SFD Report

Choma
Zambia

Final Report

This SFD Report - Initial level - was prepared by GOPA Infra GmbH and BORDA Zambia on behalf of the GIZ Reform of the Water Sector Programme Phase II

Date of production: 20/03/2022

Last update: 12/04/2023

:

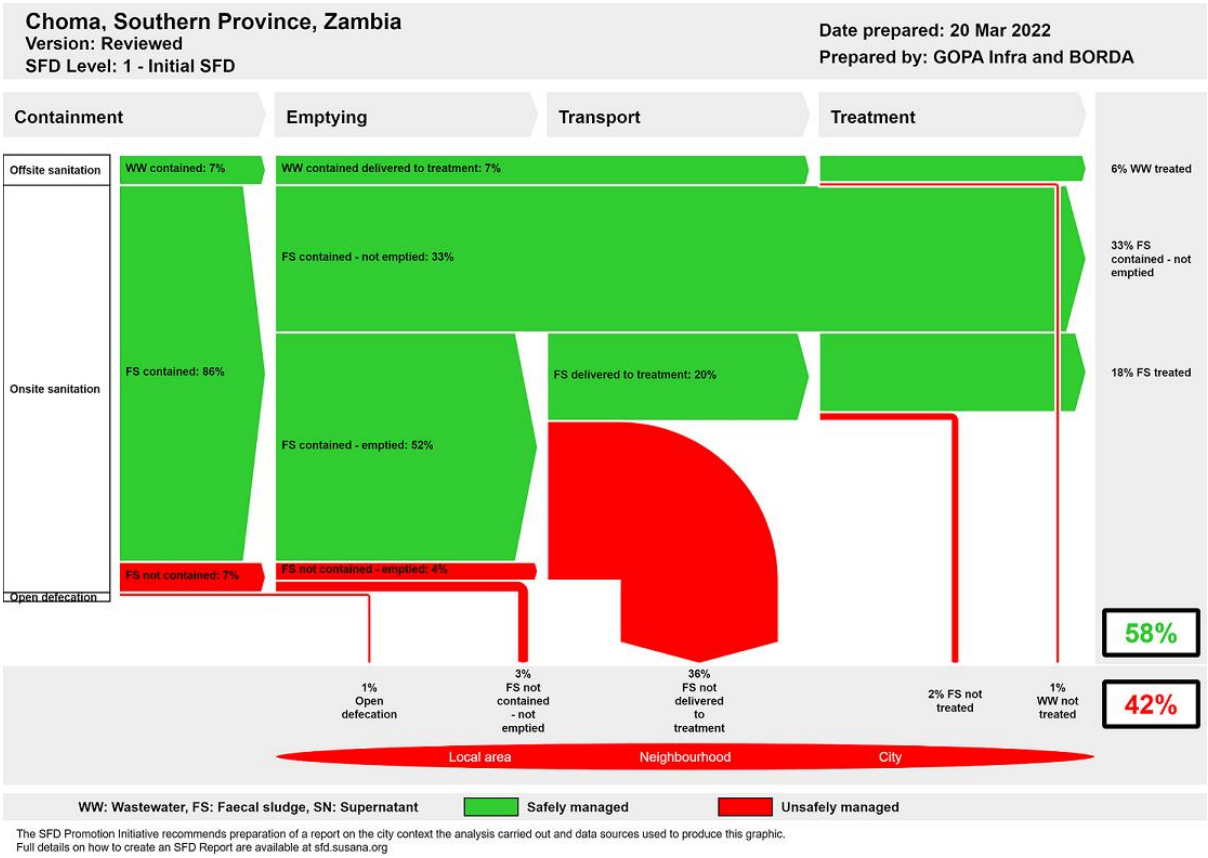
SFD Report Choma, Zambia, 2023

Produced by: Bright Haampeyo, Ortega Choombe, Warren Habeenzu, Eustakia Milimo Hamuchenje, James Madalitso Tembo, Aubrey Simwambi, Ngenda Situmbeko, Johanna Braack

This Executive Summary and SFD Report are available from:

www.sfd.susana.org

1. The SFD Graphic



The SFD Promotion Initiative recommends preparation of a report on the city context the analysis carried out and data sources used to produce this graphic.
Full details on how to create an SFD Report are available at sfd.susana.org

2. Diagram information

SFD Level:

This is an Initial level SFD report for Choma Town.

Produced by:

This SFD report was produced by GOPA Infra and BORDA Zambia on behalf of the GIZ Reform of the Water Sector Programme Phase II.

Collaborating partners:

- GIZ Zambia Water and Energy Cluster.
- Southern Water and Sanitation Company (SWSC) Ltd.
- Choma Municipal Council (CMC).
- Ministry of Health (MoH).

Status:

Final Initial level SFD Report.

Date of Production: 20/03/2022

3. General city information

Choma Town is the provincial administrative capital of the Southern Province of Zambia on Latitude -16.812822 and Longitude 26.987640. The town lies at an elevation of 1,314m above sea level in Choma District, which has a total land area of approximately 7,296 square kilometres and a population of about 247,860 according to the 2010 national census of housing and population (Central Statistical Office, 2013).

Urban Choma (Choma town) hosts approximately 110,218 people and is approximately 285km south of the country's capital city Lusaka, and approximately 188km from Livingstone city - the tourism capital and former administrative capital of the Southern province.

For the purposes of production of this Shit Flow Diagram (SFD), only urban Choma and its population was considered.

4. Service outcomes

The population of Choma Town predominantly relies on On-site Sanitation (OSS). Approximately, 93.1% of the town's population is on OSS systems and presently off site sanitation is limited to only 6.9% of the population. The proportions of OSS systems in the town are as follows: 37.8% septic tanks connected to soak pits, 47.7% Ventilated Improved Pit latrines (VIPs) and 7.0% unlined or traditional pit latrines. Less than 1 % of the population are estimated to be practising Open Defecation (OD).

Challenges in management of onsite sanitation facilities in the town are mainly attributed to inadequacies in the provision of formal sludge emptying services. Therefore, the larger proportion of the emptied excreta ends up in the environment untreated because service providers are informal and where they take the sludge after emptying is undocumented. Other factors contributing to sanitation challenges in the town include the lack of investment in capital equipment for sanitation services such as emptying, transportation and treatment; lack of private sector participation and the lack of coordination between the Local Authority (LA) and the Commercial Utility (CU) in the planning of residential areas in the town. Mostly, the LA`s planning department does not bring on board the CU when planning new developmental residential areas hence there exists a gap between the development of housing and the provision of sanitation services in new development areas (Makasa, 2007, p. 19).

Given the conditions in some of the residential areas, (Mwapona and Zambia Compound for example) where the groundwater table is high and the predominant sanitation facilities in these areas are unlined pit latrines, it is very likely that there is groundwater contamination in these areas. The spatial limitation of the sewer network coverage in Choma, the nature of constructed onsite sanitation facilities in most households and the geophysical nature of Choma signal huge challenges in respect to addressing sanitation challenges of the town. Therefore, there is urgent need to either extend offsite sanitation coverage, or construct lined containment facilities to prevent groundwater contamination.

Offsite sanitation systems in Choma convey sewer to three sets of stabilisation ponds located within the town as follows; Shampande stabilisation ponds located 1 km south off the T1 road along the D356, Macha east and Macha West stabilisation Ponds located about 1.7 km north off the T1 road along Macha Road.

Overall, the SFD graphic shows that 58% of the excreta generated is safely managed while 42% is unsafely managed.

5. Service delivery context

To guide the vision to achieve universal access to sanitation by 2030, the Government Republic of Zambia (GRZ) has put up a very clear policy, regulatory and legal framework for water supply and sanitation services. Important sanitation and environmental protection policies that have been put in place and are used include: the Zambia Vision 2030; the 7th National Development Plan 2017 – 2021; National Water Supply and Sanitation Policy of 2020, and UN Sustainable Development Goals 2015 – 2030. All these policy documents set clear objectives and targets on sanitation service improvement for both urban, peri-urban and rural areas which include Choma Town. In addition, the Framework for Provision and Regulation of Urban Onsite Sanitation and Faecal Sludge Management and the Framework for Provision and regulation of Rural Water Supply and Sanitation in Zambia sets a robust institutional arrangement that clearly specifies the roles and responsibilities of all key players in the Sanitation Sector. The following are the major sector players:

- Ministry of Water Development and Sanitation (MWDS).
- National Water Supply and Sanitation Council (NWASCO).
- Zambia Environmental Management Agency (ZEMA);
- Choma Municipal Council (CMC).
- Water Resources Management Authority (WARMA).
- SWSC.
- Private Service Providers, and
- Cooperating partners such as International Funding Institutions (IFIs) and Non-Governmental Organizations (NGOs).

