SFD Report

Kisumu
Kenya

Final Report

This SFD Report - Comprehensive Level - was prepared
by WSUP, i-San Consulting and Opero Services

Date of production: 09/03/2024

Last update: 16/07/2024

SFD Report Kisumu, Kenya, 2024

Produced by: WSUP, i-San Consulting and Opero Services

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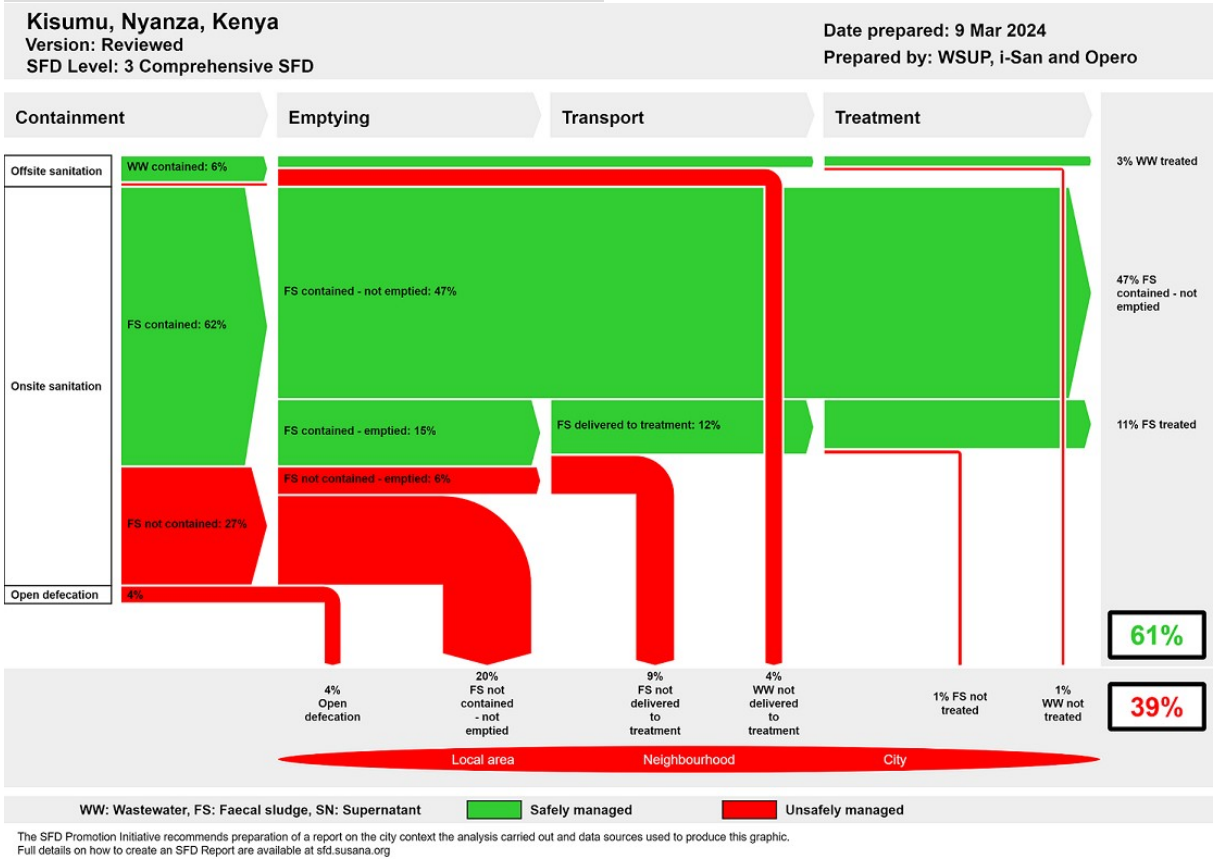
1. The SFD Graphic



2. Diagram information

SFD Level: SFD report Level 3 - Comprehensive.

Produced by: WSUP, i-San Consulting and Opero Services. With support from the Kisumu Joint Intergovernmental Sanitation Committee, County Government of Kisumu (CGK), City Board of Kisumu, and Kisumu Water and Sanitation Company Limited (KIWASCO).

Status: Final report.

Date of production: 09/03/2024

3. General city information

Kisumu, western Kenya's third-largest city, spans 231 km² and serves as Kisumu County's capital. Located at the north-eastern fringe of the Winam Gulf, it is a vital industrial and commercial hub. The city administratively comprises 25 sub-locations grouped into 10 main locations.

In 2019, Kisumu's population was 457,278 with a density of 4,164 persons/km², projected to reach 519,909 by 2024, increasing the density to 4,734 persons/km². High-density areas such as Migosi, Manyatta A and B, and Nyalenda A and B will exceed 5,000 persons/km².

Kisumu features both formal and informal housing, with low-lying areas like Usoma, Manyatta, and Nyalenda prone to flooding due to high groundwater levels. The terrain's black cotton soils and rocky outcrops impact drainage and latrine construction.

The city has a tropical rainforest climate with average temperatures of 22°C to 26°C, peaking at 32°C. Rainy seasons occur from March to May and October to December, with April and May being particularly wet. High humidity (74%-85%) and 8 hours of daily sunshine contribute to frequent thunderstorms. This context presents unique challenges and opportunities for Kisumu's urban sanitation planning and infrastructure development.

4. Service outcomes

Water supply: The primary water source is piped network, reaching 87% of households, 88% of public schools, and 77% of healthcare facilities. However, a small portion of the population (around 13%) relies on boreholes, springs, wells, and surface water, which can be contaminated due to high population density.

Sewered sanitation: A functional sewer network exists in parts of Kisumu, serving only 6% of households, 33% of public schools, 35% of public healthcare facilities, and 58% of public toilets. High sewer charges, limited coverage (6% of the population connected), inaccessible clogged lines (47% not clogged), and aging infrastructure are some of the sewer challenges.

Non-sewered sanitation: Most people in Kisumu (90%) use pit latrines, septic tanks, or other containment options. However, unlined pit latrines, the most common option (62%), pose a high risk of groundwater contamination. Many toilets are shared by multiple households (66% share, 34% with over 5 households), and proper emptying practices are often lacking, with 11% abandoning filled pits and 52% unaware of proper disposal methods.

Around 4% of the population resort to open defecation. For young children under 5, 26% of households practice open defecation or use methods that pose similar hygiene risks. There is a need for improved waste management education for mothers and caregivers.

