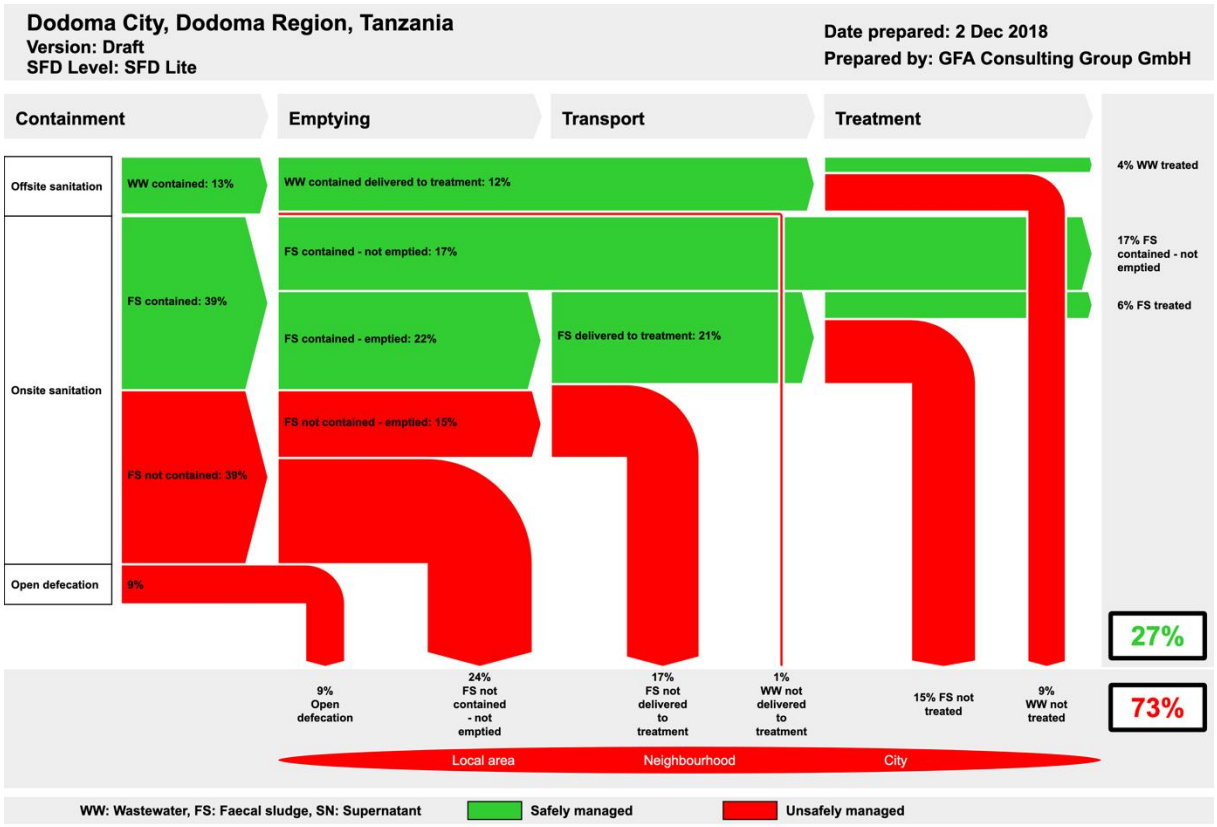
SFD Lite Report

Dodoma City
Tanzania

This SFD Lite Report was prepared by GFA Consulting Group GmbH.

Date of production/ last update: 02/12/2018

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 SFD Lite information

Produced by:

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- We acknowledge the support of Eng. Mgunda, Sewerage Engineer of DUWASA who contributed to the production of the SFD Lite and arranged several site visits and stakeholder meetings. We would also like to thank Mr. Ally-Kebby Abdallah, Chief Technical Services Officer, HPSS Project for sharing On-Site Sanitation information.

