SFD Report

Lusaka
Zambia

Final Report

This SFD Report – SFD comprehensive - was prepared by GFA Consulting Group GmbH.

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SFD Report Lusaka, Zambia, 2018

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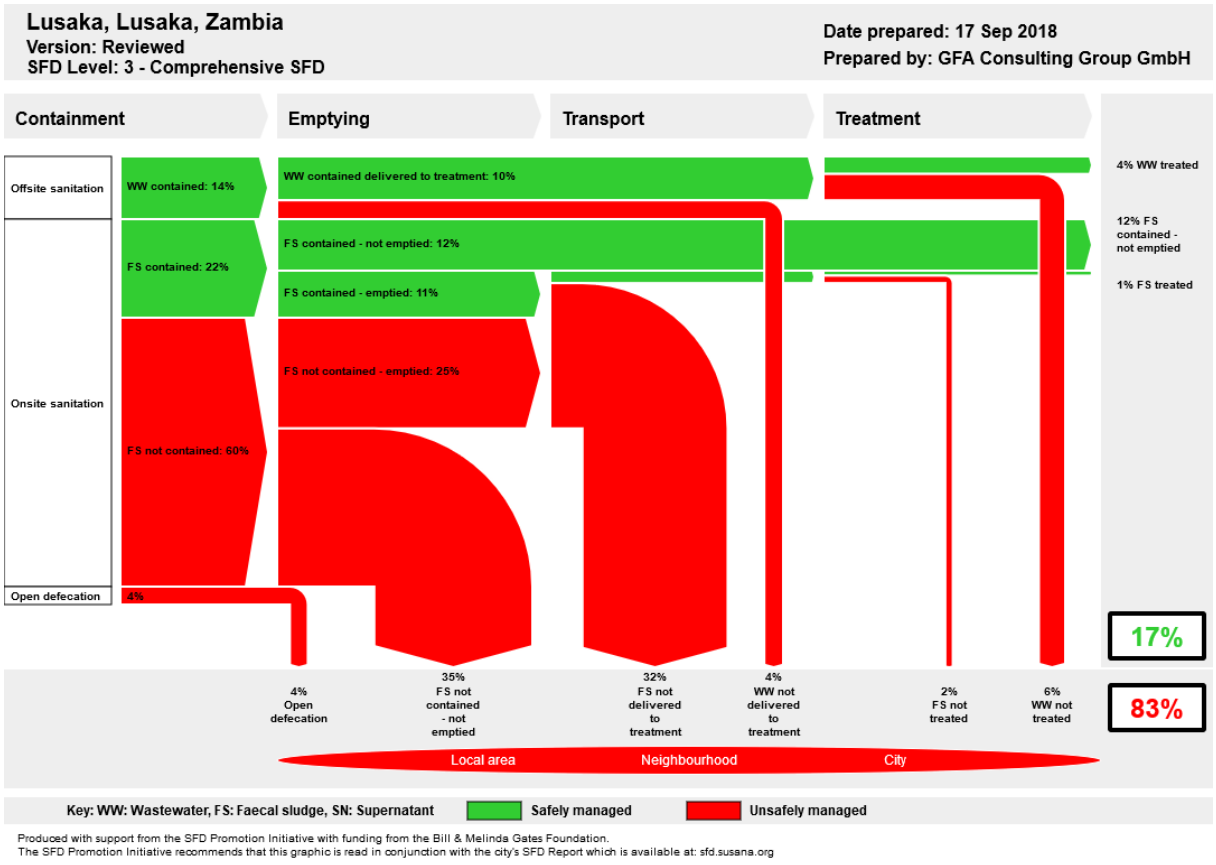
1. The SFD Graphic



Produced with support from the SFD Promotion Initiative with funding from the Bill & Melinda Gates Foundation.
The SFD Promotion Initiative recommends that this graphic is read in conjunction with the city's SFD Report which is available at: sfd.susana.org

2. Diagram information

SFD Level:

This is a Comprehensive level SFD report

Produced by:

This SFD report was produced by GFA Consulting Group GmbH.

Collaborating partners:

- GIZ Climate-friendly Sanitation in peri-urban areas of Lusaka Programme (GIZ CFS)
- Lusaka Water and Sewerage Company (LWSC)
- Lusaka City Council (LCC)

Status:

This is a final SFD report

Date of production: 26/09/2018

3. General city information

Lusaka is the capital city of Zambia. Situated in the central part of Zambia on the Central African Plateau it is one of the fastest-developing cities in Southern Africa.

Lusaka is both the political and economic centre of Zambia. Lusaka District is located within Lusaka Province, the smallest but most densely populated of the eleven Zambian provinces (CSO, 2014).

According to projections by the Central Statistical Office (CSO), the population of Lusaka District is estimated to be 2,526,102 in 2018 (CSO, 2013).

Around 70% of Lusaka's population lives in so-called peri-urban areas (PUAs) (UN-HABITAT, 2007). The PUAs are generally characterized by lack of adequate housing, infrastructure and services (UN-HABITAT, 2007).

Lusaka is located in an area with vulnerable hydrogeological conditions which results in a high risk for groundwater pollution in large parts of the city (Section 2.2.2) (Seureca - Veolia, 2017).

4. Service outcomes

This SFD arrives at 83% of the faecal sludge not being safely managed. Most people in Lusaka rely on on-site sanitation systems. The sewer network managed by Lusaka Water and Sewerage Company (LWSC) covers currently only about 14% of the population and has insufficient capacity to handle the current flows (LWSC, 2018a; Brown et al., 2012). LWSC manages seven wastewater treatment plants (WWTP) and stabilization ponds (SPs) distributed across Lusaka. The overall treatment capacity of the wastewater treatment facilities is around 40% (LWSC, 2018a; Brown et al. 2012). In total, only 4% of the total volume of wastewater generated in Lusaka can be estimated to be safely managed.

Of the 70% of Lusaka's population living in PUAs, it is estimated that 90% rely on pit latrines. Data on these proportions however vary in the literature (World Bank, 2015). 60% of the sludge generated on-site is not contained and 35% of it gets directly discharged into the environment. Reasons are poorly constructed overflowing septic tanks, permeable-pit latrines, damaged facilities and drains directly into the environment. Less than half of these latrines and tanks (25% in total) get emptied. Moreover, only 2% of septic tanks are estimated to be correctly constructed and discharge to a soak pit (GIZ, 2018a).

Septage from all septic tanks should be transported by vacuum trucks to LWSC's only official septage disposal facility in Lusaka: the Manchinchi Wastewater Treatment Plant (WWTP). However, only an estimated 16% of the accumulated sludge volume reaches the plant. The rest is assumed to by illegally dumped by the truck operators, as it is supposed by various stakeholders in Lusaka (GIZ, 2018a).

Only 1% of the sludge from pit latrines is reaching a treatment facility. It remains somewhat unclear what happens to the 99% of toilet waste that is not emptied by the Water Trusts. Illegal and unsafe emptying plays a significant role, however also not all latrines get emptied. 41% of households report to abandon their pit when full (WSUP, 2018). It is assumed that this includes flooded and damaged pits (16%), and that only 10% of the sludge stays contained inside the (semi-) permeable pits.

Open Defecation is estimated at 4% in Lusaka. A toilet mapping (GIZ 2018) as well as discussions with community representatives supported this estimation, which is set higher than the 1-2% OD rate which is generally found in the literature.

Around one third of the city area of Lusaka is located in areas with that can be classified as being at high or extreme groundwater pollution risk (GPR) (Bäumle & Museteka, 2011). A total of 66% of the on-site facilities are calculated to be located in areas with a significant risk of groundwater pollution. The most vulnerable areas of Lusaka's aquifer system largely coincide with low-income areas with a high prevalence of on-site sanitation systems (as shown in section 2.2.2) leading to severe health risks, such as the cholera outbreak in early 2018 (WSUP 2018b).

5. Service delivery context

The Vision 2030 aims for a full coverage of improved sanitation facilities in both urban and rural areas by the year 2030. The Lusaka Sanitation Master Plan (SMP) (2010-2025) aims to achieve 57% off-site and 43% on-site sanitation coverage by 2035 (GRZ, 2011). Eventually full sewerage coverage is targeted yet it is widely acknowledged that on-site sanitation services are required as interim solution (WSUP 2018).

The estimated budget required to implement the SMP and achieve 100% coverage is USD1.9 billon, out of which 640 million are foreseen for on-site systems. The SMP is being implemented mainly by the Lusaka Water and Drainage Project and the Lusaka Sanitation Program (LSP). The LSP is a 5-year program led and implemented by LWSC and funded by international donors.

LWSC as the main utility is running a peri-urban department in charge of serving the PUAs, and is currently building a department for faecal sludge management.

Emptying and transportation of sludge is provided through formal and informal services including vacuums trucks and manual emptiers. Trucks mainly focus on formalized areas due to higher accessibility as well as revenue collection. The PUAs are mainly served by informal manual pit emptiers.

LWSC has contracted eleven Water Trusts, which are community-based organizations providing water in the PUAs. The trusts in Kanyama and Chazanga are also providing Faecal Sludge Management (FSM) services through formalised emptying, transport and decentralised pre-treatment. This model is planned to be extended to other PUAs.

As for treatment facilities, the overall Sanitation Master Plan target to build four FSTPs and extend or rehabilitate two WWTS. The current main WWTP in Machinchi will be decommissioned by 2022.

6. Overview of stakeholders

On a national level, the 2016 established Ministry of Water, Development, Sanitation and Environmental Protection (MWDSEP) is responsible for water resource management (WRM), urban and rural water supply and sanitation (WSS), and environmental protection. The Ministry's main responsibilities include development of National Policies, Guidelines and Strategies, including resource mobilization. The Ministry of Local Government and Housing (MLGH) is in charge of solid waste management and has the overall mandate to coordinate Local Authorities (LAs).

The National Water Supply and Sanitation of Zambia Council (NWASCO) is responsible for regulating the provision of WSS and ensure efficiency and sustainability. NWASCO has recently published the Urban Sanitation Strategic Plan which is the key framework for guidance and regulation of FSM in Zambia. So far, the regulation of onsite sanitation has been lacking. Also, NAWASCO is licensing the Commercial Utilities (CUs) and establishes Service Level Agreements with the CUs as well as Minimum Service Levels.

Key Stakeholders	Institutions / Organizations
Public Institutions	Ministry of Water, Development, Sanitation and Environmental Protection (MWDSEP), Ministry of Local Government and Housing (MLGH), Water Resources Management Authority (WARMA), NAWASCO, ZEMA, Lusaka Water and Sewerage Company
Non-governmental Organizations	Water Trusts, WSUP, BORDA
Private Sector	Private emptiers
Development Partners, Donors	World Bank, African Development Bank, European Investment Bank, GIZ, KfW
Others	Academia

Tab. 1: Overview of Key Stakeholders

7. Process of SFD development

This SFD is a combination of a desk-based review and a field based research. Two of the authors were able to collect data in Lusaka. A SFD training, implemented by the African Water Association (AfWA), was used as a first assessment of relevant stakeholders and for establishing contact. The support from and collaboration with the GIZ Climate-friendly Sanitation in peri-urban areas in Lusaka programme (GIZ-CFS) is acknowledged.

Key informant interviews were conducted with stakeholders from water sector institutions in Lusaka. Several field visits and observations were made in order to collect additional data and crosscheck information given by stakeholders. A first draft of the SFD graphic was provided at a key stakeholder workshop on September 17 and submitted to LWSC for feedback and verification. Last questions resulting from the literature review were clarified through follow-ups with stakeholders by one of the authors who is based in Lusaka.

8. Credibility of data

The data availability for Lusaka is relatively good due the assessments that have been made in prior to the development of the Sanitation Master Plan. The credibility of these assessments is valued high as they are mainly provided by the locally implementing water utility LWSC, often through the support of international consultants. Household surveys and Focus Group Discussions (FGDs) as well as reports by the World Bank and other international donors are available.

As part of the field research, ten Key Informant Interviews were conducted. Additionally, the SFD training and validation workshop at the beginning and end of the data collection phase enabled to engage with a wide range of stakeholders.

There remains a significant uncertainty with regards to the gap between sludge produced and sludge that reaches the treatment facility. Further assessment on the proportion of toilets and septic tanks that are emptied would be required. Yet for this SFD graphic, improved data on toilets would not have fundamentally changed the proportions of sludge safely managed and sludge unsafely managed.

