

SFD Report

Naivasha Sub-county Kenya

Final Report

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SFD Report Naivasha sub-county, Kenya, 2017

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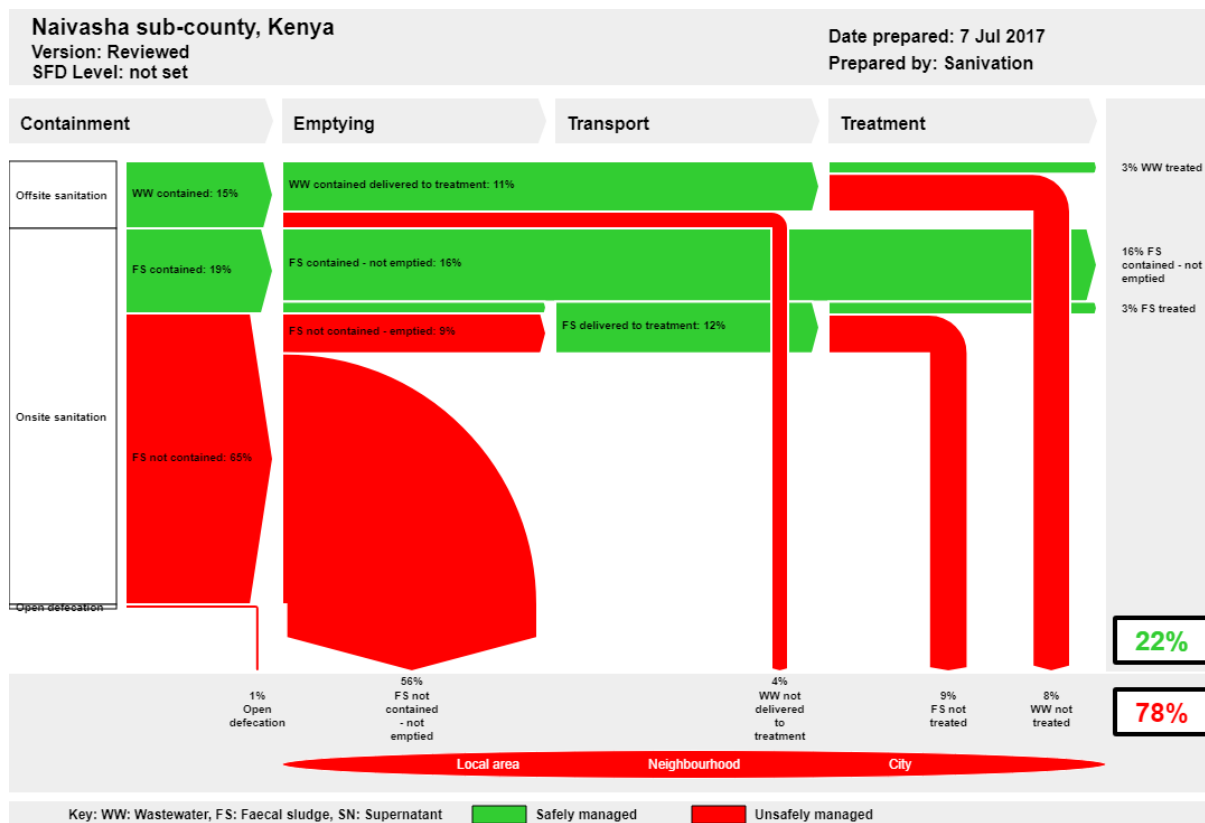
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1. The SFD Graphic



2. Diagram information

SFD Level:

Intermediate

Produced by:

Produced by Sanivation with close collaboration with the Naivasha Water and Sewerage Company (NAIVAWASS) and the Naivasha sub-county Public Health Office.

Sanivation is a sanitation social enterprise headquartered in Naivasha, Kenya tackling the sanitation crisis by partnering with municipalities and water service providers to be their comprehensive non-sewered sanitation provider. The feces is then treated and converted into a sustainable fuel.

Status:

Draft

Date of production: 27/11/2017

3. General city information

Naivasha sub-county is one of 11 constituencies in Nakuru County, Kenya. This geographical boundary was chosen for the SFD because the local water service provider, Naivasha Water Sewerage and Sanitation Company. (NAIVAWASS), is mandated to serve the sub-county.

Naivasha sub-county has an estimated population of 314,052. At the time of the last census, there were an estimated 73,457 households spread out over 12 locations (KNBS 2013). Naivasha sub-county has the second highest population behind Nakuru sub-county (Nakuru County 2013). Naivasha sub-county has about 1900 hectares of land under flower farming. These flower farms account for 70% of Kenya's flower exports (Kenya News 2015). In Kenya, nearly 65% of flower farm workers are temporary, seasonal, or casual (Smith et al 2004).

The average temperature is 17.1 °C and the average annual rainfall is 677 mm (Climatedata, 2017). The land topography is characterized by mountain ranges and savannah vegetation cover that support various species of wildlife. Some of the soil is latosolic and imperfectly drained loam with



dark brown subsoil covers. Other soil is alluvial and lacustrine deposits, which are shallow soils resulting from volcanic ash sediments (Nakuru County 2013).

4. Service outcomes

Onsite sanitation

For the SFD, the number of people served by sewerage was 15% of the population, or 47,107 people. The sewer network has been known to leak; therefore, it is estimated that 75% of sewerage is actually transported to the wastewater treatment plant. Through interviews and treatment records, the treatment plant is ineffective at reducing chemical oxygen demand, biological oxygen demand, total nitrogen, and suspended solids. In a report completed by Vitens-Evides, the results from sampling the inlet and final effluent do not meet the legal limit for disposal. In interviews with the Managing Director, the effluent occasionally meets NEMA's standards for disposal. For this reason, it was assumed that only 25% of fecal sludge coming into NAIWASS is treated to the legal limit for disposal.

Offsite sanitation

The percentage of the population using pit latrines ranges from 62%-88%, based on household survey (by Sanivation) and national census data (2009), respectively. For the SFD, an adjusted 61% was used. We assumed that since 2009, more people have been connected to sewerage, thus reducing the percentage of pit latrines. The household survey data is therefore more relevant than the outdated census data.

The percentage of septic tanks ranged from 2%-7%. For the SFD, an average of 4% was used. In addition to septic tanks, 18% of households in the survey reported using fully lined tanks that are sealed. This number was adjusted, after realizing that households thought they had septic tanks when it was just a lined pit, to 15% to add up to 100% in the SFD matrix.

From the transect walks, it was observed that the rock type for the ground was fine sand, silt, and clay. The depth of groundwater varied in the sub-county. Near the lake, the groundwater is less than 10m from the surface and in areas farther from the lake, the groundwater is greater than 30m from the surface (Jolicoeur 2000). Fewer than 25% of sanitation facilities were observed uphill of groundwater sources. Of all the areas observed, five had visible human feces in either a few or several locations, which indicates practices of open defecation.

Thus, the risk for groundwater contamination varies from area to area. As a result, we decided to use the default value of 50% of groundwater has significant risk for contamination, whereas 50% does not.

5. Service delivery context

Kenya recently passed a new national sanitation policy entitled Kenya Environmental Sanitation and Hygiene (KESH) Policy 2015-2030. This policy proposes the provision of sanitation services and maintenance of sanitary facilities for proper collection, treatment, environmentally-friendly ways to dispose of liquid and solid waste, water treatment and safety, hygiene promotion, sanitation marketing, regulation and legislation by mandated institutions, sustainable financing, and research and development.

With the revision of the Constitution, Kenya devolved most sanitation functions and services to the 47 county governments. The national government still maintains responsibility for nation policy, training, capacity building, technical assistance, and standards formulation. The county governments are responsible for county sanitation services including licensing, solid waste disposal, and storm water management in built-up areas. In the KESH policy, the described actions are designed to harmonize sector laws and create appropriate and enforceable regulations.

Furthermore, specifications and guidelines for sanitation and hygiene services (including the selection of technologies for waste treatment and disposal) will be done by NESCR, WASREB, and NEMA.

The government of Nakuru County is responsible for the provision of water and sanitation services. NAIWASS is mandated by the county to provide water and sanitation services. The county government, NESCR, and WASREB regulate the technologies for sanitation, while adhering to the national government's guidelines for design parameters and recommended operating procedures. The KESH policy proposes transfer of management and maintenance of all public toilets in urban areas to the private sector, either by franchising existing facilities or granting concessions for the construction and operation of new ones. Under the policy, the national and county governments are required to provide an enabling environment to the private sector to



build, manage and/ or operate faecal sludge treatment facilities. The private sector will have to operate within national government's policy guidelines and standards in order to regulate the delivery of sanitation services and promote sustainable private sector involvement.

As laid out in the KESH policy, Kenya aspires to have universal coverage of sanitation services by 2030. Additionally, they hope to end open defecation practices nationally by 2020. Currently, only 30% of Kenyans have access to improved sanitation.

With the Water Act in 2002, the Water Services Trust Fund was established as a State Corporation with the mandate to assist in financing the provision of water services to areas of Kenya which are without adequate water services.