While container-based toilets offer an affordable option in the short-run, upfront costs for sewer connections and flush toilets limit accessibility, especially for low-income households. Unlined pit latrines, while the cheapest option, pose environmental risks and require emptying eventually.

Sanitation in schools and healthcare facilities: Schools have improved toilets with washable slabs in all surveyed locations. Most secondary schools meet user-to-stance ratios, but overcrowding is an issue in primary schools (83% exceeding recommended ratios). Some schools (48% in primary) still rely on unlined pit latrines, and non-functional cisterns in many pour-flush toilets necessitate alternative flushing methods.

Similarly, high user-to-stance ratios exist in 45% of healthcare facilities, faulty cisterns affect many pour-flush toilets, and some facilities (13%) rely on unlined pit latrines.

Public toilets: Disrepair and inconsistent management are challenges for public toilets, with 51 out of 134 currently non-functional.

Faecal sludge emptying, transport and treatment: An established market exists for faecal sludge emptying, with both exhauster trucks (55%) and manual emptiers (34%) serving the population. The County Government and KIWASCO recognise manual emptying, providing an economic option for low-income households. Free disposal sites for manual emptiers at the Nyalanda Treatment Plant incentivise proper disposal, but a lack of awareness about the final destination of emptied waste persists among most households (52%).

Overall sanitation challenges: Kisumu faces challenges in achieving safe and sustainable sanitation. Limited coverage (especially sewer networks), improper management practices, and cost barriers hinder progress. Upgrading infrastructure, improving emptying and disposal practices, and promoting affordable sanitation solutions are all crucial for improvement.

Excreta management: The SFD graphic reveals that 61% of faecal matter in Kisumu is safely managed, while over 39% remains unsafely managed, posing a contamination risk to water sources. The 47% out of 61% of safely managed excreta includes the Faecal Sludge (FS) stored in containments without significant risk to groundwater pollution. Thus, the safely managed percentage of FS generated by this 47% of the population is temporary until the FS from the containments is emptied. Therefore, these systems will require emptying services in the short and medium term as they fill up.

The improvement from 33% safely managed in the 2018 SFD report developed by WEDC is attributed to initiatives by the County Government, KIWASCO, and development partners, such as allowing safe disposal at Nyalenda ponds for all pit emptiers and the adoption of UDDTs/container-based toilets. However, further efforts are necessary to achieve 100% safely managed excreta in Kisumu.

5. Service delivery context

Policy, legislation, and regulation: Kisumu's sanitation services are governed by the Kisumu County Environmental Health and Sanitation Act (2022) and the Kisumu County Water Act (2023). These laws provide a robust framework, but their limited publicity and inconsistent enforcement reduce their effectiveness, especially for non-sewered sanitation. KIWASCO primarily manages sewerage services, while smaller informal providers handle non-sewered sanitation, posing regulatory challenges.

Planning: Sanitation service planning in Kisumu involves setting targets and identifying investments. KIWASCO has a clear strategy for expanding sewerage coverage, but non-sewered sanitation services lack similar clarity and funding. Investment plans often favour sewerage infrastructure, neglecting informal service providers. An integrated planning approach is needed to ensure comprehensive sanitation coverage.

Equity: Equity in service provision is crucial, particularly for the urban poor relying on non-sewered sanitation. Current options for these populations are limited and of lower quality. Efforts to reduce inequities include extending sewerage networks to underserved areas and improving informal sanitation services. However, these initiatives require more scale and funding to be effective.

Outputs: The capacity to meet Kisumu's sanitation needs is mixed. KIWASCO has expanded sewerage services, but demand, especially in informal settlements, outpaces supply. Monitoring and reporting mechanisms are inconsistent, hindering accurate assessment of service access and quality. More robust data collection and reporting systems are needed for informed decision-making.

Expansion: Expanding sanitation services is critical for Kisumu. Ongoing efforts to stimulate demand include public awareness campaigns and incentives for sewerage connections. Strengthening the roles of both formal and informal service providers through capacity-building, regulatory support, and financial assistance is essential for sustainable service delivery.

Conclusions: Kisumu's service delivery context reveals key challenges and opportunities. The legislative framework is solid but needs better enforcement and public awareness. Planning must include non-sewered sanitation to address urban poor needs effectively. Equity issues require targeted interventions to improve service quality and accessibility. Outputs show progress in sewerage services but highlight gaps in non-sewered sanitation. Expansion efforts should focus on stimulating demand and enhancing service providers' capacities for comprehensive sanitation coverage.

6. Overview of stakeholders

The City-Wide Inclusive Sanitation (CWIS) initiative in Kisumu is coordinated by the **Kisumu Joint Intergovernmental Sanitation Committee (KIJISC)** and involves multiple stakeholders to ensure comprehensive and inclusive sanitation services. The **County Government of Kisumu** leads the initiative through its Public Health, Sanitation, and Water Departments, with additional support from the Departments of Environment and Natural Resources, Gender and Youth Affairs, Education, and Tourism. These departments are responsible for policy formulation, stakeholder mobilisation, public toilet maintenance, and by-law enforcement. **The City of Kisumu** manages sanitation services with funding from the County Government, while the **Kisumu Water and Sanitation Company Limited (KIWASCO)** oversees water supply, public toilets, sewer networks, and treatment plants. The **Lake Victoria South Water Works Development Agency (LVSWWDA)** provides infrastructure, and the **Water Services and Regulatory Board (WASREB)** regulates services and tariffs. The **Water Sector Trust Fund (WaterFund)** offers grants for service development, especially in underserved areas, and the **National Environment Management Authority (NEMA)** controls water pollution and waste management. The **private sector** contributes significantly to sanitation services, complemented by the efforts of various **NGOs and community-based organisations**. Key NGOs include UNICEF, Habitat for Humanity Kenya (HFHK), Fresh Life, Water and Sanitation for the Urban Poor (WSUP), and the USAID Western Kenya Sanitation Project (WKSP), among others. Key development partners or donors include, among

others, French Development Agency, European Investment Bank, KfW, Sanitation Hygiene Fund (SHF) for Kenya, and Government of Kenya. This collaborative approach aims to provide safely managed sanitation for all residents of Kisumu.

A summary of the public institutions, the main cooperation agencies and other organizations that participate in the development of the water and sanitation sector are shown in Table 1.

Table 1: Overview of key stakeholders in Kisumu.