9. List of data sources

- Bäumle, R. and Museteka, L. 2011. Groundwater in Lusaka. A Resource in Need of Protection. Workshop presentation presented 08 February, Fringilla Lodge, Lusaka
- CSO 2013. 2010 Census of Population and Housing. Population and Demographic Projections 2011 – 2035. Lusaka: Central Statistical Office
- GIZ 2018a. Presentation and discussions at SFD Validation Workshop in Lusaka organised by GIZ Climate-friendly Sanitation (CFS) Programme. 17th September 2018.
- GIZ 2018b. Mapping of toilets in Chawama, Chasanga and George. Data provided by GIZ CFS Programme. August 2018.
- GIZ 2018c. Interview with Technical Advisor to LSP within GIZ CFS Program in Lusaka. 13th September 2018.
- GRZ / MLGH 2010. Lusaka Water Supply, Sanitation and Drainage Project. Lusaka, Zambia: Ministry of Local Government and Housing.
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- VisionRi 2016. Lusaka Sanitation Program - Baseline Socio-Economic & Health Assessment, & Willingness to Pay Study. Lusaka: Lusaka Water and Sewerage Company (LWSC)

SFD Lusaka, Zambia, 2018

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Abbreviations

AfrDB	African Development Bank
AfWA	African Water Associated
BMGF	Bill and Melinda Gates Foundation
BGR	German Federal Institute for Geosciences and Natural Resources
BORDA	Bremen Overseas Research Development Association
CBO	Community Based Organisation
CFS	Climate Friendly Sanitation
CSO	Central Statistical Office
CU	Commercial Utility
CWT	Chazanga Water Trust
DEWATS	Decentralised Wastewater Treatment System
EIB	European Investment Bank
ECZ	Environmental Council of Zambia
DTF	Devolution Trust Fund
FSM	Faecal Sludge Management
FSTP	Faecal Sludge Treatment Plant
GIS	German Development Cooperation
GIZ	Geographic Information System
GPR	Groundwater Pollution Risk
GRZ	Government of the Republic of Zambia
JICA	Japan International Cooperation Agency
KfW	Kreditanstalt für Wiederaufbau
KII	Key Informant Interview
KWT	Lusaka City Council
LCC	Kanyama Water Trust
LSP	Lusaka Sanitation Program
LWSSDP	Lusaka Water and Sanitation Company
LWSC	Lusaka Water Supply, Sanitation and Drainage Project
MCA	Millennium Challenge Account
MD	Managing Director
MLGH	Ministry of Local Government and Housing
MOH	Ministry of Health

MSL	Minimum Service Level
MWDSEP	Ministry of Water, Development, Sanitation and Environmental Protection
NGO	Non-Governmental Organisation
NUWSSP	NUWSSP
NWASCO	National Water Supply and Sanitation Council
OD	Open Defecation
PUA	Peri-urban areas
PHAST	Participatory Hygiene and Sanitation Transformation
RASOP	Reinforcing Capacity of African Sanitation Operators
SFD	Shit Flow Diagram
SLA	Service Level Agreement
SLG	Service Level Guarantee
SMP	Sanitation Master Plan
USD	United States Dollar
UUS	Unplanned Urban Settlements
UWSS	Urban water supply and sanitation
WASAZA	Water and Sanitation Association Zambia
WSS	Water Supply and Sanitation
WSUP	Water and Sanitation for the Urban Poor
WWTP	Waste Water Treatment Plant
ZABS	Zambia Bureau of Standards
ZEMA	Zambia Environmental Management Authority

1 City context

Lusaka is the capital city of Zambia. Situated in the central part of Zambia on the Central African Plateau, it is one of the fastest-developing cities in Southern Africa. Lusaka is both the political and economic centre of Zambia. Lusaka District is located within Lusaka Province, the smallest but most densely populated of the eleven Zambian provinces (CSO, 2014). According to projections by the Central Statistical Office (CSO), the population of Lusaka District is estimated to be 2,526,102 inhabitants in 2018 (CSO, 2013). Taking into account that the 2010 census counted the population of Lusaka District at 1,747,152 inhabitants (CSO, 2014) this results in an annual growth rate of 4.7% for this period. The district has a total surface area of 360km², resulting in a population density of 7,017 people/km² in 2018. There are two categories of residential area in Lusaka:

- Unplanned Urban Settlements (UUS), often named peri-urban areas (PUA).
- Planned Urban Settlements (PUS), also referred to as conventional area or housing area.

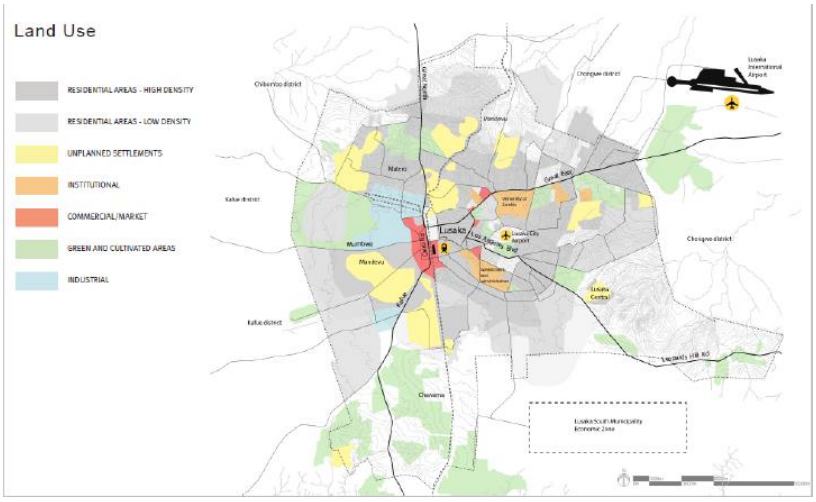

Figure 1: Map of Lusaka showing unplanned settlements (source: Seureca Veolia, 2017)

Around 70% of the population lives in PUAs of which there are over 30 (UN-HABITAT, 2007). The PUAs are expanding faster than the rest of the city and are generally characterized by lack of adequate housing, infrastructure and services (UN-HABITAT, 2007).

The topography of Lusaka is mostly flat with an elevation ranging from 1,200 to 1,300m above sea level. The city is divided into three drainage basins, namely Chongwe, Chunga-Mwembeshi and Kafue Basins. There are only small rivers in Lusaka (Ngewerere and Chunga Streams). Part of the city is prone to flooding. In general, Lusaka is located in an area with vulnerable hydrogeological conditions which results in a high risk for groundwater pollution in large parts of the city (Section 2.2.2) (Seureca - Veolia, 2017).

2 Service Outcomes

2.1 Overview

This section presents the range of infrastructure technologies, methods and services designed to support the management of wastewater and faecal sludge through the sanitation service chain in Lusaka. The chapter also provides some general information on the current condition and capacities of the different systems. For details on quantitative estimations, refer to section 2.2).

Figure 2: SFD Selection Grid for Lusaka

2.1.1 Containment

Off-site sanitation: The off-site-sanitation system in Lusaka consist of sewers connected to centralized wastewater treatment plants (WWTPs) managed by Lusaka Water and Sewerage Company (LWSC). The LWSC off-site sanitation system in Lusaka comprises 480km of sewers, eight pumping stations and seven WWTPs. The majority of the collection system is more than 40 years old and has received insufficient maintenance and investments since its construction. The sewer network covers around 30% of the city area and around 14% of the inhabitants of Lusaka are currently connected to the central network (World Bank, 2015).

On-site sanitation: Around 70% of Lusaka's population lives in so-called peri-urban or unplanned areas. It is generally estimated that around 90% of the population living in these peri-urban areas rely on pit latrines (World Bank, 2015). Percentage of Lusaka inhabitants using different types of on-site sanitation facilities differ between various reports but generally range between 55 - 70% for pit latrines and 10 - 20% for septic tanks (World Bank, 2015; GRZ,

2011; JICA et al. 2009; WSUP, 2018b; VisionRi, 2016). For the preparation of the SFD graphic we have assumed that 64% of the entire Lusaka population use any type of pit latrine and 18% of the population use septic tanks (Section 2.2.1).

Open defecation in Lusaka is usually cited to range between 1 - 2% (VisionRi, 2016; MLGH, 2015). Based on the results of a comprehensive toilet mapping conducted in four peri-urban areas in Lusaka (Kanyama, George, Chazanga and Chawama), the commonly cited open defecation rate is likely to be underestimated (GIZ, 2018b). Extrapolating the results of the assessment, whilst taking into account that these areas are known to be open defecation hot spots, we arrived at an assumed open defecation rate of at least 4% for the entire city (for details refer to Section 2.2). Community representatives in the four areas confirmed high rates of open defecation, including “flying toilets”. In addition, there was a consensus amongst participants of the SFD validation workshop that sporadic open defecation is very common in trading/market zones where public toilet facilities are not available or in a poor hygienic status. Representatives of Lusaka City Council (LCC) reported that during the cleaning of the city centre, which was done as part of LCC’s response to the cholera outbreak in early 2018, the extent of exposed open defecation had been alarming (GIZ, 2018).

2.1.2 Emptying services

Exhausting services for septic tanks and pit latrines with vacuum trucks are provided by various private operators as well as by Lusaka City Council. According to a market assessment for faecal sludge management services (WSUP, 2018b) 55% percent of the demand for septic tank emptying is industrial, 25% commercial/institutional and 20% domestic. WSUP (2018c) notes that there is a significant gap in the calculated sludge accumulation rates and the sludge that is delivered to the only septage treatment facility (Manchinchi WWTP). According to their modelling, only 16% of septage produced in Lusaka makes it to the treatment facility. The authors further assume that the 84% of waste that is not delivered is mainly due to customers not emptying their tanks but according to various stakeholders in Lusaka, illegal dumping of waste from septic tank is not uncommon. In 2018, ZEMA has charged 16 vacuum truck operators who were selling untreated septage to farmers for irrigation (GIZ, 2018).

Pit latrine emptying services are provided by both formal and informal service providers. However, the only formalised manual emptying services for pit latrines are offered by the Water Trusts in Kanyama and Chazanga. These providers are only able to service a very small percentage of the latrines and are limited with regard to the area of their operation. Generally, it is assumed that 90% of the sludge gets emptied and 10% remain in tanks and pits, since a full emptying increases the costs and households aim to save on these services. According to WSUP (2018c), 41% of the households in Lusaka abandon their toilets once they are full and the Water Trust emptiers in Kanyama and Chazanga currently empty less than 1% of the annual demand in Lusaka for pit emptying (WSUP). They work based on a volume tariff scheme in blocks of 12, 24 and 32 barrels of 60l each, which gives households the opportunity to decide whether they want a full or partial emptying of their latrines based on their liquidity and cashflows. Tariffs have just been slightly raised and are now at ZMW380 (31$US) (12 barrels) and ZMW600(50$US) (32 barrels).

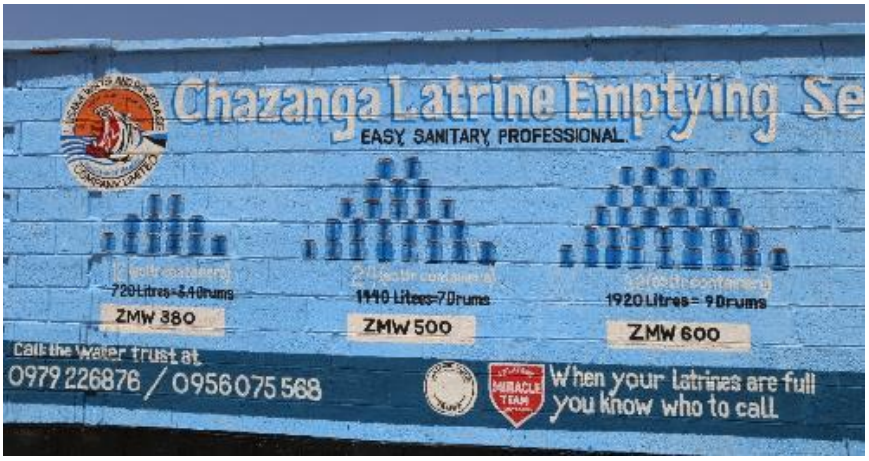

Figure 3: Advertised tariffs for pit emptying at Chazanga Water Trust

It remains somewhat unclear, what happens to the 99% of toilet waste that is not emptied by the Water Trusts. Illegal and unsafe emptying (through informal service providers or the household themselves) plays a significant role, although participants of the stakeholder validation workshop could not agree on a proportion. Common forms of such unregulated emptying are puncturing the pit lining and draining the sludge to an adjacent pit, draining the latrine to an open drain or directly into a water body, or empty it to the open ground during rainy seasons and wait for the rains to wash it away (GIZ-CFS, 2018). A few participants at the SFD validation workshop in Lusaka commented that they would not believe that illegal emptiers would play a major role since they had tried to identify these informal service providers for another assessment and failed to do so. A representative of LCC refuted this line of argument by comparing it to finding drug dealers who will not make themselves known if someone is '*just asking around'* but people will usually know who *'knows somebody who knows somebody'* if they really wanted to buy drugs. A second explanation for the gap between toilets that do not get abandoned and toilets that get officially emptied are 'bottom-less' toilets (toilets that do not fill up for very long times were mentioned). Most recent surveys on toilet coverage and use (WSUP, 2018; GIZ, 2018b; World Bank/LWSC 2016; VisionRi, 2016) have the limitation that only a very small percentage of the respondents knew what happened when the toilet was full and high percentages reported that the current facility had never filled up. This can be explained by the fact that in all abovementioned studies the majority of respondents were tenants who might not have stayed on the plot long enough. We factored in the remaining uncertainty about the 'destiny' of the waste in pit latrines when filling the SFD matrix (Section 2.2)

2.1.3 Transport

Transport in sewer network: The existing sewer network consist of approximately 480km of sewer pipes with around 80% of the pipes being 150mm diameter or less. The sewer network is divided into 5 sewer sheds. Most of the sewer system was constructed at least 40 years ago and has insufficient capacity to handle the current flows. Most of the network was designed as a separate sewer system, but there is also a section of combined sewer network in the Kaunda Square area. The network has eight (8) main interceptor sewers and eight pumping stations (GRZ, 2011). Table 1 describes the location and condition of the main interceptors.