Collaborating partners:

- Dodoma City Council
- Dodoma Urban Water Supply and Sanitation Authority

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3 General city information

Dodoma City Council is located at the south-eastern end of the Tanzania Central Plateau at an elevation of 1,200 metres above sea level with coordinates 6°10′23″S 35°44′31″E. The city council is divided into 41 wards and Mtaas (streets) and covers an area of about to 2,769 sq. km. The 41 wards are grouped into four divisions, which are Dodoma Mjini, Hombolo, Kikombo and Zuzu. Statistically, 61.5% (282,500) of the population in the Municipal council is found in Dodoma Mjini division, 15.8% (72,577) in Hombolo division, 14.1% (64,768) in Zuzu division and 8.6% (39,504) in Kikombo (Dodoma Municipal Council, 2017).

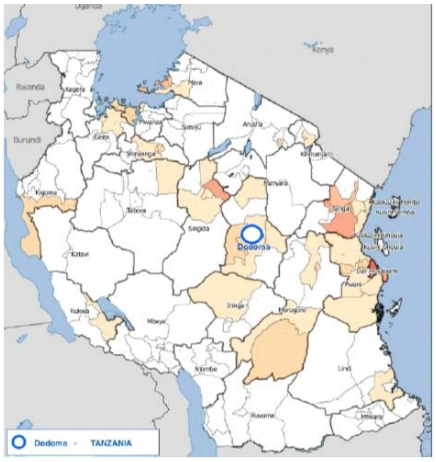

Figure 1 Location of Dodoma City Council

The Dodoma region is characterized by broad upland plains which are part of the East African‘s Central Plateau. The Plains shelve gently down to mbuga swamps and are separated by ranges of hills and punctuated by inselbergs, prominent, isolated rock outcrops (Dodoma Municipal Council, 2017).

Currently, the population of Dodoma Municipal is estimated to be **459,350** according to Sub-National Population Projection Based on 2012 Population and Housing Census (PHC) (National Bureau of Statistics, 2012). The projected population density for the Municipality in 2017 was 166 persons per sq.km. Over the past years, the population of Dodoma urban district has been increasing steadily. The average population annual growth rate was 2.4%. In general, the Dodoma City Council population dynamics is on a growing trend in both size and settlement as it is the “new” capital. (Dodoma Municipal Council, 2017).

According to PHC 2012, the highest household (HH) size in the Municipality is experienced in Hombolo division (4.6) suggesting high fertility level. Dodoma city council includes a large portion of squatted unplanned areas and housing. The land in the city is used for subsistence agriculture, grazing and forest reserve. The city has roads, which are accessible all year round especially in urban areas (Dodoma Municipal Council, 2017).

Dodoma City is a sem-iarid area, characterized by a marked seasonal rainfall distribution with a long dry season starting from late April to late November and a short wet season starting late November to the end of April. Average rainfall ranges from 550mm to 600mm per annum. The average temperatures vary from 20^0C in July to - 30^0C in November. Generally, the Council experiences both high and low temperature. The highest temperature is 31^0C while the lowest temperature is 13^0C (GFA Consulting Group GmbH, February 2018).

Sanitation challenges exist due to the very high groundwater table in Dodoma city. During the dry season, shallow unprotected boreholes are dug for drinking water. During the rainy season, overflow of pits and tanks are challenging too.