The roles and responsibilities of all the key sector players are presented in Table 1.

In addition, several laws and regulatory tools exist which provide a clear legal and regulatory framework for sanitation at both National and local level. These include the following:

- The Water Supply and Sanitation Act No. 28 of 1997: Mandates NWASCO to regulate

water supply and sanitation provision in urban, peri-urban and rural areas as well as provides for the formulation of utility companies who are responsible for water supply and sanitation service provision.

- Local Government Act Chapter 281, Volume 16 of the Laws of Zambia: Mandates local authorities as providers of water supply and sanitation services in their respective districts. Service provision is delegated to the utility companies who are owned by the local authorities.
- The Public Health Act Chapter 295, Volume 17 of the Laws of Zambia: Mandates local authorities to enforce public health protection.
- The Environmental Management Act No. 12 of 2011: Mandates ZEMA to license, regulate and enforce environmental safeguards which include treated wastewater effluent discharge standards.
- Water Resources Management Act of 2011: Establishes and mandates WARMA to set, regulate and enforce standards on surface and groundwater quality which are often receiving bodies of treated effluent. It further prescribes the minimum distances for structures including onsite sanitation facilities from natural water resources.
- The Statutory Instrument No. 112 of 2013: Sets limits and standards for environmental protection including licensing of vehicles for transportation of faecal sludge and treatment facilities.
- Statutory Instrument No. 100 of 2011: Provides for local authorities to manage solid waste in the areas of operation. Poorly managed solid waste systems lead to indiscriminate disposed of municipal waste into onsite sanitation facilities, making emptying services challenging.

6. Overview of stakeholders

The Urban Onsite Sanitation and Faecal Sludge Management – Framework for Provision and Regulation in Zambia which was launched by NWASCO in 2018 creates an enabling environment for sanitation service provision including OSS and Faecal Sludge Management (FSM). The framework clearly defines the roles and responsibilities of all the key stakeholders as illustrated in Table 1.

Table 1: Key Actors in Urban Onsite Sanitation (Source: NWASCO, 2018).

Stakeholder		Responsibility
Group	Stakeholder	
Public	MWDS	Policy and Laws
	NWASCO	Service Provision regulation(setting service standards and regulation of emptying andtransportation tariffs)
	ZEMA	Environmental protection regulation (licensing of transportation vehicles/ enduse, treatment standards)
	CMC	Enforcement of sanitation systems and public health standards.
Service Providers	SWSC	Sanitation service provision to rural, urban and peri-urbanareas.
	Private Operator	Emptying and transportation/O&M of treatment facilitiesunder delegated management arrangement with SWSC.
Customer	Households, Commercial and Public institutions.	Responsible for investment in OSS facilities e.g., constructionof standard containment facilities at a household level and connecting to sewer systems.
Cooperating Partners	GIZ, African Development Bank.	Sanitation improvementfinancing and capacity building of ZEMA, CMC, WARMA, NWASCO, SWSC and MWDS to effectively manage sanitation services.

7. Process of SFD development

This SFD report was produced in collaboration with SWSC staff. The data collection process involved desk review of available literature in water, sanitation and the geophysical nature of the town, in-depth discussions with the staff of the SWSC and site visits to various areas and sanitation facilities in the town.

The key documents consulted during this process were the "Southern Water and Sanitation Company Survey Report on the sanitation status in Choma" which was undertaken by the SWSC in 2019. The document provided critical insights into the management of onsite sanitation including emptying ratios, the management of the emptied sludge as well as identification of key players in the management of onsite sanitation within the communities of Choma Town. The other document consulted was the CUs "monthly benchmarking database" which provided critical population data as well as the proportions and types of sanitation systems used in the town. The database also provided a good estimate of the amount of effluent being conveyed through the sewer system. Research papers by scholars on the subject of water and Sanitation in the Choma District were also consulted in order to establish the critical issue affecting sanitation in the district.

Further, additional information was obtained through in-depth discussions with staff of the CU. The data gathered were critical in understanding the overall sanitation situation in the district as well as in clarifying some of the data gaps established through literature review.

Site visits to sanitation facilities and wastewater treatment facilities of the utility and transect walk-throughs were carried out in respective communities of Choma to observe and further understand the environmental and social economic context within which the various sanitation types and services are setup. The data gathered here were critical in the understanding of the practices and norms at both community and household level in the management of onsite sanitation.

8. Credibility of data

Population data requires a confirmatory study as the present population data used in this study was obtained from the CU`s database which is based on household service levels. However, the CU population figures are derived by assuming a population factor per household and the number of service points in given town sections. From the district perspective, the assumption can lead to a fair estimation of the overall population. However, at micro level (town section level), this can lead to gross over or under estimation leading to inaccurate representations of the sanitation situation in the district.

Furthermore, data on the number and types of onsite sanitation facilities in the Peri Urban Centre (PUC) require a confirmatory study as well. As presented in the CU`s database, it is highly unlikely that the PUC has more septic tanks and soak pits than pit latrines.

The proportions of onsite sanitation facilities that are emptied as well as the proportion of population whose excreta is emptied and delivered to the treatment facility and effectively treated across all the three types of onsite sanitation systems (septic tanks, VIPs and traditional pit latrines) require to be confirmed in order to appropriately inform the subsequent SFD graphic.

The data collected and highlighted in the preceding paragraphs are questionable in instances and hence, the need for confirmatory studies to verify as well as validate it.

9. List of data sources

The following data sources were consulted to develop this executive summary:

- SWSC, 2019. Southern Water and Sanitation Company Survey Report on Sanitation Status in Choma, Choma:
- CSO, 2013. 2010 Census of Population and Housing Descriptive tables, Central Statistical Office, Lusaka.
- SWSC, 2022. Monthly Benchmarking Data Sheet: SWSC, Choma.
- Makasa, F. M., 2007. The Challenges of Providing Public Water and Sanitation Services in a Rural Town in Zambia, The case of Southern Water and sewerage Company in Choma Town, SOAS University, London.
- Baumler, R., Neukum, C., Nkhoma, J., & Silembo, O. (2007). The Ground Water of Southern Province, Zambia Phase 1. Lusaka: Ministry of Energy and Water Development. Available at: https://www.bgr.bund.de/EN (28th March, 2022).

SFD Choma, Zambia, 2023

Produced by:

Gopa Infra and Borda Zambia

Editing:

Gopa Infra and Borda Zambia

Table of Contents

List of Tables

List of Figures

Abbreviations

BGR	Federal Institute for Geosciences and Natural Resources
BMZ	German Federal Ministry of Economic Cooperation and Development
BOD	Biochemical Oxygen Demand
CMC	Choma Municipal Council
COD	Biochemical Oxygen Demand
CU	Commercial Utility
FS	Faecal sludge
FSM	Faecal Sludge Management
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
LA	Local Authority
MESN	Macha East Sewer Network
MEWD	Ministry of Energy and Water Development
MLG	Ministry of Local Government
MWSN	Macha West Sewer Network
NUSS	National Urban and Peri Urban Sanitation Strategy
NUWSSP	National Water Supply and Sanitation Program
NWASCO	National Water and Sanitation Council
OD	Open Defecation
OSS	Onsite Sanitation
PUC	Peri Urban Centre
SFD	Shit Flow Diagram
SWSC	Southern Water and Sanitation Company
UN	United Nations
UPL	Unlined Pit Latrine
VIP	Ventilated Improved Pit latrine
VT	Vacuum Tanker
WARMA	Water Resources Management Authority
WWSP	Waste Water Stabilisation Pond
WWTP	Waste Water Treatment Plant
ZEMA	Zambia Environmental Management Agency

1 City context

Choma is a town located in Southern Province of Zambia located on latitude -16.812822 and longitude 26.987640. It is the provincial administrative capital of Southern Province and is approximately 285 km south of the country's capital city. Choma district sits at an elevation of approximately 1,314 m above sea level and covers a total land area of 7,296 square kilometres. According to the 2010 national census of housing and population (Central Statistical Office, 2013), the district had a total population size of about 247,860 with a growth rate of 1.9%. Urban Choma (Choma town) however accommodates approximately half of the population of the district (110,218). For the purposes of developing this Shit Flow Diagram (SFD), only the population of Choma town was considered. Figure 1 shows the boundaries of Choma Town.

