SFD Promotion Initiative

Ulundi

Zululand District Municipality, KwaZulu-Natal, South Africa

SFD Lite Final Report

This SFD Lite Report was created through field-based research by Emanti Management for a Water Research Commission project and as part of the SFD Promotion Initiative.

Date of production: 30 November 2018

Last update: 30 November 2018

SFD Lite Report

The SFD Promotion Initiative (SFD PI) has developed recommended methods and tools for preparing SFD Graphics and Reports. A full SFD Report consists of the SFD Graphic, the analysis of the service delivery context and enabling environment for service provision in the city for which you are preparing your SFD, and the complete record of data sources used. This analysis allows a systemic understanding of excreta management in the city, with evidence to support it. As a starting point (first step stone) to this (explained in detail in the SFD Manual), the SFD Lite is a simplified reporting template that summarises the key information about the excreta management situation in the city.

SFD Lite Report Ulundi LM, South Africa, 2018

Produced by:

Thabisa Manxodidi, Emanti

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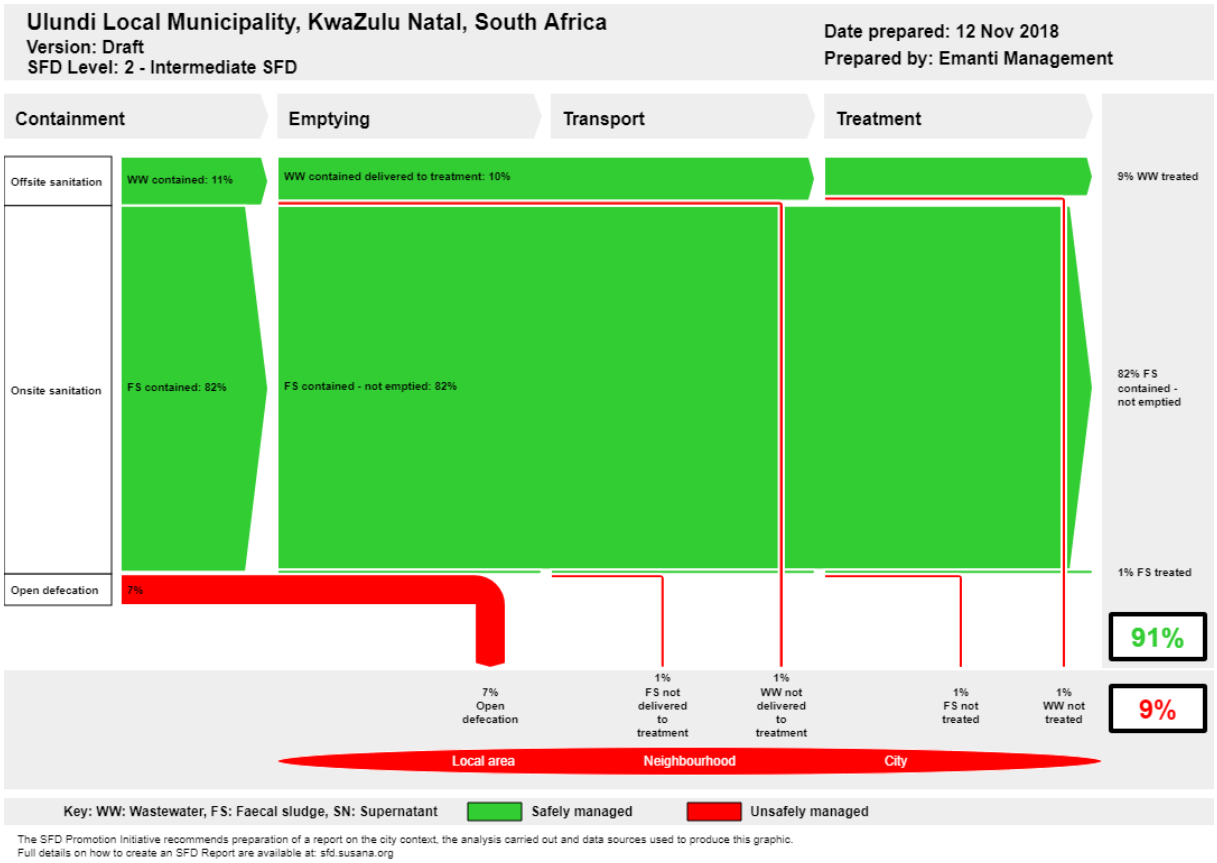
Unathi Jack, Emanti

Executive Summary

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

Desk or field based:

This is a field based SFD.

Produced by:

Emanti Management (Pty) Ltd, Stellenbosch, South Africa.

Status:

This is a final SFD.