Table 1: Description and condition of main interceptor sewers in Lusaka

Inceptor sewer	Description
Western Interceptor Sewer	Consists of 300mm to 750mm sewer pipe and serves approximately 794ha of area that consist of industrial zones at the upstream end and residential zones at the downstream end near the Matero Pond and Chunga treatment plant. ➔ Upstream & downstream portions have inadequate capacity
Manchinchi Interceptor-West	Conveys a portion of the industrial area's wastewater flow to the Manchinchi WWTP ➔ Mostly inadequate capacity
Manchinchi Interceptor-Southwest	➔ Mostly adequate capacity ➔ Limited capacity at downstream end between the Manchinchi WWTP and Garden Ponds.
Manchinchi Interceptor-South	Serves the largest area, starting in the Woodland area, and receives flows from multiple pumping stations. ➔ Multiple sections have limited capacity ➔ Inadequacy of hydraulic capacity during the wet weather condition due to large inflows from users and/or broken manhole covers.
Manchinchi Interceptor-East	Serves the Rhodes park area ➔ inadequate capacity due to large flows generated from non-residential users such as commercial and hotels.
Ngwerere Pond Interceptor-West	Serves a large residential area ➔ generally adequate capacity
Ngwerere Pond Interceptor-East	Serves relatively small area ➔ hydraulic capacity is inadequate at upstream end
Kaunda Square Interceptor Sewer	The interceptor crosses the eastern part of the city from south to north, terminating in the Kaunda Square Ponds. ➔ Sewers upstream of the Kaunda Square area appear to have adequate capacity. The eastern part of Kaunda Square and Chamba Valley are the only areas with combined sewer systems. ➔ Combined sewer systems cause frequent flooding of the interceptor sewer at the downstream end during large storms.

(source: GRZ, 2011)

According to GRZ (2011) the most common problems with the sewer system are:

- Blocked lines.
- Missing or broken manholes (often stolen by scavengers).
- Surcharging sewers/sewage contamination/overflowing manholes.
- Leaking pipes.
- Siltation.
- Vandalism.

The pumping stations were also built around 40 years ago and are partly compromised by age as well as lack of maintenance. Common problems at the pump stations include inadequate capacity, no back-up power, and flooding (Brown et al., 2012). Based on discussions during the SFD factors, we have assumed that only 70% of the produced wastewater is transported to the wastewater treatment facilities in the off-site system (Section 2.2).

There are currently ongoing investment programmes for the expansion, rehabilitation and upgrading of parts of the sewer systems, which will improve the network conditions over the next 5 – 10 years (Section 0).

Transport of sludge: Septage from septic tanks should be transported to LWSC's only official septage disposal facility in Lusaka: the Manchinchi Wastewater Treatment Plant (WWTP). As mentioned above, only 16% of the model-based total accumulated sludge volume reaches the plant. Depending on the volume of the vacuum tank, exhauster truck operators are charged between ZMW144 (12$US) and 288 (24$US) per load or 3$ per cubic-meter (BORDA, 2018) for discharging sludge at Manchinchi WWTP (Emptier Association, 2018). Participants at the SFD Validation Workshop (GIZ, 2018a) noted that the centralised discharge point for septage contributes to the problem of illegal discharge and dumping of septage. The long transportation ways from some parts of the town to Manchinchi make it financially unattractive for the truck operators to discharge legally since this would come with high costs for fuel and loss of business during time spent in traffic. It is therefore widely known that exhauster truck drivers sell the untreated septage to nearby farmers who use it for irrigation.

The two emptying schemes under Kanyama and Chazanga and Water Trust have their own treatment facilities. The treatment facilities implemented under aspects of DEWATS (Decentralized Wastewater Treatment Facilities) were funded by WSUP and designed and constructed by WASAZA/BORDA for the Kanyama FSTP whilst the Chazanga FSTP was funded and constructed by WSUP with recommendations from WASAZA/BORDA M&E findings of the Kanyama FSTP of 2013 and the implementation and business management model were carried out by WSUP and LWSC. The Kanyama FSTP was designed not as a full faecal sludge treatment plant but as a sludge transfer station in which the sludge was to be put for stabilization and taken by vacuum pickup trucks to drying beds, located five kilometres away due to lack of space at the transfer station. The drying beds are on a piece of land also owned by the Water Trust. The treatment plant however is placed in an area which the emptiers can easily access for many latrine emptying trips in a day. As the plant was meant to be a transfer station, it requires weekly maintenance that includes the emptying of the stabilised sludge and taken to the drying beds in order to create space for new sludge in the plant and the transportation of the separated solid waste to the dump site. The solid waste comes to the plant as it is emptied together with sludge; It is generally thrown into latrines by the households due to lack of solid waste services in most peri-urban areas of the city. The FSTP management model turned out to be costly on the emptiers benefits as the vacuum truck and solid waste collection trucks are hired out of their monthly emptying earnings. In times of low-income generation, truck hire is reported to be subsidized by the Water Trust through outer income sources, such as water sells and sometimes emptying was re-scheduled on monthly. The re-scheduling of desludging affected the operation and performance of the plant (BORDA 2018).

However, during the time of the filed visits, both sludge treatment sites were non-operational and the emptiers had to bring the barrels to Manchinchi WWTP. As the amount of faecal sludge temporarily transported by the Water Trusts is small comparably to the capacity of Manchinchi of 36,000m^3/day, it is assumed that this does not have a negative impact on the functionality of the WWTP.

Treatment

LWSC manages seven wastewater treatment plants (WWTP) and stabilization ponds (SPs). The seven WWTP are distributed across the Lusaka District and include two conventional biological treatment plants (trickling filters) and five pond systems (Brown et al., 2012). In addition, LWSC has two decentralized faecal sludge treatment sites which are managed by

the Water Trusts in Kanyama and Chazanga. Table 2 gives an overview on the available treatment facilities.

Table 2: Overview available treatment facilities of LWSC (source: updated from Brown et al., 2012)

Plant	Plant type	Capacity (m^3/d)	Drainage Area	Discharge stream
Chelston	Stabilization Pond	2,700	Chelston	Kapiriyomba
Matero	Stabilization Pond	7,100	Western	Chunga
Chunga	Trickling Filter	9,100		Mwembesi
Kaunda Square	Stabilization Pond	3,600	Kaunda	Ngwerere
Manchinchi	Trickling Filter	36,000	Machinchi	Ngwerere
Garden	Stabilization Pond			
Ngwerere	Stabilization Pond	8,350	Ngwerere	Ngwerere
Kanyama	Sludge Digester	4	n/a	n/a
Chazanga	Sludge Digester	4		

It needs to be noted that the capacities above are the calculated design capacities of the facilities. Most facilities do not have functional flow meters but LWSC reported much higher flows for the two conventional treatment plants (LWSC, 2018a; LWSC, 2018b) and it can be assumed that all facilities apart from Chelston, Ngwerere and Kaunda square ponds (recently rehabilitated see below) are severely overloaded (Brown et al., 2012).

The conventional biological treatment plants include screening and grit removal in their headworks, primary clarification, trickling filter secondary treatment, final clarification and bio-digesters for sludge treatment. The technical condition of the two conventional WWTP is alarming. In Manchinchi only two of the primary clarifiers are working. None of the trickling filters are working and only the secondary digester is operational (Figure 4). The effluent is pumped into the Garden Ponds where some tertiary treatment is provided (GRZ, 2011).

Figure 4: Truck discharging at Manchinchi/dysfunctional clarifier and trickling filter (source: Author)

In Chunga the situation is even worse. After primary treatment the water is pumped directly into the Mwembeshi River, which eventually discharges into the Kafue River, which is the sole surface water source for water supply in Lusaka. The Kafue River water intake is located at the Lolanda water treatment plant several miles downstream from the Chunga WWTP. The bio-digester in Chunga has not been operational for over 10 years. Chunga WWTP receives considerable amounts of industrial wastewater which is often not pre-treated and as a result the facility is severely overloaded and in the current condition can be considered as failed.

In summary, the problems at the conventional treatment plants are the following (updated from Brown et al., 2012):

- Lack of operational flow meters.
- Improper disposal of grit.
- Non-functioning of the trickling filters.
- Non-functioning of the bio-digesters.
- Inoperable or malfunctioning clarifiers.
- Inadequate security & poor worker health and safety.

The SPs are designed as multi-stage sewage ponds employing physical and facultative biological treatment. At the time of the preparation of the SFD, Kaunda Square Ponds had just been rehabilitated and upgraded through MCA funding and were operating well. Chelston and Ngewerere Ponds are also operating reasonably well and are meeting the ZEMA effluent standards for total and faecal coliform whilst all other facilities were in poor condition.

Brown et al. (2012) summarises the problems at the ponds as follows:

- No working flow meters.
- Non-functioning bar screens and grit chambers.
- Improper disposal of grit.
- Inadequate hydraulic resistance time due to sludge accumulation.
- No security.
- Erosion of earthen embankments.

Effluent quality data from the LWSC laboratory shows an overall quality compliance of the effluent for all facilities of around 60% (LWSC, 2018a). There is no data on the efficiency of the sludge treatment but since the biodigesters at both facilities are not working it can be assumed to be very limited.

The two decentralized sludge treatment facilities operated by the Water Trusts in Kanyama and Chanzanga are currently not operational as they are clogged with sand and grit. The sand, grit comes with the sludge emptied from pit latrines. To operationalise the facilities again requires a full complete system emptying in order to de-clog. Generally during normal operating periods, a full desludging is required about every eight months (BORDA, 2018) yet during the cholera outbreak in early 2018 the system got clogged in a short period of time due to huge sludge loads that were fed into the system daily.

Currently, WSUP is working on modalities for desludging Chazanga FSTP and improving the modalities that will allow a natural flow of sludge from the digester treatment unit to on-site drying beds in the way the plant was supposedly to be constructed. The site has enough slopes to accommodate natural desludging of sludge and overcome O&M challenges that currently requires mechanical pumping that currently hinder the weekly process (BORDA, 2018). For both plants operations are expect to within the next month. Currently, all sludge collected by the manual emptier teams is brought to Manchinchi WWTP.

2.1.4 Disposal / End-use

Dried sludge from Manchinchi and Chunga WWTP as well as the dried sludge produced at the decentralized sludge treatment facilities in Kanyama and Chazanga is sold to farmers for soil conditioning. The farmers are advised to use the sludge only on fields with high off ground crops and not vegetables.

2.2 SFD Matrix

Lusaka, Lusaka, Zambia, 17 Sep 2018. SFD Level: 3 - Comprehensive SFD
Population: 2526100
Proportion of tanks: septic tanks: 100%, fully lined tanks: 100%, lined, open bottom tanks: 100%

System label	Pop	W4a	W5a	F3	F4	F5
System description	Proportion of population using this type of system	Proportion of wastewater in sewer system, which is delivered to centralised treatment plants	Proportion of wastewater delivered to centralised treatment plants, which is treated	Proportion of this type of system from which faecal sludge is emptied	Proportion of faecal sludge emptied, which is delivered to treatment plants	Proportion of faecal sludge delivered to treatment plants, which is treated
T1A1C1 Toilet discharges directly to a centralised combined sewer	2.0	70.0	40.0			
T1A1C2 Toilet discharges directly to a centralised foul/separate sewer	12.0	70.0	40.0			
T1A2C5 Septic tank connected to soak pit	1.0			90.0	16.0	40.0
T1A3C5 Fully lined tank (sealed) connected to a soak pit	2.0			90.0	16.0	40.0
T1A3C9 Fully lined tank (sealed) connected to 'don't know where'	1.0			90.0	16.0	40.0
T1A4C5 Lined tank with impermeable walls and open bottom, connected to a soak pit	2.0			90.0	16.0	40.0
T1A4C9 Lined tank with impermeable walls and open bottom, connected to 'don't know where'	1.0			90.0	16.0	40.0
T1A5C10 Lined pit with semi-permeable walls and open bottom, no outlet or overflow	12.0			50.0	1.0	40.0
T1B10 C7 TO C9 Containment (septic tanks, fully lined tanks, partially lined tanks and pits, and unlined pits) failed, damaged, collapsed or flooded - connected to water bodies, or open ground or 'don't know where'	5.0			0.0	0.0	0.0
T1B11 C7 TO C9 Open defecation	4.0					
T1B7C10 Pit (all types), never emptied but abandoned when full and covered with soil, no outlet or overflow	5.0					
T1B9 C1 TO C10 Toilet failed, damaged, collapsed or flooded, connected to sewer, soak pit, open drain or storm sewer, water body, open ground or 'don't know where'	5.0					
T2A2C5 Septic tank connected to soak pit, where there is a 'significant risk' of groundwater pollution	1.0			90.0	16.0	40.0
T2A3C5 Fully lined tank (sealed) connected to a soak pit, where there is a 'significant risk' of groundwater pollution	4.0			90.0	16.0	40.0
T2A4C5 Lined tank with impermeable walls and open bottom, connected to a soak pit, where there is a 'significant risk' of groundwater pollution	6.0			90.0	16.0	40.0
T2A5C10 Lined pit with semi-permeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	26.0			50.0	1.0	40.0
T2B7C10 Pit (all types), never emptied but abandoned when full and covered with soil, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	11.0					

Figure 5: SFD matrix

2.2.1 Distribution of containment technologies

Based on the results of the literature review and discussions with different stakeholder we arrived at the following general distribution of containment systems in Lusaka (Table 3).