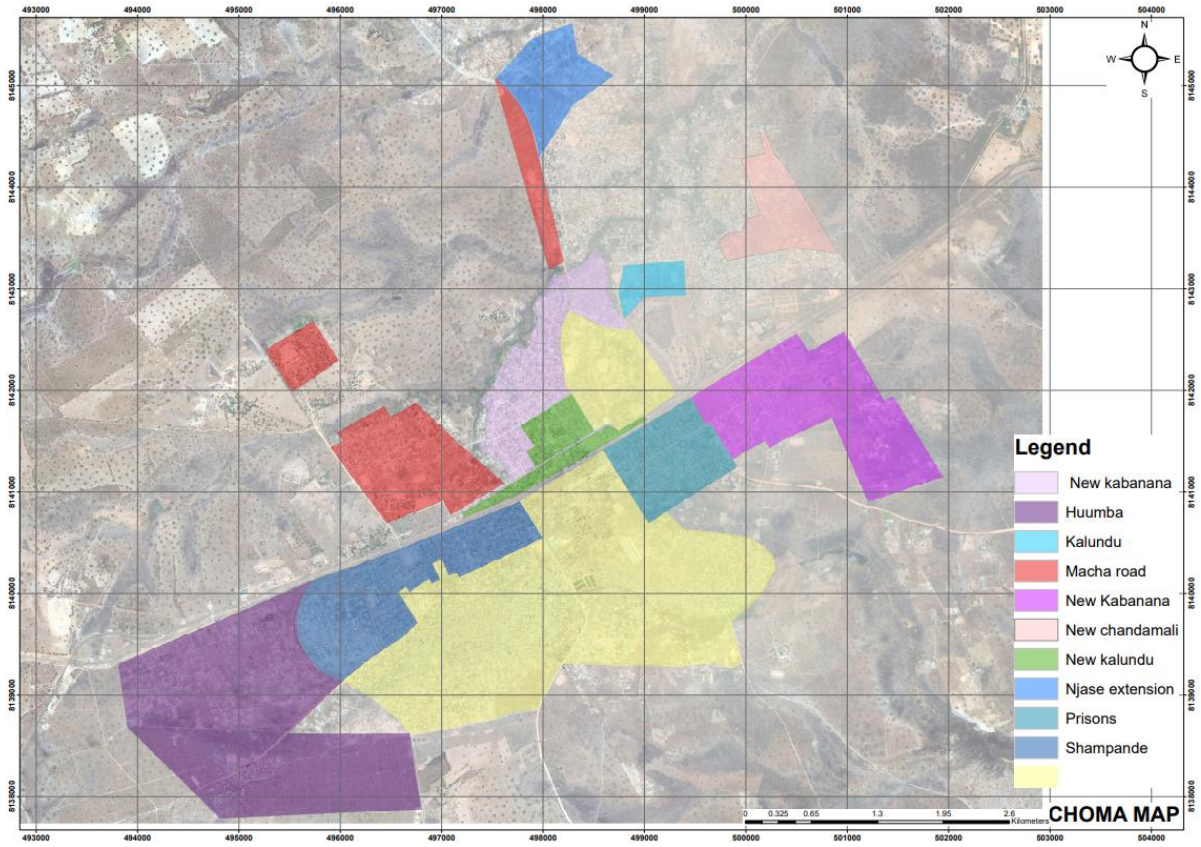


Figure 1: Choma Town Boundary Map (Source Google Maps 2022).

1.1 Climate

The weather in Choma is the typical climate of southern Zambia with temperatures ranging between 14°C and 28°C, and sunshine hours ranging between 9 and 12 hours per day. The highest temperatures are recorded between October and December while the lowest temperatures are around June and July. The rains generally start in the middle of October and continue through up to the beginning of April with the rainfall peak being around January after which it diminishes until it ceases in April. The town has an average rainfall of 800 mm with winds generally blowing from the east and south-west, and rarely from the north-east.

1.2 Population

The district is predominately an agricultural district with agriculture being the main economic activity. The district has approximately 180 commercial farmers, 150 emergent farmers and about 23,206 farming families involved in the production of livestock and cash crops. Primary crops cultivated include maize, cotton, tobacco and groundnuts; while primary livestock including cattle, goats, pigs and poultry.

Choma Town has experienced in the recent past tremendous growth in infrastructure development owing to its recent designation as the provincial administrative capital. The town is comprised of twenty-one (21) residential areas out of which seventeen (17) are planned and four (4) are unplanned. Table 1 shows the different sections of the town and their demographic attributes.

Table 1: Town sections making up Choma Town together with some demographical attributes (Source: Choma Municipal Council).

	Area	Classification	Total Population
1	Mochipapa	High-cost	2,360
2	River side/Town Area	High-cost	3,756
3	Showgrounds	High-cost	3,342
4	Kalundu Site and Service	Low-cost	505
5	Macha Rd	Low-cost	5,152
6	Messenger/Prisons/Hospital	Low-cost	784
7	Humba (Kozo Plots)	High-cost	1,470
8	Zambia Compound	Peri-urban	20,360
9	Muzuma/Shah	Low-cost	2,028
10	Mwapona	Peri-urban	16,900
11	New Kalundu	Medium-cost	1,608
12	New Kabanana	Peri-urban	7,126
13	Mediums	Medium-cost	852
14	Chandamali	Low-cost	14,456
15	Kabanana	High-cost	1,560
16	Shampande	Low-cost	8,414
17	Kamunza	Peri-urban	8,060
18	Manchinda	Low-cost	651
19	Mukasa	High-cost	1,314
20	Overspill	Low-cost	7,336
21	Kachacha	Low-cost	2,184
		Town Total	110,218

2 Service Outcomes

2.1 Overview

The data provided by the Commercial Utility (CU) does not consider the contribution of excreta from public toilets, institutions, commercial and industrial areas, restaurants as well as the hospital and churches as this data is not available. However, the inclusion of these data may not significantly alter the outcomes of this SFD graphic as most of the population using these facilities is the same population within the town of Choma. However, it may be necessary to undertake studies on transient population for the town to confirm the assumptions made in this study which has taken transient population as negligible. Therefore, in this SFD report, it is assumed that all excreta is only emanating from household facilities. The sanitation facilities existing in Choma have been categorised based on the options provided in the selection grid (Figure 3).

List A: Where does the toilet discharge to? (i.e. what type of containment technology, if any?)	List B: What is the containment technology connected to? (i.e. where does the outlet or overflow discharge to, if anything?)									
	to centralised combined sewer	to centralised foul/separate sewer	to decentralised combined sewer	to decentralised foul/separate sewer	to soakpit	to open drain or storm sewer	to water body	to open ground	to 'don't know where'	no outlet or overflow
No onsite container. Toilet discharges directly to destination given in List B	T1A1C1				Significant risk of GW pollution Low risk of GW pollution					Not Applicable
Septic tank					Significant risk of GW pollution T1A2C5					
Fully lined tank (sealed)					Significant risk of GW pollution Low risk of GW pollution					T1A3C10
Lined tank with impermeable walls and open bottom	Significant risk of GW pollution Low risk of GW pollution	Significant risk of GW pollution Low risk of GW pollution	Significant risk of GW pollution Low risk of GW pollution	Significant risk of GW pollution Low risk of GW pollution	Significant risk of GW pollution Low risk of GW pollution					Significant risk of GW pollution Low risk of GW pollution
Lined pit with semi-permeable walls and open bottom	Not Applicable									Significant risk of GW pollution Low risk of GW pollution
Unlined pit										T2A6C10 Low risk of GW pollution
Pit (all types), never emptied but abandoned when full and covered with soil										Significant risk of GW pollution Low risk of GW pollution
Pit (all types), never emptied, abandoned when full but NOT adequately covered with soil										
Toilet failed, damaged, collapsed or flooded										
Containment (septic tank or tank or pit latrine) failed, damaged, collapsed or flooded										
No toilet. Open defecation	Not Applicable							T1B11 C7 TO C9		Not Applicable

Figure 2: SFD selection grid.

