

# PILOT PROJECT ON FAECAL SLUDGE MANAGEMENT IN POLOKWANE MUNICIPALITY: CONSOLIDATED REPORT

February 21, 2022

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United States Agency for International Development (USAID)/Southern Africa  
USAID Contracting Officer's Representative:  
Graham Paul



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## LIST OF ACRONYMS

CSDA	City Service Delivery Assessment
DWS	Department of Water and Sanitation
FS	Faecal Sludge
FSTP	Faecal Sludge Treatment Plant
FSM	Faecal Sludge Management
HH	Households
IDP	Integrated Development Plan
MTEF	Medium-term Expenditure Framework
O&M	Operations and maintenance
PLM	Polokwane Local Municipality
PPP	Public Private Partnership
RSA	The Republic of South Africa
SFD	Faecal waste (Shit) Flow Diagram
SSP	Sanitation Safety Plan
USAID	United States Agency for International Development
VIP	Ventilated Improved Pit latrine
VIDP	Ventilated Improved Double Pit
WSA	Water Services Authority
WW	Wastewater
WWTW	Wastewater Treatment Works

# PILOT PROJECT ON FAECAL SLUDGE MANAGEMENT IN POLOKWANE

## MUNICIPALITY: CONSOLIDATED REPORT

### INTRODUCTION

This report consolidates the findings from three reports representative of the workstreams undertaken in this pilot project. The pilot project was funded by the USAID Resilient Waters Program, through a Collaboration Agreement with the Polokwane Local Municipality. The project piloted a series of planning and decision making tools in on-site sanitation management with the aim of documenting all steps, approaches and lessons learned throughout the process. The ultimate objective of this pilot project was to use the documented findings as a guide in the development of a National Faecal Sludge Management Strategy for South Africa. This national strategy was being developed in parallel to the pilot project and through a separate collaboration agreement between the USAID Resilient Waters Program and the National Department of Water and Sanitation in South Africa. This report is a summary of the findings and recommendations from five of the six project workstreams, as follows:

- City Service Delivery Assessment (CSDA)
- Faecal waste flow diagram (SFD)
- Sanitation Safety Plan (SSP)
- Wastewater (WW) Analysis
- Wastewater and Faecal Sludge Management (FSM) Reuse Options Analysis

The Urban Resilience workstream will build on the findings and recommendations from the five workstreams and will result in a standalone Urban Resilience Toolkit for the Polokwane Local Municipality. Therefore it is not included in this Consolidated Report.

This document represents Report 4 from a series of reports developed throughout the pilot project. The full list of reports are:

- Report 1: CSDA and SFD Report – Context, findings and priority action recommendations
- Report 2: Sanitation Safety Plan Report – Risks and hazards, findings and risk mitigation implementation and monitoring plan
- Report 3: WW and FSM Reuse Options Report – Findings and recommendations for reuse options
- Report 4: Consolidated Report of all findings

The first three reports are extremely detailed, and context research was integrated through the reports, to enable each new report to build on the findings from the previous reports. The sanitation context is Polokwane, and information gaps along the service chain – which led to the assumptions for the SFD and are included in Report 1: CSDA / SFD Report. The hazard and risk analysis conducted in