In respect of investment, Kenya has only allocated 0.2 percent of GDP to sanitation as compared to the global target of 0.9 percent and eThekweni Declaration commitment of at least 0.5 percent of GDP to sanitation and hygiene (now succeeded by the Ngor Declaration). In 2010, Kenya's water and sanitation expenditure represented 0.86 percent of GDP, down from 1.10 percent in 2008.

6. Overview of stakeholders

Key informant interviews were used to collect information about the "enabling environment" and "operating environment" affecting fecal sludge management in Naivasha sub-county. The "enabling environment" included interviews with the Nakuru County Public Health Officer, the Naivasha sub-county Public Health Officer, the Naivasha sub-county Planner, the Naivasha sub-county NEMA officer, a NEMA expert officer, and the Managing Director at NAIWASS. The "operating environment" included the vacuum truck operators.

10. Credibility of data

Data came from key informant interviews, household surveys, observations of service providers, and transect walks. In total, 10 key informant interviews were conducted, 464 household surveys completed, 10 service provider practices observed, and 30 transect walks completed.

Some of the challenges with the data included outdated census data and inconsistencies with the key informant interviews. More recent data

9. Process of SFD development

Data was collected using primary sources and then triangulated with secondary sources. This was to assess the validity of the primary sources. From this, the data was entered into the SFD graphic generator to calculate the flow in terms of percentage of the population. An SFD graphic was then produced.

from household surveys was opted for in place of the outdated data. Information from key informant interviews was adjusted using published data.

11. List of data sources

Reports and Articles:

- KNBS 2009 Census



- Nakuru County Development and Integration Plan 2009-2013
- KESH Policy 2015-2030

Key Informant Interviews:

- Public Health Officers, Managing Director at NAIVAWASS, NEMA officers

Community Data:

- Household surveys
- Transect walks
- Observations

Naivasha sub-county, Kenya, 2017

Produced by:

Sanivation

Editing:

Institution, Name of Author (if applicable)

Institution, Name of Author (if applicable)

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Abbreviations

BOD	Biological Oxygen Demand
COD	Chemical Oxygen Demand
GDP	Gross Domestic Product
ESH	Environmental sanitation and hygiene
KESH	Kenya Environmental Sanitation and Hygiene
KII	Key Informant Interviews
KNBS	Kenya National Bureau of Statistics
M&E	Monitoring and Evaluation
NAIVAWASS	Naivasha Water Sewerage and Sanitation Company
NEMA	National Environmental Management Authority
NESCRA	National Environmental Sanitation Coordination and Regulatory Authority
O&M	Operation and Maintenance
SFD	Shit flow diagram
VIP	Ventilated improved pit latrine
VTO	Vacuum truck operators
WASREB	Water Services Regulatory Board
WSB	Water Service Board
WSP	Water Service Provider
WSTF	Water Service Trust Fund
WWTP	Wastewater treatment plant

1 City context

1.1 Location

Naivasha sub-county is one of 11 constituencies in Nakuru County, Kenya. This geographical boundary was chosen because the local water service provider, Naivasha Water Sewerage and Sanitation Company (NAIVAWASS), is mandated to serve the sub-county. It spans 1960.2 km², although much of the land is uncultivated plains, vast cattle ranches, parks, conservancies, and Lake Naivasha (Nakuru County 2013).

1.2 Population

Naivasha sub-county has an estimated population of 314,052. At the time of the last census, there were an estimated 73,457 households spread out over 12 locations (KNBS 2013). Locations are administrative regions in Kenya, and are fourth level subdivision below counties and sub-counties and wards. Naivasha sub-county has the second highest population in Nakuru County, behind Nakuru Town sub-county. (Nakuru County 2013). There are locations containing some pockets of middle-income residents, but they are dominantly occupied by low-income residents.

1.3 Population growth rate

The county population growth rate is estimated at 3.05 percent as per 2009 National Population and Housing Census (KNBS 2013).

1.4 Significant variations in population

The floriculture and horticulture farms around Lake Naivasha bring in seasonal and temporary workers. In Kenya, nearly 65% of flower farm workers are temporary, seasonal, or casual (Smith et al 2004). Seasonal variation at the flower farms is in part because of holidays in Europe and the United States, where most of the flowers are exported. It is estimated that the flower industry employs approximately 30 000 people in Naivasha directly (Kenya Flower Council 2018).

1.5 Topography

The land topography is characterized by mountain ranges and savannah vegetation cover that support various species of wildlife. Some of the soil is latosolic and imperfectly drained loam with dark brown subsoil covers. Other soil is alluvial and lacustrine deposits, which are shallow soils resulting from volcanic ash sediments (Nakuru County 2013).

1.6 Climate

The climate is warm and temperate in Naivasha. The climate here is classified as Csb (Cool-summer Mediterranean) by the Köppen-Geiger system (Climatedata, 2017). This likens Naivasha's climate to the 'Cool-summer Mediterranean' climates, that experience warm summers. The average temperature is 17.1 °C and the average annual rainfall is 677 mm (Climatedata, 2017). There are two rainy seasons with the short rains between October and December while the long rains are between March and May (SafariBookings, 2017).



1.7 Key physical and geographic features

Within Naivasha sub-county is Lake Naivasha, a 139km² freshwater lake that is fed by the Malewa River and the Gilgil River (Becht and Harper 2002). The lake has no known outlet.

1.8 Geographical boundaries (incl. map highlighting significant areas)

A map of Naivasha sub-county is shown in Figure 1. Naivasha town is located in Naivasha East ward, which covers 90.9 km² (Nakuru County 2013).

There is a variety of sanitation systems in Naivasha sub-county (Figure 2). The systems are discussed in detail in the following sections.

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					T2A2C5 T1A2C5			T1A2C8		
Fully lined tank (sealed)					Significant risk of GW pollution Low risk of GW pollution				T1A3C9	
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									T2A5C10
										T1A5C10
Unlined pit										T2A8C10
										T1A8C10
Pit (all types), never emptied but abandoned when full and covered with soil										T2B7C10
										T1B7C10
Pit (all types), never emptied, abandoned when full but NOT adequately covered with soil										T1B8C10
User interface failed, damaged, collapsed or flooded										T1B9 C1 TO C10
Containment (septic tank or tank or pit latrine) failed, damaged, collapsed or flooded										T1B10C10
No toilet. Open defecation	Not Applicable								T1B11 C7 TO C9	Not Applicable

Figure 2: Sanitation options in Naivasha sub-county

Offsite sanitation systems

According to the operation manual for NAIVAWASS, there is 6,260m of sewer in Naivasha town, of which 1,680m are made of concrete and 4,580m are made of uPVC (Mulder 2016). The wastewater treatment plant was originally designed for a population of 17,000 but current estimates of the number of people connected to sewerage range from 40,000-50,000 (Mulder 2016). The wastewater flows via a gravity sewer system. The system is separate from storm water; however, there are several manholes missing, which allow for inflow of storm water into the sewage system (Mulder 2016).

Onsite sanitation systems

Naivasha sub-county primarily uses pit latrines. Pit latrines consist of a pit dug into the ground, covered by a slab manufactured mostly of reinforced concrete (Majidata.org 2017). The latrine usually has a superstructure made of tin or wood (Majidata.org 2017). Approximately 5% of the pit latrines in Naivasha are ventilated improved pit latrines (VIPs), which have a superstructure and is vented by a pipe with a fly-screen fixed to it (Majidata.org 2017). The pipe extends above the latrine roof.

Septic tanks and lined tanks with unknown outlets are becoming more common in Naivasha, especially on plots where the sanitation is shared among households. It is important to note

that there are some discrepancies with reporting on the difference between lined tank and septic tank. It is unknown how many lined tanks are incorrectly reported as septic tanks.

Households

From the household survey, the average household size is four people. If there are 314,052 people in Naivasha sub-county, then there are approximately 78,513 households.

Shared or Communal Toilets

It is estimated that 75% of households share sanitation infrastructures with one or more other households (Majidata.org 2017).

Commercial and Industrial Areas

Approximately 33% of the sewage that comes to the wastewater treatment plant is from Keroche Brewery (Theuri 2017). Of all the fecal sludge that is brought to the wastewater treatment plant from vacuum truck operators, 33% of the fecal sludge is from commercial or industrial areas in Naivasha sub-county, including restaurants, schools, and hotels (Theuri 2017).

Mechanical Emptying

Both pits and tanks are emptied mechanically in Naivasha sub-county. Vacuum truck operators (VTOs) are called to residential or commercial areas to empty the pits or tanks with 10,000L pumper trucks. To assist with emptying, VTOs pump water into the pit or tank to break up solids.

Areas within coverage by these VTOs are Kasarani, Olkaria, Kamere, DCK, Mirrera, Karagita, Kayole, Kinamba, Viwandani, Naivasha Town, Karati and Gilgil. Some of these areas are within the Central Business District, and others 5-50 kilometers away from the Naivasha waste water treatment plant. The VTOs charge for service depending on distance. From the KIIs, majority of clients in rural areas are commercial and residential premises with septic tanks.

According to the household survey, emptying pits and tanks is more common than abandoning or covering pits. NAIVAWASS estimates that 75 trucks deliver to the wastewater treatment plant per week (Mulder 2016).