2.1.1 Offsite sanitation

According to the Southern Water and Sewerage Company (SWSC), monthly benchmarking data, 6.9% of the population in Choma are serviced by offsite sanitation. As the sewer network is reported leakage free, it is assumed that all the wastewater collected is conveyed to the treatment facilities. The treatment facilities are equally in a good operational condition. It therefore follows that all the excreta received at the Wastewater Stabilisation Ponds (WWSP) is reasonably assumed to go through all the treatment stages of the treatment process and

that it is adequately treated. This assertion is supported by available laboratory results for the three wastewater treatment plants in Choma where the organic matter removal for the period 2015 to 2020 has consistently been adequate. Table 2 presents results for the annual average concentration of Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) together with the pH value of the effluent.

Table 2: Annual average results for effluent from the WWTPs in Choma.

PLANT	YEAR						ZEMA Guideline
	2015.0	2016.0	2017.0	2018.0	2019.0	2020.0	
Shampande Oxidation Ponds							
Annual Average BOD (mg/l)	31.2	28.5	30.5	30.9	36.5	29.5	50.0
Annual Average COD (mg/l)	62.6	57.1	47.7	47.4	61.6	78.9	90.0
Annual Average pH (-)	7.9	8.2	8.0	7.4	6.8	8.0	6.0-9.0
Macha West Oxidation Ponds							
Annual Average BOD (mg/l)	34.7	32.7	28.1	35.8	25.3	12.4	50.0
Annual Average COD (mg/l)	61.0	55.9	53.0	58.2	67.0	15.0	90.0
Annual Average pH (-)	7.0	6.6	7.7	7.8	7.9	8.0	6.0-9.0
Macha East Oxidation Ponds							
Annual Average BOD (mg/l)	4.0	3.2	3.2	4.5	9.2	4.6	50.0
Annual Average COD (mg/l)	8.4	6.6	7.5	8.7	11.7	14.0	90.0
Annual Average pH (-)	7.5	7.1	7.4	7.6	7.6	7.5	6.0-9.0

Sewerage Network and Treatment System

Offsite sanitation system in Choma comprises three separate sewer sheds with each shed having its own treatment system in form of stabilisation ponds namely Shampande, Macha East and Macha West Stabilisation ponds; the ponds are in perfectly good working order. The first sewer network services the sewer sheds for Shampande WWSPs and this sewer shed collects wastewater from sections of Shampande, Munzuma/Shah, Kalundu site and service, and overspill. A record of 708 households are connected to this network hence servicing approximately 4,956 people. The network and its treatment system is in a fairly good condition. The Shampande WWSP was reportedly recently renovated.

The second sewer network services the sewer shed for the Macha East WWSPs which collects wastewater from Riverside/ Town area and Macha Road. On this network, only 264 households with approximately 1,848 people are connected. The network is also in good condition as at the date of inspection, no leakages were reported or observed. The network was further observed to be functional with effluent at the WWSP. The third and last sewer network with 145 household connections (hosting 1,015 people) is the Macha West network which collects wastewater from an area called Kamunza and conveys it to the Macha West WWSPs. This network is equally in a good and functional condition.

The wastewater at all the three sets of WWSPs flows through all the treatment stages (i.e., primary, secondary and tertiary (Table 3)) and therefore, it is assumed that all the wastewater that is received at these WWSPs undergoes effective treatment. This assertion is supported by the quantitative data on the effluent quality analysed over a period of 6 years (i.e., from 2015 to 2020) as presented Table 2, which shows that the effluent quality meets the Zambia

Environmental Management Agency (ZEMA) standards for effluent being discharged into the environment.

Table 3: Design parameters of the treatment facilities available in Choma Town.

Name of Plant	Available Units
Shampande WWSPs	Two 12,900m^3 Primary ponds with approx. dimensions of 115m x 45m in in parallel arrangement connected to one 14,000m^3 Secondary and Tertiary ponds (both approx.130 x40m) in a series arrangement.
Macha West WWSPs	One 3,125m^3 Primary Pond with approx. dimensions of 40m x 15m in series connection to one 1,210 m^3 Secondary and one 1,210m^3 Tertiary Ponds (approx. 18m x 18m) in series connection.
Macha East WWSPs	One 1,875m^3 Primary Pond with approx. dimensions of 40m x 15m in series connection to one 1,500m^3 Secondary and one 1,500m^3 Tertiary Pond (approx. 18m x 18m) in series connection.

However, even though Macha west and Macha east SP being functional, they are in need of maintenance especially on aspects of maintaining the surroundings as they are overgrown with grass and shrubs and are without proper access roads (Figure 4).

Figure 3: The status of the wastewater stabilization ponds in Choma (Top: The Macha Ponds which need maintenance of the surroundings; Bottom: The well maintained Shampande WWSPs.

2.1.2 Onsite sanitation

93.1% of the population in Choma are served by onsite sanitation, of which 37.8% are septic tanks connected to soak pits, 47.7% are sealed tanks or pits referred to as VIPs by SWSC, and 7.0% are unlined pit latrines or traditional pit latrines.

According to the SWSC report on a Household Survey on Sanitation Status in Choma undertaken by the SWSC in 2019, it was established that only 60.9% of onsite sanitation systems are emptied (Southern Water and Sewerage Company, 2019). However, the report and the available data do not provide an analysis or breakdown of the proportions of the emptying that is attributed to the different types of onsite sanitation under use. Therefore, 60.9% emptying is assumed to apply to all the types of onsite sanitation facilities in use. Due to the above, it is imperative to institute a data capturing mechanism within the CU that would capture data on emptying specific to each type of onsite systems in use in Choma.

It has been reported that the treatment facility has no leakages hence all the delivered excreta is assumed to be treated with a 90% efficiency before discharge to the environment.

Containment

Construction of onsite sanitation facilities is the responsibility of the household hence SWSC and the Local Authority (LA) have no control over the construction quality of the facilities (Makasa, 2007). As a result, the constructed onsite facilities often do not meet the minimum required building standards. And because of Choma's generally low topography coupled with the hydrogeological characteristics which promote flooding, wastewater overflows from these constructed onsite sanitation facilities are common during the rainy season (Makasa, 2007). It is therefore imperative that the CU together with the LA are involved in at least the supervision of the construction of OSS facilities. This is expected soon due to the launching of the Framework for Provision and Regulation of Urban Onsite Sanitation and Faecal Sludge Management (FSM) by the National Water Supply and Sanitation Council (NWASCO) and will create an enabling environment for sanitation service provision including OSS and FSM. Through this Framework, CUs are mandated to ensure adequate provision of OSS facilities.

The proportion of onsite sanitation containment is as follows: 37.8% of the population use septic tanks connected to soak pits, 47.7% use fully lined tanks or toilets constructed on a concrete slab also denoted to as VIP by the SWSC (Figure 4) and 7.0% use unlined pit latrines, also denoted as traditional pit latrines by the SWSC (Southern Water and Sanitation Company, 2019). It is noted that some of the existing onsite sanitation facilities could further be sub categorised as "lined tank with impermeable walls and open bottom" or as "lined pit with semi-permeable walls covered with soil". This was however not possible at this stage because of insufficient existing data which makes such sub categorization impossible. The geological formation of Choma can be approximated to be fine sand, silt and clay, providing a relative containment of excreta in unlined pit latrines (SWSC staff discussion notes).

Figure 4: Typical VIP latrines found in Choma Town.

Emptying and Transport

Emptying services for OSS facilities are solely the responsibility of SWSC and the emptying is mainly done for septic tanks. In the case of pit latrines, it is done only on those latrines which are structurally sound and with sludge that can be pumped by the available CU vacuum truck. The utility has one 10,000L capacity vacuum truck which caters for the whole area under the utilities jurisdiction (i.e., the whole of Southern Province). The cost of the services depends on the category of the customers. Domestic customers are charged K450 (USD 23) per load while commercial and public institutions are charged K 700 (USD 36) per load, withstanding the volume of sludge pumped into the tank.

Since the emptying services are provided by the utility, safety and hygiene guidelines are adhered to during the emptying and transportation process. All staff directly involved in provision of emptying services are provided with the necessary protective attire and necessary chemicals for disinfection after service provision are also provided to ensure adequate sanitisation of the working environment and the equipment.