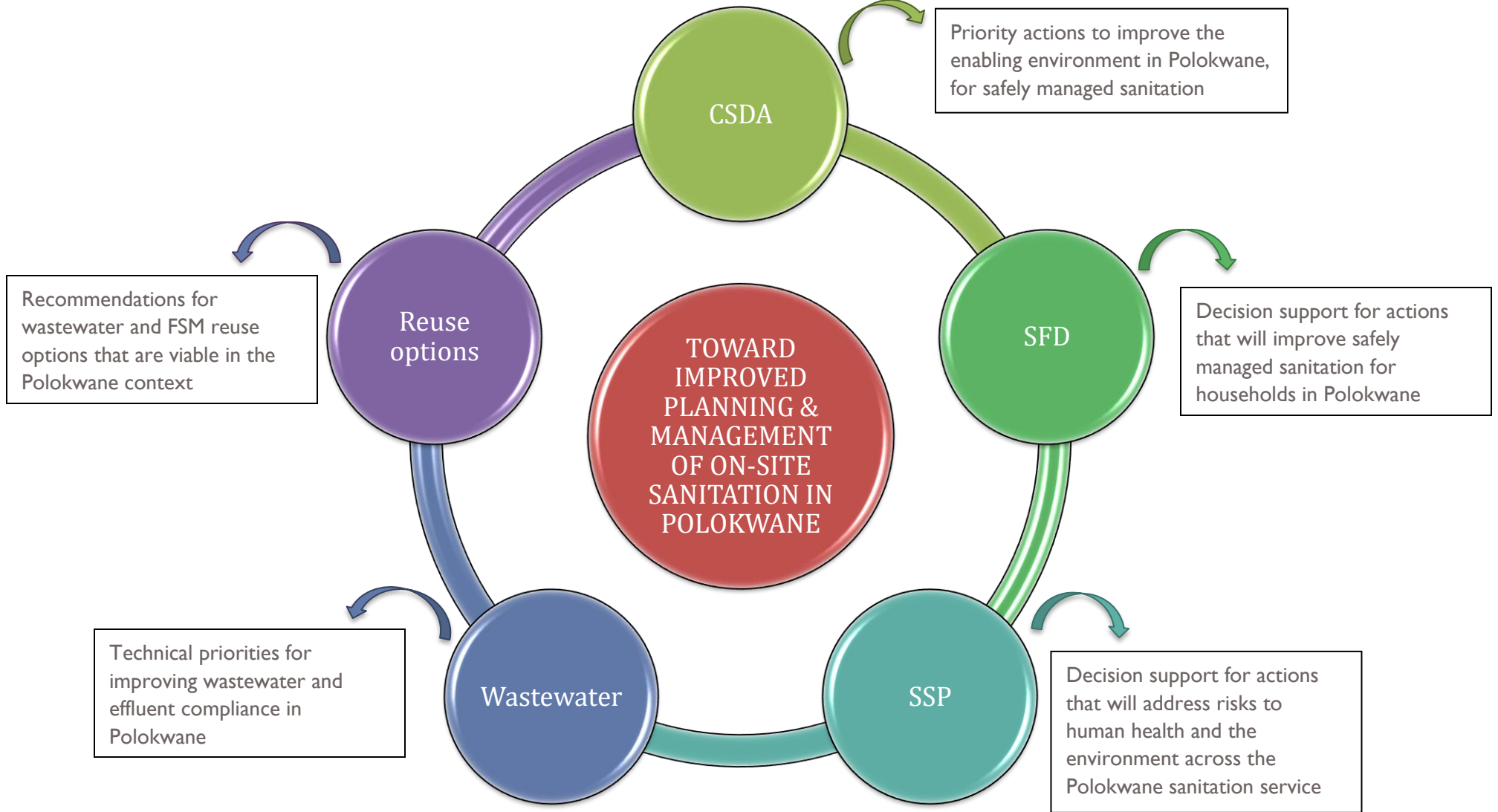


Report 2: SSP, provided considerable background for the development of the Urban Resilience toolkit. Report 3: Options analysis builds on the findings of the previous workstreams to identify on-site sanitation technology options that are viable in the Polokwane context. Report 4: Consolidated Report summarises the findings from Report 1, 2 and 3 and presents the main recommendations for the Municipality aligned with the sanitation service chain.

A diagrammatic representation of this report is shown in Figure I.



FIGURE 1: TOWARD IMPROVED PLANNING & MANAGEMENT OF ON-SITE SANITATION IN POLOKWANE - IMPLEMENTATION ACTIONS



## THE CITY SERVICE DELIVERY ASSESSMENT

The City Service Delivery Assessment is structured around three broad areas: enabling services, delivering services, and operating and sustaining services. Across these broad areas there are eight categories of indicators and a total of 24 indicators altogether. A detailed CSDA and SFD report comprises Report I of the project report series.

### SUMMARY OF FINDINGS

The summary views for the CSDA findings for Polokwane are shown in **FIGURE 2.2** below. These scores are an aggregation of the individual indicator scores, collapsed under nine headings.

- Overall, there is a strong enabling policy and legislative environment for sewered sanitation and for the containment of faecal waste. However significant gaps exist in terms of the emptying, transport, and treatment of faecal waste.
- In line with National Policy, Polokwane has a normative framework which seeks to ensure the delivery of inclusive sanitation services. However, in reality this framework only really addresses issues of sanitation access for the poor and even on this measure, funding constraints mean the Local Municipality is struggling to keep pace with the backlog of demand. Moreover, support to other parts of safe faecal sludge management across the service chain are neglected.
- Budgeting and investment planning for sanitation only covers sewered sanitation and faecal sludge containment through public funds. These funds are increasingly scarce, undermining service delivery and service sustainability.
- Local Municipal capacity to plan, deliver and sustain sewered sanitation service is weak given chronic underfunding of staff roles. Local Municipal capacity to plan, delivery and sustain non-sewered FSM service beyond containment is almost non-existent.
- The current levels of planned investment in sewered and non-sewered sanitation service expansion are not sufficient to keep pace with expected growth, meaning the backlog in access to basic services is likely to increase without increases in public sector, private sector, or household funding of safe sanitation services.