Information gathered from the KIIs indicated that neither manual emptying nor illegal dumping happens in Naivasha sub-county. Hefty fines were said to be

Wastewater and Fecal Sludge Transportation

Wastewater is transported to the wastewater treatment plant in the sewer lines, which are known to leak, and deliver approximately 75% only (Daily Nation 2016).

Fecal sludge is delivered to the wastewater treatment plant by the VTOs. The VTOs operate under strict procedures set by NAIVAWASS. They pay a fee to NAIVAWASS monthly to empty fecal sludge at the waste water treatment plant. Violation of the set rules attracts hefty fines. As a result, no illegal dumping of fecal sludge has been reported in Naivasha sub-county. The VTOs are also well maintained, and are not known to leak as they transport fecal sludge.

Wastewater Treatment Plant

When fecal sludge or sewage arrives to the treatment plant, it first undergoes a mechanical pre-treatment, where solid waste and sand are removed (Mulder 2016). The inlet goes through a biological treatment process called “extended aeration.” The discharge then goes into Lake Naivasha. The process flow is detailed in the schematic in Figure 3.

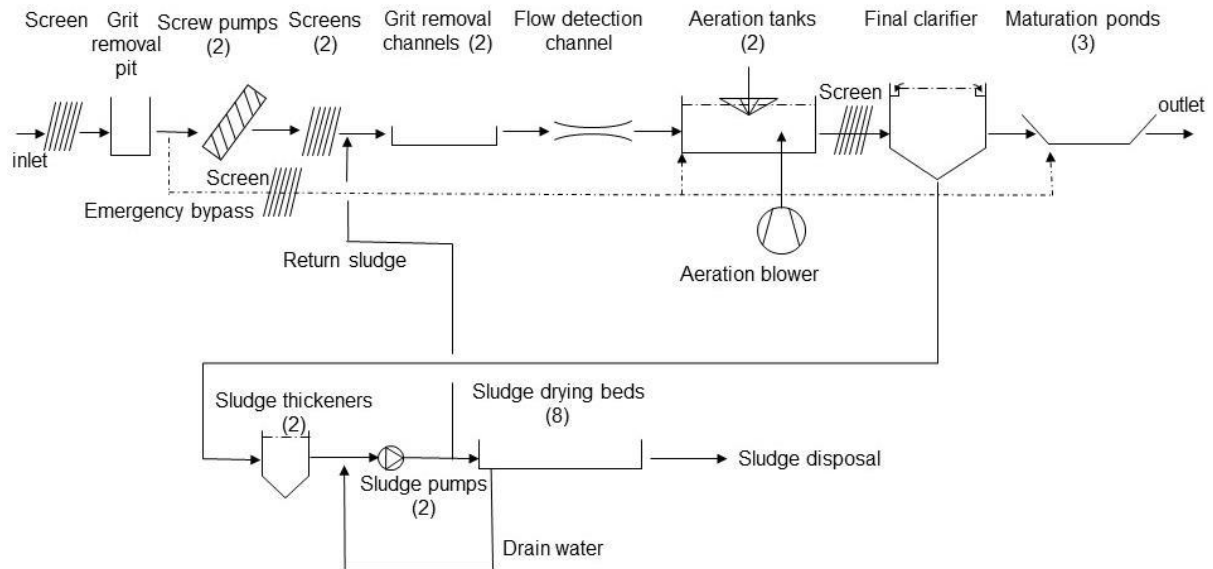


Figure 3: Process flow of wastewater treatment plant

2.2 SFD Matrix

The final SFD Matrix is found in Appendix 7.3.

1) Technologies and methods

Table 1: Description of sanitation matrix

Variables	Description	Percentage of population
T1A1C1	User interface discharges directly to a centralized combined sewer	15%
T2A2C5	Septic tank connected to soak pit, where there is a 'significant risk' of groundwater pollution	1%
T1A2C5	Septic tank connected to soak pit	1%
T1A2C8	Septic tank connected to open ground	3%
T1A3C9	Fully lined tank (sealed) connected to "don't know where"	14%
T2A5C10	Lined pit with semi-permeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	1%
T1A5C10	Lined pit with semi-permeable walls and open bottom, no outlet, or overflow	1%

T2A6C10	Unlined pit, no outlet, or overflow where there is a 'significant risk' of groundwater pollution	6%
T1A6C10	Unlined pit, no outlet, or overflow	6%
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	12%
T1B7C10	Pit (all types), never emptied but abandoned when full and covered with soil, no outlet, or overflow	11%
T1B8C10	Pit (all types), never emptied, abandoned when full but NOT adequately covered with soil, no outlet, or overflow	24%
T1B9C1 TO C10	User interface failed, damaged, collapsed or flooded, connected to sewer, soak pit, open drain or storm water, water body, open ground or 'don't know where'	2%
T1B10C10	Containment failed, damaged, collapsed, or flooded – connected to water bodies or open ground or 'don't know where'	2%

- 2) Percentages of the population using those systems and services along the sanitation service chain

Offsite sanitation

For the SFD, the number of people served by sewerage was 15% of the population, or 47,107 people (Theuri 2017; Mulder 2016). The sewerage network has been known to leak; therefore, it is estimated that 75% of sewerage is actually transported to the wastewater treatment plant (Daily Nation 2016). Through interviews and treatment records, the treatment plant is ineffective at reducing chemical oxygen demand, biological oxygen demand, total nitrogen, and suspended solids (Mulder 2016). In a report completed by Vitens-Evides, the results from sampling the inlet and final effluent do not meet the legal limit for disposal (Mulder 2016). In interviews with the Managing Director, the effluent occasionally meets NEMA's standards for disposal (Theuri 2017). For this reason, it was assumed that only 25% of wastewater and fecal sludge coming into NAIVAWASS is treated to the legal limit for disposal.

Onsite sanitation

The percentage of the population using pit latrines ranges from 62%-88% (Majidata.org 2017; KNBS 2010). For the SFD, an adjusted 61% was used (the lower end of the range). We assumed that as more people connect to sewerage, the percentage of pit latrines decrease, so the household survey data is more relevant than the outdated census data from 2009.

The percentage of septic tanks ranged from 2%-7% (Majidata.org 2017; KNBS 2010). For the SFD, an average of 4% was used. In addition to septic tanks, 18% of households in the survey reported using fully lined tanks that are sealed. This number was adjusted,

after realizing that households thought they had septic tanks when it was just a lined pit, to 15% to add up to 100% in the SFD matrix.

Vacuum Truck Operators deliver fecal sludge from pit latrines and septic tanks to the wastewater treatment plant. The fecal sludge is discharged into the wastewater inlet point, after which the two waste streams are mixed with a mechanized screw and then treated.

3) Risk of groundwater contamination

From the transect walks, it was observed that the rock type for the ground was fine sand, silt, and clay. The depth of groundwater varied in the sub-county. Near the lake, the groundwater is less than 10m from the surface and in areas farther from the lake, the groundwater is greater than 30m from the surface (Jolicoeur 2000). Fewer than 25% of sanitation facilities were observed uphill of groundwater sources. Of all the areas observed, five had visible human feces in either a few or several locations, which indicates practices of open defecation. Thus, the risk for groundwater contamination varies from area to area according to the SFD Promotion Initiative tool. As a result, we decided to use the default value of the tool at 50% of groundwater has significant risk for contamination, whereas 50% does not.

4) Levels of Uncertainty

Data were mostly sourced from Key Informant Interviews and the household survey. Secondary data was used to triangulate the primary data. At times, the secondary data was averaged with the primary data to get means to input in the SFD matrix.

However, there were discrepancies in the data. This was in part because of outdated census data and in part because most secondary data only focused on Naivasha town as opposed to Naivasha sub-county. Information from interviews varied slightly from source to source. For this reason, the authors erred on the side of caution in presenting conservative estimates of the data.

A final copy of the SFD report was given to all stakeholders in Naivasha sub-county for review. A follow-up workshop was thereafter held to validate the SFD, and the co-authors endorsed the findings in signed declaration letters.

3 Service delivery context

3.1 Policy, legislation and regulation

3.1.1 Policy

Kenya recently passed a new national sanitation policy entitled Kenya Environmental Sanitation and Hygiene (KESH) Policy 2016-2030. This policy proposes the provision of sanitation services and maintenance of sanitary facilities for proper collection, treatment, environmentally-friendly ways to dispose of liquid and solid waste, water treatment and safety, hygiene promotion, sanitation marketing, regulation and legislation by mandated institutions, sustainable financing, and research and development (KESH 2016). The policy strategies are outlined in Table 2.

Table 2: Strategies as proposed in the KESH policy

Strategies for Kenya Environmental Sanitation and Hygiene Policy
--

1. Scaling up access to improved rural and urban sanitation
2. Assuring clean and healthy environment free from public nuisances
3. Fostering private sector participation and investment in sanitation
4. Building enabling and regulatory environment for sanitation
5. Building governance and leadership capacity for sanitation
6. Sustainable sanitation financing and investment
7. Establishing an effective research and development framework for sanitation
8. Establishing and strengthening monitoring and evaluation systems for the sanitation sector

At the local level, Nakuru County passed a new bill entitled Nakuru County Public Health and Sanitation Bill 2016, which proposes the development of a public health and sanitation fund, provision of decentralized waste treatment, provision and use of sanitary facilities, and focus on fecal sludge management.