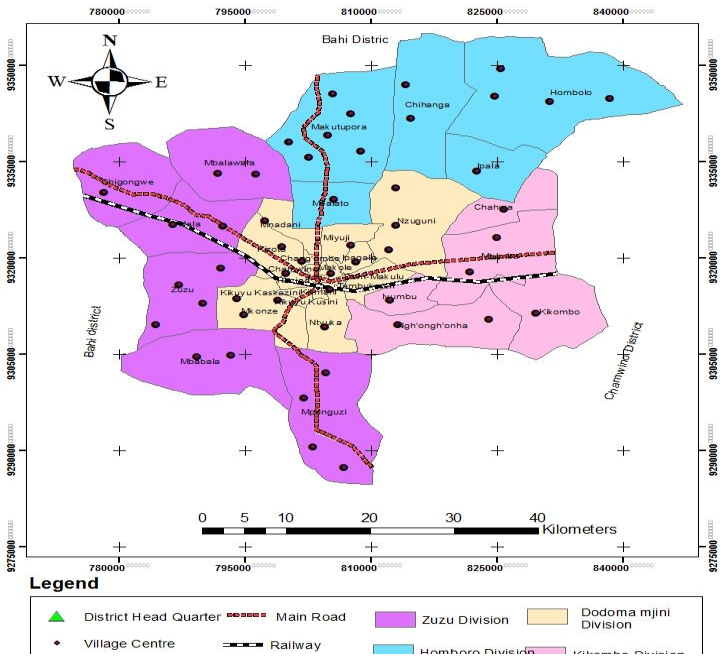

Figure 2 Dodoma City Council Boundary

4 Service outcomes

Only 13% of the population of the City Council is connected to the sewerage line. The rest of the population depends on Onsite Sanitation (OSS) with a 9% reporting to have no toilets.

About 50% of traditional latrines are reported to not be properly constructed and damaged bringing issues at the containment stage of faecal sludge management (FSM). For those using lined tanks, a larger proportion is emptied and transported to SWASWA Waste Stabilization Ponds (WSP). However,, HHs have reported frequently to manually empty their pits and dispose them in a nearby pit. With the growing population trend in the city, there will soon not be enough space for this form of sanitation, making this practice very soon an unsustainable and improper one.

The SWASWA WSP also receives the City Council's sewage. These WSP are not apt for faecal sludge treatment, although dumped there. Hence, it is reported to not function properly. The effluent water quality is below the Tanzania standards. Lastly, most of Dodoma City Council depends on groundwater for Water supply. Some high concentrations of Nitrate have been reported in both shallow and deep groundwater in the Dodoma area of central Tanzania. High values were linked to pollution from sewage effluents, with penetration of the pollution to deep levels in the crystalline aquifer via fractures (British Geological Survey, 2000). Another recent study showed that the vulnerability of ground water pollution increases with human activity mostly due to agricultural activities, but also due to improper management of sewage effluent from waste water systems, pit latrines and mismanaged solid waste (Massawe, 2017). In summary, groundwater contamination has been reported to be contaminated partly due to sewage and therefore, we assume that a risk exists for at least 20% of the population, which is not connected to the DUWASA supply network (British Geological Survey, 2000).

4.1 Containment

The Public Health Department of the City Council, who oversees sanitation, monitors the number of Households using different types of toilets. The following information comes from the latest National Sanitation Management Information System (NSMIS) on Household (HH) sanitation surveyed between July and September 2018 (KII-4, 2018) (Ministry of Health, 2018).

Table 1 Type of Toilets/Containment in Dodoma City Council

Local Classification	Nº of HHs	Percent (%)
Type A: Traditional Pit Latrine (TPL)	58,678	32
Type B : Improved Pit Latrine	36,914	21
Type C : VIP Latrine	14,093	8
Type D : Flush	52,856	29
Type E : Ecosan	2,505	1
Type X : None	15,750	9
Total	**180,796**	**100**

During the rainy season, poorly constructed traditional pit latrines easily collapse (GFA Consulting Group GmbH, 2018). Another factor in containment is that according to our KII, solid waste is often disposed

directly in the latrines or with the final disposal of faecal sludge (KII-1, 2018). We also observed many cases of “Flying toilets” which we consider as Open Defecation (ODF) (FGD-2, 2018).

Figure 3 Examples of OSS and “Flying toilets” in Dodoma City Council

4.2 Emptying

Low-income areas practice manual emptying. The households themselves empty and dig a hole close to the pit for disposal. This is very risky to the groundwater especially in areas of high water table (KII-1, 2018). In addition, during the rainy season, manual emptying increases (FGD-2, 2018). It was observed in our FGD in Muzengo Mtaa, another ward in Dodoma City, that manual emptying is illegal and a Household (HH) can be fined with Sh 50.000 (USD 25) (FGD-4, 2018).