Table 3: Distribution of containment systems for preparation of SFD graphic

Containment technologies	Total	SFD Classification
Off-site	**14%**	T1 A1 C1 T1 A1 C2
Septic tanks/Lined tanks (all types)	**18%**	
Septic tanks (correctly constructed) to soak pit	2%	T1 A2 C5 T2 A2 C5
Poorly constructed 'septic tanks' (without compartments/proper lining etc.) with overflow to soak pit	14%	T1 A3 C5 T1 A4 C5 T2 A3 C5 T2 A4 C5
Poorly constructed 'septic tanks' (without compartments / proper lining etc.) with overflow to any other than soakpit (incl. open water body, drains etc) – "don't know where"	2%	T1 A3 C9 T1 A4 C9
All types of pit latrines	**64%**	
Semi-lined pit latrines	38%	T1 A5 C10 T2 A5 C10
Pit latrines which get abandoned once full (incl. unlined pit latrines)	16%	T1 B7 C10 T2 B7 C10
Flooded & damaged facilities (assumption these will also be abandoned)	10%	T1 B10 C7 TO C9 T1 B10 C7 TO C10
Open defecation	**4%**	T1 B11 C1 TO C9

Septic tanks: During various discussions with key informants and the discussions during the SFD Validation Workshop in Lusaka (GIZ, 2018a) it was confirmed that most septic tanks (even in the high-income areas) in Lusaka are not constructed in line with the building standards and mostly do not have two compartments and/or proper lining. Tanks without lining at the bottom are very common. Whilst most septic tanks are connected to some type of soak pit there are cases when septic tanks are directly connected to water bodies or drains (GIZ, 2018a).

Pit latrines: In line with the information from literature and past surveys we estimate that a total of 64% of the population uses some type of pit latrine (Section 2.1.1). 41% of the pit latrines *(or 0.64 x 0.41 = 26% of the total facilities)* are abandoned once full (WSUP, 2018). We have assumed that facilities that get abandoned include all unlined pit latrines as well as flooded and damaged facilities. The proportion of unlined pit latrines was estimated to be around 10% (World Bank & LWCS, 2016; GIZ, 2018b), during the validation workshop participants mentioned that there are cases that unlined pits are getting emptied but for the preparation of the SFD this number was considered to be negligibly. The estimate for the toilets that are flooded or damaged was mainly based on the results of the GIZ supported toilet mapping exercise (GIZ, 2018b) and the structural assessment of the toilets done during the LSP baseline survey (VisonRi, 2016).

Open defecation: There is a lot of uncertainty around the actually proportion of open defecation (OD) in Lusaka. During the SFD Validation Workshop (GIZ, 2018a) participants confirmed the following OD rates for the four peri-urban areas covered under the toilet mapping exercise:

- Chawama: 10%
- George 10%
- Chazanga 8%
- Kanyama 15%

Taking into account, that these figures might be overestimated and that the four areas are known to be sanitation hotspots we have reduced the assumed proportion of OD for all other peri-urban areas (we suggest that the majority OD happens in the peri-urban areas) to a third of the average OD in the four areas mentioned above, namely 3.5%. Based on this assumption we arrive at an average OD rate for Lusaka of 4% (more details see Appendix 5).

2.2.2 Risk of groundwater contamination

60 percent of Lusaka's water supply is derived from fairly shallow groundwater abstracted within the city. Lusaka is situated on a plateau of around 3,000 sq. km covering Lusaka City and the adjacent parts of Mwembeshi and Chongwe catchment (Figure 6). The main aquifer supplying the city is hosted by the marbles of the Lusaka Dolomite. This aquifer and some subordinate aquifers with marbles of the Cheta formation located to the north and south show fast flowing groundwater and are highly prone to contamination through fissures in the underlying rock. Minor aquifers developed in schists and quartzites of the Cheta and Chunga formation and with alluvial deposits host slower flowing ground water and allow more filtration (Bäumle & Museteka, 2011).

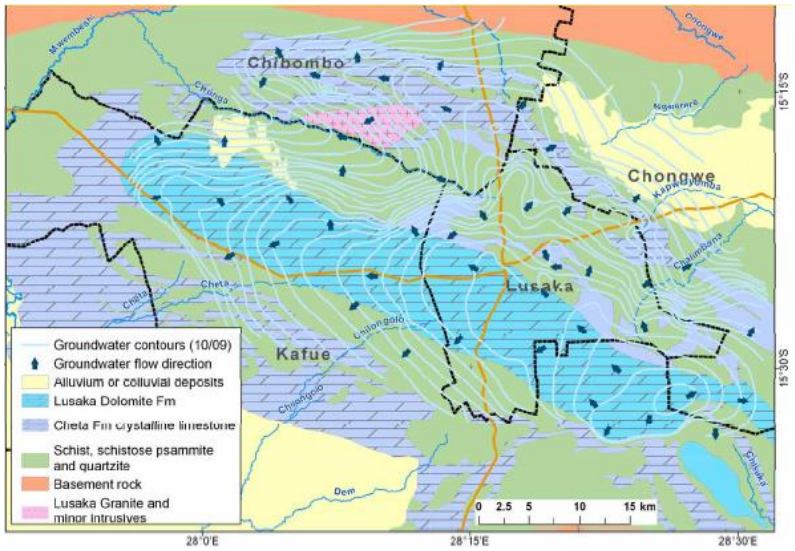

Figure 6: Aquifer system in Lusaka (source: Bäumle & Museteka, 2011)

In 2012, the German Federal Institute for Geosciences and Natural Resources (BGR) published a comprehensive groundwater vulnerability map for Lusaka and its surroundings. The map shows that the most vulnerable areas coincide with large low-income neighbourhoods situated to the south-west of the city centre (Figure 7).

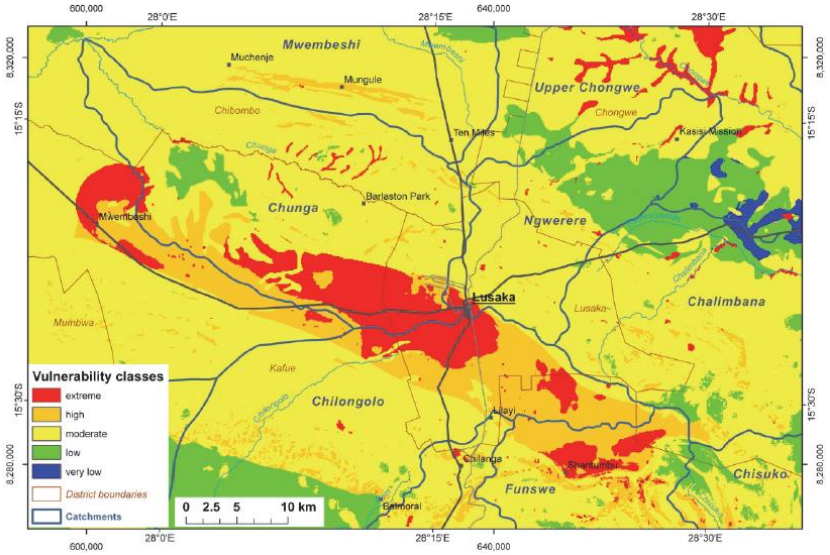

Figure 7: Groundwater vulnerability map for Lusaka (source: Bäumle, & Kang'omba, 2013)

Around one third of the city area of Lusaka is located in areas that can be classified to have a high or extreme groundwater pollution risk (GPR). The remaining city areas have a moderate risk of groundwater pollution. Given the high dependency of the Lusaka's urban population on the local groundwater resources, the high population density, as well as taking into consideration that cholera outbreaks occur regularly, it appears reasonable to consider a residual risk of groundwater pollution for the 'moderate vulnerability zones'. For the preparation of the SFD graphic, it was therefore assumed that 50% of the facilities in the moderate zone should be added to the 'high risk' facilities. This results in a theoretical distribution of 66% of the on-site facilities being categorized as being located in areas with a significant risk of groundwater pollution and 33% groundwater of the on-site facilities being categorized as being located in areas with a low risk of groundwater pollution. Whenever percentages were too small for subdivision a high risk of groundwater pollution was assumed (Table 2). This assumption led to the following theoretical distribution of on-site sanitation facilities used for the generation of the SFD graphic.

Table 2: Theoretical distribution of on-site facilities in relation to groundwater pollution risk

Type of on-site containment	Total	high GPR	Low GPR	unspecific
Septic tank to soak pit	2%	1%	1%	
Other types of (septic) tanks to soak pit	14%	10%	4%	
Poorly constructed 'septic tanks' to *don't know where*	2%			2%
Total septic tanks	**18%**	**11%**	**5%**	**2%**
Semi-lined pit latrines Lined Pits with semi-permeable walls and open bottom, not outlet or overflow	38%	26%	12%	
Pit latrines which get abandoned once full (incl. unlined pit latrines)	16%	11%	5%	
Flooded & damaged facilities (assumption these will also be abandoned)	10%			10%
Total pit latrines	**64%**	**37%**	**17%**	**10%**

2.2.3 Emptying, transport and treatment

Off-site: Due to the dilapidated state of the sewer network and regular overflows during rains (see Section 2.1.3) we estimated the network losses to be 30%. This means that only 70% of the off-site sewage reaches the treatment facility. The overall treatment capacity of the wastewater treatment facilities (effluent and sludge combined) was estimated to be 40%. Both figures were accepted during the validation workshop.

On-site: We believe that most people who have invested in the lining of a tank (even though it might not be a septic tank constructed to building standards) will empty the facility eventually. For well-designed septic tanks the period before emptying might be very long. Consequently, we assumed that 90% of the population empty their septic tanks. According to WSUP (2018c) only 16% of the septage reaches Manchinchi. The treatment capacity was again estimated at 40%.

As outlined in Section 2.1 there remains a bit of a mystery around the emptying of pit latrines. In line with the recommendation of the SFD-PI, we assumed that 50% of the pits are emptied (for the remaining part it was assumed that the sludge stays in the latrine for an indefinite time). Only 1% of the sludge reaches the treatment facility (mainly sludge collected by the emptier teams of the Water Trust and some people that use exhausting services to desludge their latrines). Due to the current non-operations of the faecal sludge treatment facilities in Kanyama and Chanzanga, all sludge from pit latrines is delivered to Manchinchi where only 40% is effectively treated.

2.2.4 Data uncertainties

As mentioned above there remains a lot of uncertainty with regard to the gap of sludge produced and sludge that reaches the treatment facility. Further assessment on the proportion of toilets and septic tanks that are actually emptied would be required. However, due to the high level of groundwater vulnerability, changing the proportions of sludge that gets emptied will mainly lead to a reallocation of proportions between the *FS not contained* and the *FS not delivered to treatment site* streams in the SFD graphic but will not fundamentally change the proportions of *sludge safely managed* and *sludge unsafely managed*.