3.1.2 Institutional roles

With the revision of the Constitution, Kenya devolved most sanitation functions and services to the 47 county governments. The national government still maintains responsibility for nation policy, training, capacity building, technical assistance, and standards formulation. The county governments are responsible for county sanitation services including licensing, solid waste disposal, and storm water management in built-up areas. In the KESH policy, the described actions are designed to harmonize sector laws and create appropriate and enforceable regulations (KESH 2016).

In order to strengthen the legislative and regulatory environment for sanitation at the national level, the Ministry of Health, along with other partners, will be required to address the following:

- Review existing laws relating to sanitation and identify all existing and proposed institutional arrangements that require legal backing for effectiveness.
- Ensure enactment of national environmental health and sanitation law to support institutional functions relating to sanitation including encouraging private sector participation, public-private partnerships, financing and funding arrangements, licensing, monitoring, control and ownership of wastes, point and non-point discharges, acquisition of land for treatment and disposal sites, including procedures for site valuation, negotiation and payment of compensation.
- Enact, update, make available to all sector actors, disseminate and enforce sector-wide standards, laws and regulations on environmental sanitation.
- Develop environmental sanitation impact assessment guidelines and standards and ensure that all developments comply with NEMA environmental assessment regulations.

- Engage with NESCRRA and NEMA on regular updates of environmental sanitation assessment standards and progress.
- Support the strengthening of the capacity of the Judiciary and law enforcement agencies in dealing with environmental sanitation and related issues.
- Develop model by-laws covering all aspects of environmental sanitation.
- Ensure that city and town authorities promulgate by-laws consistent with model by-laws while taking into consideration specific local conditions.
- Develop regulation to support waste reduction, re-use, recycling and recovery.
- Enact and enforce legislations/regulations/by-laws prohibiting the dumping of waste in wet lands and water courses (including drains).
- Enforce existing statutes and regulations on the prevention of pollution of ground water sources.
- Institute adequate measures to protect beaches and prevent marine pollution.
- Develop rapid response systems for adopting emerging international regulations on issues such as global warming, e-waste as well as special hazardous waste.
- Ensure effective regulation for prevention of trans-boundary dumping in a free-trade regime.
- Enforce anti-dumping conventions and protocols.
- Enact statute for compulsory participation of environmental sanitation officers in destination inspections at entry points

Furthermore, specifications and guidelines for sanitation and hygiene services (including the selection of technologies for waste treatment and disposal) will be done by the National Environmental Sanitation Coordination and Regulatory Authority (NESCRRA), WASREB, and NEMA (KESH 2016).

3.1.3 Service provision

The government of Nakuru County is responsible for the provision of water and sanitation services. NAIVAWASS is mandated by the county to provide water and sanitation services. The county government, NESCRRA, and WASREB regulate the technologies for sanitation, while adhering to the national government's guidelines for design parameters and recommended operating procedures (KESH 2016). The KESH policy proposes that the public toilets in urban areas are transferred to the private sector. Under the policy, the private sector would also regulate the desludging of septic tanks and pit latrines (KESH 2016). The private sector will have to meet the national government's policy guidelines and standards, as outlined in the KESH policy, in order to provide the delivery of sanitation services and promote sustainable private sector involvement.

3.1.4 Service standards

1. Environmental Management and Co-Ordination (Waste Management) Regulations 2006: specifies licenses and permits needed to manage, transport, treat, and reuse waste.
2. The National Environment (Standards for Discharge of Effluent into Water or on Land) Regulations, S.I. No 5/1999: specifies effluent discharge standards.

3.2 Planning

3.2.1 Service targets

As laid out in the KESH policy, Kenya aspires to have universal coverage of sanitation services by 2030. Additionally, they hope to end open defecation practices nationally by 2020. Currently, only 30% of Kenyans have access to improved sanitation (KESH 2016).

3.2.2 Investments

With the Water Act in 2002, the Water Services Trust Fund was established as a State Corporation with the mandate to assist in financing the provision of water services to areas of Kenya which are without adequate water services (Water Services Trust Fund 2012).

There are three funding streams for sanitation and hygiene in Kenya. They include:

- 1) Treasury funds transferred directly from the Ministry/Department of Finance to the Ministry/Department of Health
- 2) Budget funds transferred from donors to the Ministry/Department of Health and other relevant ministries such as Water directly via various mechanisms
- 3) Off-budget funding which present a particular challenge as they are not effectively captured as part of the overall national and county budgets.

In respect of investment, Kenya has only allocated 0.2 percent of GDP to sanitation as compared to the global target of 0.9 percent and eThekwini Declaration commitment of at least 0.5 percent of GDP to sanitation and hygiene (now succeeded by the Ngor Declaration) (KESH 2016). In 2010, Kenya's water and sanitation expenditure represented 0.86 percent of GDP, down from 1.10 percent in 2008 (KESH 2016).

3.3 Outputs

3.3.1 Monitoring and reporting access to services

From the KESH policy, the national and county governments are mandated to do the following:

- Develop a framework for ESH monitoring and evaluation at all levels within the sector.
- Assess capacity for implementing an M&E system at all levels including how the existing M&E platforms within the health sector and other allied sectors integrate environmental sanitation.
- Develop appropriate indicators for each of the policy focus areas.
- Monitor and evaluate the performance of sanitation facilities and services and institute remedial measures where required.

- Establish/strengthen structures for effective M&E including mechanisms for county, urban areas and community-level monitoring and institute procedures for carrying out participatory M&E at all levels.
- Develop a responsive reporting and feedback mechanism for a Results-Based Management and M&E System for the sanitation sector;
- Define an appropriate strategy for communicating information from the M&E System in collaboration with other allied institutions;
- Ensure that relevant agencies, at all levels, provide timely and reliable data and information for tracking sector progress and contributing to periodic sector updates;
- Support counties, city, municipal and town authorities in collaboration with appropriate agencies to implement and manage appropriately designed MIS and M&E systems for tracking/monitoring of special categories of wastes such as electronic, medical and hazardous wastes;
- Encourage all stakeholders to regularly monitor the environmental impact of their adopted sanitation system such as. VIP latrines or sanitary landfill systems for disposal of solid wastes;
- Make budgetary allocations for the monitoring and evaluation of sanitation programmes within their areas of jurisdiction (KESH 2016).

In addition to the proposed M&E plan, the WASREB monitors and evaluates the performance of WSBs and WSPs. It assesses performance using the following indicators: water coverage, sanitation coverage, unaccounted for water, water quality, hours of supply, metering, revenue collection efficiency, O&M cost coverage, and staff productivity (WASREB 2016). The results are disseminated in an annual report *Impact Report*. According to the last report, Naivasha's public utilities were in a state of deterioration (WASREB 2016).

4 Stakeholder Engagement

4.1 Key Informant Interviews

Key informant interviews were used to collect information about the “enabling environment” and “operating environment” affecting fecal sludge management in Naivasha sub-county. The “enabling environment” included interviews with the Nakuru County Public Health Officer, the Naivasha sub-county Public Health Officer, the Naivasha sub-county Planner, the Naivasha sub-county NEMA officer, a NEMA expert officer, and the Managing Director at NAIVAWASS.

For the enabling environment, a combination of open- and close-ended questions were asked to better understand quality of services, engagement with other stakeholders (i.e., regulation, reporting procedures), availability of technical options, cost-recovering mechanisms, and supporting facilities. For the operating environment, questions were asked about demand for service provision, cost, disposal locations, obstacles, transport to disposal, volumes collected, staffing, and equipment used. Appendix 2 lists stakeholders that were engaged in Key Informant Interviews.

4.2 Household Survey

A cluster survey approach was employed to collect data from households. Two enumerators carried out surveys at 24 households from 12 different primary sampling units (geographically-defined locations) in Naivasha sub-county. Selected households were determined by interviewing every 5th house in the geographically-defined locations until 24 surveys were obtained. If there were not enough households in the location to achieve 24 surveys, then every other household was surveyed (this happened in 2 locations which had fewer than 50 households). Survey answers were recorded in ODK and analyzed in STATA 12. Surveys included questions about sanitation infrastructure and fecal sludge management practices and preferences.

4.3 Observation of Service Provider Practices

The purpose of the observations of service provider practices was to provide information about containment, collection, transport, and treatment/disposal of fecal sludge. A checklist was completed during each observation and included location of collection, type of on-site sanitation system from where waste was collected, percentage of waste that was collected from system, percentage that remained in the system, and percentage of waste that is actually transported to the wastewater treatment plant.

4.4 Transect Walks

The purpose of the transect walk was to make a subjective and qualitative assessment of conditions within a community. Specifically, the transect walks provide information about the environmental risks to public health, in respect to the presence of fecal and solid waste, and the proximity of these wastes to drainage channels and water sources. The data collected from the transect walk complement the household survey and service provider observations.

A transect walk was carried out in every location where household surveys were conducted. A checklist was completed during each walk and included observed risks of drainage systems, sewerage, access to water points, evidence of solid wastes, evidence of human fecal waste, coverage of household toilets, presence of public sanitation facilities, paths, and roads.