**FIGURE 2: OVERALL SUMMARY OF CSDA FINDINGS IN POLOKWANE**

Sewered sanitation				Non-sewered sanitation			
	WC, house connection	Sewerage	Sewage treatment & reuse	Toilet, pit or septic tank	Emptying & transport	Sludge treatment & reuse	
<b>Enabling</b>				<b>Enabling</b>			
Policy, legislation	1.0	1.0	1.0	0.8	0.2	0.3	
Planning, budgeting	1.0	0.8	0.8	0.8	0.0	0.0	
Inclusion	0.5	0.5		1.0	1.0		
<b>Delivering</b>				<b>Delivering</b>			
Funding	0.7	0.3	0.5	0.5	0.0	0.0	
Capacity, outreach	0.3	0.2	0.2	0.3	0.0	0.2	
Inclusion	0.5	0.3		0.8	0.5		
<b>Sustaining</b>				<b>Sustaining</b>			
Regulation, cost recovery	0.5	0.2	0.3	0.5	0.0	0.2	
Institutions, service providers	0.4	0.5	0.4	0.1	0.1	0.3	
Inclusion	0.5	0.3		0.3	0.0		

## PRIORITY ACTIONS

As a result of the CSDA analysis the following proposed priority actions were endorsed by Polokwane stakeholders:

1. Formally agree on a local strategic framework for FSM, which clearly outlines mandates, responsibility and accountabilities for FS emptying, transport, and treatment services. Beyond the role of Municipalities and the private sector, this framework should also clarify household responsibilities in terms of safe management of faecal waste and address the role of Municipality monitoring and enforcement.
2. Incentivise faecal sludge disposal at recognized sites and introduce sanctions for illegal dumping.
3. Strengthen monitoring framework and capabilities for both sewerred and non-sewerred sanitation.
4. Build awareness and an evidence-base around the budgetary requirements for sewerred and non-sewerred sanitation to better Local and National Government budgeting processes.
5. Explore opportunities and the scope to build customer demand/willingness to pay for safe FSM, particularly safe on-site containment of full pits and/or pit emptying.
6. Build public and private sector capacity for city-wide FSM services.

## THE FAECAL WASTE FLOW DIAGRAM

The SFD graphic provides an overview of sanitation service outcomes across a variety of contexts (city centre, peri-urban, township and rural).

Three SFDs are presented below:

- An SFD graphic was developed for the overall Polokwane Local Municipality (PLM) (Figure 33).

This overall SFD helps with understanding localised FSM risks and thus priority areas such as the most densely populated and underserved areas of PLM.

- An SFD was designed for the urban cluster (City Centre/Seshego township) (Figure 44), where most households have access to flush toilets connected to the sewer.
- Another SFD was developed for the rural areas (FIGURE 55), where households solely rely on on-site sanitation with no sewer connections.

These SFDs were based on fieldwork data collection and observations. Developing separate SFDs allows PLM to identify areas of concern in the urban and rural areas.