Date of production:

30 November 2018

3. General City Information

Location

Town background

Population

Urban/rural split

Households

Growth rate

Persons per household

Area

Persons per km^2

Rainfall

Temperature

4. Service outcomes

The following sanitation technologies were noted:

- Toilet discharges directly to a centralised foul/separate sewer – flush toilets are connected directly to the wastewater treatment plant.
- Fully lined tank – sealed, no outlet or overflow – these are either buried concrete tanks, buried plastic tanks or plastic tanks covered with concrete slabs.
- Containment (fully lined tanks, partially lined tanks and pits, and unlined pits failed, damaged, collapsed or flooded – with no outlet or overflow – these are the tanks made from cement blocks with two compartments. Seepage emanating from these tanks through these blocks was noted.
- Pit (all types) never emptied, but abandoned when full and covered with soil, no outlet or overflow – these are pits that are not lined and never emptied. When full, the top structure is removed and taken to a new pit. These pits are covered with soil when abandoned.
- Pit (all types) never emptied but abandoned when full but NOT adequately covered with soil, no outlet or overflow – these are pits that are not lined and never emptied. When full, the top structure is removed and taken to a new pit. It is believed that these pits are not adequately covered with soil when abandoned.
- Pit (all types) never emptied but abandoned when full and covered with soil, no outlet or overflow – some of these unlined pits are located where the groundwater table is high. Some of these unlined pits are located in sandy soil type and ground water monitoring results have indicated non-compliance.

5. SFD development process

Data was collected through secondary sources (reports, plans), and then Ulundi was visited to conduct interviews with the relevant stakeholders, including site visits to infrastructure to witness the on-the-ground situation. This information was used to fill in gaps and cross-check data collected.

The data was fed into the SFD Graphic Generator to calculate the excreta flow in terms of percentage of the population.

91% of the excreta in Ulundi is managed safely as there is some treatment at the Ulundi WWTW, but excreta for 9% of Ulundi is not managed safely, as it is not contained and can pollute groundwater sources and the environment. No open defecation is noted.

NOTE: Excreta being safely managed or not is dependent on the containment of the system, and not on whether the waste is safely handled or not.

6. List of data sources

Below is the list of data sources used for the development of the SFD.

- Published reports: Census 2011, Community Survey 2016
- Unpublished documents: IDP, WSDP
- Key informant interviews: ZDM

SFD Lite Report ZDM, South Africa, 2018
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Abbreviations

DM	District Municipality
DWS	Department of Water and Sanitation
FS	Faecal sludge
GDS	Green Drop System
IAM	Infrastructure Asset Management
ICT	Information and Communications Technology
IDP	Integrated Development Plan
IT	Information Technology
LG	Local Government
LM	Local Municipality
MuSSA	Municipal Strategic Self-Assessment
NRW	Non-Revenue Water
O&M	Operations and Maintenance
RDP	Reconstruction and Development Programme
SALGA	South African Local Government Association
SDBIP	Service Delivery and Budget Implementation Plan
SFD	Shit Flow Diagram
StatsSA	Statistics South Africa
VIP	Ventilated Improved Pit Latrine
W_2RAP	Wastewater Risk Abatement Plan
WCDM	Water Conservation and Demand Management
WRC	Water Research Commission
WSA	Water Services Authority
WSDP	Water Services Development Plan
WSP	Water Service Provider
WTW	Water Treatment Works
WW	Wastewater
WWTW	Wastewater Treatment Works
ZDM	Zululand District Municipality

1. Municipal Context

Ulundi is situated in the Ulundi Local Municipality of Zululand District Municipality (ZDM) in the KwaZulu-Natal province of South Africa.

Location

The Zululand District is located on the northern regions of the KwaZulu-Natal Province and it covers an area of approximately 14 810 km². Approximately half of the area is under the jurisdiction of traditional authorities while the remainder is divided between commercially-owned farms and conservation areas. Cities and towns that form the District are Ulundi Local Municipality (ZDM IDP, 2018). The majority of its population speaks *IsiZulu* (StatsSA, 2011).

The ZDM is a Water Services Authority (WSA) for its area of jurisdiction in terms of the Water Services Act (Act 108 of 1997, Water Services Act). It therefore has statutory responsibilities and accountability in terms of legislation and policy with respect to the provision of water services.

Town background

Ulundi, also known as Mahlabathini is a town in the Zululand District Municipality. At one time the capital of Zululand in South Africa and later the capital of the Bantustan of KwaZulu, Ulundi now lies in KwaZulu-Natal Province (of which, from 1994 to 2004, it alternated with Pietermaritzburg as the provincial capital). The town now includes Ulundi Airport, a three-star hotel, and some museums amongst its sights. In the 2001 Census, the population of the town was recorded as 18,420. When Cetshwayo became king of the Zulus on 1 September 1873, he created, as was customary, a new capital for the nation, naming it "uluNdi" ("The high place"). On 4 July 1879, in the Battle of Ulundi (the final battle of the Anglo-Zulu War), the British army captured the royal kraal and razed it to the ground.