According to the SWSC report on the sanitation status in Choma, 92.4% of the population reported that they have never had their onsite sanitation facilities fill up implying that only 7.6% of the population have had their facilities filling up. The report further revealed that 60.9% of the population reported having had their onsite sanitation facilities periodically emptied. However, SWSC only accounts for provision of these services to only about 35.7% of the population signifying a large proportion of services being offered by informal pit emptiers. It was reported that Informal emptiers provided emptying services to about 48.7% of the population while family members account for 11.8%. Furthermore, it should be noted that only the sludge that is emptied by the SWSC gets transported to the treatment plant.

Treatment and Disposal

There are no specific Faecal Sludge Treatment Facilities (FSTPs) and hence, faecal sludge that is emptied from OSS facilities is disposed of into the Shampande WWSP for co-treatment with the wastewater. There was no clear indication as to which set or sets of ponds are used for the purpose of faecal sludge treatment. However, it is obvious that co-treatment of faecal sludge with sewage is not a very good option for Choma Town especially because of the treatment facilities were designed to treat sewage with low organic matter content. This assertion is based on the observation of the available treatment facilities which are all designed without anaerobic ponds. The design of the ponds is summarised in Table 3.

Based on laboratory results for the period January 2025 to July 2020 (Table 2), all the three sets of ponds have adequate treatment capacity based on the observed BOD removal efficiencies. The effluent quality in terms of BOD and COD concentration over the period for which laboratory results were available, was within the ZEMA effluent quality disposal guidelines. Unfortunately, due to unavailability of information on the depth of the ponds and the hydraulic loading rates, it is not possible to estimate the capacity and retention time of these facilities.

Given that OSS is predominant in the Choma, the need for a faecal sludge treatment plant is imperative. It should be noted that WWSPs are not designed to treat faecal sludge. The absence of anaerobic ponds in these facilities makes the situation even more serious as facultative ponds are not able to handle wastewater with high content of organic matter which is characteristic of faecal sludge.

2.1.3 Open Defecation

Presently, Open Defecation (OD) is approximated to be practised by less than 1% of the population. This information was obtained from SWSC staff and was based on an assessment of households that have no sanitation facilities within their respective properties. Examples of these include properties which are still under construction but are already serving as dwelling structures.

2.2 SFD Matrix

Table 4 shows the SFD matrix.

Table 4: SFD Matrix.

Choma, Southern Province, Zambia, 20 Mar 2022. SFD Level: 1 - Initial SFD
Population: 110218
Proportion of tanks: septic tanks: 100%, fully lined tanks: 100%, lined, open bottom tanks: 100%

Containment						
System type	Population	WW transport	WW treatment	FS emptying	FS transport	FS treatment
	Pop	W4a	W5a	F3	F4	F5
System label and description	Proportion of population using this type of system (p)	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	6.9	100.0	90.0			
T1A2C5 Septic tank connected to soak pit	37.8			60.9	35.7	90.0
T1A5C10 Lined pit with semi-permeable walls and open bottom, no outlet or overflow	47.7			60.9	35.7	90.0
T1B11 C7 TO C9 Open defecation	0.7					
T2A6C10 Unlined pit, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	7.0			60.9	35.7	90.0

2.2.1 Distribution of containment facilities and population utilising the facility

Table 5: Distribution of containment and population utilizing the facility.

Containment Technology	Proportion of Population (%)	SFD Matrix Classification
Offsite	6.9	T1A1C1
Septic tank with soak pit	37.8	T1A2C5
Lined Pit Latrines	47.7	T1A3C10
Unlined Pit Latrines	7.0	T2A6C10
Open Defecation	0.7	T1B11C7TOC9

Offsite

6.9% of the population in Choma are serviced by offsite sanitation according to the SWSC. The sewer network is reported leakage free, so it is assumed that all the wastewater collected is delivered to treatment and thus, variable W4a set to 100%.

The effluent quality meets the Zambia Environmental Management Agency (ZEMA) standards for effluent being discharged into the environment. However, since there is always some

outages, breakdowns etc., wastewater treatment efficiency was estimated at 90% (W5a = 90%),

Septic and fully lined tanks

37.8% of the population use septic tanks connected to soak pits (T1A2C5). Emptying services for OSS facilities are solely the responsibility of SWSC.

Pit latrines

7.0% of the population use unlined pit latrines, also denoted as traditional pit latrines by the SWSC. 47.7% use latrines constructed on a concrete slab also denoted as VIP by the SWSC (T1A5C10). Emptying of pit latrines is done only for those latrines which are structurally sound and with sludge that can be pumped by the available CU vacuum truck.

2.2.2 Emptying of onsite technologies

The emptying rate of 60.9% for all sanitation systems was obtained from the SWSC report on the sanitation status in Choma and thus, variable F3 for systems T1A2C5, T1A5C10 and T2A6C10 was set to 60.9% in all cases.

2.2.3 Transport of FS from onsite technologies

It was estimated that 35.7% of emptied FS reaches treatment. This value was also obtained from the SWSC report on the sanitation status in Choma and thus, variable F4 for systems T1A2C5, T1A5C10 and T2A6C10 was set to 35.7% in all cases.

2.2.4 Treatment of FS from onsite technologies

Since all the FS sludge from septic tanks is co-treated with wastewater in the same WWTP (Chawama WWTP), the F5 value (the FS that is treated) is the same as that for wastewater and hence, variable F5 is set to 90%.

Open defecation

The population practising open defecation is less than 1%.

2.2.5 Groundwater Contamination risk

In the Peri Urban Centre (PUC) of Choma (Mwapona and Zambia Compound), the groundwater table is very high, and in some low lying areas groundwater is visible at ground level. About 79.8% of the population have access to clean piped water supplied by the SWSC (Southern Water and Sanitation Company, 2019) and only about 6% of the population in Choma are dependent on groundwater from unprotected wells (Southern Water and Sewerage Company, 2019). However, the water from shallow wells is mainly used for non-consumptive purposes (SWSC discussion notes).

SWSC however sources some of its fresh water supply from groundwater sources (boreholes) around the district (SWSC monthly benchmarking Database). The town has eight commercial boreholes which are deep wells with full protection from the top to the bottom. In all cases, the lateral separation between these SWSC groundwater sources and onsite sanitation is more than 10 metres. The parameters presented here were used in the Groundwater Assessment Tool included in the SFD generator to assess the overall groundwater risk.

Hydrogeological condition

Choma is situated on the Gneiss and undifferentiated metamorphic rock aquifer. This aquifer stretches over the north eastern area of Southern Province covering Monze, Gwembe, Pemba and Choma (Baumler et al., 2007) as presented in Figure 5. According to Baumler et al.(2007), the rock aquifer underlying Choma is associated with low to medium water yields except for selected few points that are thought to be associated with fault systems in the underlying rock. SWSC draws less than 3% of its water from groundwater resources. With as few as eight commercial boreholes managed by the SWSC, four have been suspended from operation due to low yields and high energy costs associated with the pumping.