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6 References

Becht, R. and Harper, D.M., 2002. Towards an understanding of human impact upon the hydrology of Lake Naivasha, Kenya. In *Lake Naivasha, Kenya* (pp. 1-11). Springer Netherlands.

Climate Data. 2017. <http://en.climate-data.org/location/11126/>

Jolicoeur, J.L.C., 2000. Groundwater Contamination potential of agriculture around Lake Naivasha: Comparison of five unsaturated soil zones models. ITC.

Kenya Flower Council. 2018. FAQs. http://kenyaflowercouncil.org/?page_id=158

Kenya News. 2015. Flower farming in Naivasha, Kenya. <https://kenyanews.co.ke/flower-farming-in-naivasha-kenya/>

KESH - Kenya Environmental Sanitation and Hygiene Policy. 2016. http://sanitationandwaterforall.org/wp-content/uploads/download-manager-files/KESH%20POLICY_1.pdf

KNBS. 2010. The 2009 Kenyan population and housing census volume 2: Population and housing distribution by socio-economic characteristics. http://www.knbs.or.ke/index.php?option=com_phocadownload&view=category&id=109:population-and-housing-census-2009&Itemid=599

Majidata. 2017. <http://www.majidata.go.ke/town.php?MID=MTE=&SMID=MTM=>

Nakuru County. 2013. First county integrated development plan (2013 -2017). <http://www.nakuru.go.ke/wp-content/uploads/2014/03/Nakuru-COUNTY-INTERGRATED-DEV-PLAN-2013-2017.pdf>

Mulder, JW. 2016. Operation Manual Sewer Treatment Naivasha.

Smith, S., Auret, D., Barrientos, S., Dolan, C., Kleinbooi, K., Njobvu, C., Opondo, M. and Tallontire, A., 2004. Ethical trade in African horticulture: gender, rights and participation.

Safaribookings. 2017. <https://www.safaribookings.com/kenya/climate>

Theuri. 2017. Key informant interview.

WASREB. 2016. Impact Report: A performance review of Kenya’s water service sector 2014-2015. Issue No.9. <http://wasreb.go.ke/impact-reports>

Water Services Trust Fund. 2012. What You May Want to Know about the Water Services Trust Fund! <http://waterfund.go.ke/procedures/Downloads/1.%20General%20Information%20on%20the%20WSTF.pdf>

7 Appendix

7.1 Appendix 1: Stakeholder identification

Stakeholder Group	In Naivasha Sub-county
Municipality	NAIVAWASS
County	County Planner
Ministry of Health	Public Health Office

Ministry of Environment	NEMA
Service provider for emptying and transport of fecal sludge	VTOs

7.2 Appendix 2: Tracking of Engagement

Stakeholder Name	Date	Purpose of Engagement
Caroline Ngeta, Public Health Office, Naivasha sub-county	3-Feb-17	To get permission to collect data.
Samuel King'ori, Public Health Officer; Nakuru County	17-Feb-17	KII
Theuri, Managing Director, NAIVAWASS	17-Feb-17	KII
Charity Mwangi, NEMA Officer; Naivasha Sub-county	17-Feb-17	KII
Patrick Bosire, Naivasha sub-county Planner	10-Apr-17	KII
Josiah Nyabuti, NEMA Expert Officer; Kwapeshi Logistics and Solutions Ltd	10-Apr-17	KII
Patrick Wanjohi, Public Health Area Officer; Karagita; Naivasha	10-Apr-17	KII

7.3 Appendix 3: Household Survey

SFD NAIVASHA SUB-COUNTY HOUSEHOLD SURVEY			
Type	Label	Hint	Required
Text	In what area is the household?		yes
Integer	A1: How many people total live and eat in your household?		yes

Integer	A1.1: How many people are under the age of 1 year?		yes
Integer	A1.2: How many people are between the ages of 1-5 years?		yes
Integer	A1.3: How many people are between the ages of 5-15 years?		yes
Integer	A1.4: How many people are between the ages of 15-50 years?		yes
Integer	A1.5: How many people are over the age of 50 years?		yes
Male Female NA	A2: What is the gender of the household head?		yes
Yes No	A3: Is the survey respondent the head of the household?		yes
Text	A4: What is the highest level of education of the household head?		yes
Yes No	A5: Have children under five in the household had diarrhea in the past week (7 days)?	Describe diarrhea as 3 or more loose or watery stools in 24 hours.	yes
Yes, hospital or health center Yes, shop or pharmacy Yes, traditional healer No N/A	A6: For any of these occurrences of diarrhea in children in the last week, did you seek advice or treatment from any source?		yes
Yes No	A7: Do you consider that any household members have disabilities?		yes
Hearing impairment Deafness	A8: How would you describe the disabilities of the most disabled household member?		yes

<p>Visual impairment</p> <p>Blindness</p> <p>Mobility impairment</p> <p>Housebound</p> <p>Upper limb impairment</p> <p>Speech impairment</p> <p>Learning difficulties</p> <p>Mental impairment</p>			
integer	E1: How many rooms in this household are used for sleeping?		yes
<p>Private residence (single story)</p> <p>Private residence (multi-story)</p> <p>Shared residence (single story)</p> <p>Shared residence (multi-story)</p> <p>Others, Specify</p>	E2: What kind of building does the household occupy?		yes
<p>Owned</p> <p>Rented</p> <p>Rent Free</p> <p>Mortaged</p> <p>Others, Specify</p>	E3: Is this house/residence owned, rented, rent-free, or mortgaged by a member of the household?		yes
Integer	E4: If rented, how much is the rent per month?		yes



Integer	E5: How long have you/members of your household been living on this location/plot?	Record in completed years; if under one year, enter 00.	yes
Piped into dwelling Piped to yard/plot Public tap/standpipe Tube well/borehole Protected dug well Unprotected dug well Protected spring Unprotected spring Rainwater collection Bottled water/gallon container and dispenser Refilled bottled water Cart with small tank/drum Tanker-truck Surface water (river, dam, lake, pond, stream, canal,	F1: What is the main source of <u>drinking water</u> for members of your household?		yes



irrigation channels) Others, Specify			
Integer	F2: On average, how long does it take you travel to this water point?	If on premise, enter 98. Record time in minutes.	yes
Integer	F3: On average, how long do you/ the household member have to wait in the queue to get water?	If on premise, enter 98. Record time in minutes.	yes
Automatic cistern flush Pour/maunal flush Ventilated improved pit latrine Pit latrine with slab Pit latrine without slab/open pit Composting toilet Bucket Hanging toilet Container-based toilet No facilities or bush or field Others, Specify	F4: What kind of toilet facility do members of your household usually use?		yes



<p>Piped sewer system</p> <p>Fully-lined septic tank with soakaway</p> <p>Fully-lined septic tank with overflow to drain/open ground/other</p> <p>Partially-lined septic tank</p> <p>Fully-lined pit</p> <p>Pit with unlined bottom or sides</p> <p>Directly to open drain/ditch</p> <p>Directly to the lake or river</p> <p>Directly to open ground</p> <p>Don't know</p> <p>Others, Specify</p>	<p>F5: Where do the contents of this toilet discharge to?</p>		<p>yes</p>
<p>Piped sewer system</p> <p>Fully-lined septic tank with soakaway</p> <p>Fully-lined septic tank with overflow to</p>	<p>F6: At home, where do you dispose of wastewater from kitchen, bathing, and/or laundry?</p>		<p>yes</p>



<p>drain/open ground/other</p> <p>Partially-lined septic tank</p> <p>Fully-lined pit</p> <p>Pit with unlined bottom or sides</p> <p>Directly to open drain/ditch</p> <p>Directly to the lake or river</p> <p>Directly to open ground</p> <p>Don't know</p> <p>Others, Specify</p>			
<p>Child used toilet/latrine</p> <p>Put/rinsed into toilet or latrine</p> <p>Put/rinsed into drain or ditch</p> <p>Thrown into garbage</p> <p>Buried</p> <p>Left in the open</p> <p>Others, Specify</p> <p>No child under 3</p> <p>Don't know</p>	<p>F7: How are the stools of children <3 years usually disposed of?</p>		<p>yes</p>



Yes No	G1: Consider the toilet you mentioned in the last section, do you share this toilet with other households?		yes
Integer	G2: How many other households share this toilet?		yes
Integer	G3: How many people use this toilet regularly?		yes
Yes No	G4: Can any member of the public use this toilet?		yes
Inside Outside	G5: Where is this toilet located?		yes
No Yes, pay per use (public) Yes, weekly payment Yes, monthly payment Others, Specify	G6: Do you have to pay to use this toilet?		yes
Integer	G7: How much do you pay for the toilet?	Enter 0 if they don't pay.	yes
Integer	G8: How long does it take, on average, to use the toilet (walk there, queue, use, walk back)?	Enter time in minutes.	yes
Integer	G9: How many times do you do this per day?		yes
This household Neighbor Landlord NGO/CBO Private provider Government Nobody in charge	G10: Who manages this toilet?		yes