Population

Zululand District has a population of 892,310 accounting for about 7.8% of the total KZN population after UMgungundlovu District [1,100,000] and King Cetshwayo District [980,000]. The population growth rate is similar to that of its neighbouring districts ranging between 1.4% and 1.6%. Between 2011 and 2016, the Zululand growth rate rose from 1.2% to 1.4% which is on par with its neighbouring districts. The Zululand District Municipality contributes 22% to the provinces population.

Households

The number of households within the district has increased between 2001 and 2011, from 141 192 to 157 748, with a corresponding decline in the average household size (from an average of 5.4 persons per household to 5.1 persons per household). Of these households, a larger percentage were headed

by females across the district in 2011 compared to 2001, most likely as a result of males moving outside of the municipal area to seek employment.

Topography and Drainage

The topography of the site is flat. The site is located at 17 masl; has a high point at 20 masl and drops off towards the beach to 13 masl. No watercourses or wetlands are located on or within close proximity to the site. The Mvoti and Nonoti Rivers are located 1.97 km and 3.25 km to the south and north respectively.

Geology and Soils

The geology and soils of the project area (ordinarily under coastal belt vegetation) consist of Ordovician Natal Group Sandstone, Dwyka tillite, Ecca Shale and Mapumulo gneiss. Weathering of old dunes has produced the red sand, called Berea Red Sand, in places. The soils supported by the aforementioned rocks are shallow over hard sandstones and deeper over younger softer rocks (Mucina and Rutherford, 2006).

Groundwater

In general the overall groundwater quality in the ZDM is good in the northern parts (see Appendix 6), with the water quality in eDumbe, uPhongola and Abaqulusi LMs falling within Class 0 and 1 (Kempster Classification). In the southern parts the water quality is generally poor however, with most boreholes falling in Class 3. It is pertinent to note that a large number of the Traditional Authority areas are situated within these areas of poorer groundwater quality. The deterioration of groundwater quality from west to east, can be ascribed to:

- Declining rainfall from west to east.
- Concentration of dissolved solids from through flow below the Dwyka Formation and coal seams in the Vryheid Formation in the central and eastern regions of the catchments.

Owing to the fact that groundwater is utilised extensively in the supply of water services to the rural communities of the ZDM, it is important that groundwater levels and quality are monitored to ensure sustainability and SABS drinking water standards. The outbreak of cholera in KZN in 2000 resulted in extensive emergency work into the protection of surface water resources and sanitation supply. However groundwater quality is only occasionally monitored.

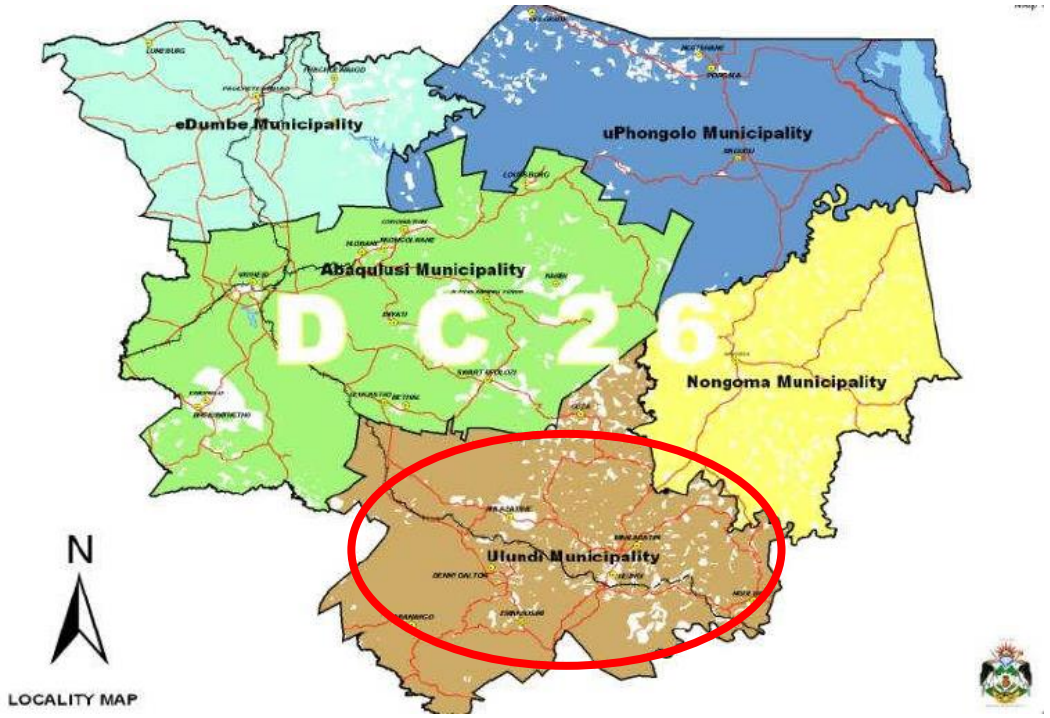


Figure 1: Location of Ulundi within Zululand District Municipality

2. Service outcomes

Service outcome analysis is based on secondary sources. The following key sources of data are used:

- StatsSA Census (2011)
- StatsSA Community Survey (2016)
- Integrated Development Plan for ZDM (2017-2018)
- Draft Water Services Development Plan for ZDM (2018-2019)
- Draft Water Services Development Plan for Ulundi Local Municipality (2018-2019)
- IWA Water Balance for ZDM (2017/2018)
- Zululand District Municipality Growth and Development Plan

Data on emptying and transport is not currently closely monitored, and is mostly qualitative in nature.

2.1 Overview

This section presents the range of sanitation technologies/infrastructure, methods and services designed to support the management of faecal sludge (FS) and/or wastewater (WW) through the sanitation services chain in Zululand District. The details on the quantitative estimations are presented in the table below and sections that follow.

Table 1: Sanitation technologies and contribution of excreta in terms of percentage of population

No.	Sanitation technologies and systems as defined by:		SFD reference variable	Percentage of population
	Zululand DM	SFD promotion initiative		
1	Toilet flushes directly to sewer	Toilet discharges directly to a centralised foul/separate sewer	T1A1C2	11%
2	Septic tank (plastic or concrete)	Fully lined tank (sealed), no outlet or overflow	T1A3C10	1%
3	VIPs – lined with cement blocks and open bottom	Lined pit with semi-permeable walls and open bottom	T1A5C10	53%
4	VIPs – unlined	Unlined pit	T1A6C10	28%
5	Not serviced (rural and informal)	No toilet, open defecation	T1B11C7 to C9	7%

2.1.1 Containment

There is a limited flush toilets network, with the only off-site formal waterborne sewer system being linked to the Ulundi Wastewater Treatment Works (WWTW) with domestic effluent originating from the ZDM and associated truck-stop.

2.1.2 Emptying and Transport

There is no emptying strategy for tankers. There only conservancy tanks that are emptied when they are full. The municipality utilised private tankers as well as municipal tankers.

2.1.3 Treatment and disposal

Ulundi town and surrounding areas are serviced by Ulundi Wastewater Treatment Works. There is Agricultural school and 2 hospitals who have their on-site systems i.e. On-site sanitation are appropriately implemented, where the geotechnical condition are suitable, that is, there is no danger of ground water contamination can be in the form of VIP toilet, septic tanks and soak-way system.

The remaining areas are reliant on on-site sanitation systems. The following on-site containment systems are generally noted:

- Flush toilet connected to a “septic tank” (concrete) for an individual house/building
- Flush toilet connected to a “septic tank” (concrete) which is shared (communal)
- Flush toilet connected to a “septic tank” (plastic) for an individual house
- VIPs
- Flush toilet connected to a conservancy tank (concrete)
- Community ablution blocks (flush toilets connected to a conservancy tank; replaced previous use of chemical toilets in specific areas)
- VIPs – lined, but open bottom (semi-permeable)
- VIPs – unlined (mostly installed before 2012)
- Old pit latrines – unlined (noted as “no service”)

Number of WWTWs

There is a total of 4 Wastewater treatment plants at ZDM area.

Details of WWTWs

Name	Treatment type	Design Capacity (ML/day)	Flow (ML/day)	Sludge treatment	Sludge disposal/use
Ulundi WWTW	Conventional	2.5 ML	3 ML	None	Stock Piling
2 Hospitals Ponds	Oxidation Ponds	Unknown	Unknown	None	Stock Piling
Agricultural School	Oxidation Ponds	Unknown	Unknown	None	Stock Piling

2.1.4 Service Charges

The following charges are noted:

- Monthly charges
  - Domestic (availability): R124,94
  - Septic tank: R432,59 per draw
  - Waterborne sewerage – domestic (per connection): R132.44 per month
  - Waterborne sewerage – school (per connection): R267.65 per month
  - Waterborne sewerage – hostel (per connection): R267.65.44 per month
  - Waterborne sewerage – hospital (per connection): R669.11 per month
  - Business (per connection): R264.87 per month
  - Government (per connection): R264.87 per month

2.1.5 Water Conservation and Demand Management

This section views water services holistically taking into account the amount of water abstracted, supplied to consumers, lost in processing and returned to the resource in order to understand the functioning of the water supply system and ensure a balanced cycle for future sustainability. The overall idea is that what is taken out of the system must be returned to the system.

