and negotiate their support for sanitation operations and services.



WaterAid/Andrés Hueso

▲ [Wastewater treatment plant in Islamabad, Pakistan.](#)



Introduction

Worldwide, a low proportion of wastewater and faecal sludge is treated. The problem is particularly acute in parts of Asia and Africa, with negative consequences for public health and the environment. Currently, most faecal waste is either used untreated to irrigate or fertilise crops, or directly dumped in the environment, polluting water bodies and creating significant public health risks.

The poor level of wastewater treatment in low- and middle-income countries is caused not just by a lack of treatment facilities but also by the poor functionality of existing WWTPs. Many have stopped working altogether, and there are cases of WWTPs having been built but never used.

How prevalent are these functionality problems? And what are their causes? There are no established research materials or publications that can provide straight answers to these questions, so WaterAid commissioned a desk review to examine the published evidence and views of key experts.

The resulting document – *Functionality of wastewater treatment plants in low- and middle-income countries*¹ – describes the flow of official development assistance (ODA) to large sanitation systems, and the evidence on WWTP functionality. It analyses the causes of failure, captures best practice and outlines potential responses.

This policy brief summarises the key findings from the desk review and presents WaterAid's take on the response needed and the role governments and donors can play.



WaterAid/Andrés Hueso



WaterAid/Andrés Hueso

▲ Wastewater treatment plant in Siem Reap, Cambodia.

1. WaterAid (2019). *Functionality of wastewater treatment plants in low and middle-income countries*. Available at: washmatters.wateraid.org/wwtp-functionality (accessed 19 Feb 2020).

How much ODA goes to WWTPs?

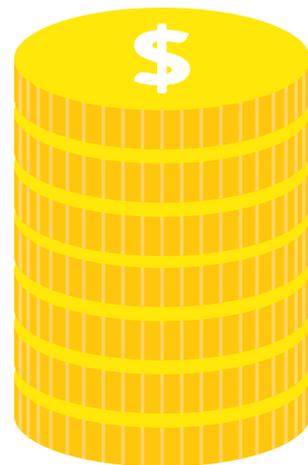
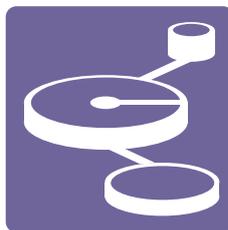
We estimate ODA disbursements to be roughly 1.1 billion USD a year. This covers large sanitation systems – WWTPs and the related infrastructure (sewers, pumping stations, and so on). It represents 22% of the total disbursements for water, sanitation and hygiene (WASH), and more than twice the disbursements for basic sanitation (about 500 million USD a year).