2.3 SFD Graphic

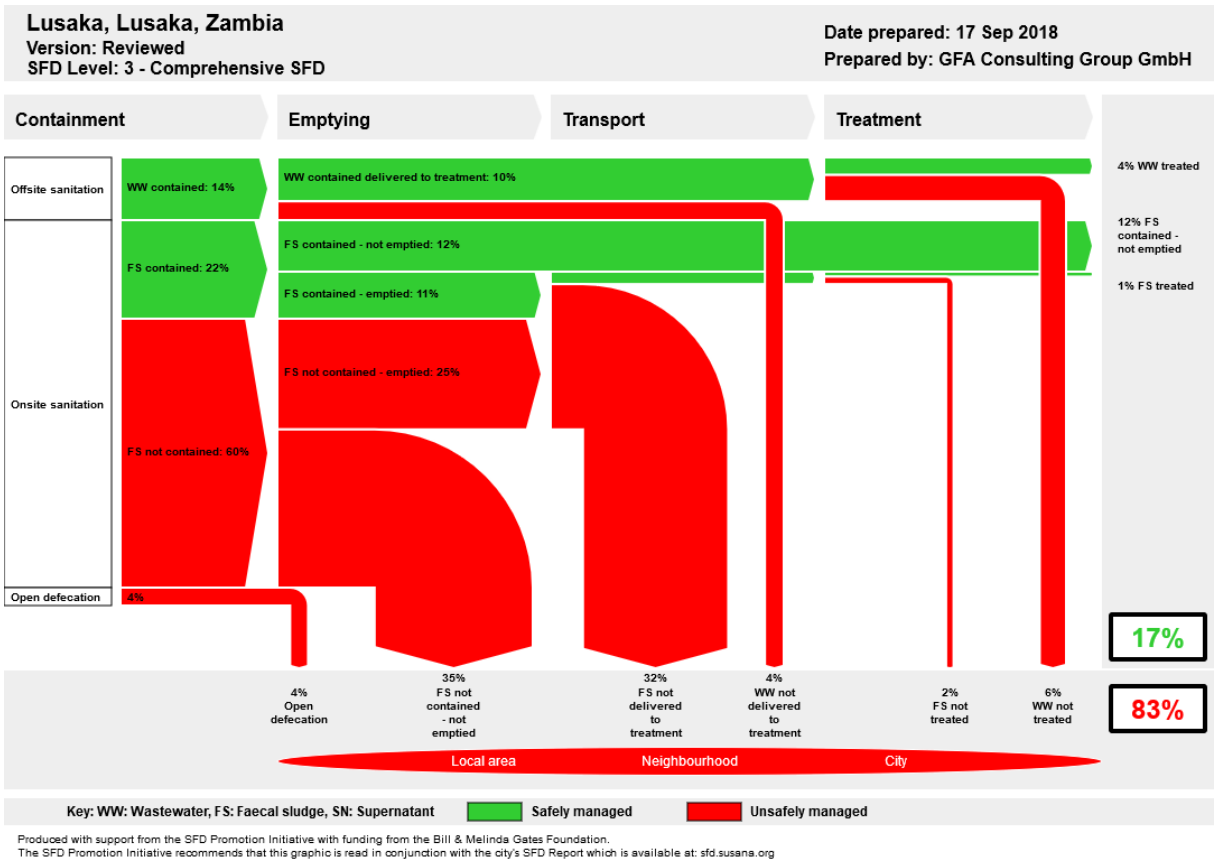

Figure 8: SFD graphic

This SFD arrives at 83% of the faecal sludge not being safely managed. Most people in Lusaka rely on on-site sanitation systems (Figure 8). The sewer network managed by Lusaka Water and Sewerage Company (LWSC) covers currently only about 14% of the population and has insufficient capacity to handle the current flows (LWSC, 2018a; Brown et al., 2012). 10% of wastewater arrives at the treatment facilities and in total, only 4% of the total volume of can be estimated to be safely managed.

Over 80% of the faecal waste in Lusaka is generated onsite a large share of this is generated since 70% of Lusaka's population live in PUAs, of 90% are estimated to rely on pit latrines. Data on these proportions however vary in the literature (World Bank, 2015).

Of the onsite generated FS, only 22% is actually contained onsite of which even 12% is estimated to not get emptied since 41% of households report to abandon their pit when full (WSUP, 2018). It is assumed that this includes flooded and damaged pits (16%), and that only 10% of this sludge stays contained inside the (semi-) permeable pits. Of the sludge which is contained 3% is delivered to a treatment facility through vacuum trucks and the manual emptiers of the two Water Trusts.

60% of the sludge generated on-site is not contained and 35% of it gets directly discharged into the environment. Reasons are poorly constructed overflowing septic tanks, permeable-pit latrines, damaged facilities and drains directly into the environment. Less than half of these latrines and tanks (25% in total) get emptied. Moreover, only 2% of septic tanks are estimated to be correctly constructed and discharge to a soak pit (GIZ, 2018a). Only 1% of the sludge

from pit latrines is reaching a treatment facility. It remains somewhat unclear what happens to the 99% of toilet waste that is not emptied by the Water Trusts. Illegal and unsafe emptying plays a significant role, however also not all latrines get emptied.

Open Defecation is estimated at 4% in Lusaka. A toilet mapping (GIZ, 2018) as well as discussions with community representatives supported this estimation, which is set higher than the 1-2% OD rate which is generally found in the literature.

Around one third of the city area of Lusaka is located in areas with that can be classified as being at high or extreme groundwater pollution risk (GPR). A total of 66% of the on-site facilities are calculated to be located in areas with a significant risk of groundwater pollution.

3 Service delivery context

3.1 Policy, legislation and regulation

3.1.1 Policy & Acts

The Constitution of Zambia, 1996, in Article 112 stipulates that the State shall endeavour to provide clean and safe water. In this context, developed and adopted by the GRZ in 1994, the National Water Policy is the overarching policy framework for the water and sanitation sector in Zambia and was subsequently updated in 2010. The National Water Policy envisions “to optimally harness water resources for the efficient and sustainable utilization of this natural resource to enhance economic productivity and reduce poverty”. This is in line with Zambia’s economic blueprint Vision 2030 that aims at transforming Zambia into a prosperous middle-income country providing secure access to safe potable water sources and improved sanitation facilities to 100 percent of the population in both urban and rural areas by the year 2030. An overview over all documents that shaped the development of the water and sanitation sector is provided in Appendix 10.

A particularly important document is the Sanitation Master Plan for Lusaka. The aim of this plan is to establish the investment needs of LWSC over a 25-year period and to provide a principal framework for planning investment in the sanitation sector. It includes investments for both the rehabilitation and extension of wastewater collection and treatment and for the development of on-site sanitation, consisting mainly of the construction of improved latrines and flush toilets connected to septic tanks.

3.1.2 Institutional roles

The water and sanitation sector has been undergoing reforms since the early 1990s with the aim of improving access to water supply and sanitation (WSS) services and improving water resources management (WRM). Since the establishment of the National Water Policy of 1994, WRM was placed under the Ministry of Energy and Water Development (MEWD) and WSS under the Ministry of Local Government and Housing (MLGH).

Ministerial restructuring was gazetted in Nov. 2016 and led to the establishment of the Ministry of Water, Development, Sanitation and Environmental Protection (MWDSEP), responsible for the water sector, including WRM, urban and rural WSS, and Environmental Protection on national level. Its main responsibilities include development of National Policies, Guidelines and Strategies, including resource mobilization. The functions of water supply and sanitation

were transferred from the Ministry of Local Government and Housing (MLGH) into the MWDSEP, while the functions of Solid Waste Management remained at MLGH. The Ministry of Local Government has the overall mandate to coordinate Local Authorities (LAs). In urban areas LAs provide WSS through the commercial water companies (CUs). The CUs, despite being owned by LAs, are implementing agents under the MWDSEP and have the overall responsibility for provision of sanitation services, including on-site and off-site sanitation services. CUs are represented in the Water Supply and Sewerage Association of Zambia (WASAZA). The LAs are responsible for the enforcement of the public health Act, Chapter 295 of the Laws of Zambia. Figure 9 presents the responsibilities for WSS after the Ministerial Restructuring.

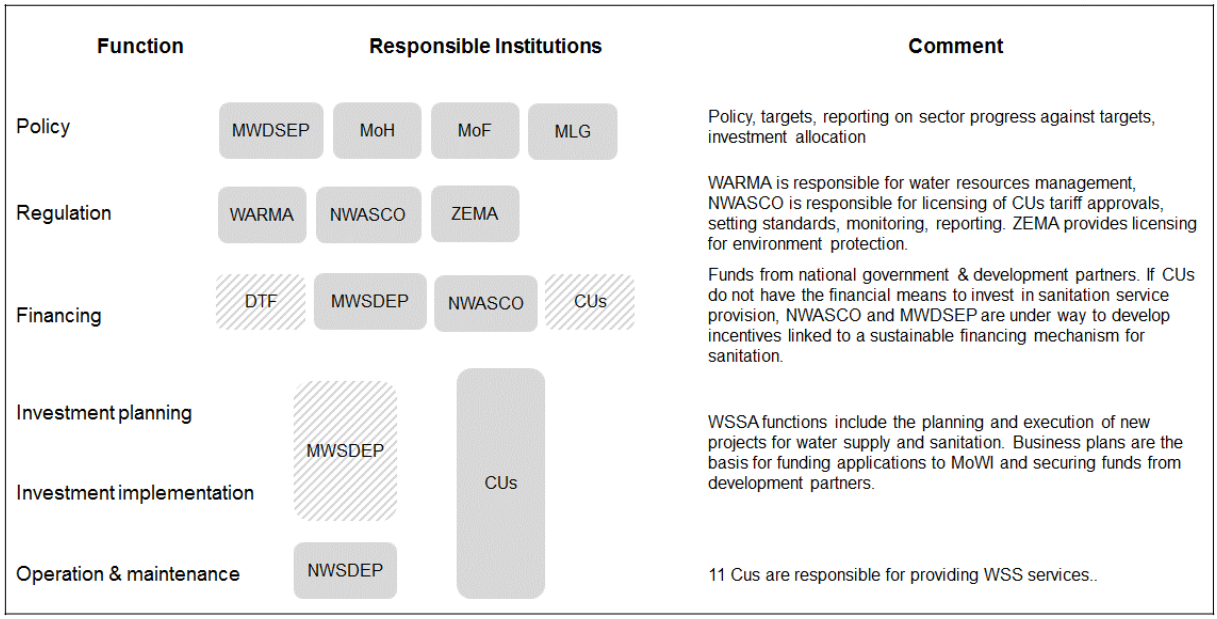

Figure 9: Institutional roles in the water & sanitation sector (source: adapted from Schuen, 2017)

On regulatory level, the National Water Supply and Sanitation of Zambia Council (NWASCO), established by the WSS Act No. 28 of 1997, is responsible for regulating the provision of Water Supply and Sanitation services to ensure and improve CUs delivery, efficiency and sustainability. The Water Resources Management Authority (WARMA) is the lead agency in the Management of Water Resources. The Zambia Environmental Management Authority (ZEMA) is responsible for the Regulation of Environmental Protection and as such has a vital role in the regulation of sanitation.

Lusaka City Council (LCC) has the overall responsibility for delivery of WSS and solid waste services in Lusaka. LCC has franchised SWM to 17 service providers, and delegated WSS services to Lusaka Water and Sewerage Company, who provides WSS in urban and peri-urban areas of Lusaka and five towns (Kafue, Chongwe, Luangwa, Chirundu, Chilanga).

It must be noted that there was a lack of clarity with regards to on-site sanitation, with NWASCO regulating sanitation service provision only through sewerage systems and not on-site sanitation, and ZEMA licensing vacuum trucks, and the construction and operation of wastewater treatment plants. For this reason, NWASCO mapped out current gaps in urban on-site sanitation regulation, and listed a new regulatory framework that covers institutional arrangements, licensing and permits, monitoring and performance reporting, inspection, amongst others.

3.1.3 Service provision

Off-site Sanitation: The Water Supply and Sanitation Act of 1997 offers the option for local authorities to delegate their responsibility for water and sanitation provision to commercial utilities within their urban boundaries. Since 2000, water supply and sanitation services in urban and peri-urban areas of Zambia has been commercialised through the formation of eleven commercial utilities (CUs). The Lusaka City Council (LCC) fulfils its mandate to provide water and sanitation through the Lusaka Water and Sewerage Company (LWSC), which provides water and sewerage services on behalf of the LCC.

LWSC has delegated their service provision mandate in eleven of the peri-urban areas in Lusaka to so-called Water Trusts. The Trusts are community-based organisations responsible for providing water in a defined area through a delegated management model with LWSC (WSUP, 2017). Kanyama Water Trust is the largest of these organisations serving 167,000 customers. In total about 32% of Lusaka's population receive water from these trusts.

Table 4: The new service provision and licensing system for water supply and sanitation (NWASCO, 2018)

Area	Water supply technology mainly used	Sanitation technology used	Service provision responsibility	Licencing arrangements for service provision
Urban	Conventional water supply systems with individual connections, standpipes and kiosk, etc.	Conventional sewer systems or FSM with on-site san. (septic tanks, pit latrines, etc.)	CU	Overall NWASCO licence for the whole district SLA/SLG cover all urban areas
Peri-urban	Piped water supply schemes with mainly standpipes, kiosks and few individual connections	FSM with on-site sanitation, mainly pit latrines, septic tanks, DEWATS	CU Delegated management to community or private sector, e.g. water trusts	Overall NWASCO licence for the whole district. SLA/SLG cover all peri-urban area. Through CU licence using a management contract that includes SLA/SLG for peri-urban areas as licensed to a CU

On-site Sanitation: Services available for on-site sanitation management, especially FSM, include mechanical and manual emptying services. Mechanical or vacuum trucks are mostly run by private businesses and they tend to concentrate their services on the central districts which are formally planned and more accessible, hence appear more lucrative for business owners. The vacuum tanker operators obtain permits to discharge waste at LWSC's Manchinchi wastewater treatment plant, however there are no proper checks in place to ensure that only those with valid licenses use the facility (WSUP, 2018c).

As part of the LSP, LWSC is planning to expand the delegated management model for FSM (Section 3.5) to several PUAs. LWSC and WSUP are currently in the process of assessing the viability of various Public-Private Partnerships (PPP) models and franchising options for FSM service delivery, and developing a business model. According to the current planning, at least four additional decentralized sludge treatment facilities and sanitation emptying teams will be established, operating in Matero, Chelston, Chawama and Kanyama. 12,000 subsidised household latrines will be built as part of the LSP on-site sanitation intervention. Service standards.

3.1.4 Service Standards

The Water Supply and Sanitation Act, No. 28 of 1997 (as amended by Act No. 10 of 2005) requires WSS providers to ensure efficient, affordable and sustainable services within their service areas providing the service customers with a certain “value for money”.