Higher income groups get emptying and transportation services from private services or from DUWASA for their pit latrines and septic tanks (GFA Consulting Group GmbH, 2018).

It is also the case that some households simply do not empty their containments. Some households have been fined for overflowing containments.

4.3 Transport

4.3.1 Vehicle

Figure 4 Private cesspit emptier disposing at Swasa WSP

Emptying and transportation services are available and are provided by cesspit emptiers provided by both the private sector and the respective councils (GFA Consulting Group GmbH, 2018). There are Private (7 companies) and DUWASA (1) trucks. DUWASA monitors and issues permits to the private trucks.

Households pay about 30,000 (USD 15) to 60,000 (USD 30) Shillings per trip. When using a private service, households pay 45,000 (USD 22) to 120,000 (USD 60) Shillings (KII-1, 2018). One truck carries about 7,000 litres per trip and can make seven to ten trips per day (KII-3, 2018). It also occurs that during the rainy season with difficult roads, private trucks dump the FS on illegal sites (KII-1, 2018).

4.3.2 Sewer

The existing sewerage system has a total length of 81 km which consists of trunk sewers (600mm to 1,100mm diameters) covering 24.3km and lateral sewers (150mm to 400mm) covering 56.7 km. Trunk sewers have a maximum diameter of 1,100mm, a design flow rate of 3,672m^3/h and capacity of serving 423,000 people. However, due to inadequate lateral sewers, the system is currently serving about **13%** of the population occupying the metropolitan area (GFA Consulting Group GmbH, February 2018).

4.4 Treatment

The collected wastewater and faecal sludge are treated using four (4) temporary waste stabilization ponds (WSP) comprising of only anaerobic and facultative ponds, located at Swaswa area, about 7km north-east of Dodoma city (GFA Consulting Group GmbH, 2018). However, the SWASA WSP was meant to treat wastewater and not sludge. There is a need for dry beds for sludge treatment. In addition, Dodoma City Council allocated a new area for WW Treatment system at Nzughuni with an area of 60 hectares. The design involves the provision of sludge drying beds (GFA Consulting Group GmbH, 2018).

Figure 5 Swaswa WSP

According to our KII, there is 70 to 80% treatment efficiency, but the results of the effluent analysis reveal that it does not comply with the Tanzania Standards (GFA Consulting Group GmbH, 2018).

4.5 Reuse and disposal

Treated wastewater for agriculture is illegal but practised. We also observed that the sludge from wastewater stabilization ponds is disposed directly to the land and utilized as agricultural manure. Since there are no industries in Dodoma, the sludge is a result of only domestic waste, which can be considered as a soil conditioner. The SWASA WSP also disposes the sludge on the sides of the WSP where people can take the sludge for free (KII-1, 2018). However, this wet sludge remains not safe, must be handled with care, and should not be used as a soil conditioner on crops for human consumption.

4.6 Groundwater contamination

Dodoma Urban Water Supply and Sanitation Authority (DUWASA) is responsible for provision of water supply and sanitation services in Dodoma Municipality. DUWASA is currently serving **72%** of the existing town population with water supply (GFA Consulting Group GmbH, February 2018). Dodoma City depends on underground water drawn from Mzakwe Basin at Mzakwe Vil-lage. This basin is about 30km north of Dodoma town. The basin has 24 boreholes (100-130 m deep).

Figure 6 Shallow Well

The depth of the groundwater is very shallow between 2-5 m (KII-2, 2018). The area has three principal soil types; white sandy soil, red loamy soil, and poorly drained black clay soil called 'mbuga'. The groundwater is mostly found in fractured formation. Despite these fractured aquifers, groundwater is also found in the upper regolith part of the catchment. Studies have shown that high values of Nitrate levels and high groundwater pollution risk linked to pollution from sewage effluents with penetration of the pollution to deep levels in the crystalline aquifer via fractures occur in Dodoma City (Massawe, 2017)(British Geological Survey, 2000).