22% 

of WASH funds go to large sanitation systems



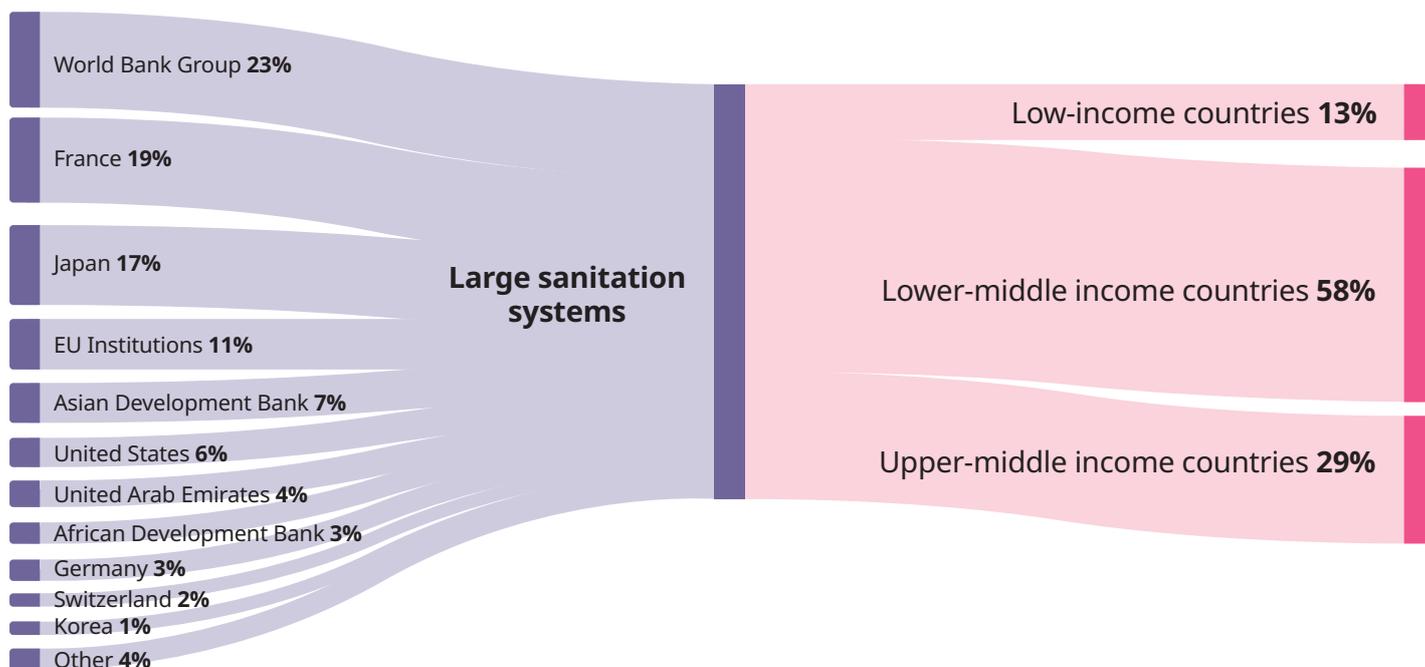
USD 506 million



USD 1,104 million

In many cases, donors combine water and sanitation disbursements in the Creditor Reporting System, so our sanitation estimates are based on an educated guess of the proportion allotted to each (see the full report for details on the methodology). We focus on ODA because flows are publicly monitored and because this is the main source of WWTP funding in many countries. But countries like China and India also invest from their own budgets.

The top providers of ODA for large sanitation systems are, in descending order, the World Bank (23%), France (19%), Japan (17%), EU institutions (11%), the Asian Development Bank (7%) and the United States (6%). The funds are primarily in the form of loans (70%) and directed towards lower-middle-income countries (58%).



Are existing WWTPs working?



There is little detailed published evidence on the sustainability and functionality of WWTPs in low- and middle-income countries. The lack of systematic monitoring and sharing of information is a major concern.

Our review revealed many examples of non-functioning WWTPs, which were either built but never commissioned or stopped working completely after some time. Many WWTPs were also found to be partially-functioning – either malfunctioning or operating severely overloaded or underloaded – and therefore not properly treating wastewater.

In Dar es Salaam, Tanzania, almost all wastewater is discharged directly into the Indian Ocean or the Msimbazi River. Five out of a total of seven wastewater stabilisation ponds were malfunctioning.

World Bank (2017). Reaching for the SDGs: The untapped potential of Tanzania's water supply, sanitation and hygiene.

Due to the lack of data, it is impossible to accurately assess the prevalence of these issues. The studies that have analysed multiple plants are of mixed quality and often dated.

But they can provide an approximation:

- In Mexico, 95% of 194 WWTPs were not working.
- In Ghana, 80% of 44 WWTPs were not working.
- In India, 54% of 84 WWTPs were operating poorly or very poorly.
- In Vietnam, around 33% of 17 WWTPs were substantially underloaded.
- In Brazil, most plants met effluent standards.

The table on page 5 summarises the status of WWTPs in the studies reviewed. The situation varies widely from country to country and depending on the study, but the review seems to confirm that a big share of WWTPs are not functional or partially functional. We haven't included faecal sludge treatment plants – which may present similar problems – due to the low number of studies on them.