Key Stakeholders	Institutions / Organisations
Public Institutions	County Government of Kisumu Lake Victoria South Water Works Development Agency Kisumu Water and Sanitation Company Limited
Non-governmental Organisations	WSUP, UNICEF, Habitat for Humanity Kenya (HFHK), USAID Western Kenya Sanitation Project (WKSP), and Fresh Life, among others
Private Sector	Private pit emptiers and masons
Development Partners, Donors	French Development Agency, European Investment Bank, KfW, SHF, and Government of Kenya
Others	Academia

9. Process of SFD development

The SFD report was produced as part of the baseline assessment for developing the City-Wide Inclusive Sanitation Plan (CWISP) for Kisumu City.

Desk review: This involved reviewing 22 documents on sanitation policies, plans, and past assessments. Additionally, the 2018 SFD report was analysed to identify trends and existing challenges in sanitation services.

Survey in households, public schools and healthcare facilities and public places: Household surveys were a crucial part of the assessment, reaching 491 households chosen through a random sampling method, representing 0.4% of the total households in Kisumu City (projected at 149,196 for 2024). The surveys were conducted from February 13 to 16, 2024. Questionnaires, observations, and a mobile app were used to collect data. However, challenges arose during this process, such as hesitancy from some households to allow photography of indoor toilets and discrepancies in mapping boundaries. Additionally, some households were reluctant to disclose income information, and enumerators faced difficulty accurately identifying toilet structures. To address these issues, a thorough data cleaning process was implemented, which included meticulous review of toilet photographs and emptying frequency data to ensure accuracy. Bathroom water drainage data was also cross-checked to align with toilet interface and containment details, resolving any inconsistencies encountered.

Public schools and healthcare facilities were also included in the assessment. Surveys were conducted between March 26 and 28, 2024, at 82 institutions in Kisumu City (51 public schools and 31 public healthcare facilities). Existing data from KIWASCO provided additional information on public toilets.

Key informant interviews: To gain a deeper understanding of sanitation service delivery across the city, 14 key informant interviews were conducted. These interviews included government officials, representatives from utility companies, NGOs, and private sector stakeholders such as toilet contractors and pit emptiers. The interviews took place between January 23 and March 28, 2024, utilising both in-person and online formats.

Data analysis and documentation: All collected data, encompassing aspects like containment, emptying & transport, treatment, and disposal or reuse, was analysed across the entire sanitation value chain. A new SFD graphic for Kisumu City was created based on the findings from the various data collection methods. The results were integrated into a comprehensive baseline assessment report.

Stakeholder validation: Finally, to ensure stakeholder buy-in, the Baseline Assessment and SFD reports were presented to key decision-makers in Kisumu County on June 20, 2024 at a High-level Stakeholder Workshop held at Sarova Imperial Hotel, Kisumu. Their feedback was incorporated into the final reports, solidifying the information gathered. This multi-faceted approach, employing document review, surveys, interviews, and data analysis, provided a clear picture of Kisumu's current sanitation situation.

10. Credibility of data

The depth of the data gathered by this report is greater than the past SFD report of 2018. The

main differences rely on the disaggregation of the data related to the sanitation options, the household survey, and the greater number of KIIs and field visits carried out. As a consequence, the SFD graphic outcome is also different.

11. List of data sources

Below is the list of data sources used for the development of the SFD executive summary:

- Kenya National Bureau of Statistics: 2019 Kenya Population and Housing Census (December 2019)
- LVSWWDA: Kisumu City Sanitation Coverage Report (2024)
- WSUP: Onsite Sanitation Capacity Assessment Report for Kisumu Water and Sanitation Company Limited (Draft Report, 2024)
- BRL ingénierie & ISEP: Water Resources and Wastewater Master Plan in Kisumu County Under LVWATSAN Programme (2021)
- Office of the Auditor-General: Performance Audit Report on Provision of Sewerage in Major Towns in Kenya: A Case Study of Kisumu City (2018)
- Other reports and studies:
  - Agong et al. (2014): Baseline survey on governance, policies and knowledge of urban sustainability in the Kisumu local interactions.
  - Günther et al. (2012): When is shared sanitation improved sanitation?
  - Kwiringira et al. (2014): Gender variations in access, choice to use and cleaning of shared latrines.
  - Maoulidi (2010): A water and sanitation needs assessment for Kisumu city, Kenya.
  - Odwar et al. (2017): The Kisumu Port - The Challenges and Promise of a Port City on Lake Victoria.
  - Opisa et al. (2012): Faecal contamination of public water sources in informal settlements of Kisumu City.
  - UN-Habitat (2005): Situation analysis of informal settlements in Kisumu.
  - Wright et al. (2013): A spatial analysis of pit latrine density and groundwater source contamination.

SFD Kisumu, Kenya, 2024

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Abbreviations

BOD	Biochemical Oxygen Demand
Capex	Capital Expenditure
CGK	County Government of Kisumu
COD	Chemical Oxygen Demand
CSDA	City Service Delivery Assessment
CWIS	City-Wide Inclusive Sanitation
CWISP	City-Wide Inclusive Sanitation Plan
FSM	Faecal Sludge Management
KII	Key Informant Interview
KIJISC	Kisumu Joint Intergovernmental Sanitation Committee
KIWASCO	Kisumu Water and Sanitation Company Limited
KMBS	Kenya Market-Based Sanitation
LVSWWDA	Lake Victoria South Water Works Development Agency
LVWATSAN	The Lake Victoria Water and Sanitation
MBS	Market-Based Sanitation
NEMA	National Environment Management Authority
NGO	Non-Governmental Organisation
NSS	Non-Sewered Sanitation
Opex	Operational Expenditure
SDG	Sustainable Development Goal
SFD-PI	Shit Flow Diagram Promotion Initiative
SFD	Shit Flow Diagram
SHF	Sanitation Hygiene Fund
SOP	Standard Operating Procedure
TSS	Total Suspended Solids
UBSUP	Up-scaling Basic Sanitation for the Urban Poor
UDDT	Urine-Diverting Dry Toilet
WASREB	Water Services Regulatory Board
WKSP	Western Kenya Sanitation Project
WSTF	Water Sector Trust Fund
WSUP	Water and Sanitation for the Urban Poor
WWTP	Wastewater Treatment Plant

Conversion rate: 1USD ≈ 127KES, March 2024

1 City Context

1.1 Country, City, and Region

Kisumu, located in western Kenya, is the country's third-largest city, following Nairobi and Mombasa (KNBS, 2019). Within the Lake Victoria Basin, it ranks as the second-largest city, after Kampala and is renowned as a crucial industrial and commercial centre in Kenya (UN-Habitat, 2005). As the capital of Kisumu County, the city spans a land area of 231 km² and sits at an elevation of 1,131 metres. Positioned at the north-eastern fringe of the Winam Gulf, an elongated and shallow extension of Lake Victoria, Kisumu enjoys a strategic location within the region (Odwar et al., 2017).