ZDM has initiated a reporting system whereby all Water Services Providers (WSP's) in the district have to provide certain prescribed operational information to the municipality on a monthly basis. Included in the information is water abstraction volumes, treatment volumes, consumer metered and billed volumes and effluent volumes at the sewage works.

Unfortunately there is currently insufficient information related to internal losses and inflows into the sewage works to complete a comprehensive water balance. However, an attempt was made to produce a first order water balance with figures from data that was available at the time, as indicated below:

DESCRIPTION	% LOSSES	Ml/d	Ml/year
Estimated bulk water abstracted		77.99	28 446
Estimated bulk water purchased from others		-	-
Estimated bulk water treated		**77.99**	**28 446**
Estimated losses during treatment	10%	7.8	2 844.6
Estimated physical water losses during distribution	15%	11.69	4 266.9
Estimated volume of water supplied to consumers	**75%**	**58.49**	**21 334.5**
Estimated influent at wastewater works	60%	27.9	10 184
Estimated losses during treatment	10%	4.7	1 697
Estimated effluent discharged to source		**14.0**	**5 092**
Balance (discharge - abstraction)		**-48.1**	**-17 538**

Water conservation and demand management is related to the wise use of water, such that the inefficiencies within the bulk and reticulation system that result in water losses are minimised and controlled, and that the wastage of treated water either within the network or by the consumer is reduced. Through education and appropriate tariff structures the ZDM may reduce the water services demand and provide effective water conservation.

Water resource management interventions

The ZDM liaised closely with the DWA Water Resources Department in the province when the back-to-back, regional, water master planning exercise was done. Water resources that were known to be under stress were avoided and the more sustainable water resources were targeted for long-term future supply. Chapter 3 of this report provides an overview of which resources are under stress.

The ZDM participates in DWA and other initiatives aimed at protecting the water resources in the district, e.g. the Working for Water Programme and is also an active member of the various Catchment Management Agencies within which the water resources of the District are located as well as the various Water User Associations that have been established in the District.

The quantum of water available for use within the District is both stressed and finite such that the only way of ensuring an adequate and sustainable supply in the long terms is to manage wasteful practices. In this regard the ZDM has recognised the need and embarked on a plan of action to redress non-revenue water (NRW). This programme is intended to quantify the usage of water within the district by way of a water balance, compare this with the design norms and standards set by the ZDM and to identify specific interventions to manage the demand within acceptable limits and to reduce water losses.

The NRW programme will be implemented progressively throughout the District with the initial focus primarily on the Nkonjeni RWWSS/Ulundi and Frischgewaagd areas. This approach will enable the ZDM to refine the programme before rolling it out in all other areas.

The information gathered from the NRW programme will be incorporated into MANZI, be aligned with the ZDM WSP reporting system and used to develop a water balance for individual schemes and eventually a water balance for the entire District as required by the WSDP. The NRW programme will assist in aligning O&M interventions where most needed and thereby improve the efficiency of scarce resources.

The following specific interventions have already been launched in the target areas to address water losses through:

- Pressure management;
- Leak repair programmes;
- Meter repair & replacement programmes;
- Internal plumbing leaks; and
- Consumer end-use demand management initiatives.

2.2 SFD matrix

The final SFD for Zululand District Municipality is presented in **Appendix 6.1**.

2.2.1 SFD matrix explanation

In this report, all sanitation infrastructure is categorised according to their design and functioning as per SFD terms. Below is a description of each of the sanitation technologies in ZDM.

- Toilet discharges directly to a centralised foul/separate sewer – flush toilets are connected directly to the wastewater treatment plant.
- Fully lined tank – sealed, no outlet or overflow – these are either buried concrete tanks, buried plastic tanks or plastic tanks covered with concrete slabs.
- Containment (fully lined tanks, partially lined tanks and pits, and unlined pits failed, damaged, collapsed or flooded – with no outlet or overflow – these are the tanks made from cement blocks with two compartments. Seepage emanating from these tanks through these blocks was noted.
- Pit (all types) never emptied, but abandoned when full and covered with soil, no outlet or overflow – these are pits that are not lined and never emptied. When full, the top structure is removed and taken to a new pit. These pits are covered with soil when abandoned.
- Pit (all types) never emptied but abandoned when full but NOT adequately covered with soil, no outlet or overflow – these are pits that are not lined and never emptied. When full, the top structure is removed and taken to a new pit. It is believed that these pits are not adequately covered with soil when abandoned.

- Pit (all types) never emptied but abandoned when full and covered with soil, no outlet or overflow – some of these unlined pits are located where the groundwater table is high. Some of these unlined pits are located in sandy soil type and ground water monitoring results have indicated non-compliance.

Considering the above, the following is noted:

Off-site

According to municipal records, 11% of the population are serviced via off-site sanitation. All of this wastewater is transported to the Ulundi WWTWs (i.e. no leakage, relatively new sewer pipes with low flows) where it is treated to meet specified requirements (no evidence of treatment efficiency, but assume compliance to treated effluent requirements).