Others, Specify Don't know			
On plot (shared or private) Off plot (communal or public)	G11: Place the toilet in one of two categories: on plot or off plot.	Don't ask this question aloud.	yes
Yes No	H1: Is it currently operational/useable?		yes
Full/waiting to be emptied Collapsed (fully or partially) Blocked Other Don't know	H2: If no, why is it not operational/useable?		yes
Yes No	H3: May I see this toilet?	If no, just ask questions instead of observations.	yes
Yes No	H4: Is the toilet operational/useable?		yes
Yes No	H5: Does it have a water seal?		yes
Yes No	H6: Does it have a cleanable slab?		yes
Brick - or other permanent material Wood / bamboo / cloth - or other semi-permanent material	H7: What is the material of the superstructure?		yes



No superstructure			
Yes No	H8: Does it have a roof?		yes
Yes No	H9: Does it have a curtain, door, or other materials that provides privacy?		yes
Feces, or feces and urine Urine only No feces and no urine	H10: Is the floor or slab contaminated with feces or urine?		yes
Poor access, only accessible to hand-carried emptying equipment. Reasonable access for small (manual or mechanized) emptying equipment. Good access for medium/large size (mechanized) emptying equipment	H11: Can emptying equipment get access?		yes
Yes, purpose built hatch for easy access Yes, but squatting plate must	H12: Is there an access point/hatch for emptying?		yes

be removed No, slab must be broken for access			
Yes No Don't know	H13: Has the pit been sealed and covered?	Only ask if toilet no longer in use.	no
Very satisfied Satisfied Dissatisfied Very dissatisfied	I1: Please rate your satisfaction level with the quality of construction?		yes
No, we have no plans Yes, plan to build a new toilet Yes, plan to upgrade a toilet Yes, others Don't know	I2: Please rate your satisfaction level with the ease of access?		yes
Very satisfied Satisfied Dissatisfied Very dissatisfied	I3: Please rate your satisfaction level with privacy?		yes
Very satisfied Satisfied Dissatisfied Very dissatisfied	I4: Please rate your satisfaction level with cleanliness?		yes

<p>No, we have no plans</p> <p>Yes, plan to build a new toilet</p> <p>Yes, plan to upgrade a toilet</p> <p>Yes, others</p> <p>Don't know</p>	<p>15: Are you planning to improve your sanitation arrangements in the next 1 year?</p>		<p>yes</p>
<p>Lack of finance</p> <p>Lack of knowledge on how to do this</p> <p>Lack of interest of other household members</p> <p>Lack of skilled people to construct</p> <p>Landlord does not want to invest</p> <p>Others</p> <p>Don't know</p>	<p>16: What is the biggest challenge to improving your sanitation arrangements in this way?</p>		<p>yes</p>
<p>Integer</p>	<p>17: How many years ago was this toilet built?</p>	<p>If don't know, enter 9999.</p>	<p>yes</p>
<p>Integer</p>	<p>18: If your household spent money to build the toilet, how much did you spend at the time when it was built? (Include materials and labor)</p>	<p>If no expenses, enter 8888. If don't know, enter 9999.</p>	<p>yes</p>
<p>Yes</p>	<p>J1: Do you pay for your water supply?</p>		<p>yes</p>



No Don't know			
Local government Utility company Standpipe manager Tanker truck manager Water vendor Neighbor Other	J2: Whom do you pay for water?		yes
Daily/on delivery Weekly Monthly Quarterly Biannually Yearly Other	J3: How often do you pay for water?		yes
Integer	J4: How much do you usually pay for water in this frequency?	If don't know, enter 9999.	yes
Very cheap Inexpensive Expensive Very expensive Don't know	J5: How would you rate the cost of the water for your household?		yes
Yes No Don't know	J6: In the last year, did your household have expenses to pay in relation to the toilet discussed in the previous section?		yes
Repairs to toilet bowl /	J7: What were the expenses for?		yes



<p>mechanism / plumbing / slab</p> <p>Repairs to toilet room / superstructure</p> <p>Fixing drainage problems</p> <p>Emptying of septic tanks/pits</p> <p>Others</p> <p>Don't know</p>			
<p>Integer</p>	<p>J8: How much were total expenses during the last 12 months?</p>	<p>If don't know, enter 9999.</p>	<p>yes</p>
<p>Stored at household and collected by a company, the community, or others</p> <p>Stored at a public place and collected by a company, the community, or others</p> <p>Kept within the compound - put in a hole</p> <p>Kept within the compound -</p>	<p>J9: What is the primary means of solid waste disposal for your household?</p>		<p>yes</p>



<p>put on the ground</p> <p>Kept within the compound - put into a pit latrine</p> <p>Burned within or outside the compound</p> <p>Taken outside the compound to a disposal site by household members</p> <p>Taken outside the compound to river/stream/pond</p> <p>Taken outside the compound to gutter/ditch /along the road</p> <p>Taken outside premise elsewhere</p>			
<p>Integer</p>	<p>J10: If any, how much do you pay per month for solid waste collection?</p>	<p>Enter 0 if nothing. If don't know, enter 9999.</p>	<p>yes</p>
<p>Me Someone else who is nearby -> go and find the person</p>	<p>J11: Coming back to your toilet, we have questions about where the feces and urine go and pit/tank emptying. Can you answer these or can someone else?</p>		<p>yes</p>



<p>accompanied by the respondent</p> <p>No, no one nearby can answer</p>			
<p>Same respondent</p> <p>Neighbor</p> <p>Landlord</p> <p>Caretaker of building</p> <p>Other</p>	<p>K1: Who is now responding?</p>		<p>yes</p>
<p>Yes</p> <p>No</p> <p>Don't know</p>	<p>K2: If this toilet empties to a pit or septic tank, has it ever filled up?</p>		<p>yes</p>
<p>integer</p>	<p>K3: In the last 5 years, how many times has it filled up?</p>	<p>If don't know, enter 9999.</p>	<p>yes</p>
<p>Yes</p> <p>No</p> <p>Don't know</p>	<p>K4: Has the toilet ever overflowed?</p>		<p>yes</p>
<p>Blocked</p> <p>Flooded with rising water table (from below ground)</p> <p>Flooded by surface water/storm water (from above ground)</p> <p>No money to empty</p> <p>Emptiers not available when needed</p>	<p>K5: If yes, what was the reason for this?</p>		<p>yes</p>



Other Don't know			
Emptied and reused pit/tank Abandoned and pit/tank unsealed Abandoned with sealed cover on pit/tank Covered and used alternative pit Other Don't know	K6: What did you do when the pit or septic tank filled up last time?		yes
Integer	K7: On average how many years does it take for an emptied toilet to be full again?	Enter 0 for less than 1 year. If don't know, enter 9999.	yes
Empty by member of household Empty by private individual or company Cover and seal pit Abandon toilet without covering/seal	K8: Next time the toilet fills up, what do you intend to do?		yes
Member of household Neighbor	L1: Last time it was emptied, who did the emptying?		yes



Informal provider (individual) Formal provider (company / NGO) Formal provider (utility) Other			
By hand, using buckets or similar By hand, using manual pump Mechanically, using small machine Mechanically, using tanker truck	L2: How was it emptied?		yes
directly into drain/water body/field into a pit on the compound that is then covered Into a pit on the compound that is then left open Directly into drum/open container Directly into	L3: What was it emptied into?		yes

machine/tanker			
Very satisfied Satisfied Dissatisfied Very dissatisfied	L4: Please rate your satisfaction level with that service provider in terms of price.		yes
Very satisfied Satisfied Dissatisfied Very dissatisfied	L5: Please rate your satisfaction level with that service provider in terms of overall service quality.		yes
Very satisfied Satisfied Dissatisfied Very dissatisfied	L6: Please rate your satisfaction level with that service provider in terms of safety.		yes
Very satisfied Satisfied Dissatisfied Very dissatisfied	L7: Please rate your satisfaction level with that service provider in terms of ease of obtaining service.		yes
Yes No Don't know	L8: Did you pay for the pit to be emptied?		yes
Integer	L9: How much did you pay in total?		yes
Flat rate Cost per volume removed	L10: How was the payment calculated?		yes
No, paid in full am	L11: Did you pay in installments?		yes

<p>ount t</p> <p>Yes, two</p> <p>Yes, three</p> <p>Yes, more than three</p>			
<p>Too high</p> <p>About fair</p> <p>Quite cheap</p>	<p>L12: Was this a fair price?</p>		<p>yes</p>
<p>Yes</p> <p>No</p> <p>Don't know</p>	<p>L13: Did the emptier face difficulties in getting their equipment to your toilet, such as lack of space, poor road conditions, etc?</p>		<p>yes</p>
<p>Lack of space</p> <p>Poor road conditions</p> <p>Night-time working</p> <p>Others</p>	<p>L14: What difficulties did they face with the street?</p>		<p>yes</p>
<p>Entrance/gate too narrow</p> <p>Lack of space for equipment once inside</p> <p>Poor surface conditions</p> <p>Night-time working</p> <p>Others</p>	<p>L15: What difficulties did they face with the compound?</p>		<p>yes</p>
<p>Distance too far for equipment to reach the toilet</p> <p>Access point too</p>	<p>L16: What difficulties did they face with the toilet?</p>		<p>yes</p>

smal to get equipment into the pit Had to break/dam age the slab to gain access Had to remove/da manged latrine pan or seat Collapsed pit Others			
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7.4 Appendix 4: Transect walk observation guide