Present-day Kisumu City comprises 25 sub-locations: Bandari, Buoye, Chiga, Dago, Kadero, Kaloleni, Kanyakwar, Kasule, Kogony, Konya, Korando A, Korando B, Manyatta A, Manyatta B, Mayenya, Migosi, Miwani West, Northern, Nyalenda A, Nyalenda B, Nyalunya, Nyawita, Okok, Southern, and Wathorego (Figure 1). These sub-locations are further grouped into 10 main locations: Township, East Kolwa, Central Kolwa, South-west Kisumu, North Kisumu, Central Kisumu, East Kisumu, West Kajulu, East Kajulu, and West Kolwa.

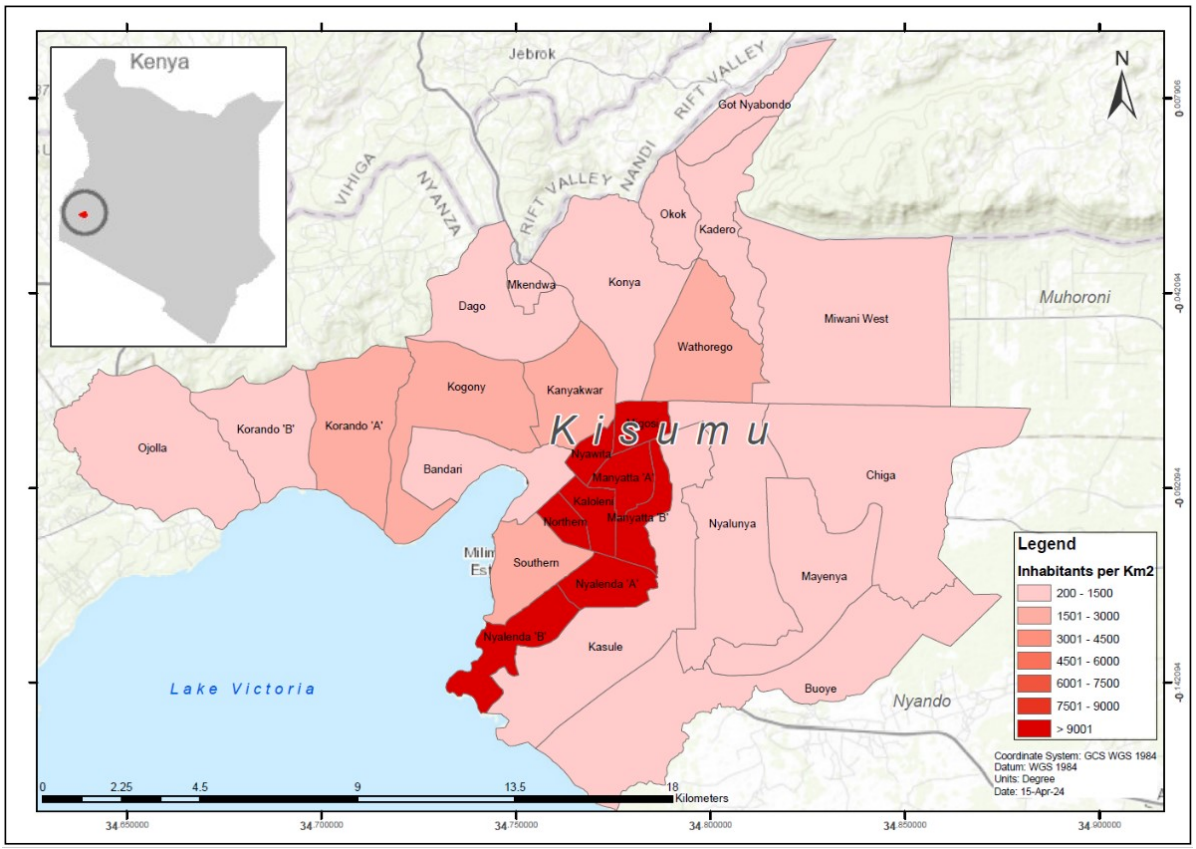


Figure 1: Map of Kisumu with the sub-locations and their population densities (Source: Adopted from KIWASCO, 2024).

1.2 Population

According to the 2019 Kenya Population and Housing Census, the 25 sub-locations in Kisumu had a population of 457,278 people and 131,223 households. The average population density in 2019 was approximately 4,164 persons/km². The projected population for Kisumu in 2024 is estimated at 519,909 people residing in 149,196 households, considering a population growth rate of 2.6%. The average population density for Kisumu is anticipated to be 4,734 persons/km². Particularly, eight sub-locations—Migosi, Manyatta B, Manyatta A, Northern, Kaloleni, Nyawita, Nyalenda B, and Nyalenda A—are expected to have population densities exceeding 5,000 persons/km².

1.3 Climate

Kisumu experiences a tropical rainforest climate characterised by consistent warmth and significant precipitation throughout the year. The city sees average temperatures ranging from 22°C to 26°C, with the hottest periods typically occurring in January and February, reaching up to 32°C. Kisumu's rainy season spans from March to May and October to December, with April and May being particularly wet, receiving up to 544.89 mm of rainfall. The high humidity, averaging around 74% to 85%, and an annual sunshine duration of about 8 hours per day, contribute to the city's green environment and frequent thunderstorms, especially in the afternoons and evenings (Climates to Travel, 2024; Weather and Climate, 2024; Meteoblue, 2024).

1.4 Geography

The city slopes from east towards the lake in the west. Kisumu's terrain consists of black cotton soils with rocky outcrops, impacting drainage and latrine construction (Wright et al., 2013). The mean groundwater level is approximately 6 metres, although it can be higher in informal areas such as Usoma (Bandari), Manyatta, and Nyalenda, reaching depths of up to 3 metres. Notably, three major low-lying areas - Usoma, Manyatta, and Nyalenda - are prone to flooding (Agong et al., 2014; Maoulidi, 2010).