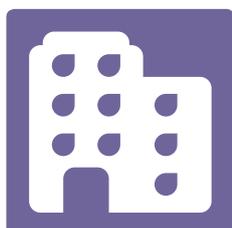
	Location	Never functioned	Stopped functioning	Malfunctioning / Partially functioning	Functioning well
Low-income	Kathmandu Valley, Nepal		4 plants (1980s) not functioning	Plant (2002) partially functioning	
	Bulawayo, Zimbabwe	Plant built, not commissioned	Plant decommissioned (1981)		
	Dar es Salaam, Tanzania			5 of 7 plants malfunctioning	
	Uganda			25 plants overloaded	
	Addis Ababa, Ethiopia			2 plants overloaded	
	DRC		Virtually all plants not functioning		
	Port-au-Prince, Haiti		Plant (2012) closed after 18 months		
	Bamako, Mali				Plant (2006) functioning well
Lower-middle-income	Islamabad, Pakistan		2 plants not functioning	Plant partially functioning	
	Karachi, Pakistan			3 plants not providing any treatment	
	Faisalabad, Pakistan		Plant not functioning		
	Sambrial, Pakistan				Plant functioning
	Rawalpindi, Pakistan	Plant not fully built			
	Kohat, Pakistan	Plant never used			
	Peshawar, Pakistan	Plant never used			
	Jatoi, Pakistan			Plant partially functioning	
	Thatta, Pakistan			Plant partially functioning	
	India			115 plants functioning at 72% capacity	
	India			54% of 84 plants functioning poorly/very poorly	36% of plants satisfactory and 10% of 84 plants functioning well
	Egypt			2 plants underloaded	
	Dhaka, Bangladesh			Plant partially functioning	
	Kenya			Many plants functioning below capacity (15–20%)	
	Ghana		80% of 44 plants not functioning	Most of the 20% of functioning plants below design loading	
	Asafo, Ghana			Plant functioning below capacity	
Accra, Ghana			Plant functioning below capacity		
Vietnam			About a third of plants functioning substantially over or under capacity	Most of 17 plants meeting effluent standards and functioning close to capacity	
Gaza Strip, Palestine			Plants overloaded and functioning poorly		
Upper-middle-income	2 states, Brazil				166 plants mostly meeting effluent standards
	Chiapas state, Mexico		182 of 194 plants not functioning		
	Mexico state and DF, Mexico	3 of 10 plants not fully built	1 of 10 plants not functioning	4 of 10 plants partially functioning	1 of 10 plants functioning well
	South Africa			30% of plants discharging increasing quantities of untreated wastewater	

Why are so many WWTPS not working?

Across the studies included in the desk review, poor functionality was down to both inadequate design and poor operations and maintenance (O&M), and the following pointers emerged as areas to be addressed:

- **Technology choice** not suited to the context and biased towards sophisticated options, which are more expensive and more difficult to operate and maintain – this is compounded by flawed procurement systems.
- **Weak capacity** to operate and manage the plant, with poor conditions making it difficult to attract and retain skilled workers, and weak training plans in place.
- **Insufficient resources** to cover O&M costs, due to inadequate tariffs and domestic investment, a lack of household connections, and optimistic operational expenditure forecasts.
- **Upstream issues** resulting in too much or too little wastewater reaching the plant, or wastewater that is too concentrated or unpredictable. Issues include leaking sewers, faulty pumping stations and inaccurate scenario planning (for instance, due to unplanned urbanisation).

These causes of poor functionality reinforce each other and are underpinned by supra-municipal **institutional weaknesses and constraints**, involving inadequate policies and regulations, weak implementation of these, and a lack of serious political engagement by responsible authorities.