Once the wastewater reaches the WWTWs, it is treated to meet specified requirements. Considering the various flows per WWTW and associated overall effluent compliance per WWTW, an overall flow weighted compliance of more than 80% was provided by the municipality. This implies that a small proportion of the wastewater is not treated effectively, and can pollute the environment.

Table 2: Compliance for Zululand District Municipality WWTWs

No.	Wastewater Treatment Works (WWTW)	Flow (Ml/day)	Overall Effluent compliance (%)
1	Ulundi WWTW	2.5	Unknown
2	Agricultural School WWTW (Private)	Unknown	Unknown
3	Hospital WWTW (Private)	Unknown	Unknown

To-date, wastewater sludge has not yet been analyzed or categorized, and sludge compliance still needs to be determined. Wastewater sludge is currently stockpiled at the respective WWTWs.

On-site

There is a total of 5185 population connected to waterborne. A small fraction (i.e. 52~0.1%) of private septic tanks which is serviced privately or a request is made to the municipality to empty them. There are 37 741 VIPs (81%) installed by the municipality. Of the 37 741 VIPs 35% (13 209) are fully lined and 65% (24 532) semi lined.

There is no strategy to empty the VIPs when they are full. This is still an issue as the strategy is currently being developed.

Open defecation

Of the current population 7% uses open defecation. This is considered the sanitation backlog, and needs to be addressed.

Table 3: Description of variables used in SFD

Variable	Description
W4a	WW delivered to centralized treatment plant
W5a	WW treated at centralized treatment plant
F3	FS emptied
F4	FS delivered to treatment plant
F5	FS treated

Ulundi Local Municipality, KwaZulu Natal, South Africa, 12 Nov 2018. SFD Level: 2 - Intermediate SFD
Population: 46398
Proportion of tanks: septic tanks: 50%, fully lined tanks: 50%, lined, open bottom tanks: 50%

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	11.0	90.0	90.0			
T1A3C10 Fully lined tank (sealed), no outlet or overflow	1.0			50.0	80.0	90.0
T1A5C10 Lined pit with semi-permeable walls and open bottom, no outlet or overflow	53.0			0.0	0.0	0.0
T1A6C10 Unlined pit, no outlet or overflow	28.0			0.0	0.0	0.0
T1B11 C7 TO C9 Open defecation	7.0					

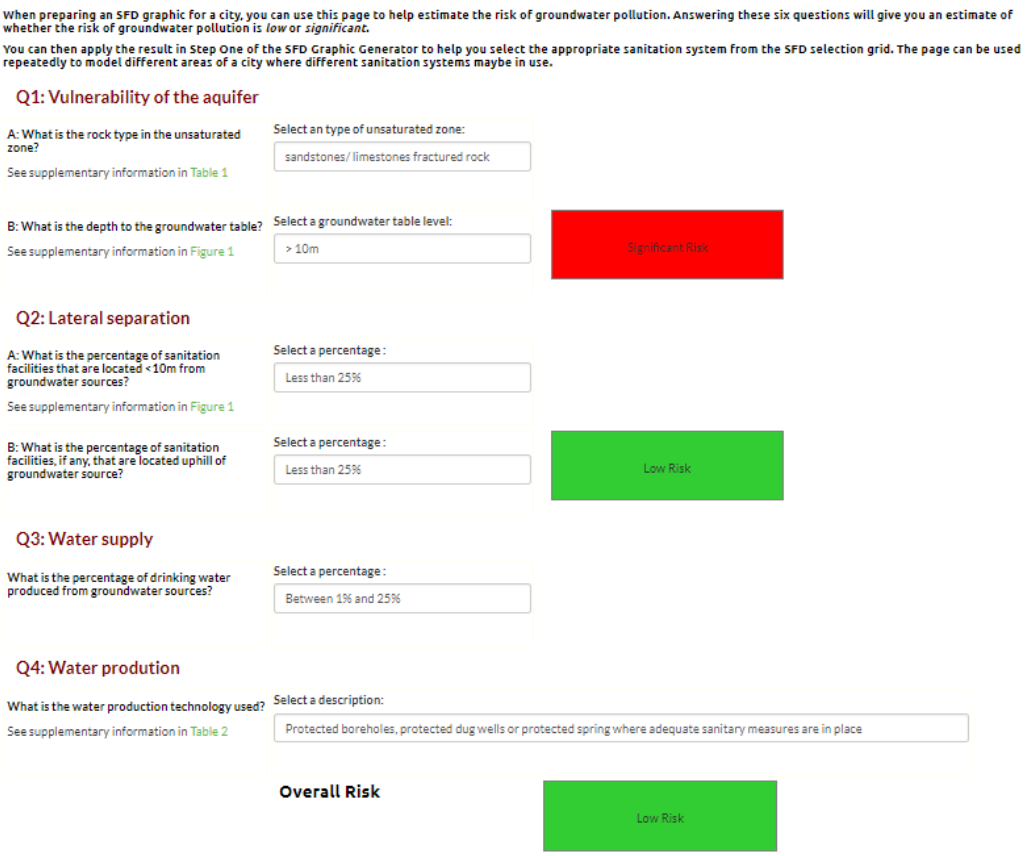
Figure 2: SFD Matrix for ZDM (2018)