2 Service Outcomes

2.1 Water Supply

Households: According to the baseline survey 2024, the majority (87%) of households fetch their drinking water from the piped water system: 34% from standpipes, 23% from yard taps, 18% from household connections within dwellings, and 12% from household connections at neighbours'. Around 3% utilise boreholes, rainwater harvesting tanks (3%), delivered water on carts (2%), and protected dug wells (2%), with less than 1% relying on protected springs. The use of boreholes, springs, wells, and surface water poses challenges in Kisumu due to increased risk of groundwater contamination as population density rises (Wright et al., 2013, Opisa et al., 2013).

Schools: Among public primary schools, the majority (88%) fetch drinking water from the piped water system, with 53% accessing institutional connections within dwellings and 35% utilising yard taps. Additionally, a few rely on rainwater or protected dug wells. Similarly, all public secondary schools have access to piped water, either directly into dwellings (55%) or via yard taps (45%).

Healthcare facilities: Around 77% of public healthcare facilities rely on piped water into dwellings, 19% rainwater harvesting tanks, and 3% boreholes.

Public toilets: Around 78% of public toilets use piped water, 11% rely on water delivered by vendors, and 6% utilise boreholes. Only 5% source water from the river.

2.2 Sanitation

2.2.1 Sewered Sanitation Situation

2.2.1.1 Sewer Network

Kisumu City's sewer network (Figure 2) is divided into the Central, Eastern, and Western Wastewater Treatment Districts, established from 1955 to 1985. Spanning 168 km, the system features four pumping stations (Mumias Road, Kendu Lane, Sunset, and Tom Mboya) mainly serving the Central and Eastern districts. The Western district, however, has minimal infrastructure (BRL ingénierie & ISEP, 2021; LVSWWDA, 2024).

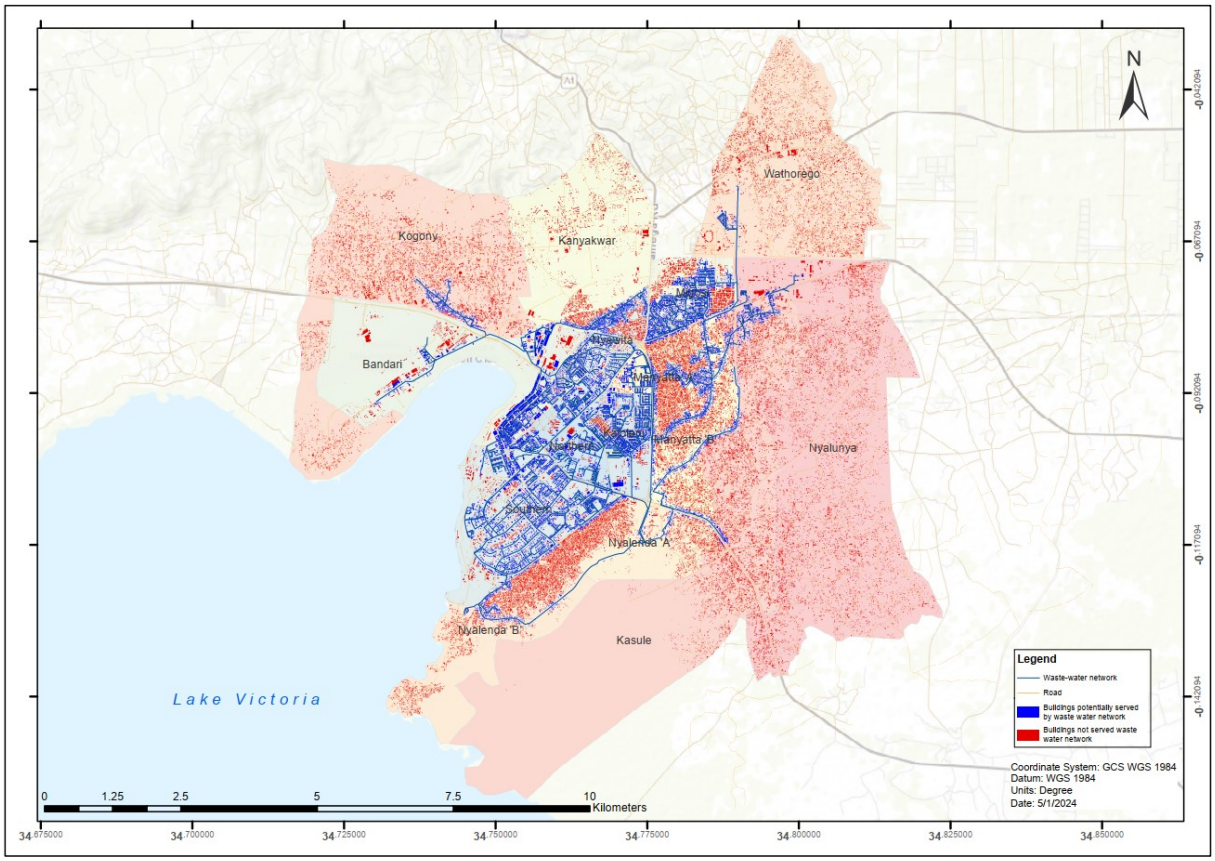


Figure 2: Map of Kisumu indicating the sewer network with building potentially served (blue) and unserved (red) (Source: Authors' geo-informatic analysis, adopted from KIWASCO, 2024).

The baseline survey revealed that only 6% of households in Kisumu City have sewer connections. These connected households are primarily found in the Central (Manyatta A, Migosi, Bandari, Northern, Nyalenda B, Kaloleni, Nyawita) and Eastern (Kasule) parts of Kisumu. Among these, the highest concentrations of sewer-connected households are in Migosi (58%), Northern (30%), and Kaloleni (15%), with coverage in other areas with sewer infrastructure below 10%. In the surveyed locations of Kisumu Central, sewer coverage reached 17%.

The Water Resources and Wastewater Master Plan 2021, indicates that around 6-7% of the population in Kisumu is connected to the sewer network. The aggregated percentage of the population using the sewer network in Kisumu East, Central, and West Kisumu stands at around 8.6%, based on the 2019 Kenyan Census (Table 1). The 2019 Kenyan Census estimates the sewer coverage in Kisumu Central at 20%. The reduction in the percentage of households connected to the sewer network from 8.6% in 2019 to 6% based on the survey in 2024 suggests that population growth may be outpacing the expansion of sewer services. Consequently, the value set to the percentage of people connected to the sewer network in the SFD matrix is 6%.

Table 1: Comparison of household sewer usage with 2019 Kenyan Census – aggregated based on relative populations.