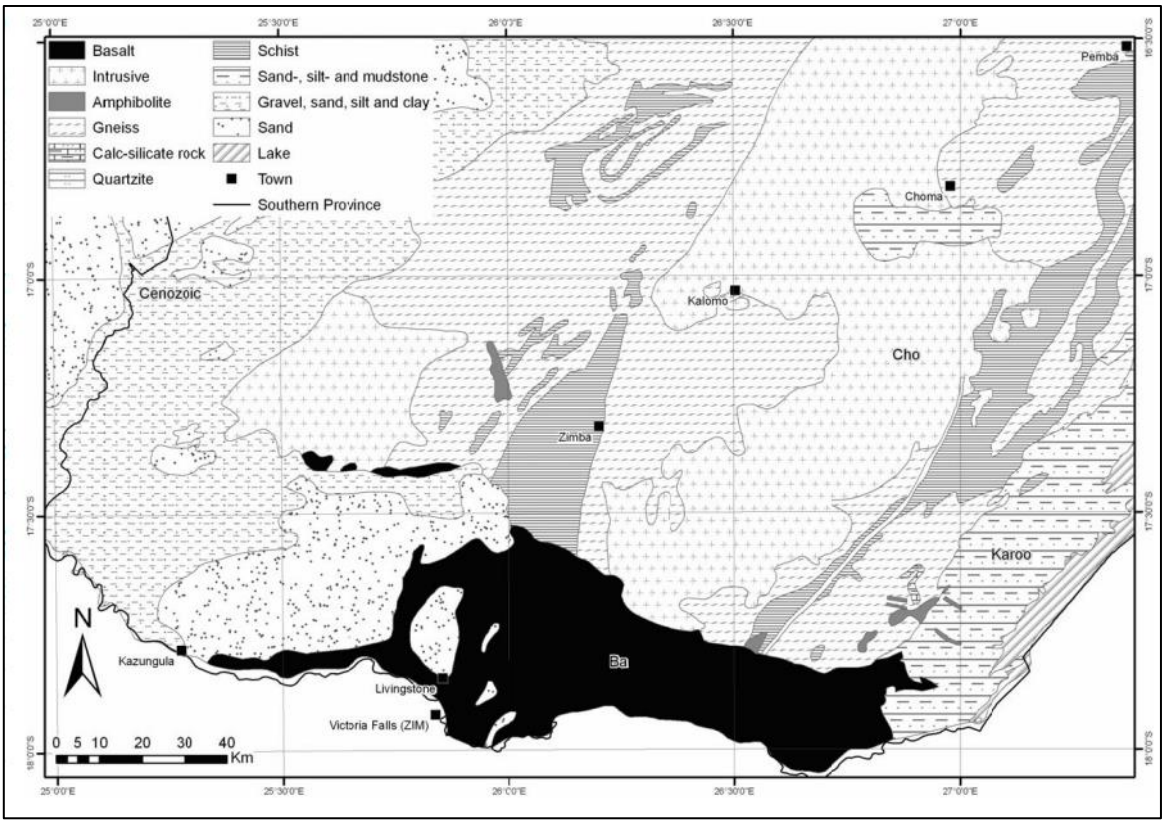


Figure 5: Lithological Map of the SW part of Southern Province inclusive Choma (source: The ground water resources of southern Province).

Lateral separation between facilities and ground water sources

At the time of the study, SWSC was operating four out of eight boreholes in Choma Town. The boreholes were drilled to supplement the surface water supply in times of droughts as was most recently experienced. Out of the eight boreholes that SWSC manage, four had been decommissioned due to low water yields and high running costs. It is evident by observation that all the eight boreholes managed by SWSC are more than 10m away from sanitation facilities. For the larger public that depends on water supply from SWSC, there is adequate lateral separation between facilities and the respective groundwater sources.

However, in the PUC, where shallow wells are used, the case might not be the same. Nonetheless, hand dugs wells are in all cases, as confirmed by SWSC, restricted to non-consumptive use.

2.2.6 Data Uncertainties

Population figures are obtained based on an assumed population factor per household multiplied by the number of water connections in a given community. Whilst the assumption gives a fair estimate of the population of Choma, it inherently ignores the population that is not serviced with water connections in the area of study. At community level, this has a significant impact on the outcome of this SFD graphic.

SWSC data on onsite sanitation suggests that PUC have more septic tanks and soak pits than pit latrines. It is highly unlikely that the given data accurately depicts the sanitation scenario in the PUC given the existing environmental and social-economic context within which they exist. Additional surveys are required to verify and validate the existing data.

There are insufficient data on the management of onsite sanitation. This is partly because of a lack of a comprehensive inventory of all the onsite sanitation infrastructure within the district. It therefore proves challenging for the SWSC to collect data on the emptying ratios of onsite sanitation facilities as well as provide oversight on the treatment of the excreta emptied by communities.

2.3 Summary of assumptions

Offsite sanitation systems:

- ✓ 6.9% of the population are connected to the sewer system. It was estimated that all wastewater is delivered to treatment (W4a = 100%) since there are no leakages in the sewer network and all wastewater is treated with a 90% efficiency (W5a = 90%).

Onsite sanitation systems:

- ✓ The proportion of Faecal Sludge (FS) in septic tanks was set to 100% and the proportion of FS in lined tanks with impermeable walls and open bottom and pits was set to 100% according to the relative proportions of the systems in the municipality, as per the guidance given in the Frequently Asked Questions (FAQs) in the Sustainable Sanitation Alliance (SuSanA) website.
- ✓ Variable F3 for all onsite sanitation systems (T1A2C5, T1A5C10 and T2A6C10) was derived from the SWSC data available and set to 60.9% in all cases.
- ✓ It is assumed that 35.7% of the FS emptied is delivered to treatment (F4 = 35.7%) and all the FS delivered to treatment is treated with a 90% efficiency (F5 = 90%).

2.4 SFD Graphic

Figure 6 shows the SFD graphic where 58% of the excreta is safely managed while 42% is unsafely managed.

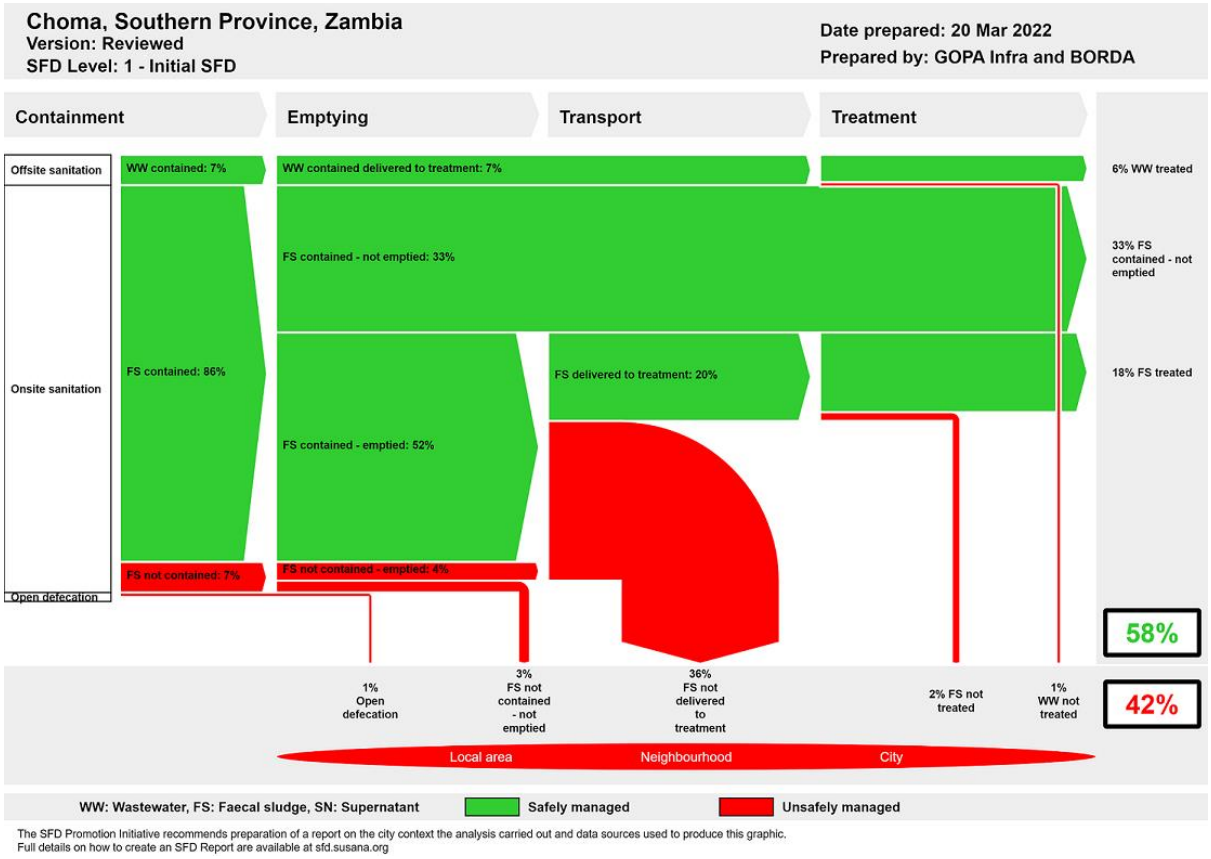


Figure 6: Choma SFD graphic.