5 SFD Graphic

The above-described sanitation chain of Dodoma is summarised in the following SFD Graphic (Figure 7) and SFD Matrix (Table 2) and.

Most of the safely managed excreta (27%) originates from FS contained but not emptied from onsite systems located in areas of low groundwater pollution risk (17%). These tanks and pits have not yet

filled, and the situation is therefore temporary. When these pits and tanks fill, improvements to emptying, transport and treatment services will be required.

The balance (73%) of excreta are unsafely managed. Most of which is from FS not contained and not emptied from unsafe pits (24%), FS emptied but not delivered to treatment (17%) and FS delivered to treatment but not treated (15%), WW delivered to treatment but not treated (9%), and open defecation (9%).

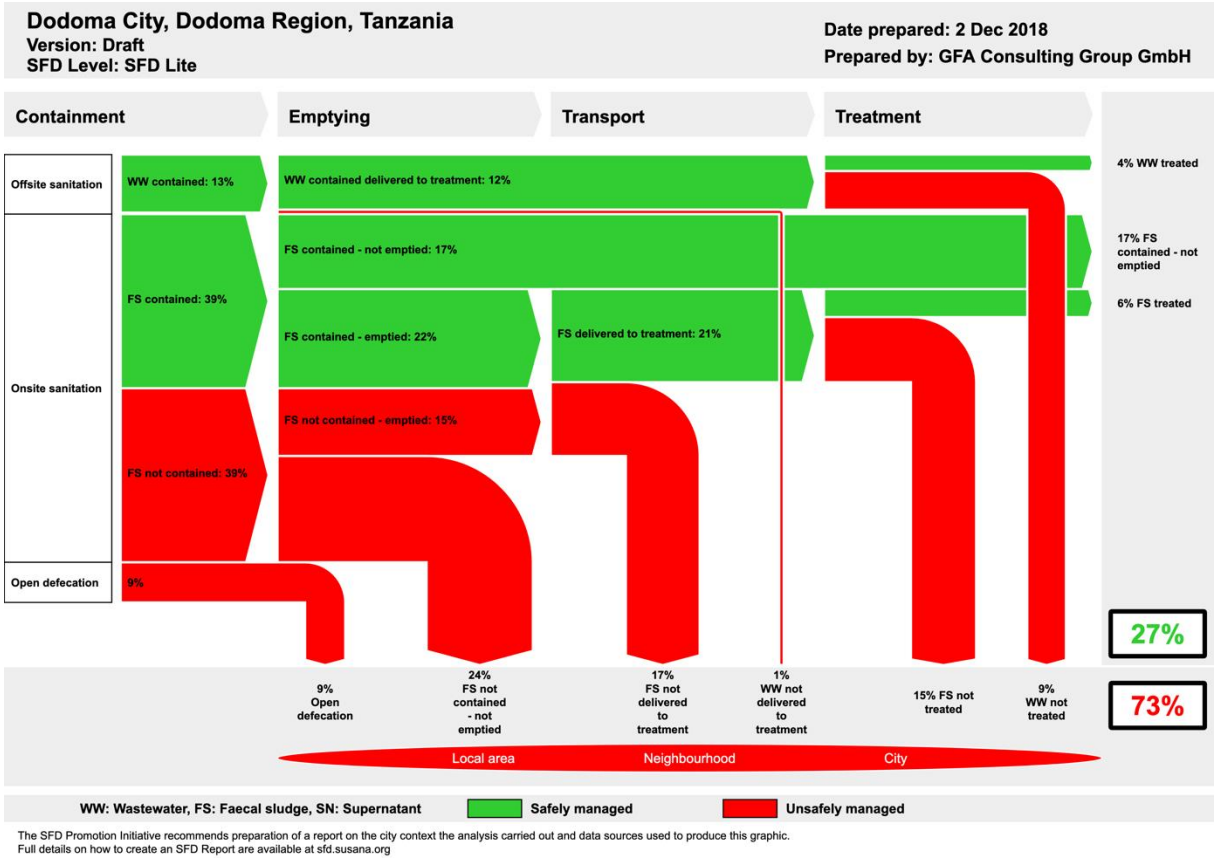

Figure 7: SFD Graphic for Dodoma City

Table 2: SFD Matrix for Dodoma City

Dodoma City, Dodoma Region, Tanzania, 30 Nov 2018. SFD Level: not set
Population: 459350
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
T1A1C2 Toilet discharges directly to a centralised foul/separate sewer	13.0	95.0	30.0			
T1A1C5 Toilet discharges directly to soak pit	3.0					
T1A2C5 Septic tank connected to soak pit	3.0			90.0	70.0	30.0
T1A3C5 Fully lined tank (sealed) connected to a soak pit	3.0			90.0	70.0	30.0
T1A3C9 Fully lined tank (sealed) connected to 'don't know where'	4.0			90.0	70.0	30.0
T1A5C10 Lined pit with semi-permeable walls and open bottom, no outlet or overflow	24.0			70.0	50.0	30.0
T1B10C10 Containment (fully lined tanks, partially lined tanks and pits, and unlined pits) failed, damaged, collapsed or flooded - with no outlet or overflow	8.0			70.0	50.0	30.0
T1B11 C7 TO C9 Open defecation	9.0					
T1B7C10 Pit (all types), never emptied but abandoned when full and covered with soil, no outlet or overflow	6.0					
T1B8C10 Pit (all types), never emptied, abandoned when full but NOT adequately covered with soil, no outlet or overflow	8.0					
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'	8.0					