TRANSECT WALK OBSERVATION GUIDE		
Type	Label	Hint
Text	Location:	
High-income Middle-income Low-income	Economic status of the area:	
Yes No	Is the area at risk of flooding?	
text	Weather conditions on the day:	
text	Brief description of the community:	Recent development, main type of housing, residential/commerci al, main employment of people

<p>Limited drainage infrastructures. Standing storm water and/or greywater is visible on the ground, close to homes or water points.</p> <p>Limited drainage infrastructure, with signs of storm water and/or greywater having overflowed recently close to homes or water points.</p> <p>Limited drainage infrastructure, but with no signs of having overflowed close to homes or water points.</p> <p>Drainage channels in a poor condition directing stormwater and/or greywater away from homes and water points.</p> <p>Drainage channels well maintained and adequate to take flows.</p>	<p>Describe the condition of the drainage structure.</p>	<p>Greywater is domestic wastewater that does not include toilet wastes and does not contain visible fecal materials.</p>
<p>text</p>	<p>Briefly state the problem that you have seen.</p>	
<p>text</p>	<p>State how humans are interacting (coming into contact) with the contamination (e.g. washing, playing, walking, scavenging).</p>	
<p>text</p>	<p>State the main routes of contamination (e.g. hands, feet, flies, food, fields, soil).</p>	
<p>text</p>	<p>Comment on who is exposed to the contamination (e.g. all people, adults only, children only, vulnerable groups).</p>	



<p>Limited sewer infrastructure with visible standing blackwater close to homes or water points.</p> <p>Broken sewer pipes close to homes or water points, with signs of having overflowed recently.</p> <p>Broken sewer pipes close to homes or water points but with no signs of having overflowed.</p> <p>Piped sewers with signs of some leakage or blockages.</p> <p>Adequate and well-maintained piped sewers with no signs of leakage or blockages.</p>	<p>Describe where you see, or identify, that blackwater is entering into the environment.</p>	<p>Blackwater is domestic wastewater that includes toilet wastes and contains visible fecal materials.</p>
<p>No piped water supply to households or public water points are identified.</p> <p>No piped water supply to households but water is available from public standposts, vendors, private wells, or boreholes.</p> <p>Some piped water supply to households or boreholes. Other water is available from public standposts or vendors.</p> <p>Intermittent piped water supply to all or most households. Water from vendors may also be available.</p> <p>Continuous piped water supplies to public standposts, on-plot, or in-house. Water from vendors may also be available.</p>	<p>Describe access to water points.</p>	
<p>Piles of solid waste are accumulating in many sites, close to where people live and work, and at times are obstructing drainage or irrigation channels.</p> <p>Piles of solid waste are accumulating in three or more sites, close to where people live and work, but are not obstructing drainage or irrigation channels.</p> <p>Piles of solid waste are accumulating in one or two sites, but away from where people live and work.</p>	<p>Describe if there is any evidence of solid wastes.</p>	

<p>Waste bins or enclosures are provided for solid waste collection, but the number of bins is inadequate and overflow is evident.</p> <p>An adequate number of waste bins or enclosures are provided with no overflow evident.</p>		
begin group	High risk with drainage	
Text	Briefly state the problem that you have seen.	
text	State how humans are interacting (coming into contact) with the contamination (e.g. washing, playing, walking, scavenging).	
Text	State the main routes of contamination (e.g. hands, feet, flies, food, fields, soil).	
Text	Comment on who is exposed to the contamination (e.g. all people, adults only, children only, vulnerable groups).	
<p>Frequent visible, widespread evidence of human feces is seen.</p> <p>Visible evidence of human feces is seen but limited to a few locations.</p> <p>Human feces are seen one or two times but in places away from the population.</p> <p>Possible evidence of human feces seen, mixed with solid waste.</p>	Describe if there is any evidence of human fecal materials - through open defecation.	Open defecation is when people defecate directly in the environment rather than defecating in a latrine with a pit or septic tank.



<p>No visible evidence of human feces through open defecation is seen.</p>		
<p>Text</p>	<p>Briefly state the problem that you have seen.</p>	
<p>text</p>	<p>State how humans are interacting (coming into contact) with the contamination (e.g. washing, playing, walking, scavenging).</p>	
<p>Text</p>	<p>State the main routes of contamination (e.g. hands, feet, flies, food, fields, soil).</p>	
<p>Text</p>	<p>Comment on who is exposed to the contamination (e.g. all people, adults only, children only, vulnerable groups).</p>	
<p>Frequent visible and widespread evidence of dumped fecal sludge is seen.</p> <p>Visible evidence of dumped fecal sludge is seen but limited to a few locations.</p> <p>Dumped fecal sludge is seen one or two times but in places away from the population.</p> <p>Possible evidence of fecal sludge is seen, mixed with solid waste.</p> <p>No visible evidence of dumped fecal sludge is seen.</p>	<p>Describe if there is any evidence of human fecal materials - through dumped fecal sludge.</p>	<p>Fecal sludge may be dumped into the environment when the contents of septic tank/pit waste is emptied manually.</p>
<p>Text</p>	<p>Briefly state the problem that you have seen.</p>	

<p>text</p>	<p>State how humans are interacting (coming into contact) with the contamination (e.g. washing, playing, walking, scavenging).</p>	
<p>Text</p>	<p>State the main routes of contamination (e.g. hands, feet, flies, food, fields, soil).</p>	
<p>Text</p>	<p>Comment on who is exposed to the contamination (e.g. all people, adults only, children only, vulnerable groups).</p>	
<p>Frequent visible and widespread evidence of animal feces is seen.</p> <p>Visible evidence of animal feces is seen, limited to a few locations.</p> <p>Animal feces are seen one or two times but in places away from the population.</p> <p>Possible evidence of animal feces is seen, mixed with solid waste.</p> <p>No visible evidence of animal feces seen.</p>	<p>Describe if there is any evidence of animal fecal materials.</p>	
<p>Less than 25% of households have access to a household toilet. The majority (more than 75%) appear to be poorly maintained.</p> <p>Between 25% to 75% of households have access to a household toilet. Most (more than 50%) appear to be poorly maintained.</p> <p>Between 25% to 75% of households have access to a household toilet. Most (more than 50%) appear to be well maintained.</p>	<p>Describe the coverage of household toilets (individual or shared).</p>	



<p>More than 75% of households have access to a household toilet. They are in various conditions of maintenance and cleanliness.</p> <p>More than 75% of households have access to a household toilet. Most (more than 75%) appear to be clean and well-maintained.</p>		
<p>Text</p>	<p>Briefly state the problem that you have seen.</p>	
<p>text</p>	<p>State how humans are interacting (coming into contact) with the contamination (e.g. washing, playing, walking, scavenging).</p>	
<p>Text</p>	<p>State the main routes of contamination (e.g. hands, feet, flies, food, fields, soil).</p>	
<p>text</p>	<p>Comment on who is exposed to the contamination (e.g. all people, adults only, children only, vulnerable groups).</p>	
<p>Where public facilities are present, they are all poorly maintained with evidence of fecal contamination in the local environment.</p> <p>Where public facilities are present, most (more than 50%) are poorly maintained with some evidence of fecal contamination in the local environment.</p> <p>Where public facilities are present, they are in various conditions of maintenance and cleanliness.</p>	<p>Describe the presence of public sanitation facilities.</p>	<p>This category includes "pay-per-use" facilities but not facilities at schools, offices, etc.</p>

<p>Where public facilities are present, most (more than 50%) are generally clean and well-maintained.</p> <p>Where public facilities are present, they are in frequent use, clean and well-maintained OR there are no public facilities present.</p>		
<p>Wastewater and/or fecal sludge treatment facilities (e.g. composting of wastes) are present, poorly-maintained and insecure.</p> <p>Wastewater and/or fecal sludge treatment facilities are present, poorly maintained, secure but with possible direct risks - such as from overflow.</p> <p>Wastewater and/or fecal sludge treatment facilities are present and are well-maintained but with some possible indirect risks - such as from scavenging animals or waste pickers.</p> <p>Wastewater and/or fecal sludge treatment facilities are present, and are well-maintained with no evident risks.</p> <p>No wastewater and/or fecal sludge treatment facilities present.</p>	<p>Describe the presence of wastewater and/or fecal sludge treatment facilities inside the area.</p>	<p>In many areas, it is very unlikely that you will see any treatment facilities.</p>
<p>Less well or poorly organized development, with highly restricted access for public service vehicles and no clearly defined public spaces.</p> <p>Less well organized development, with mostly temporary housing, limited access for public service vehicles and very few clearly defined public spaces.</p> <p>Well organized development with semi-permanent and/or temporary properties, limited access for public service vehicles and only a few clearly defined public spaces</p> <p>Well organized development with permanent and/or semi-permanent properties but restricted access for public service vehicles and public spaces, including some open spaces.</p>	<p>Describe housing and public space arrangement.</p>	