Service Level Agreements (SLAs) are signed every three years between the CUs and the regulator NWASCO. The SLAs define the provision targets to ensure that services reach at least the Minimum Service Level (MSL) as defined by NWASCO (Section 3.2.2 and Appendix 6). Service Level Guarantees (SLGs) determine the standard of service guaranteed to customers at any time in a given period. Thus, both the SLAs and SLGs are instruments to push CUs to reach the minimum acceptable levels of their customers. The SLGs are required to be displayed at all customer service points.

As the MSL were developed almost 20 years ago, there are large gaps in regulating on-site sanitation services. In order to respond to these gaps, NWASCO is in the process of developing standards for regulating OSS and FSM, alongside major national stakeholders (including LWSC, Lusaka City Council, MWDSEP, ZEMA and the Water Resources Management Authority).

NWASCO has been requested to introduce minimum standards (MSL) for the design of household sanitation facilities, pit emptying procedures, treatment and storage requirements for faecal sludge, and classifying faecal waste flows as ‘safe’ and ‘unsafe’ for different purposes (WSUP, 2018; NWASCO, 2018).

The Zambia Bureau of Standards (ZABS) is mandated to develop design and construction standards for sanitation facilities, and the Zambia Environmental Management Authority (ZEMA) is required to develop environmental protection standards e.g. for effluent and faecal sludge.

3.2 Planning

3.2.1 Service targets

The Lusaka Sanitation Master Plan (SMP) is the roadmap for developing the sanitation sector for a 25-year planning period (2010 - 2035). The SMP was published in 2011 and has been developed with inputs of LWSC, MLGH, LCC, NWASCO, Environmental Council of Zambia (ECZ), MCC, and Millennium Challenge Account (MCA).

The SMP was not developed as a static document but it is supposed to be reviewed annually as an integral component of the LWSC operating budget and revised as necessary to reflect new initiatives and/or major changes in priorities. A complete review/update is recommended at least every five years since changes in scope, details and phasing of certain projects may be required over time to respond to new developments, regulations or emerging technologies (GRZ, 2011). However, according to our information, neither the annual nor the five-year review have been performed so far (LWSC, 2018c).

The SMP aims at full sanitation service coverage by 2035. This shall be achieved by extending the sewer coverage to 57%. The remaining population shall be served by improved on-site systems of which 10% are envisaged to be improved pit latrines and 33% septic tanks (GRZ, 2011). The estimated total costs required for the implementation of the plan are USD 1.9 billon

of which approximately USD 640 million will be needed for on-site systems. Wherever the environmental and settlement conditions are suitable, the SMP recommends septic tanks with soak-aways as the preferred on-site technology. In areas with high groundwater or flooding, elevated Ecosan toilets are the preferred option (GRZ, 2011).

3.2.2 Investments

For the implementation of the Sanitation Master Plan, 130 investment projects have been identified, which will be implemented mainly under the umbrella of two programs:

- The Lusaka Sanitation Program - LSP (funded by World Bank, EIB, AfrDB, and KfW)
- The Lusaka Water Supply Sanitation and Drainage Project – LWSSD (funded by MCA)

The 130 investment projects are categorised into short-term projects (20% of the total program/USD 370 million), medium term projects (30%/USD 635 million) and long-term projects (50% USD 925 million). Short-term investments cover the bulk of the upgrades of the sewer system and treatments works, as well as the expansion and improvement of on-site sanitation facilities and their management (GRZ, 2011). The initial timeline targeted to implement the highest priority projects was 2015. This could not be achieved and the SMP is currently lagging behind the initial schedule.

So far, the expansion of the Kaunda square ponds (LWSSD) is completed and sewer rehabilitation and expansion works under the LSP have been started. Until the end of 2018 the following projects should be finalised are the following:

- Expansion of sewer lines to Mtendere (Priority 2 LWSSDP)
- Kafue Road Extension with pump station Manchinchi (Priority 1 - LSP)
- Expansion of sewer network to Emmasdale, Chaisa Ngwerere (Priority 1 - LSP)

Lusaka Sanitation Program (LSP): The LSP is a 5-year program led and implemented by LWSC and funded by international donors (mainly World Bank, African Development Bank, European Investment Bank and KFW). The cost estimates are approximately USD 350 million (Table 5). The Lusaka Sanitation Program covers off-site, on-site as well as capacity strengthening components (VisionRi, 2016; GIZ, 2018c):

Table 5: Summary of LSP components

1. Off-site sanitation
○ Rehabilitation and expansion of sewer network ○ Upgrade and extension of Ngewere ponds (upgrade into conventional treatment facility)/Rehabilitation and upgrade of Chunga WWTP
2. On-site sanitation
○ Construction of 12,000 improved emptyable hh latrines (fully-lined preventing any infiltration into the soil) in three peri-urban areas ○ Construction of four (4) sludge treatment facilities ○ Hygiene promotion ○ Capacity development for improve FSM services
3. Institutional strengthening for LWSC

Details of the planned investments/interventions are provided in Appendix 7.

The on-site sanitation investments are not limited to physical infrastructure development but also include the set-up and support of Faecal Sludge Management (FSM). In total 216,000 LWSC costumers in 44,000 households are expected to benefit from 12,000 on-site sanitation facilities and decentralized sludge treatment systems. The target areas for the construction of the subsidised household facilities are Kanyama, George and Chawama. According to the LSP Baseline Assessment (VisionRi, 2016) FSM infrastructure and service providers will be developed with the capacity to serve an estimated 25,000 on-site facilities, which in turn would benefit 450,000 people. Taking into consideration the current demand for pit emptying in the pilot areas for improved FSM services (Kanyama and Chasanga) these numbers appear to be slightly too optimistic in the medium term. The pilot teams of Chasanga and Kanyama Water Trust are each currently only emptying about 400 latrines a year and even though the capacity of the teams is limited, the actual bottleneck seems to be demand (KWT, 2018 & CWT, 2018). About 500,000 people will benefit from improved hygiene and sanitation awareness.

Finally, 100 public toilets are being constructed under the LSP program. These facilities are urgently needed in market/trading areas where, according to participants of the SFD Validation Workshop (GIZ, 2018a), people frequently opt to defecate in the open due non-availability of public toilet or the poor state of the available facilities (Section 2.1.1).

Lusaka Water Supply Sanitation and Drainage Project (LWSSD): The LWSSD is being implemented by LWSC in cooperation with the Ministry of Local Government and Housing (MLGH). The LWSSD project clearly targets off-site sanitation, non-revenue water reduction, and drainage. It is based on two components:

- Infrastructure Development
- Institutional Strengthening

The LWSSD also covers solid waste management through promotion of community-based enterprises. Improved drainage is targeted by constructing new primary outfall drains and upgrading existing drains, constructing culverts and foot bridges, which will improve water flow and help pedestrians traverse big drains and streams (MCA, 2016)

3.3 Equity

3.3.1 Current services for the urban poor

Most of the population in peri-urban areas relies on simple pit latrines, only few have septic tanks, but many of which are not constructed in compliance to building standards (Section 2.1.1). Toilets and septic tanks often allow infiltration into the soil including in areas with high groundwater vulnerability (Section 2.2.2). In addition, overflowing toilets during the rainy season affect shallow wells and boreholes; recurrent outbreaks of diseases such as cholera are thus common particularly in peri-urban areas.

An estimated 32% of Lusaka's population receive their water through the local Water Trusts, on average paying lower prices (72,00ZMW (7,3$US) per month) than costumers who receive metered water from LWSC for 89,40ZMW (7,30$US) per month (LWSC 2016, Baseline Study). The FSM approach of LWSC and Kanyama and Chasanga Water Trusts is a step forward towards formalised and sustainable on-site sanitation services, although the coverage and demand for the services is still very limited (WSUP 2018c).

LWSC has established a specific Peri-Urban Department that deals with the management of water supply and sanitation in PUAs. This department has predominantly focused on the provision of water supply in PUAs, however has recently increased its commitment on sanitation services, as demonstrated by the Kanyama and Chazanga FSM project. A study (Kennedy-Walter et al. 2015) with key informants from LWSC finds that the placement of the Peri-Urban Department under the Department of Commercial Services undermines the activities of the department to provide services for the urban poor. The upcoming LWSC Department for FSM will also be based under Commercial Services.

3.3.2 Plans and measures to reduce inequity

As widely known, the Water Sector is facing issues of corruption, unsustainable practices and non-ethical working environments. To respond to these sector shortfalls, NWASCO has introduced a Corporate Governance guideline, an Anti-Corruption and Integrity guideline, and a Risk Management guideline, and has launched capacity building initiatives in Water Integrity Management (Sector Report, 2017).

A Devolution Trust Fund (DTF) was established in 2001 as a basket fund for financing the improvement and extension of WSS services especially to low-income urban areas (Sector Report, 2017). A review of the DTF 10 years after implementing suggests that “much progress has been made in areas related to management and operation performance, while little success has been recorded in core areas such as expanding the network, service coverage, hours of service, and reducing the affordability burden, especially among lower-income households” (Chitonge 2011). The DTF did not have sufficient funds for any major investments over the last four years, however to this date continues to be operational.

Under the LSP program it is planned to up-scale the FSM service approach currently piloted in Chasanga and Kanyama, and to construct 12,000 subsidised improved plot-level sanitation facilities in Kanyama, George and Chawama. (LWSC, 2018d)

3.4 Outputs

3.4.1 Capacity to meet service needs, demands and targets

Despite a strong high-level commitment for achieving the national access targets as well as Sustainable Development Goal 6, the current funding gap for the implementation of the sanitation master plan is around USD 1.5 billion.

The 2018 Regulatory Framework for Urban On-site Sanitation and Faecal Sludge Management (NAWASCO, 2018), and the On-site Sanitation Strategy which was approved by the LWSC board in 2017, are significant steps towards improved on-site sanitation. Within the LSP, the physical implementation of the infrastructure is behind schedule.

According to the LWSC service level guarantee (2015-2018) the response time for sewer leakages when reported is required to be within 24 to 36 hours from the time of reporting. The LSP baseline assessment (VisionRi, 2016) indicated that the utility’s average response time to leakages in the sewer system was 27 days and the majority of costumers experienced incidents on average every two months. LWSC has established three service hotlines as well as a written contact system to improve repair services. Moreover, the utility is running an active social media platform (facebook) with a quick response time.

3.4.2 Monitoring and reporting access to services

Reporting to regulator: LWSC reports access to off-site and on-site sanitation to NAWASCO. NAWASCO publishes annual performance reports summarising the coverage for all CUs as well as important performance criteria. Whilst the figures for off-site sanitation are realistic and based on the CU's database, both NAWASCO and LWSC confirm that the figures for on-site sanitation are not credible (LWSC, 2018d; GIZ, 2018a). As part of the new regulatory framework for on-site sanitation, ideas for a national database for urban water and sanitation services have been developed but not yet followed-up upon (NAWASCO, 2018).

Toilet mapping: WSUP and GIZ have supported a toilet mapping exercise in the four peri-urban areas (Kanyama, George, Chawama and Chasanga) in 2018. The mapping is thought to inform improved FSM services in the areas and be part of the M&E concept for these services. LWSC is interested in extending the exercise to the other PUAs and thus obtain a better understanding of the potential customer base for FSM services (GIZ, 2018a). So far, no funding has been secured yet to implement an up-scaled mapping.

3.5 Expansion

3.5.1 Stimulating demand for services

There is a general awareness that a FSM market system can only be feasible if the demand and willingness to pay for improved sanitation service provision is high enough. For that purpose, the Participatory Hygiene and Sanitation Transformation (PHAST) project was conducted in Kanyama and Chazang in partnership between the Ministry of Health (MOH), LWSC, and the local Water Trusts. Through door-to-door engagement of 43,000 households (195,000 people), the project focused on hygiene promotion and commercial marketing for the planned FSM services. A willingness to pay survey was undertaken revealing that target customers would be willing to pay approximately US$40 – 60 for sludge emptying services (Mikhael, 2012; WSUP, 2015). It is intended to conduct PHAST projects again when scaling up the emptying services to further PUAs.

LWSC is currently working on increasing its capacity both in off-site and on-site services. To build the technical capacities of the utility in its "classical" role of delivering water and sewerage connections, LWSC receives technical assistance by the World Bank, GIZ and other stakeholders amongst others on financial management, asset management, and O&M of infrastructure to ensure sustainability of investments under the LSP.

For on-site sanitation services, the strategy is to position LWSC as the facilitator of a market for service delivery and managing private FSM service providers (WSUP 2018c). Therefore, LWSC is building a new FSM department under the section of commercial services (as seen in Figure 10). The projects in collaboration with Water Trusts in Chazanga and Kanyama are taken as an example to be replicated.

These pilot project have clearly shown the need for sufficient capacity building for local FSM service providers. This includes topics such as financial management, O&M of treatment facilities, emptying/transport/storage procedures, health and safety procedures, vacuum truck operations, sanitary and environmental regulations, and others. While WSUP has carried out several trainings for the operators in Chazanga and Kanyama, GIZ is developing various

related manuals and is planning the implementation of trainings for present and future FSM operators.

In order to regulate FSM services in an upcoming market, the adaptation of Minimum Service Levels (MSL) will be crucial, as well as the provision of institutional support by the leading regulating authorities, most notably NWASCO.