From the graphic, 7% of the population has their wastewater delivered to treatment, out of which 6% is adequately treated at the WWSPs and hence, safely managed. The assumption that 90% of the wastewater collected is adequately treated is based on available laboratory results which for BOD, COD and pH since they all meet the ZEMA Effluent Standard for discharge into the environment but there is always some outages, breakdowns etc.

From the 93.1% of the population on onsite sanitation systems, 86% has their faecal sludge contained. This high percentage emanates from the fact that most of the population are not reliant on groundwater sources for drinking water. From the population whose faecal sludge is safely contained, 52% have their facilities emptied while 33% do not empty their facilities. However, as these facilities fill up, they are likely to require emptying services.

Of the 52% whose facilities are emptied, only 20% have their faecal sludge delivered to the treatment plant while the rest ends up in the environment. The only portion that gets to the treatment plant is that emptied by the utility.

The population with faecal sludge that is not contained is 7%. Out of this, 4% is emptied but it is not delivered to treatment. The remaining 3% is never emptied. The population practising open defecation is less than 1%.

3 Service delivery context

3.1 Policy, legislation and regulation

The Government Republic of Zambia (GRZ) has put up in place clear policies, regulations and legal frameworks for water supply and sanitation services to create an enabling environment to attain universal access to sanitation for all by 2030. The sections below outline the policy, institutional/ regulatory and legal frameworks for sanitation which applies at both national and local levels.

3.1.1 Policy

The following policies have been put in place to provide direction and guidance on the vision to achieve the universal access to safely managed sanitation for all by 2030:

The Zambia Vision 2030: the vision identifies inadequate access to safe water supply and sanitation as one of the human well-being and social development aspect that needs to be improved for Zambia to attain the aspiration to become a prosperous middle-income country by 2030. In this regard, the vision sets target to improve access to adequate, appropriate and environmentally friendly sanitation for at least 90% of Zambians by 2030.

The 7th Development Plan 2017 – 2021: Outlines the intended five-year developmental outcomes and goals to achieve the vision 2030. Thus, the plan outlines strategies and programs that are aimed at improving access to safely managed sanitation at all levels in Zambia.

National Water Supply and Sanitation Policy of 2020: The policy was developed based on the vision 2030 and the sustainable development goals and its implementation shall be through the National Development Plans. The policy sets clear and coherent policy measures that guide the improvement of access to adequate and safely managed sanitation for all. One of the objectives of the policy is to provide the legal and institutional framework for sanitation service delivery in Zambia.

National and Local Programs: The National Urban Water Supply and Sanitation Program (NUWSSP, 2011 – 2030) enables all urban residents, commerce, institutions and industry to have access to sanitation and utilize it in an efficient and sustainable manner for improved health, well-being and livelihood by 2030. Specifically, the National Urban and Peri-Urban Sanitation Strategy (NUSS, 2015- 2030) provides a framework for financing and implementing the sanitation component of the NUWSSP and has set a target to “provide adequate, safe and cost-effective sanitation services to 90 percent of the urban population by 2030”. To achieve this target, one of the objectives is to improve access to sanitation and safely manage sanitation systems so as to reduce the incidence of water borne diseases outbreaks such as cholera

At the local level, SWSC has undertaken various initiatives aimed at attracting investment projects to improve service delivery to its customers. One notable initiative is the impending 10.8 million Euros (11.5 US million) investment intended to improve the water supply and sanitation infrastructure in Choma and Livingstone districts. This is to be financed by the federal Government of German through KfW.

UN Sustainable Development Goals 2015 – 2030: Zambia is a member of the United Nations (UN) and all developmental programs and policy documents in the water supply and sanitation sector are aligned to the Sustainable Development Goals (SDGs) No. 6 and its targets.

All these policy documents and programs have set clear objectives, targets and an enabling environment on sanitation service improvement for both urban, peri-urban and rural areas which includes Choma District.

3.1.2 Institutional roles

The Framework for Provision and Regulation of Urban Onsite Sanitation and Faecal Sludge Management and the Framework for Provision and regulation of Rural Water Supply and Sanitation in Zambia sets a robust institutional arrangement that clearly specifies the roles and responsibilities of all key players in the Water Supply and Sanitation Sector in Zambia. Figure 7 shows the institutional and regulatory framework and outlines the various roles and responsibilities of the key sector players in Zambia.

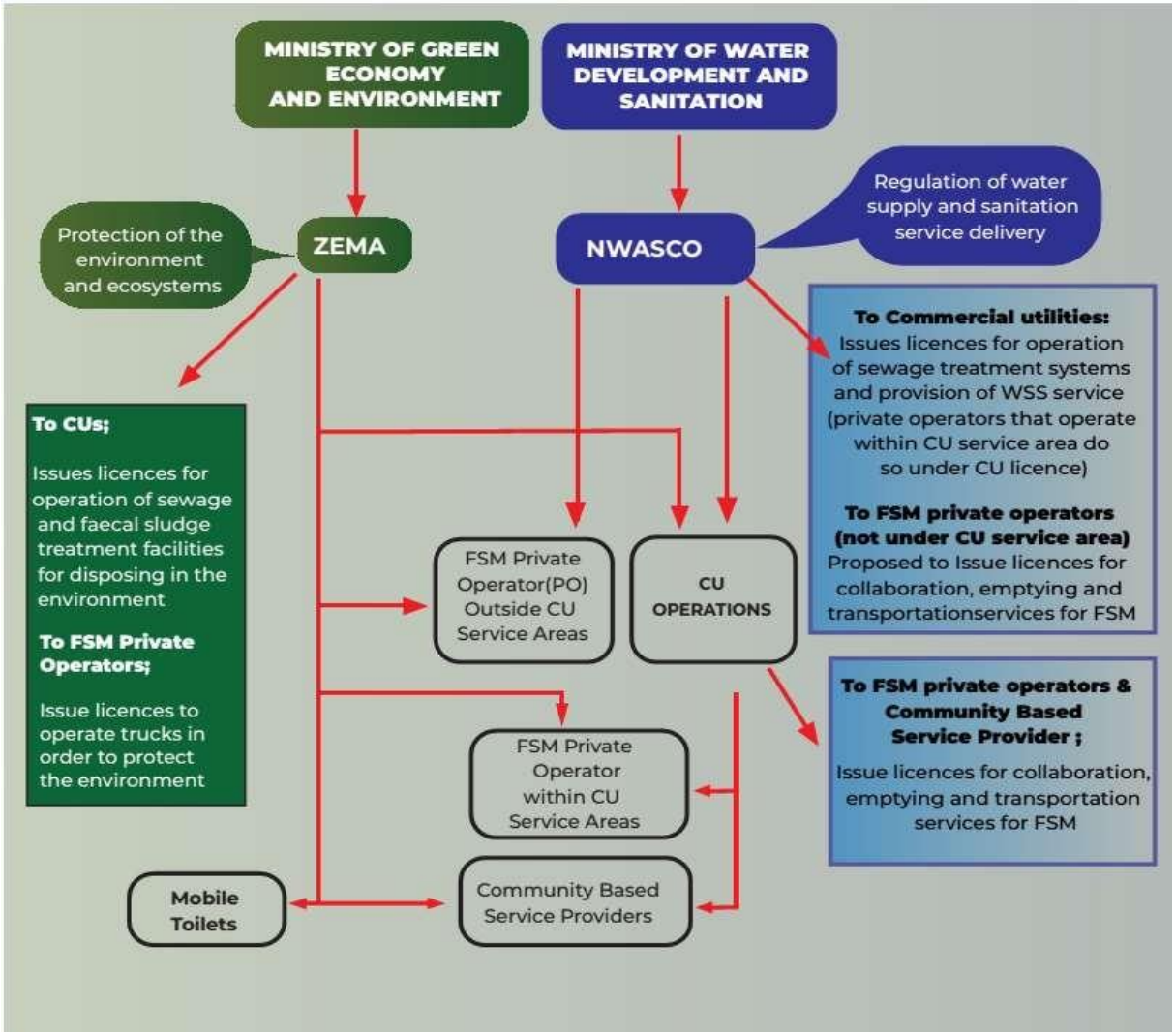


Figure 7: Regulatory Framework for Provision of Sanitation Services (Adapted from NWASCO, 2018).