T2A1C5 Toilet discharges directly to soak pit, where there is a 'significant risk' of groundwater pollution	1.0					
T2A2C5 Septic tank connected to soak pit, where there is a 'significant risk' of groundwater pollution	1.0			90.0	70.0	30.0
T2A3C5 Fully lined tank (sealed) connected to a soak pit, where there is a 'significant risk' of groundwater pollution	1.0			90.0	70.0	30.0
T2A5C10 Lined pit with semi-permeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	6.0			70.0	50.0	30.0
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	2.0					

6 Data and assumptions

Due to on-going project activities in Dodoma City Council, most of the information was easily available through the NSMIS and GIZ project reports such as a feasibility study and a sanitation baseline report (see list of data sources). To produce this SFD, a 10-day expert mission on site was carried out to complete the missing information mainly through Key-Informant-Interviews (KIIs) and Focus Group Discussions (FGDs) and site visits.

6.1 Major assumptions

Table 3 Type of Toilets/Containment in Dodoma City and SFD assumptions (GFA Consulting Group GmbH, 2018)

Local containment classification	Surveyed (%)	SFD Classification	SFD (%)
Type A: Traditional Pit Latrine (TPL)	32	Pit abandoned and covered (T1B7C10 and T2B7C10)	8 (LR: 6 ; HR: 2:)*
		Pit not adequately covered (T1B8C10)	8
		User interface collapse (T1B9 C1 TO C10)	8
		Containment collapse (T1B10C10)	8
Type B : Improved Pit Latrine	21	Lined pit (T1A5C10 and T2A5C10)	21 (LR:17 ; HR: 4:)*
Type C : VIP Latrine	8	Lined pit (T1A5C10 and T2A5C10)	8 (LR:6 ; HR: 2:)*
Type D : Flush	29	No onsite container to separate sewer (T1A1C2)	13
		No onsite container to soak-pit (T1A1C5 and T2A1C5)	4 (LR:3 ; HR: 1:)*
		Septic tank to soak-pit (T1A2C5 and T2A2C5)	4 (LR:3 ; HR: 1:)*
		Fully lined tank to soak-pit (T1A3C5 and T2A3C5)	4 (LR:3 ; HR: 1:)*
		Fully lined tank to “don’t know where” (T1A3C9)	4
Type E : Ecosan	1	Lined pit (T1A5C10)	1
Type X : None	9	No toilet. Open defecation (T1B11 C7 TO C9)	9