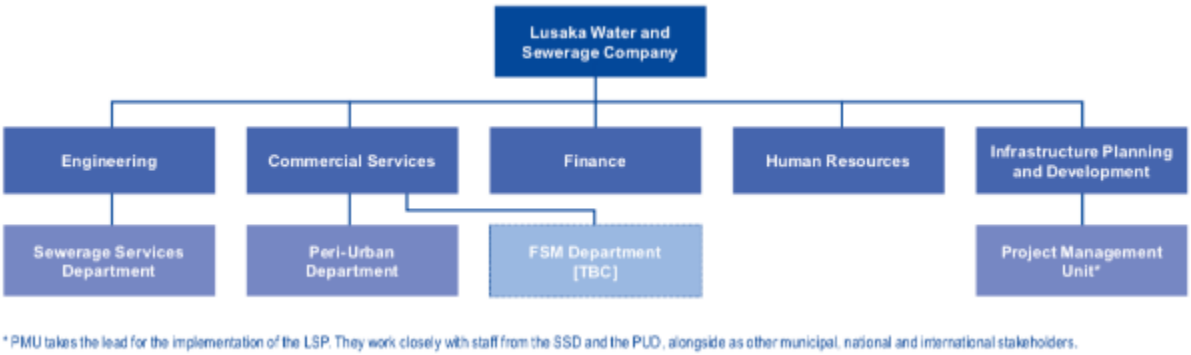

Figure 10: LSWC Organogram of intended company structure (WSUP, 2018)

Dividing the city in service zones

The LWSC sanitation strategy proposes to divide the service area of Lusaka into geographic 'FSM zones' which indicate where FSM will be provided by manual pit emptiers and vacuum tanker operators, who would work exclusively in assigned areas in order to prevent uncontrolled emptying and disposal. The zones shall comprise a mix of customers and allow for economies of scale and the introduction of cross-subsidies by service providers (WSUP 2018c). A similar approach has been successfully adopted for solid waste management by Lusaka City Council.

4 Stakeholder Engagement

Two of the authors of this report were able to collect data and engage with stakeholders in Lusaka. At the beginning of the SFD preparation process, Ms. Makuwa and Ms. Kappauf both attended the SFD training workshop in Lusaka which was held under the Reinforcing Capacities of African Sanitation Operators on non-sewer and FSM Systems through Peer-Learning Partnerships (RASOP-Africa) project funded by the Bill and Melinda Gates Foundation (BMGF) and implemented through the African Water Associated (AfWA). The workshop was used to establish contact with the main stakeholder and inform them about the ongoing SFD preparation.

Subsequent to the workshop, key informant interviews were conducted with different stakeholders in Lusaka, these included stakeholders from Lusaka City Council, different Government institutions, LWSC, the Zambian Emptier Association and experts in the Zambian Sanitation Sector. Introduction letters were distributed to Key stakeholder's, the distribution was facilitated by GIZ and this made it easier for the consultant to approach and get information from the stakeholders. Once the letters were received by the institutions, the key staff in the institution that would be better placed to provide the information required were tasked to provide information. When the organizations were visited, a list of persons to see was given to the consultant. Face to face interviews were carried out if the respondent was present. In some instances, where the person assigned was not available for face-to-face interviews they were contacted by phone and email communication. Contacts with other stakeholders was informal by email, phone or direct visits.

The authors conducted several field visits for discussions with stakeholders but also for observations that were used to validate assumptions or information from different sources. As an example of the value of such crosschecks, we would like to mention the decentralized sludge treatment plants. Various stakeholders had given us the impression that the two facilities in Kanyama and Chasanga had resumed operations but another stakeholder challenged this. During our field visit we found both facilities non-operational and could also make an assessment of their current status. In addition, we were able to validate the reported numbers of the Water Trust's capacity for manual emptying of toilets. The reported average numbers provided by the interviewees (4-5 toilets a day) seemed to be significantly overestimated when compared to the records at the treatment (1-2 toilets a day).

Discussions with the Zambian Emptiers' Association revealed that most people in the city of Lusaka do not understand the potential threat that their choice of sanitation facility has to underground water. The city has grown at a very fast pace and the Lusaka City Council cannot manage to inspect the construction works that are taking place at a large scale both in the conventional and non-conventional areas. The quality of works is dependent on the masons who are mostly not trained. The Zambian Emptiers' Association also mentioned that they are called to provide a service mostly when there is a crisis e.g. septic tank is overflowing. Other big organizations in the city have scheduled emptying periods. More sensitization and awareness is necessary for better uptake of emptying services.

From the beginning, a close cooperation was established with the GIZ Climate-friendly Sanitation in peri-urban areas in Lusaka programme (GIZ-CFS). GIZ CFS currently prepares SFD reports for four (4) peri-urban areas in Lusaka, namely Kanyama, Chasanga, George and Chawarma. GIZ CFS has recently completed a toilet mapping exercise for three of these areas

(Kanyama was already mapped by WSUP earlier this year). GIZ CFS shared the results of the mapping exercise and the data was used to refine the SFD. It was also agreed that the programme would facilitate a joint SFD validation workshop. The SFD validation workshop was held in Lusaka on 17th September 2018. Participants included representatives from LCC, ZEMA; NAWASCO, MWDSEP, LWSC, WSUP, BORDA and the Water Trusts in Kanyama and Chasanga. Unfortunately, the main stakeholders involved in LSP were not available to attend the workshop since they were in a mid-term review workshop. The workshop was very valuable in terms of sharing the preliminary results and underlying assumptions that were made to prepare the SFD. Based on the comments of the participants the SFDs were further refined and adapted.

What stood out is that none of the stakeholders had all the basic sanitation data for the city, in terms of percentage of population using a certain type of toilet or numbers of the facilities. LWSC and NWASCO were able to provide some percentages of population with access to on-site and off-site sanitation. The numbers for off-site sanitation were more precise but the numbers for on-site sanitation were not representative of the entire city. Most of the stakeholders met bemoaned the lack of information on sanitation facilities in the city and recommended to implement a sanitation facility mapping or a sanitation census but none of the stakeholders seemed to consider it as their responsibility to collect and manage sanitation data.

5 Acknowledgements

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7 Appendices

7.1 Appendix 1: Stakeholder Identification

Table 6: Stakeholder identification

N°	Stakeholder group	In Lusaka Context
	City council	Lusaka City Council
1	Municipal authority	Lusaka City Council
	Utility	Lusaka Water and Sewerage Company / Water Trusts
2	Ministry in charge of urban sanitation and sewerage	Ministry of Water, Development, Sanitation and Environmental Protection (MWDSEP) / Zambia Environmental Management Authority (ZEMA)
3	Ministry in charge of urban solid waste	Ministry of Local Government and Housing (MLGH)
4	Ministry for finance and economic development	Ministry of Finance
5	Regulation of urban water and sanitation	National Water Supply and Sanitation of Zambia Council (NWASCO),
6	Service provider for construction on on-site sanitation technologies	Private Businesses, BORDA, LSWC (within LSP implementation)
7	Service provider for emptying and transport of faecal sludge	USAFI (CBO), private exhauster trucks
8	Service provider for operation and maintenance of treatment infrastructure	LWSC / Water Trusts
9	Market participants practising end-use of FS end products	WSUP / Water Trusts/ Farmers
10	Market participants practising collection of solid waste	LCC

7.2 Appendix 2: Stakeholder Engagement Tracking

N°	Stakeholder	Date(s) of engagement	Purpose of engagement
1	GIZ CSF	Various Augustr 2018 – September 2018	Cooperation between different SFDs being prepared for Lusaka
2	LWSC Peri-urban section	12.09.2018	KII - Data on on-site sanitation / information on on-going and planned projects in peri-urban areas in Lusaka
3	LWSC Effluent & Pollution Control Lab.	12.09.2018	Discussions on treatment capacity of LWSC treatment plants
4	Water Trust Kanyama	13.09.2018	Visit of treatment facility / data on emptying capacity
5	GIZ CSF – Advisor to LSP	13.09.2018	KII targets and updates of LSP
5	Water Trust Chazanga	13.09.2018	Visit of treatment facility / data on emptying capacity
6	Zambian Emptier Association	08.08.2018 /14.09.2018	KII
7	LWSC MD	01.08.2018/ 14.09.2018	Introduction / short summary of findings so far
8	LCC – Public Health Department	14.09.2018	Short discussion
9	LWSC – Infrastructure Development	14.09.2018	Discussion on on-site sanitation under LSP
10	LWSC / LSP - ESS	14.09.2018	Confirmation of effluent assumptions
11	LWSC – Sanitation	07.08.2018/ 14.09.2018	Discussion on on-site sanitation under LSP
12	LWSC – Sewerage Services	07.08.2018	KII
13	CSO	07.08.2018	Population Data on Ward level
14	Various	17.09.2018	SFD Validation Workshop
15	BORDA	17.10.2018	KII - Short discussion on decentralized treatment facilities

7.3 Appendix 3: Calculation of OD rate

Population in peri-urban areas of Lusaka (70%): 0,7 x 2,526,100 = ***1,768,270***

Total population in areas of mapping exercise: ***575,600*** *(GIZ, 2018b / WSUP & GIZ, 2018)*

Population in peri-urban areas not included in mapping exercise: 1,768,270 - 575,600 = ***1,192,670***

Average OD rate in areas of mapping exercise: ***11%***

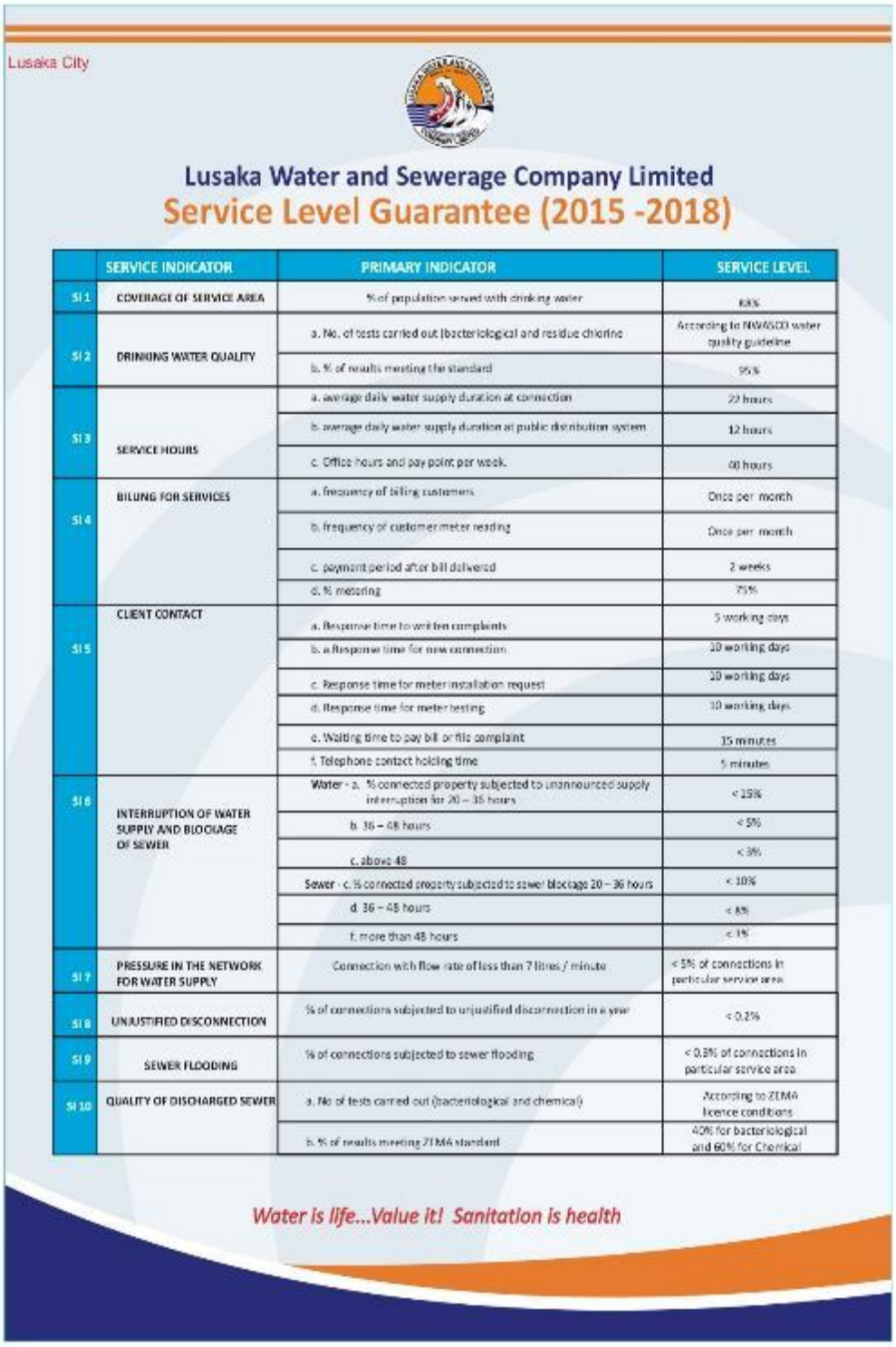
Number of people practicing OD in areas of mapping exercise: 0.11 x 575,600 = ***61,580***