At the local level, the following are the key players:

Choma Municipal Council (CMC) - Under the direction of Ministry of Local Government (MLG), Choma Municipal Council (CMC) focuses on the enforcement of Ministry of Health's Hygiene regulations and the development of by-laws on sanitation service provision through the Public Health Departments. CMC also holds the majority of the shares in SWSC and sits on the board as well as delegates' SWSC for water supply service and sanitation provision as per the WSS act No. 28 of 1997. CMC, through Environmental Health Officers and Health Inspectors, are mandated to enforce and regulate the sanitation relevant laws related to the Public Health Act (Drainage and Latrine), Regulation 1994 (Amended 2006) related to collection, transportation and treatment of wastewater. CMC also has a mandate for other services that relate to the quality of the urban environment and therefore have a broader responsibility for sanitation that also includes solid waste management and storm-water drainage system for areas within Choma District.

CMC also issues business levy licenses to all businesses operating in the city including service providers in solid and liquid waste management. There is however a weak enforcement pertaining to registration of businesses providing OSS and FSM services in the district.

Southern Water Supply and Sanitation Company (SWSC) - SWSC is the commercial Utility delegated by CMC to provide water supply and adequate sanitation services to rural, urban and informal areas of Choma District and the 12 other districts in Southern Province. SWSC is supervised and regulated by the National Water Supply and Sanitation Council (NWASCO) and manages the current water supply and sanitation infrastructure for the district.

National Water Supply and Sanitation Council (NWASCO) - According to the Framework for Provision and Regulation of Urban Onsite Sanitation and Faecal Sludge Management, regulation of sanitation service provision (including OSS and FSM) in Choma District is done through new licensing conditions of 2018 issued to SWSC by NWASCO. Under the licensing conditions, any private operator providing sanitation services (e.g. emptying of OSS facilities) within the SWSC's designated service area will do so under a delegated management contract with SWSC. Private operators providing services outside the service areas of SWSC need to obtain a permit directly from NWASCO (NWASCO, 2018).

Zambia Environmental Management Agency (ZEMA) - ZEMA is responsible for applying the legal framework for the protection of the environment and the control of pollution. Under the Environmental Management Act, no 12 of 2011, ZEMA regulates discharges into the environment and promotes water pollution monitoring and prevention programs based on enforceable water quality guidelines and standards. ZEMA is also responsible for issuance and enforcement of waste management licenses to any individual or entity who wishes to collect and transport domestic and commercial waste in the city for environmental protection.

3.1.3 Standards

Several laws and regulatory tools exist which provide a clear legal framework for sanitation at both National and local level. These include the following:

The Water Supply and Sanitation Act No. 28 of 1997: Mandates NWASCO to regulate water supply and sanitation provision in urban, peri-urban and rural areas as well as provides for the

formulation of utility companies who are responsible for water supply and sanitation service provision.

Local Government Chapter 281, Volume 16 of the Laws of Zambia: Mandates local authorities for provision of water supply and sanitation services in the respective districts. Service provision is delegated to the utility companies who are owned by the local authorities.

The Public Health Act Chapter 295, Volume 17 of the Laws of Zambia: Mandates local authorities to enforce public health protection.

The Environmental Management Act No. 12 of 2011: mandates ZEMA to license, regulate and enforce environmental safeguards which includes treated wastewater effluent discharge standards.

Water Resources Management Act of 2011: Establishes WARMA to set, regulate and enforce standards on surface and ground water quality which are often receiving bodies of treated effluent. It further prescribes the minimum distances for structures including onsite sanitation facilities from natural water resources.

The Statutory Instrument No. 112 of 2013: Sets limits and standards for environmental protection including licensing of vehicles for transportation of faecal sludge and treatment facilities.

Statutory Instrument No. 100 of 2011: Provides for local authorities to manage solid waste in the areas of operation. Poorly managed solid waste systems lead to indiscriminate disposal of municipal waste into onsite sanitation facilities, making emptying services challenging.

4 Stakeholder Engagement

During the development of this SFD report, the major stakeholders were staff of the SWSC. These stakeholders were the key informers to this SFD and included:

- Operations Directorate Mr. Walace Shawa (Director of Operations);
- Operations Directorate Mr. Ortega Choombe (Technical Manager);
- Community Relations. Ms Eustakia Hamuchenje (Community Relations);
- Operations Directorate Mr. Haabenzu Warren (Sanitation Engineer); and
- Operations Directorate Mr Noddy Kanyenda (Central Regional Manager).

Other stakeholders engaged included:

- Choma Municipal Council; and
- Community member as select few Households.

From inception, SWSC staff listed above were engaged through in-depth discussions. Through these discussion critical documented reports on studies and survey done on the subject were availed to the consultant. The literature review was then undertaken as a collaborative effort involving SWSC staff and the consultant.

Further, with the lead of the community relations officer, field visits were made to the respective WWSP and also to selected households to observe the onsite sanitation systems in place and how households manage them.

5 Acknowledgements

This SFD Report was compiled as part of the consultancy entitled "Support the Data Collection on Water and Sanitation for the Implementation of the ECAM Tool in Six (6) Selected CUs in Zambia" funded by the German Federal Ministry of Economic Cooperation and Development (BMZ) to Zambia which was commissioned by the GIZ.

Gratitude and special thanks to the SWSC for their overwhelming support to the successful generation of this Initial SFD report. Special thanks to the Company Managing Director Mr. Gift Monde, the Director of Operations Mr. Wallace Shawa, the Technical Manager Mr. Ortega Choombe, the Regional Manager Mr. Kanyenda, the sanitation Engineer Mr. Warren Habeenzu and the Community Relations Officer Ms. Eustakia Hamuchenje.

Further thanks to all the Plant/Pump operators stationed in the plants for their support and relentless input to ensure the success of this outcome. Lastly the Community in Choma District, most so, those contacted and engaged into discussions at field investigations stage.

6 References

-Baumler, R., Neukum, C., Nkhoma, J., & Silembo, O. (2007). The Ground Water of Southern Province, Zambia Phase 1. Lusaka: Ministry of Energy and Water Development. Available at: https://www.bgr.bund.de/EN (28th March, 2022)

-Central Statistical Office. (2013). 2010 Census of Population and Housing Descriptive Tables. Lusaka: Central Statistical Office. Available at:

-Makasa, F. M. (2007). The Challenges of providing Public Water and Sanitation services in a Rural Town in Zambia, The case of the Southern Water and Sewerage Company in Choma Town. London: SOAS University. Available at: https://agritrop.cirad.fr/(23rd March, 2022)

-Southern Water and Sanitation Company. (2019). Southern Water and Sanitation Company Survey Report on Sanitation Status in Choma. Choma: Southern Water and Sanitation Company.

-14 KIIs conducted to several stakeholders during 2022 (Further information in Appendix 7).

7 Appendix

7.1 Appendix 1: Stakeholder identification

Southern Water and Sanitation Company			
Gift Monde	Managing Director	+260 97 497 2414	giftmonde2003@gmail.com
Shawa Wallace	Operations Director	+260 97 740 2943	textwally@gmail.com
Ortega Choombe	Technical Manager	+260 97 842 7087	choombedanielortega@gmail.com
Eustakia Humuchenje	Community	+260 96 597 8314	emhamuchenje@gmail.com
Haabenzu Warren	Sanitation Engineer	+260 97 787 7097	warrenhabeenzu@gmail.com
Khako Siluma	Plant Operator	+260 97 736 3999	Null
David Nyondo	Maintenance Foreman	+260 97 771 1824	dvdnyondo@gmail.com
Mweetwa Patrick	Operations Officer	+260 97 779 7768	patrickmweetwa@gmail.com
Innocent Hamuyala	Plant Operator	+260 77 700 702	Null
Adrian Sibachindu	Pump attendant	+260 97 542 4309	Null
Mwiya Kayiwala	Plant Operator	+260 97 727 0997	Null
Hardly Shanumbwe	Plant Operator	+260 97 865 3000	Null
Kanyenda Noddy	Regional Manager	+260 97 748 5162	noddykanyenda@gmail.com
Thomas Chinjamba	Mechanical Fitter	+260 97 690 4569	Null

SFD Choma, Zambia, 2023

Produced by:

Gopa Infra and Borda Zambia

Editing:

Gopa Infra and Borda Zambia

This Executive Summary and the SFD Report are available from:

www.sfd.susana.org

SFD Promotion Initiative