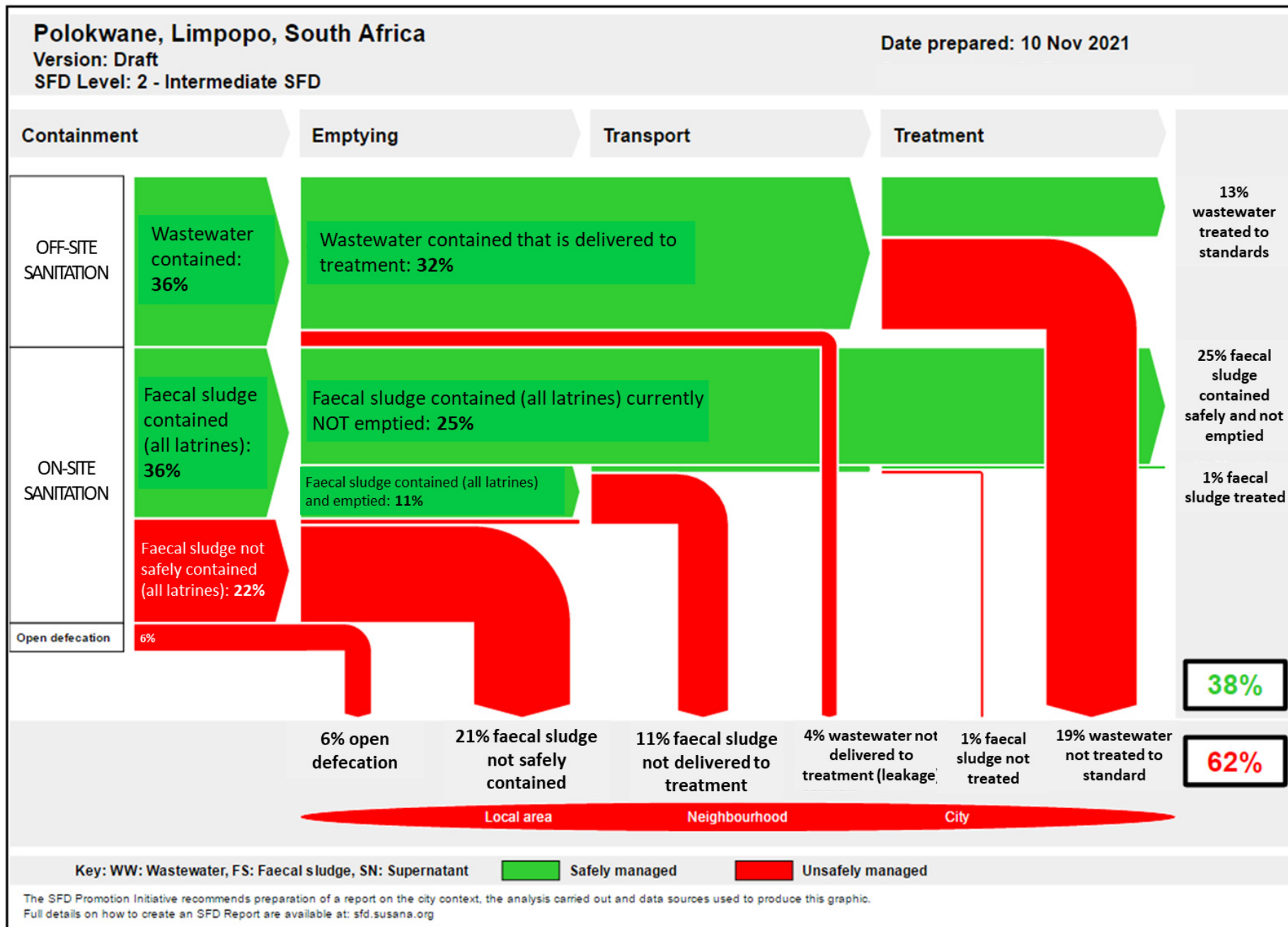
- Thirty-eight percent of the population of Polokwane’s faecal sludge, is, safely managed across the sanitation service. This percentage does not differ from greatly between the urban (37% of the population) or rural (38% of the population) contexts.
- Among the percentage of the population in urban (63%) and rural areas (62%) that are exposed to unsafely managed faecal sludge, the challenges experienced in both contexts are different,