These problems are not new or unknown. But they have persisted for decades. At their root are **perverse incentives** that favour building expensive sewer networks and high-tech WWTPs but do not help ensure they are properly operated and maintained. These incentives include vested interests from governments and service providers, as well as weak scrutiny and accountability demands from citizens or consumers.

Incentives within bilateral donors and development banks also favour big operations, adding up to enormous amounts of ODA being made available for building and rehabilitating WWTPs, while limited efforts are put into monitoring the long-term sustainability of the plants or addressing the persistent functionality crisis.

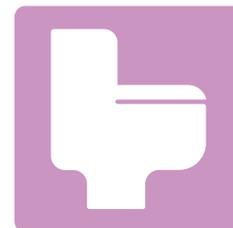
In Islamabad, Pakistan, two activated sludge plants were in a poor condition and were refurbished with a €19 million loan from the French government in 2005, which also helped build an additional plant, under a design and build contract to the French company Veolia.

Broken sewer lines, which had been discharging wastewater into freshwater streams instead of the treatment plants, were not fixed, so only one plant continued to operate, and by 2016 it stopped working effectively.

Raza (2008). *Plant ready to treat 17mgd sewage.*

Anwar S (2016). *A complete waste: Untreated sewage poisoning capital's waterways.*

What response is needed?



Governments and donors must radically rethink their investments in WWTPs, acknowledging that efforts so far have not successfully tackled the recurrent functionality problems:

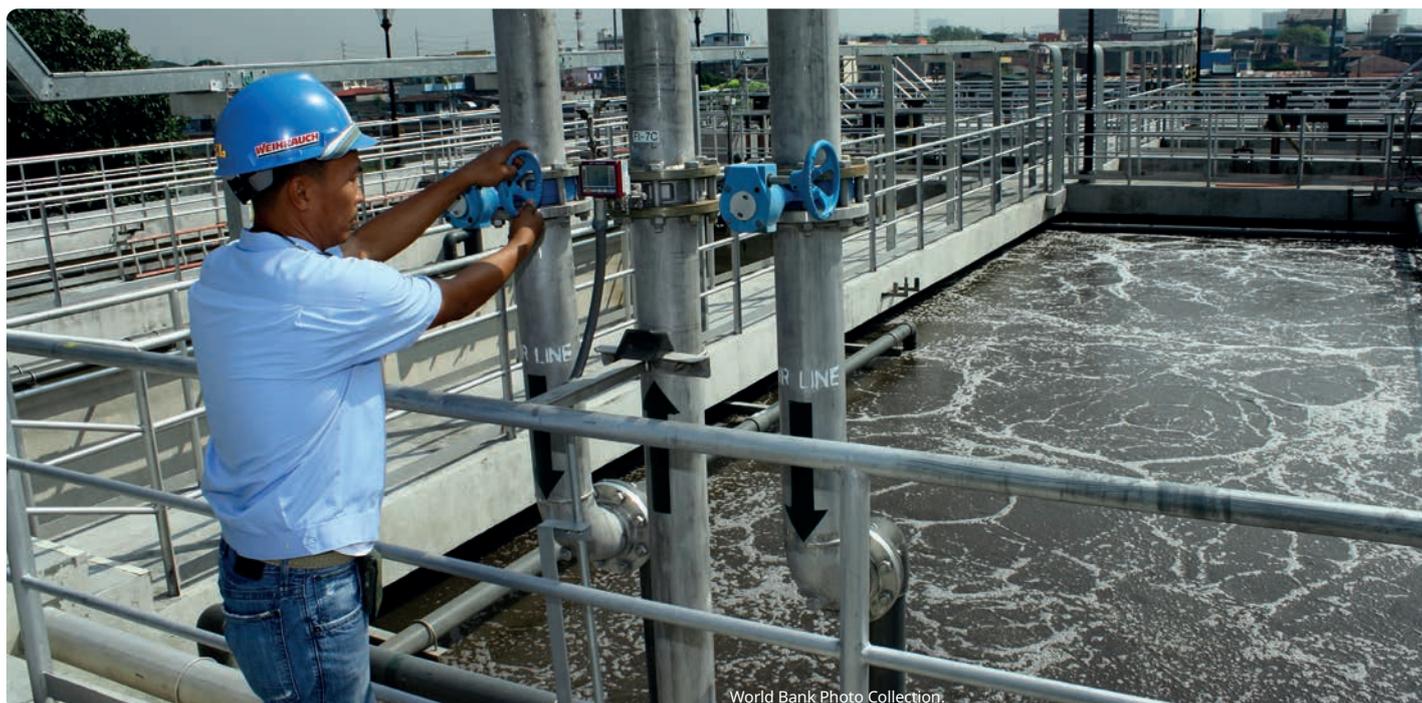


A **holistic approach** to urban sanitation is required, where sewers and WWTPs are not seen as the only solution. In line with the *Citywide inclusive sanitation call to action*,² it is important to always consider the whole sanitation service chain and also invest in faecal sludge management services, which are required in most cities.

The **design** of and technology choice in WWTPs should be approached from a service delivery perspective that emphasises the sustainability of operations. Resources for O&M, the reliability and cost of the power supply, the supply chains for materials and spare parts, and institutional and human resource capacity should be considered at the design stage, not become excuses for poor functionality later.

The system's **capacity** for WWTP O&M must be strengthened, and good practice should be the norm, encouraged by initiatives such as the nationwide vocational training for plant operators in Vietnam, the establishment of water operator partnerships (WOPs), and contracting modalities with long operational periods, which discourage designs that are expensive to operate and help build long-term capacity.

An **institutional reform** agenda is needed to address wider bottlenecks, improving regulation, strengthening regulators, clarifying roles and responsibilities, easing financial constraints, and supporting social accountability mechanisms, among other things.



World Bank Photo Collection.

2. World Bank (2019). *Citywide inclusive sanitation – A call to action*. Available at: citywideinclusivesanitation.files.wordpress.com/2018/02/cwis_cta_brochure_v033117.pdf (accessed 19 Feb 2020).

What should donors do differently?



Governments are ultimately responsible for leading the response to these problems and ensuring the proper treatment of wastewater and faecal sludge, a public good. However, WWTP investments in most low- and middle-income countries are driven by more than one billion USD in ODA made available every year by donors.

Bilateral donors and development banks therefore have an opportunity to address this crisis and a responsibility to ensure their operations have sustainable outcomes, with the funds they lend being spent effectively and efficiently.

With the scale of public funds at stake and with the chronic and widespread failures in outcomes, it is incumbent on donors to take urgent action and bring about the changes needed in the design of WWTPs, the approach to sanitation, capacity building and institutional reform, as well as addressing the perverse incentives highlighted earlier.



Bilateral donors and development banks should:

1. review the sustainability of the WWTPs in their portfolios, to assess the scale of the problem and understand its causes, and share this evidence with client countries and the WASH sector.
2. set up monitoring mechanisms to systematically collect and share data on the sustainability of the wastewater and faecal sludge treatment plants they fund.
3. review the balance between basic sanitation and large sanitation systems in their investment portfolio, as well as between wastewater and faecal sludge, and centralised and decentralised options.
4. make capacity building and institutional reform central to their operations and investments, addressing any shortfalls in internal skills and capacity.
5. review the approach, processes and criteria used to design and negotiate sanitation operations, and explore ways to realign internal incentives.

March 2020

Acknowledgements

This policy brief was written by Andrés Hueso (WaterAid) and is based on the desk review *Functionality of wastewater treatment plants in low- and middle-income countries* by Sue Cavill, Kevin Tayler and Andrés Hueso.

Available at: washmatters.wateraid.org/wwtp-functionality

This document should be cited as: WaterAid (2020). *Troubled wastewaters: A review of the functionality of wastewater treatment plants in low and middle-income countries. Policy brief*. London: WaterAid.