2.2.2 Risk of groundwater contamination

Water for urban areas of Ulundi Local Municipality is supplied from the Ulundi drinking-water treatment plant via pipeline to households with the majority of households either receiving water via household taps or yard connections. Raw water is obtained from the White Umfolozi River (i.e. surface water).

Rural areas (outside of the urban boundary) are reliant on groundwater sources, and as little/no treatment is noted, protection of these water sources is essential. Although the groundwater is not presently being used in Ulundi urban areas, climate change impacts and the increasing water scarcity facing many parts of South Africa and KwaZulu-Natal.

There is a need to create awareness among the rural people about the need to ensure that pit latrines/VIPs are adequately sealed when closed/moved/new pit dug, and of the effects of using polluted water. The geological strata of the region are typical of the Karoo system and consist mainly of mudstones and sandstones intruded by dolerite dykes and sills. In general the dolerite dykes trend east to west. Much of the geology is of marine origin, giving rise to the high salinity of the ground water in the area. The soils are generally moderate to deep clayey loams and the erodibility index of the soils in the region is recorded as being medium to low.



3. Stakeholder engagement: key interviews

The relevant Zululand District Municipality staff were contacted through e-mail, letter and telephone call prior to the visit to the municipality. The purpose of the SFD study and depth of data required was conveyed through an introductory letter to respective staff. Although a number of stakeholders of government departments were noted, this SFD study aimed to focus on interviews with staff from Zululand District Municipality.

Interviews were held with the Manager Water Services and Technical Officer, who also accompanied the team to the site inspection.

- Process controllers at the Ulundi WWTW.
- Other

A site inspection assisted with verifying data obtained from Zululand District Municipality published reports (e.g. IDP, WSDP). The key informant interviews and data collected helped in understanding the existing situation and upcoming developments plans in the sanitation sector.

4. Acknowledgements

This report was compiled for a Water Research Commission project and as part of the SFD Promotion Initiative. We would like to thank all participating Zululand District Municipality staff for giving time and necessary information for the assessment.

5. References

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7. StatsSA (2011) *Census 2011*.
8. StatsSA (2016) *Community Survey 2016*.
9. www.municipalities.co.za – Zululand *District Municipality Locality Map* (accessed 20 December 2018).
10. www.saexplorer.co.za – *Rainfall and Temperature data* (http://www.saexplorer.co.za/south-africa/climate/stanger_climate.asp).