County/ Sub- County	Conventional households (Census 2019)	Percent of households using sewer in area (Census 2019)	Aggregated percent of households using sewer
Kisumu County	296,846	4.8%	
Kisumu East	61,499	3.2%	1.3%
Kisumu Central	52,163	20.9%	7.0%
Kisumu West	42,785	1.4%	0.4%
Total			**8.6%**

Among the public institutions surveyed, 35% of public healthcare facilities are connected to sewer lines. Around 33% of public schools have sewer connections. Furthermore, approximately 58% of public toilets are connected to sewers.

According to KIWASCO staff interviews, in the 2022-2023 fiscal year, there were 13,735 domestic and 1,483 commercial, industrial, and construction sewer connections. Connection fees were set at 5,000KES (about 38USD) for domestic users and 7,500KES (around 58USD) for commercial, industrial, and construction sectors.

KIWASCO's sewer charges are structured similarly to their water billing, with rates based on consumption. For domestic users, rates started at 42KES (approximately 0.3USD) per cubic metre for the first 1-6 cubic metres of water used, increasing to 85KES (about 0.6USD) for over 300 cubic metres. These charges typically constitute about 50% of the domestic water bill. For schools, sewer charges began at 48KES (roughly 0.4USD) per cubic metre for the first 1-600 cubic metres, rising to 74KES (approximately 0.6USD) for consumption over 1,200 cubic metres, accounting for about 63-75% of the school water bill. For the commercial, industrial, and construction sectors, sewer charges ranged from 64KES (around 0.5USD) per cubic metre for the first 1-50 cubic metres, to 85 KES (about 0.6 USD) for over 300 cubic metres, which generally represented around 50% of the water bill.

Challenges with sewer networks

According to the Kisumu Wastewater Master Plan, the sewer network in Kisumu faces considerable challenges. Despite the proximity to sewer lines, most of the population opts for on-site sanitation, deterred by the high costs of sewer connection and usage. A significant portion of the network is inaccessible because it cannot be traced due to unknown slopes and pipe depths. Approximately 26% of manholes are deemed inaccessible, and among those that can be reached, 22% cannot be opened, hindering regular maintenance operations. The majority of these inaccessible manholes are clogged with sediments, excreta, and waste solids. Only 47% of the network is not clogged, underscoring an urgent need for enhanced maintenance, ordinance enforcement, and compliance monitoring.

Moreover, the sewer network suffers from clear water intrusion through manholes due to missing (often due to vandalism) or collapsed covers, roots, and cracks. This intrusion reduces capacity and causes environmental damage through frequent discharges.

Additionally, all four pumping stations, except for the Tom Mboya station, are grappling with severe structural and equipment issues. These stations suffer from corroded and outdated electromechanical equipment, lack basic operation and maintenance tools, and require system upgrades including alternative power sources to ensure reliability and mitigate corrosion (BRL ingénierie & ISEP, 2021; LVSWWDA, 2024).

Efforts to expand coverage by LVSWWDA are currently underway, with a five-year Lake Victoria Water and Sanitation (LVWATSAN) project funded by French Development Agency (AFD) and European Investment Bank (EIB) until 2027. This initiative aims to rehabilitate and extend the sewer network by 33km, alongside piloting household promotional connection incentives. The Kisumu Wastewater Master Plan further outlines a long-term strategy to rehabilitate 70% of the network by 2050.

2.2.1.2 Wastewater Treatment

Kisumu has two main wastewater treatment facilities: the Kisat Conventional Sewerage Plant and the Nyalenda Waste Stabilisation Ponds. The Kisat Plant comprises primary sedimentation tanks, trickling filters, and sludge digesters with drying beds. Meanwhile, the Nyalenda Plant consists of a series of anaerobic, facultative, and maturation ponds. The Kisat plant (capacity of 8,000m^3 per day), commissioned in 1958, serves the Central district, while the Nyalenda ponds (capacity of 11,000 m^3 per day), commissioned in 1978, serve the Eastern district.

According to interviews with KIWASCO, the Kisat Wastewater Treatment Plant (WWTP) functions at 56% of its operational capacity. However, based on the Kisumu Wastewater Master Plan 2021, Kisat WWTP is unable to meet the NEMA standards for Chemical Oxygen Demand (COD), Biochemical Oxygen Demand (BOD), and Total Suspended Solids (TSS) due to significant operational issues. The plant's challenges include insufficient pre-treatment, deteriorating electromechanical equipment, corroded pipes, and dysfunctional sludge digesters and drying beds, hampering its effectiveness in organic pollutant removal. Furthermore, it lacks Tertiary Treatment Unit to decrease total nitrogen and phosphorus, critical for environmental protection. Addressing these issues requires substantial rehabilitation, equipment and infrastructure upgrades, and the adoption of advanced treatment technologies. Enhanced asset management mechanisms and improved operational efficiency is vital for Kisat WWTP's long-term operational viability and sustainability (BRL ingénierie & ISEP, 2021).

Interviews with KIWASCO additionally highlight that Nyalenda Wastewater Treatment Plant runs at 60% of its operational capacity. According to the Kisumu Wastewater Master Plan 2021, Nyalenda WWTP meets COD, BOD, and TSS standards, but fails bacteriological and nutrient (nitrogen, phosphorus) treatment. Challenges include limited desludging, poor maintenance, and improper solid waste management.

Furthermore, the Nyalenda ponds are designed for wastewater, but also receive faecal sludge which exacerbates the rapid filling of ponds and increase the frequency of shock loading as highly concentrated faecal sludge enters the system. Improvements are needed in maintenance, infrastructure upgrades, and technology investment for nutrient treatment. However, a more dedicated and faecal sludge treatment plant is urgently required to receive pit and septic tank sludge from the city (BRL ingénierie & ISEP, 2021; WSUP, 2024).

The treatment efficiencies of the Nyalenda and Kisat plants were evaluated for COD, TSS, and BOD parameters, based on monitoring data obtained from KIWASCO. For COD, Nyalenda achieved an average efficiency of 92% while Kisat achieved 91%. For TSS, Nyalenda had an average efficiency of 67% and Kisat had 87%. In terms of BOD, Nyalenda reached 90% efficiency and Kisat achieved 91%. The combined BOD treatment efficiency of

the two plants is 90%. This reflects the plants' substantial capability in treating faecal sludge and improving effluent quality.