<p>Well organized development, with permanent and/or semi-permanent properties, good access for public service vehicles and public spaces, including open spaces.</p>		
<p>Very narrow paths that can be used by pedestrians only (too narrow for motorbikes).</p> <p>Poorly maintained dirt paths wide enough for motorbikes.</p> <p>Well-maintained dirt paths wide enough for motorbikes.</p> <p>Gravel or paved paths, in poor condition, wide enough for motorbikes.</p> <p>Gravel or paved paths, in good condition, wide enough for motorbikes.</p>	<p>Describe the paths.</p>	<p>Routes wide enough for pedestrians and possibly motorbikes.</p>
<p>Unsurfaced roads, wide enough for small carts or 3-wheeler, but not for car access/</p> <p>Unsurfaced roads wide enough for cars to pass.</p> <p>Gravel or paved roads, wide enough for small carts or 3-wheeler, but not for car access.</p> <p>Gravel or paved roads, wide enough to allow two cars to pass.</p> <p>Well-maintained gravel or paved road, wide enough for two cars to pass.</p>	<p>Describe the roads.</p>	<p>Routes wide enough for vehicles (cars, 3-wheelers, donkey carts, etc.)</p>

7.5 Appendix 5: Key Informant Interviews_Enabling environment

Introduction

Hi, my name is _____ and I'm currently working at Sanivation. We are collecting data to create an Excreta Flow Diagram (SFD), which is a tool to readily understand and communicate visualizing how excreta physically flows through a city or town. We are interested in addressing key questions about how both the 'enabling environment' and the operating environment affects fecal sludge management (FSM) services (past, current, and future). Through your responsibilities with FSM services, we can better understand the

enabling environment and the operating environment in Naivasha sub-county. Your opinions are valuable to us and we would love for you to contribute to this conversation.

The interview will last no more than one hour. I want to emphasize that your participation in this interview is completely voluntary. Do not hesitate to tell me if a question makes you uncomfortable or if you would like to end this interview at any time. Also, feel free to add any additional information that I may not directly ask about but that you may find of importance to the study.

If it's okay with you, I'd like to record this interview to include everything you say. Is it okay if I record this interview?

Can you briefly summarize the point of this interview and what will happen today?

Thank you for agreeing to participate.

Warm-up Questions

1. To begin with, please state your name, your title, and your organization.
2. How would you define the geographical boundaries of Naivasha sub-county? How many people live in Naivasha sub-county? *Note: Ask if they have any documents they can share with demographic information.*
3. How is your position related to Fecal Sludge Management (FSM) in Naivasha sub-county?

Key Questions

I'd like to start off talking about factors affecting FSM services.

4. What are considered to be 'appropriate' FSM services within the city and how does this influence demand for these services?
5. What are some national or city-level factors affecting FSM services in Naivasha sub-county?
6. What are some institutional factors affecting public and private investment in FSM services?
7. What are the institutional responsibilities for, and relationships affecting, FSM services?
8. Please describe how stakeholders' interests, incentives, and influence either support or constrain investment in FSM.
9. Describe how decision-making processes either support or constrain appropriate FSM options for Naivasha sub-county.

Now I'd like to move on to questions about improvements of FSM services.

10. What actions are being taken by the government in relation to demand creation (promotional/educational campaigns, subsidies, etc.)? In relation to stimulating the private sector? In relation to enforcement of policy and standards?



11. Describe the requirements to address improved services – given current and future scenarios and FS characteristics – through the entire service chain.
12. What has previously worked well, or not worked well (in the community)?
13. Describe the satisfaction with current end-use options.
14. How is the quality of existing services?
15. What is your engagement with other stakeholders (regulation, reporting procedures)?
16. Describe the availability of technical options in Naivasha sub-county.
17. Are there any cost-recovering mechanisms and supporting facilities for FSM? Please describe.
18. Elaborate on the demand for FSM service provision in Naivasha sub-county.
19. Is there anything else you'd like to add about the environment – either enabling or operating – for FSM in Naivasha?

7.6 Appendix 6: Key informant Interview_Operating environment

Introduction

Hi, my name is _____ and I'm currently working at Sanivation. We are collecting data to create an Excreta Flow Diagram (SFD), which is a tool to readily understand and communicate visualizing how excreta physically flows through a city or town. We are interested in addressing key questions about how both the 'enabling environment' and the operating environment affects fecal sludge management (FSM) services (past, current, and future). Through your responsibilities with FSM services, we can better understand the enabling environment and the operating environment in Naivasha sub-county. Your opinions are valuable to us and we would love for you to contribute to this conversation.

The interview will last no more than one hour. I want to emphasize that your participation in this interview is completely voluntary. Do not hesitate to tell me if a question makes you uncomfortable or if you would like to end this interview at any time. Also, feel free to add any additional information that I may not directly ask about but that you may find of importance to the study.

If it's okay with you, I'd like to record this interview to include everything you say. This interview will be confidential. You will not be referred to by name in the transcription or any other part of the study. Is it okay if I record this interview?

Can you briefly summarize the point of this interview and what will happen today?

Thank you for agreeing to participate.

Warm-up Questions

20. To begin with, please state your name, your title, and your organization.
21. How would you define the geographical boundaries of Naivasha sub-county? How many people live in Naivasha sub-county? *Note: Ask if they have any documents they can share with demographic information.*
22. How is your position related to Fecal Sludge Management (FSM) in Naivasha sub-county?

Key Questions

23. Describe the current demand for FSM service provision.
24. What is the pricing for these services?
25. Where are the disposal locations for fecal sludge?
26. Elaborate on any obstacles you encounter for disposal. [Probe: weather, road conditions, getting turned away from the WWTP.]
27. Describe the process of transport to disposal.
28. On average, what volumes of FS are collected and then disposed of per trip?
29. What is the frequency of disposal for a pit latrine? For a septic tank?
30. What equipment is needed for collection? For transport? For disposal?
31. Who all is involved as staff in the entire process? [Probe: honey suckers? Truck drivers, operators, etc.?]

Now I'd like to move on to questions about improvements of FSM services.

1. What actions are being taken by the government in relation to demand creation (promotional/educational campaigns, subsidies, etc.)? In relation to stimulating the private sector? In relation to enforcement of policy and standards?
2. Describe the requirements to address improved services – given current and future scenarios and FS characteristics – through the entire service chain.
3. What has previously worked well, or not worked well (in the community)?
4. Describe the satisfaction with current service options.
5. How is the quality of existing services?
6. What is your engagement with other stakeholders (regulation, reporting procedures)?
7. Describe the availability of technical options in Naivasha sub-county.
8. Elaborate on the demand for FSM service provision in Naivasha sub-county.
9. Is there anything else you'd like to add about the environment – either enabling or operating – for FSM in Naivasha?



7.7 Appendix 7: SFD matrix

Naivasha sub-county, State/province name, Kenya, 7 Jul 2017. SFD Level: 2 - Intermediate SFD

Population: 314052

Proportion of tanks: septic tanks: 100%, fully lined tanks: 100%, lined, open bottom tanks: 100%

System label	Pop	W4a	W5a	F3	F4	F5
System description	Proportion of population using this type of system	Proportion of wastewater in sewer system, which is delivered to centralised treatment plants	Proportion of wastewater delivered to centralised treatment plants, which is treated	Proportion of this type of system from which faecal sludge is emptied	Proportion of faecal sludge emptied, which is delivered to treatment plants	Proportion of faecal sludge delivered to treatment plants, which is treated
T1A1C1 User interface discharges directly to a centralised combined sewer	15.0	75.0	25.0			
T2A2C5 Septic tank connected to soak pit, where there is a 'significant risk' of groundwater pollution	1.0			33.0	100.0	25.0
T1A2C5 Septic tank connected to soak pit	1.0			33.0	100.0	25.0
T1A2C8 Septic tank connected to open ground	3.0			33.0	100.0	25.0
T1A3C9 Fully lined tank (sealed) connected to 'don't know where'	14.0			33.0	100.0	25.0
T2A5C10 Lined pit with permeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of	1.0			33.0	100.0	25.0
T1A5C10 Lined pit with semi-permeable walls and open bottom, no outlet or overflow	1.0			33.0	100.0	25.0
T2A6C10 Unlined pit, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	6.0			33.0	100.0	25.0
T1A6C10 Unlined pit, no outlet or overflow	6.0			33.0	100.0	25.0
T2B7C10 Pit (all types), never emptied but abandoned when full and covered with soil, no outlet or overflow, where there is a 'significant	12.0					
T1B7C10 Pit (all types), never emptied but abandoned when full and covered with soil, no outlet or overflow	11.0					
T1B8C10 Pit (all types), never emptied, abandoned when full but NOT adequately covered with soil, no outlet or overflow	24.0					
T1B9C1 TO C10 User interface failed, collapsed or flooded, connected to sewer, soak pit, open drain or storm sewer, water body, open	2.0					
T1B10C10 Containing fully lined tanks, partially lined tanks and pits, and unlined pits) failed, damaged, collapsed or flooded -	2.0			33.0	100.0	25.0
T1B11 C7 TO C9 Open defecation	1.0					



7.8 Appendix 8: Final SFD Graphic