**LR: Low Risk; HR: High Risk*

- We observed that some households cover their traditional pits with cement and others with soil inadequately. In addition, most of the traditional pit latrines have no roof, no privacy doors, have weak slabs (soft wood used), that imply inadequate safety to users, superstructures are not stable, made up of mud bricks (48.6%), no lining for the pit thus susceptible to collapse during

the rainy season forcing households' members to seek permission from neighbours to share their sanitation facilities or go for open defecation (GFA Consulting Group GmbH, February 2018). Hence, we can assume that **50**% of traditional pit latrines collapse (25% interface and 25% containment collapse). We also assumed that **50**% of the remaining are adequately covered and others not. This assumption especially considers the risk of poor coverage and consequences during rainy season. This should further be investigated.

- It was observed that frequently HHs refer to septic tanks connected to soak pits, when in reality some were actually lined tanks connected to a soak pit. We also observed through our site visit in Ng'hong'ohna that Pour flush toilets were connected to tanks with no soak pit. (FGD-4, 2018). In addition, there are cases where the Pour flush toilet is directly connected to the soak pit. We assume that these four categories are equally divided (FGD-1, 2018).
- It has been observed that "no toilets" can also include in addition to Open Defecation (ODF), a percentage of the population that has no toilet, but uses toilets from neighbours (KII-2, 2018). Some HHs with toilets might even practice open defecation due to poor maintenance and hygiene of toilets. Hence, the 9% can represent all these scenarios.
- It has been observed that there are cases of overflowing toilets where HHs do not empty their containments. We have observed cases of HHs being fined due to the lack of emptying. Based on our FGDs and KIIs, we assume that **70%** of HHs empty their tanks (KII-3, 2018) (FGD-4, 2018)(FGD-1, 2018). We assume for what is referred as flush toilets connected to tanks, soak pits and septic tanks that **90%** of these do get emptied. More investigation is needed to understand emptying scenarios.
- We obtained an estimate that about **70%** of households transport their FS through emptying services to the Swawsa WSP (KII-3, 2018). We assume this is the case for what is referred to as lined tanks locally, but for pits it is likely to be less at **50**%. During the rainy season, there is a lot of illegal dumping. HHs also frequently manually empty and simply dump the FS to a nearby pit, which is not considered as a proper transportation to a treatment site. Hence, for pits, we assume 50%, due to these scenarios (GFA Consulting Group GmbH, 2018).
- We assume **95**% of wastewater is delivered to the WSP. Blockages causing leaks occur (FGD-1, 2018).
- We assume only **30**% of faecal sludge and wastewater are actually treated based on explanations from section 4 on treatment. The WSP is not apt for treating sludge.
- Since 72% of Dodoma City Council is served through the DUWASA Water supply network, we assume that the rest use ground water source, which may have a High Risk to pollution from inadequate sanitation. Hence, we assume that **20** % of the population is at risk, as explained in section 4 for groundwater pollution contamination.

7 List of data sources

British Geological Survey, 2000. *Ground Water Quality: Tanzania,* s.l.: WaterAid.

Dodoma Municipal Council, 2017. *Dodoma Profile,* Dodoma, Tanzania: Dodoma Municipal Council.

FGD-1, 2018. *Solid & Liquid Waste Officer, Dodoma City Council & Sewerage Engineer, Duwasa* [Interview] (November 2018).

FGD-2, 2018. *Sewarage Engineer (DUWASA), Muyengo Mtaa Sanitation Committee and GIZ Dodoma Focal Point* [Interview] (November 2018).

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KII-1, 2018. *DUWASA, Sewerage Engineer* [Interview] (November 2018).

KII-1, 2018. *Municipal Public Health Officer, Mr. Kuchibanda* [Interview] (27 November 2018).

KII-2, 2018. *DUWASA, Technical Manager* [Interview] (November 2018).

KII-3, 2018. *Kelly Drain Maintenance Services, Truck Manager* [Interview] (November 2018).

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