Similar to the sewer network, in line with Kisumu Wastewater Master Plan, the two treatment facilities are scheduled to undergo rehabilitation and upgrading under the LVWATSAN initiative until 2027. According to the Master Plan, the rehabilitation projects at Kisat and Nyalenda ponds WWTPs will focus on enhancing functionality and capacity. Both plants will undergo civil and electromechanical upgrades, efficiency improvements, and expansions to handle increased future loads (+8,000m³/day and +2,200 kgBOD_5/day for Kisat; +6,000m³/day and +3,000kgBOD_5/day for Nyalenda by 2050). Key enhancements will include upgraded pre-treatment and nutrient treatment capacities, the introduction of septage receiving stations, and the installation of backup power and security fencing, preparing them for future demands and environmental standards.

Furthermore, the Master Plan includes plans to construct new centralised sewerage systems in West Kisumu (5,000 m^3/d capacity) from 2020 to 2025, in Dunga (700 m^3/d capacity) from 2025 to 2050, and in Nyalenda (400 m^3/d capacity) from 2025 to 2050.

2.2.1.3 Disposal and/ or Reuse of Wastewater

The Nyalenda Wastewater Treatment Plant ponds have not been desludged in the past decade (WSUP, 2024), leading to no reuse of treated sludge at the plant. On the contrary, the treated wastewater sludge produced at the Kisat Treatment Plant is occasionally sold to farmers at 500KES (circa 4USD) per tonne. According to interviews with KIWASCO, only 60,200KES (473USD) was generated from the sale of treated faecal sludge in the 2022-2023 fiscal year.

2.2.2 Non-sewered Sanitation Situation

2.2.2.1 Faecal Sludge Containment

Households

Usage and type of toilets in households

Based on the baseline survey, around 93% of the households have toilets, while 7% do not. Of those without toilets, the majority (4%) defecate in the open, 3% share with neighbours, and less than 1% use public toilets or plastic bags (flying toilets).

Approximately 66% of the households share toilet facilities, with 30% using private toilets. About 34% of the total households share a toilet with over 5 households, mostly in rental residences (21%). According to research conducted in informal settlements in Kampala, toilets get dirtier when shared by over four families (Günther et al., 2012). Observation from the survey indicate that 66% of toilets shared by more than 5 households were observed dirty.

A large proportion (48%) of households use pit latrines with washable slabs. Around 19% use pour flush toilets, 17% use pit latrines without washable slabs, 6% use cistern flush toilets, 4% use Urine-Diverting Dry Toilets (UDDTs) such as Eco-San and Fresh Life Toilets, and 2% use SaTo Pans (Figure 4).

The bulk (62%) of households use unlined pit latrines (Figure 3). Approximately 16% use lined pit latrines, 8% use septic tanks, 6% are connected to sewer lines, 4% use Dehydrating vaults like EcoSan and Fresh Life Toilets, and 1% discharge waste into open fields, drainage channels, lakes, or rivers. The utilisation of unlined pit latrines has been associated with water source contamination in Kisumu, given the high-water tables and proximity to Lake Victoria (Opisa et al., 2012; Wright et al., 2013).

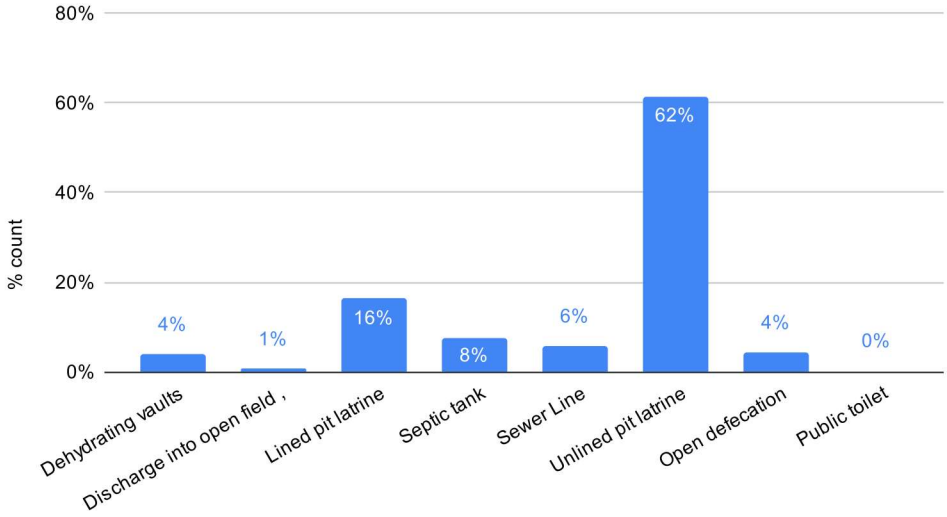


Figure 3: Type of toilet containment systems used by the households.

Regarding the connections between user interface and containment systems, all UDDTs were linked to dehydrating vaults, while cistern flush toilets were mostly connected to septic tanks and sewers. Pit latrines, with or without washable slabs, and SaTo Pans were linked to unlined or lined pit latrines. Conversely, pour flush toilets were connected to various containment systems, including sewers, septic tanks, lined and unlined pit latrines, and discharge into the environment.

Cistern flush | Pit latrine with washable slab | Pit latrine without a washable slab | Pour flush | SaTo Pan | Urine-Diverting Dry Toilet (UDDT)

Figure 4: Sample pictures of different toilet user interfaces from the household survey.

Generally, the distribution of sanitation systems in Kisumu does not correspond to the income level of the area, suggesting that pit latrines are utilised even in high-income neighbourhoods with established sewer systems, notably in Kisumu Central. Unlined pit

latrines are prevalent citywide, highlighting a heavy dependence on low-cost sanitation and spreading the potential risk of groundwater contamination throughout Kisumu. The prevalence of unlined latrines increases as one moves outward from the city centre.

Sanitation for users under five years of age

According to the baseline assessment results, 30% of households did not have children under 5 years old in their homes. Among households with young children, 31% use a potty, with excreta disposed in a toilet. Around 14% use small pits, 13% share toilets with adults, 4% practice open defecation, but the waste is collected and disposed of in the toilet, 3% practice open defecation, but the waste is collected and thrown in a rubbish pit, 3% use small pits covered after use (the cat method), and 2% practice open defecation, but the waste is collected and thrown outside the house.

Overall, in 26% of households, children under 5 years old either practice open defecation, use the cat method, or use small pits. Infants' waste poses similar risks as adults', emphasising the importance of educating mothers and caretakers on safe waste management practices, including the use of potties.