**TABLE I.**

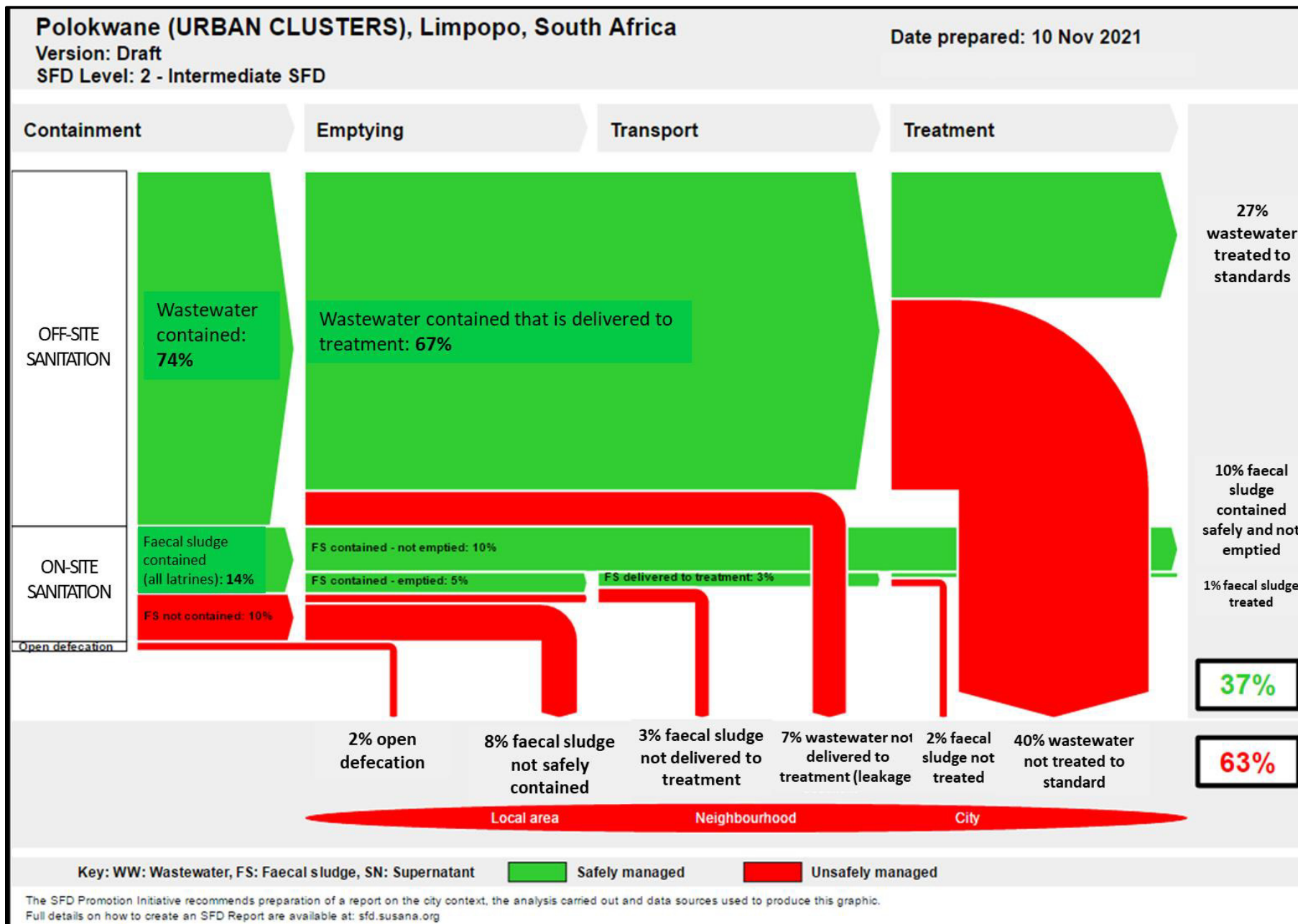
**TABLE I: PRIORITY CHALLENGES IN URBAN VS RURAL AREAS OF POLOKWANE**

Urban areas	Rural areas
60% of the population’s wastewater (off-site sanitation) returns to the environment untreated. This accounts for 40% of the total faecal sludge generated by urban dwellers.	47% of the population’s faecal sludge is not safely contained on-site
Sewer leakage means that 7% of population’s wastewater does not reach WWTWs	9% of the population practise open defecation
8% of the population’s faecal sludge is not safely contained	