Average OD rate in peri-urban areas not included in mapping: ***3.5%***

Number of people practicing OD: 0.035 x 1,192,670 = ***41,743***

OD rate for Lusaka: *(61,580 + 41,743)/ 2,526,100 =* ***4%***

7.4 Appendix 4: LWSC Service Level Guarantee 2015 - 2018



Lusaka City

Lusaka Water and Sewerage Company Limited

Service Level Guarantee (2015 -2018)

	SERVICE INDICATOR	PRIMARY INDICATOR	SERVICE LEVEL
SI 1	COVERAGE OF SERVICE AREA	% of population served with drinking water	88%
SI 2	DRINKING WATER QUALITY	a. No. of tests carried out (bacteriological and residue chlorine	According to NWASCO water quality guideline
		b. % of results meeting the standard	95%
SI 3	SERVICE HOURS	a. average daily water supply duration at connection	22 hours
		b. average daily water supply duration at public distribution system	12 hours
		c. Office hours and pay point per week.	00 hours
SI 4	BILLING FOR SERVICES	a. frequency of billing customers	Once per month
		b. frequency of customer meter reading	Once per month
		c. payment period after bill delivered	2 weeks
		d. % metering	75%
SI 5	CLIENT CONTACT	a. Response time to written complaints	5 working days
		b. a Response time for new connection	10 working days
		c. Response time for meter installation request	10 working days
		d. Response time for meter testing	10 working days
		e. Waiting time to pay bill or file complaint	15 minutes
		f. Telephone contact holding time	5 minutes
SI 6	INTERRUPTION OF WATER SUPPLY AND BLOCKAGE OF SEWER	Water - a. % connected property subjected to unannounced supply interruption for 20 – 35 hours	< 15%
		b. 36 – 48 hours	< 5%
		c. above 48	< 3%
		Sewer - c. % connected property subjected to sewer blockage 20 – 36 hours	< 10%
		d. 36 – 48 hours	< 8%
		f. more than 48 hours	< 1%
SI 7	PRESSURE IN THE NETWORK FOR WATER SUPPLY	Connection with flow rate of less than 7 litres / minute	< 5% of connections in particular service area
SI 8	UNJUSTIFIED DISCONNECTION	% of connections subjected to unjustified disconnection in a year	< 0.2%
SI 9	SEWER FLOODING	% of connections subjected to sewer flooding	< 0.3% of connections in particular service area
SI 10	QUALITY OF DISCHARGED SEWER	a. No of tests carried out (bacteriological and chemical)	According to ZEMA licence conditions
		b. % of results meeting ZEMA standard	40% for bacteriological and 60% for Chemical

Water is life...Value it! Sanitation is health

Figure 11: LWSC Service Level Guarantee 2015 - 2018

7.5 Appendix 5: Planned LSP Investments

Table 7: Lusaka Sanitation Program main objectives (LSP online, 2018; adaption through GIZ interview)

Objective	Indicator	Development Status (July 2018)	Description
More Sewer Lines	520 km sewer	7%	Over 520km of new sewer lines will be constructed in 26 locations. The first areas for 2018 will be in Kafue road, Emmasdale, Matero, Kaunda Square, Industries, and Kanyama.
Treatment facilities	6 Treatment Facilities - 4 FSTP - 2 WWTP	0%	There are four faecal sludge treatment plants **(FSTP)** planned to serve the whole city of Lusaka. They are planned to be running by 2020 hence the construction is intended to start early 2019. The new plants will likely be operated partly by LWSC and party by private operators. Their treatment capacity is designed for the projected population of 2035 (based on CSO 2010 population) ○ Matero: 18.8m^3/d Service area: George, Chunga, Matero, Mandevo, etc. ○ Chawama: 27.8m^3/d Service area: Missis, Chawama, Chibolya, Kamboka, ○ Kanyama:17.6m^3/d Service area: Kanyama, Garden, John Laing, Chibolya, etc. ○ Chelston: 10.1m^3/d Also, Matero and Chelston will have a second stream for septage with a capacity of 94.6m^3/d and Chelston 68.2m^3/d respectively. Technology: settlers (thickening tanks)
			Manchinchi Waste Water Treatment Plants **(WWTP**) will be decommissioned by 2022. Vacuum trucks will still be able to dump septage which will be transported to a new conventional WWTP in Ngwerere which has a higher capacity than Manchinchi. Chunga WWTP rehabilitated and expanded by 2022. This is funded by the European Investment Bank.
Emptying Services	Emptying teams	0%	Seven additional pit emptying team will become available across Lusaka to provide safe and affordable services for emptying septic tanks and pit latrines. The costs for equipment and protective gear will be covered. As well as training and workshops for improving business (marketing, safety, accounting, etc.).
Removed sludge/ septage	230 metric tonnes	0%	By providing available services and capacity, more households will be able to regularly empty their septic tanks and pit latrines. The program aims for 230 metric tons collected in 2019, to be doubled the following year.
Improved Toilets	12,000 toilets (Kanyama, Chawama, George)	0%	7,000 households in Kanyama, 3,000 Chawama and 2,000 in George will be able to afford and build durable toilets for their homes which are designed for comfort and to also protect the groundwater in those areas. *Project Details:* The division of the planned facilities is in these PUA is based on the size (m$^{2)}$ of the service area. The project budget will cover substructure costs (fully lined tank/fully lined pit latrine) and the household will contribute the other parts of the structure; walls, door, roof, squatting pan. Costs for a simple toilet are min 2,400K (215USD) a more luxurious design of two compartments (1 toilet, 1 bathroom) cost 4,300K (385USD).
Public Toilets	100 Public Toilets	(99%)	Sanitation facilities are needed in public spaces. 100 public toilets will be built across East and West Lusaka (George, Mundi, Kananga market, etc.). These will be set up in schools and public markets, e.g. at Kalingi market, Chunga primary school, Chunga secondary school.

7.6 Appendix 6: Minimum Service Level (2000) for WSS defined by NAWASCO

	SERVICE INDICATOR	MEASUREMENT
SI 1	**Coverage of the Service Area**	% of population served with drinking water.
SI 2	**Drinking Water Quality**	No. of tests carried out and test results within the national standards for drinking water.
SI 3	**Service Hours**	Water supply hours per day and hours to attend to customers per week.
SI 4	**Billing for Services**	Billing, meter reading sequences, conditions for payment of bills by the customer.
SI 5	**Client Contacts**	Complaints from clients, the response time on any other contacts with customers.
SI 6	**Interruption of Water Supply and Bockage of Sewer**	Unplanned interruption of water supply or sewer evacuation due to maintenance and repair work
SI 7	**Pressure in the Network and Minimum Flow Rate at the Customer Point for Water Supply**	Minimum flow rate of 7 litres/min required at customer connection
SI 8	**Unjustified Disconnections**	No. of unjustified disconnections and the compensation to be paid by the provider to the customer
SI 9	**Sewer Flooding**	The number of times sewer floods a connection per year < 5
SI 10	**Quality of Discharged Sewer**	In terms of BOD_5, COD, Nitrates, Phosphorous, etc
SI 11	**Support to Public Institutions to Curb Wastage and Settle Bills Promptly**	Activities put in place

7.7 Appendix 7: Overview Service Regulatory Acts

Table 8: Overview on service regulatory Acts in Zambia (2018)

Regulating Act	Standard indicated for WSS
Public Health Act Chapter 295, Vol 17	Workplaces (including factories) must provide adequate water & sanitation facilities fulfilling the following criteria: ○ provision of drinking water and sanitary facilities (Toilet, hand washing facilities, soap, and hand drying facilities/materials, urinals and sanitary bins) ○ facilities have to be appropriate, adequate, labelled, clean and well-lit. ○ separation of female and male facilities ○ facilities must be located at appropriate distance from the user, i.e. less than 30 meters and must offer privacy ○ special facilities for the physically challenged people must be provided In terms of number of the facilities in relation to workers the following is recommended: ○ 1-25 workers require 1 latrine (water closet) for the first 100 workers ○ >100 workers 1 added latrine for every 40 workers ○ wash hand basins and urinal must be provided for each water closet provided
The Factories Act of 1966	○ well maintained sanitary facilities must be provided at every work place ○ located at suitable points conveniently accessible to all employees ○ adequate supply of wholesome drinking water
Market and Bus Station Act of 2007	○ well maintained sanitary and ablution facilities must be provided at each market place

7.8 Appendix 8: Main legal and policy documents for the sanitation sector

Policy/Act	Key points
Vision 2030	Reflects the collective understanding, aspirations and determination of the Zambian people to be a prosperous middle-income nation; sets out the goals and targets to be achieved in the various spheres of our socio-economic life over the next generation
National Water Policy 2010	Provides a comprehensive framework for sustainable development, management and utilisation of water resources
The National Development Plan (7th to be released)	For the period 2017 to 2021, aims at attaining the long-term objectives as outlined in the Vision 2030 of becoming a "prosperous middle-income country by 2030"; builds on the achievements and lessons learnt during the implementation of the previous NDPs
The Urban and Regional Planning Act of 2015	Repealed the Town and Country Planning Act of 1962 and the Housing Act of 1975
The Public Health Act, Ch. 295, Vol. 17 of the Laws of Zambia	Mandates local authorities to enforce public health protection
SI No.79 of the Public Health Act	Empowers the Authorized Officers to take immediate closure action on premises with poor sanitation posing eminent danger for outbreak of epidemic diseases
Local Government Ch. 281, Vol. 16 of the Laws of Zambia	Mandates local authorities to provide water supply and sanitation services in the respective districts
SI No.12 of the Local Government Act	Provides legally enforceable violations ranging from indiscriminate disposal of solid waste, urinating and open defecation etc; addresses enforcement mechanisms on nuisance creation and abatement.
WSS Act No. 28 of 1997	Facilitated formation of NWASCO and CUs by describing mandate for NWASCO WSS service regulation, including on-site sanitation, and by facilitating formation of CUs by local authorities (LAs).
SI No. 63 of 2000 (Licensing of Utilities and Service Providers) Regulations under the WSS Act No. 28 of 1997	Facilitates the licensing of CUs for provision of WSS in the specific areas of CU operations
The Environmental Management (EM) Act No. 12 of 2011	For protection of the environment
The SI No. 112 of 2013, of EM Act No. 12 of 2011, the EM (Licensing) Regulations of 2013	Sets limits and standards for environmental protection
SI No. 100 of 2011	Provides for LAs to undertake activities related to solid waste management (SWM)
Occupational Health and Safety Act of 2010	Emphasizes protection of people exposed to various forms or types of hazards including sanitary cleaners, especially those involved in emptying toilets and septic tanks, including need for PPEs, medical tests and examination during conveyance treatment and product end use

Policy/Act	Key points
National WSS Capacity Development Strategy (2015 to 2020)	Operationalises capacity development components of key sub-sector national programmes (NUWSSP and NRWSSP). The strategy identifies the need for NWASCO to fully utilise the potential of its database and fulfil its mandate as regulator of the WSS sub-sector to cover on-site sanitation and RWSS, which are within its mandate and in need of strengthening
National Urban and Peri-Urban Sanitation Strategy (2015 to 2020)	Stipulates NWASCO regulating by defining sanitation service levels and standards; guiding to support enhanced service delivery, including tariffs for on-site sanitation; developing regulatory instruments, benchmarks and monitoring for sanitation; reporting on on-site and off-site sanitation service coverage (pg. 10) Describes sanitation planning in terms of LAs carrying out the mandate for sanitation and assuring the lead in the sanitation planning process in partnership with CUs, based on overall urban planning documents Reinforces management arrangements that CUs have primary responsibility for sanitation service provision and (public) asset management. CUs and LAs should consider participation of community-based organisations (CBOs) and the private sector to bring in additional capacity and financing (pg. 22)
Open Defecation Free (ODF) Zambia Strategy (2016 to 2020)	Stipulates the link to National Urban and Peri-Urban Sanitation Strategy (NUSS) Strategy in the context of preparation of sanitation plans and prioritisation of investments, led by Las supported by CUs, civil society organisations and the private sector. It highlights the need for sanitation market development, improved sanitation facilities and hygiene behaviours. Describes implementation of sanitation strategy at the local level through innovative service models – aimed at CUs taking on wider responsibility for sanitation service provision and promoting delegated management models to improve operations of on-site sanitation facilities and decentralised wastewater infrastructure (pg. 12)
NWASCO Strategic Plan (2016 to 2020)	NWASCO has outlined clear objectives and activities to enhance the regulatory framework: Develop new regulatory tools, improve regulation of sanitation service provision, enhance stakeholder engagement for enforcement and ensure efficiency and financial viability of CUs that are clearly linked to on-site sanitation and rural WSS.
Urban On-site Sanitation and Faecal Sludge Management: Framework for Provision and Regulation in Zambia	Maps out the process in which regulation of Urban On-site Sanitation Service provision can be improved to support the proper functioning of an integrated management system covering the whole sanitation chain. Aligned to National Urban and Peri-Urban Sanitation Strategy, the regulation of service provision will ensure that faecal matter generated in on-site facilities is effectively contained, collected, transported, treated and disposed of in a safe manner to protect public health and the environment.

(Source: adapted from NWASCO, 2018)