6. Appendix

6.1 SFD Matrix

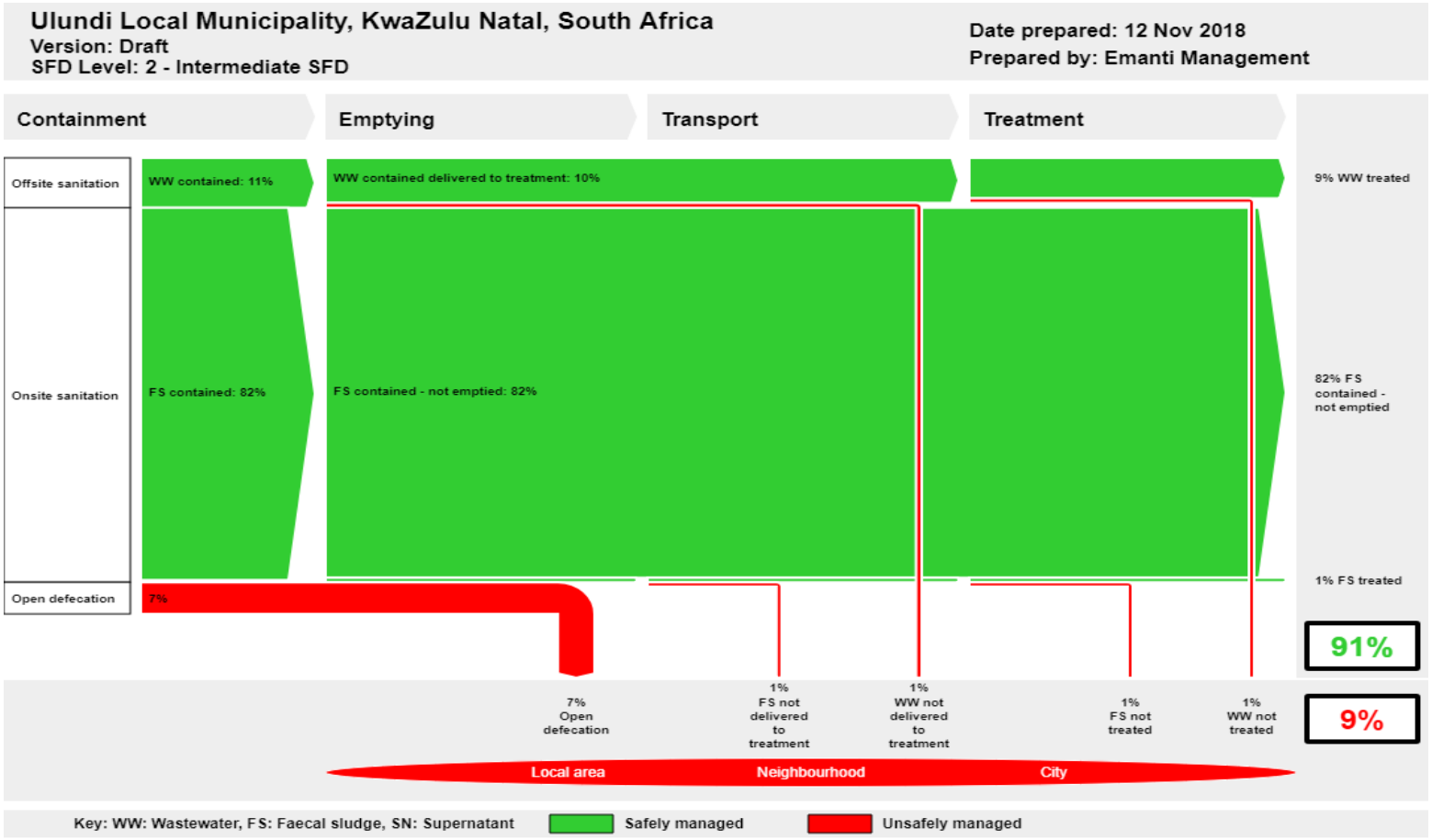

Figure 3: SFD matrix

6.2 Stakeholder identification

Table 4: Stakeholder identification

No.	Stakeholder group	In Zululand District context
1	City council / Municipal authority / Utility	Water Services Authority (WSA): Zululand District Municipality Water Services Provider (WSP): Zululand District Municipality
2	Ministry in charge of urban sanitation and sewerage	National: Department of Water and Sanitation Provincial: Department of Water and Sanitation (KwaZulu-Natal)
3	Ministry in charge of urban solid waste	National: Department of Environmental Affairs Provincial: Department of Economic Development, Tourism and Environmental Affairs of KwaZulu-Natal (EDTEA)
4	Ministry in charge of urban planning, finances and economic development	National: Department of Human Settlements Provincial: KwaZulu-Natal Department of Human Settlements National: National Treasury Provincial: KwaZulu-Natal Provincial Treasury Provincial: Department of Economic Development, Tourism and Environmental Affairs of KwaZulu-Natal (EDTEA)
5	Ministry in charge of environmental protection	National: Department of Environmental Affairs Provincial: Department of Economic Development, Tourism and Environmental Affairs of KwaZulu-Natal (EDTEA)
6	Ministry in charge of health	National: Department of Health Provincial: KwaZulu-Natal Department of Health
7	Service provider for construction of on-site sanitation technologies	Various, by tender appointment
8	Service provider for emptying and transport of faecal sludge	Various, by tender appointment
9	Service provider for operation and maintenance of treatment infrastructure	N/A
10	Market participants practicing end-use of faecal sludge end products	N/A
11	Service provider for disposal of faecal sludge (sanitary landfill management)	N/A
12	External agencies associated with faecal sludge management services (e.g. NGOs, academic institutions, donors)	N/A

6.3 Tracking of engagement

Table 5: Tracking of stakeholder engagement

Name of organization	Name of contact person	Designation	Date of engagement
Zululand District Municipality	X. Buthelezi	Technician	19 Oct 2018
Zululand District Municipality	S. Ngubane	DD: Technical Services	29 and 30 Oct 2018
Zululand District Municipality	S. Ngcobo	Technician (WSA)	29 and 30 Oct 2018
Zululand District Municipality	D. Myaka	Senior Process Controller	29 Oct 2018
Zululand District Municipality	B.M. Gasa	Superintendent	29 Oct 2018
Zululand District Municipality	L.E. Mbatha	Process Controller	29 Oct 2018
Zululand District Municipality	T. D. Mdlalose	Superintendent	29 Oct 2018

6.4 Selected pictures taken during visit

Figure 4: Evidence of stockpiled sludge

Figure 5: Chlorine Cylinders at WWTW

Figure 6: Ulundi Ponds showing sludge