**FIGURE 3: OVERALL POLOKWANE SFD GRAPHIC**

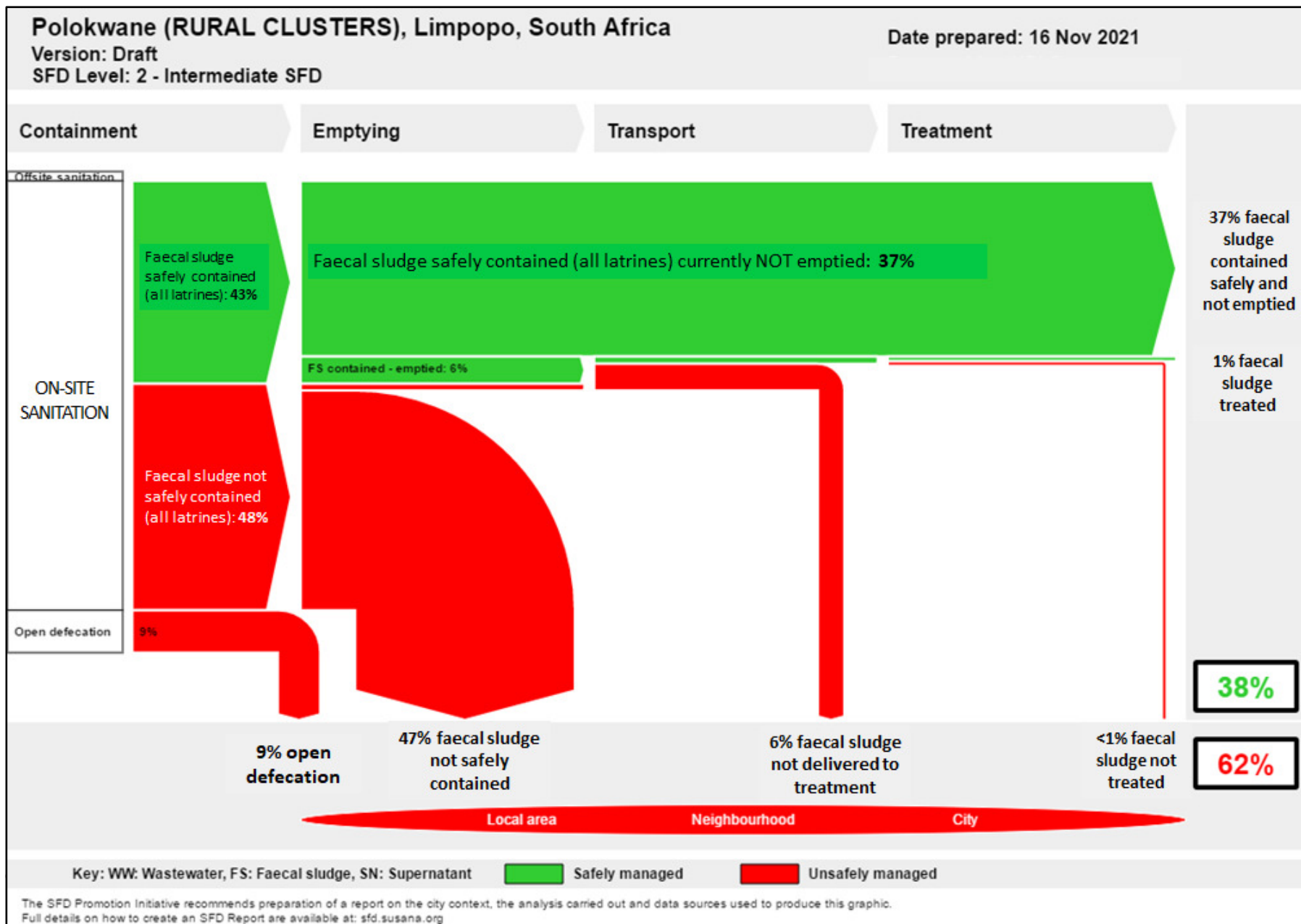


**FIGURE 4: URBAN CLUSTERS POLOKWANE SFD GRAPHIC**





**FIGURE 5: RURAL CLUSTERS POLOKWANE SFD GRAPHIC**



Key conclusions from the SFD, which also form the basis for the *Sanitation Safety Plan* are as follows:

<b>Municipal service provision:</b>	There is a high sewer connection rate in the City Centre, communal blocks and mobile toilets provision in urban areas, and a rollout plan for building VIPs in rural areas. The backlog remains around 48%.
<b>Challenges of infrequent emptying and pit maintenance in urban areas:</b>	Full pit latrines pose a major risk of a return to open defecation in a densely populated area.
<b>Limited maintenance of pits:</b>	The underground structure in a high percentage of pit latrines is estimated to be poorly maintained, and user knowledge of the effective use and maintenance of pit latrines is very limited beyond superstructure cleaning.
<b>Unsafe pit expansion practices:</b>	Emptying of full pit latrines is rare in Polokwane and 25% of the faecal sludge remains contained underground. Households tend to cover, expand, or dig a new pit, and reliance on emptying services is an uncommon practice.
<b>Pit latrines filling up fast and limited emptying services:</b>	StatsSA estimates that only 10% of households with pit latrines in the country have full pits but an important emptying challenge will emerge in 5 to 10 years in Polokwane, depending on the sludge accumulation rate in pits. Sludge contained in VIP latrines (providing the design has not been altered) is safely contained and does not represent a major public and environmental health risk, because it has gone through anaerobic digestion. PLM constructs 3,000 – 4,000 latrines each year, and many of these latrines are not full yet. However, at a rate of 5 to 10 years these VIPs will be full soon and the probability that they will not be emptied, properly dismantled, and relocated is very high.
<b>Low treatment compliance:</b>	Overall, the three existing treatment works can only treat 40% of the wastewater reaching the plants.

## THE SANITATION SAFETY PLAN

The Sanitation Safety Plan (SSP), developed by the World Health Organization in 2015, is a step-by-step risk-based methodology to assist in the implementation of local level risk assessment and management for the sanitation service chain - from toilet, containment/storage and treatment, conveyance, treatment and end use or disposal. A detailed Sanitation Safety Plan report comprises Report 2 of the project report series.

### SUMMARY OF HOUSEHOLDS AT RISK

The findings below indicate the number of households at risk from unsafely managed sanitation in the Polokwane Local Municipality. These numbers were identified by participants from the Municipality, and other Polokwane based stakeholders in participatory workshops.

**1) Users of latrines (≈ 12 000HH) and septic tanks (≈ 4 000HH) falling into the pits caused by broken/missing covers, slabs, and manholes.**

This hazardous event relates to the **design, quality of construction materials, approval procedures, maintenance and monitoring of on-site sanitation technologies.**

2) **Sanitation operators - vacuum truck operators emptying and transporting faecal sludge (≈ 150pp) and WWTP operators receiving faecal sludge (≈ 10pp) ingesting pathogens, falling into pits, and inhaling gases.**

These hazardous events express the lack of safety measures in place to safeguard **the health of sanitation workers.**

3) **Residents in urban areas of Polokwane (≈135 000HH) ingesting pathogens after contact with faecal sludge discharged without treatment onto the open environment.**

The selection of this hazardous event reflects the level of urgency that participants feel about the current practice of **disposing of fresh faecal sludge in the open environment.** This is particularly relevant for the Faecal Sludge Management Initiative in Polokwane, as tackling this problem would shed some light about technical, managerial, regulatory, and behavioral change options to safely manage faecal sludge in South Africa.

4) **Families living in or in the vicinity of informal/peri-urban areas with VIPs, traditional latrines, and communal latrines (≈ 28 000HH) ingesting pathogens after contact with faeces resulting from open defecation.**

The selection of this hazardous event reflects the level of urgency that participants feel about the current practice of **open defecation.**

**This represents a total of almost 200,000 households at risk**

























## **KEY FINDINGS OF THE SANITATION SAFETY PLAN**

The Sanitation Safety Plan report contains detailed implementation plans to mitigate these risks and each is accompanied by a risk monitoring and management plan.

An example of implementation activities that are categorized as “Immediate” and “Short-term” is shown in **TABLE 2.**

**TABLE 2: UNSAFELY MANAGED SANITATION RISK MITIGATION ACTIONS IN POLOKWANE**

















<b>CONTROL MEASURES TO MITIGATE THE RISK OF USERS OF ON-SITE SYSTEMS FALLING INTO LATRINE PITS AND TANKS</b>					
<p><b>Step of the sanitation service chain:</b> P3U -Traditional latrines in urban areas and PIU- Flush/pour toilets connected to tanks</p> <p><b>Description of the hazardous event:</b> Ingestion/Asphyxiation after falling into pits with broken/missing covers and in tanks with broken/missing manholes or covers</p> <p><b>Exposure group:</b>                      U6- Users of rudimentary, self-made latrines. Mostly vulnerable members of the population, with low income (12 000HH, around 36000pp.)                      U1- Users of flush/pour toilets connected to septic tanks and cesspool tanks on their properties in urban areas (4 000HH, around 12.000pp.)</p> <p>Improvement options:</p>					
Control measure for this hazardous event	Effectiveness	Feasibility	Resources required	Effectiveness in climate scenario	Timeframe
Prepare <b>technical standards</b> including materials, dimensions, and location of pit latrines. Get approval by the City Council.					Immediate
<b>Training</b> of masons/contractors for the correct construction and installation of VIPs, septic tanks and cesspools.					Short
Prepare an <b>SOP / technical guideline</b> for approval of new infrastructure and periodic inspections by Building Inspectorates.					Short
<b>Training</b> of contracted project engineers and PLM project managers who approve new toilets, latrines or cesspools.					Short
<b>Develop a cadaster system to monitor on-site systems in urban areas to be maintained by PLM</b>					Immediate-Short
<b>Communication campaign to encourage families to install latrines and septic tanks/cesspools with minimum safety standards</b>					Short
<b>CONTROL MEASURES TO SAFEGUARD THE HEALTH OF SANITATION WORKERS: IMPROVEMENT OPTIONS</b>					
<p><b>Step of the sanitation service chain:</b> T1- Conveyance by vacuum trucks</p> <p><b>Description of the hazardous events:</b>                      Ingestion after contact with faecal sludge /Asphyxiation while falling into tanks or pits                      Ingestion after contact with faecal sludge while emptying and transporting faecal sludge                      Inhalation of harmful gases while emptying the pits</p> <p><b>Exposure group:</b> W1- Vacuum truck operators. (About 150 operators. There are about 50 companies. They work in groups of 2-4)</p>					
<b>IMPROVEMENT OPTIONS</b>					
Control measure for this hazardous event	Effectiveness	Feasibility	Resources required	Effectiveness in climate scenario	Timeframe

<b>Building a database</b> of all private companies providing faecal sludge emptying and transport services					Immediate
Prepare a <b>technical guide</b> on safety in the workplace for sanitation workers (including the use of PPE, a vaccination program, use of equipment, washing facilities).					Short
Pass a <b>new regulation</b> about safe workplace for sanitation workers, with responsibilities for employers and employees.					Immediate
<b>Communication</b> program to all private emptying companies about the new regulations.					Short
Development of an <b>enforcement programme</b> to monitor the implementation of the safety in the workplace guidelines.					Short
Building a database of all private companies providing faecal sludge emptying and transport services					Immediate

**CONTROL MEASURES TO MITIGATE THE RISK OF INGESTING PATHOGENS RELEASED DURING THE DISCHARGE OF FAECAL SLUDGE IN THE OPEN ENVIRONMENT**

**Step of the sanitation service chain:** P8U- Disposal of faecal sludge in the open environment  
**Description of the hazardous events:** Ingestion after contact with faecal sludge discharged without treatment to the open environment  
**Exposure group:** WCI- Residents in urban areas of Polokwane (About 135 000HH)

**IMPROVEMENT OPTIONS:**

Control measure for this hazardous event	Effectiveness	Feasibility	Resources required	Effectiveness in climate scenario	Timeframe
Issuing a <b>Municipal Decree/By-law</b> for FSM in collaboration with the Local Municipality.					Immediate* it will depend on the times of the Local Municipality
Issuing a <b>regulation/by-law</b> mandating all truck operators to bring all the faecal sludge to the WWTPs/transfer stations.					Immediate* it will depend on the times of the Local Municipality
Development of a vacuum truck surveillance standard operating procedure (SOP)					Short
Training and strengthening enforcement authorities (Law Enforcement Section at PLM)					Short

















**CONTROL MEASURES TO MITIGATE THE RISK OF INGESTING PATHOGENS RELEASED DURING OPEN DEFECACTION**

**Step of the sanitation service chain:** P9U-Open defecation

**Description of the hazardous events:** Ingestion after contact with faeces resulting from open defecation

**Exposure group:** L2- Families living in or in the vicinity of informal/peri-urban areas with VIPs, traditional latrines, communal latrines (Estimated 28 000HH, about 84 000pp. About half are children)

**IMPROVEMENT OPTIONS:**

Control measure for this hazardous event	Effectiveness	Feasibility	Resources required	Effectiveness in climate scenario	Timeframe
Issuing a Municipal Decree/Resolution to recognize open defecation in urban areas as a problem with a dedicated budget.					Immediate
Increasing the frequency of communal toilet cleaning and maintenance					Immediate
Programme by Community Health Workers to survey the status of communal toilets					Short
Implement an Information, Education and Communication campaign to achieve community ownership of existing toilets					Short

## FAECAL SLUDGE AND WASTEWATER REUSE OPTIONS

Various FSM options for implementation within the Polokwane Local Municipality context, taking the entire FSM chain into consideration are identified based on the Polokwane Options Analysis Report: Report 3 of the project report series.

### CONTAINMENT

Various containment/toilet options were discussed that can be implemented in the PLM context. These included wet systems (such as pour-flush, aqua-privy and soakaway and a septic tank and soakaway system) and dry on-site systems (such as the VIP and VIDP, as well as composting and urine diversion systems). It is recommended that all new toilets are contained systems. The selection of the type of toilet system is not within the scope of this pilot project, but it is important that whatever systems are selected, that the FS is contained and the collection, transport and treatment systems are designed with the particular type of FS being generated.

It is also recommended that uncontained systems and pits currently in operation (i.e., the unimproved pits) are decommissioned and are replaced with contained systems. Decommissioning would involve safely covering the pit and allowing the FS to stabilize naturally. The phasing of this would need to be planned by PLM.

Bucket systems have been shown to result in unsafely managed FS, if not collected regularly, and thus, if the buckets cannot be used safely, then a new structure is required to ensure that the buckets are collected as per the designated schedules.

### COLLECTION/EMPTYING & TRANSPORT

Emptying and transport are very much inter-related and have therefore been grouped under one heading. It would seem that this should continue to be outsourced as the PLM indicated that there is not sufficient internal capacity to facilitate these operations. However, some changes to the existing system are required.

Emptying technologies should avoid fully manual operations where possible as this poses the highest health risk due to pathogen contact. It is likely that service providers will need both honey suckers (or vacuum tankers) – to be used where access is possible, and manually operated mechanical systems (such as the Gulper, Pitvaq or Pit Screw Auger) – to be used where trucks/tankers cannot access pits.

It is also critical that an enabling environment is created, and suitable business models and incentives put in place around collection and transport of FS to ensure pits are emptied before they are full and illegal dumping is reduced. To this end, further investigation is required into a system whereby the PLM can manage, record and co-ordinate the emptying of pits with deliveries at the treatment facility. This would need to involve the following components:

- Stakeholder engagement with private tanker operators to workshop various options
- Registration/licencing of private tanker companies

- Drafting or adjustment of bylaws to regulate licencing, emptying methods, transport, and delivery
- A centralised tanker ordering system (such as a mobile application)
- Logging of collection/emptying and deliveries at the WWTW (or other treatment location)
- Co-ordinating and checking collections and deliveries
- Issuing of fines or removal of licences for illegal dumping of FS
- Incentives for compliance
- Routine testing of the FS

Travel distance to disposal points and/or WWTW is another important consideration for FS transport. Optimisation may require transfer stations to be installed. This will need to be evaluated further in a feasibility study and could be a finding of the stakeholder engagement process with the private operators.

### TREATMENT AND DISPOSAL

Based on the SFD, 40% of the population that are exposed to unsafely managed FS in the urban area is due to poor treatment at the WWTW. Thus, the refurbishment and operational improvements at the WWTW is the primary recommendation for improving the SFD for the urban sector.

When it comes to how best to treat the FS (existing and additional), the top three FSM treatment options identified from the two workshop sessions hosted in November 2021 are listed and ranked as follows:

1. Deep Row Entrenchment
2. Co-Treatment at WWTW
3. Co-Composting

A feasibility study for each of these options is required to enable a final selection. However, the workshop processes indicated that these three are the most suitable options for the PLM context and were selected with input from the PLM Municipal Officials, Department of Water and Sanitation and USAID Resilient Waters Program team.



U.S. Agency for International Development

1300 Pennsylvania Avenue, NW

Washington, D.C. 20523

Tel.: (202) 712-0000

Fax: (202) 216-3524

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