Cost of household toilets

The cost of toilets varies depending on the containment system, ranging from 13,500 to 75,000 KES (average 65,400KES/ 514USD) for sewer systems, 12,500 to 70,000KES (average 51,667KES/ 406USD) for septic tanks, 15,000 to 60,000KES (average 43,511KES/ 342USD) for lined pit latrines, 5,000 to 30,000KES (average 29,469KES/ 231USD) for unlined pit latrines, and 850KES/ 7USD (monthly subscription) for Fresh Life's dehydrating vaults. Visual analysis of the surveyed toilets and the skewed cost responses indicate a general lack of standards in technologies and standardised prices for toilets in Kisumu.

Analysis on cost of toilets per system

The life cycle cost analysis (over 10 years) depicted in Figure 5 outlines various sanitation system options for a family of four users, derived from baseline survey data. The cost breakdown includes:

- Flush toilet with sewer connection: 85,560KES/ 673USD, inclusive of sewerage surcharge (calculated over five years based on an average water consumption of 120 litres/day per family).
- Flush toilet with septic tank: 57,667KES/ 453USD, considering periodic emptying every five years.
- Lined pit latrine: 49,511KES/ 389USD, with similar periodic emptying costs of five years.
- Unlined pit latrine: 29,469 KES/ 231USD, with no emptying costs within the 10-year period.
- Container-based toilets: 102,000KES/ 802USD, accounting for a monthly subscription of 850 KES/ 7USD over five years.

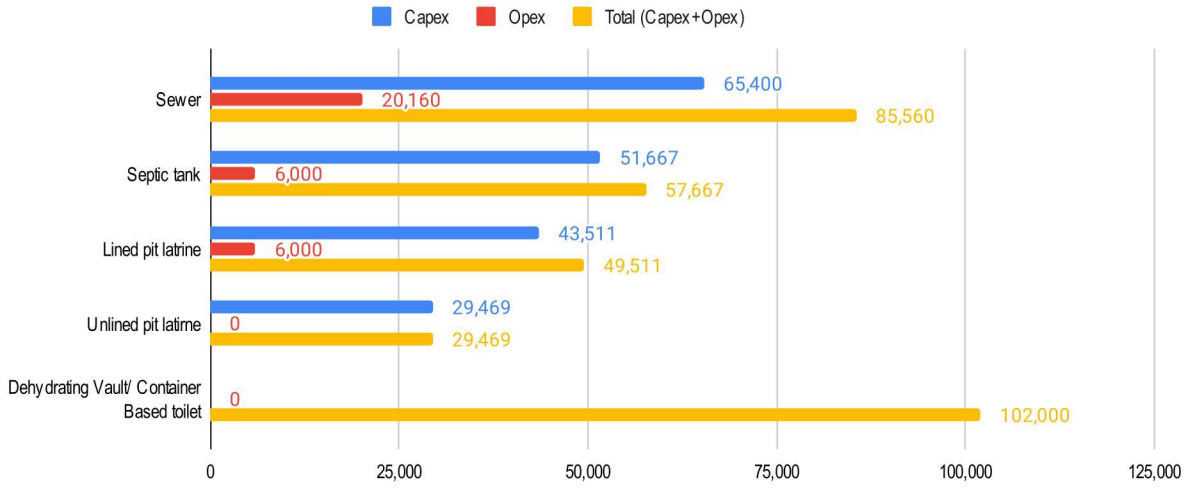


Figure 5: Analysis of cost of toilets per system.

The analysis highlights container-based toilets as the most expensive option in the long-run due to their higher operational expenditure, primarily driven by monthly subscriptions, but provide the most user-friendly, reliable, and short-term economic option for the inhabitants. Flush toilets connected to sewers follow, mainly due to the significant initial capital expenditure for the toilet and sewer connection by households, along with ongoing operational costs for sewer usage.

Costs then decrease progressively from flush toilets with septic tanks to lined pit latrines, with unlined pit latrines emerging as the most economical choice for the population. This is attributed to the deeper pits typically used for unlined latrines, requiring minimal or no emptying within the 10-year timeframe. The high prevalence of lined pit latrines in Kisumu reflects this cost consideration by households. Thus, the transition towards improving access to safely managed sanitation needs to consider that any appropriate solution promoted should match or be at least close to the unitary cost of an unlined pit latrine, i.e., 29,469 KES or 231USD.

Schools

Usage and type of toilets in schools

All the 51 public schools surveyed had improved toilets, each including at least a washable slab. All the toilets in the schools were gender segregated except for Mama Ngina Children's Home.

In terms of toilet interface, among the 51 public schools surveyed, the majority (60% / 24 schools) of primary schools relied on pit latrines with washable slabs, 23% (9 schools) utilised pour flush, and 17% (7 schools) used cistern flush systems. Meanwhile, in secondary schools, most (55% / 6 schools) relied on pour flush, 27% (3 schools) utilised pit latrines with washable slabs, and 18% (2 schools) used cistern flush systems. Regarding containment methods, in primary schools, the majority (48% / 19 schools) relied on unlined pit latrines, 25% (10 schools) had sewer connections, 20% (8 schools) utilised lined pit latrines, and 8% (3 schools) utilised septic tanks. In secondary schools, the majority (64% / 7 schools) relied on sewers, while 18% (2 schools) utilised lined pit latrines and another 18% (2 schools) utilised unlined pit latrines. Additionally, 24% (12 schools) of the public schools surveyed had other types of toilet interfaces besides the common systems at the school. Interestingly, most

pour flush systems were cistern flush systems converted to pour flush due to faulty cisterns or the lack of affordability of flush water.

The majority (83%, 33 out of 40) of primary schools had a user-to-stance ratio higher than the recommended standard of 25 and 30 users for females and males, respectively, for at least one gender. Only 7 out of the 40 primary schools met the standards for both genders. In secondary schools, the majority (64%, 7 out of 11 schools) met the standards for both females and males, while 4 out of 11 did not attain the standard. Therefore, there is a need for a total of approximately 1,163 additional toilet stances in public schools: 989 in primary (559 female, 429 male), and 175 in secondary (83 female, 92 male).

Cost of school toilets

All primary schools surveyed reported not knowing the cost of toilets. However, among secondary schools, those who were aware reported costs ranging from 1 to 2 million KES (around 7,667 to 15,335USD) per block for cistern/cistern flush system toilet blocks.

Healthcare facilities

Usage and type of toilets in healthcare facilities

Out of the 31 healthcare facilities surveyed, the distribution of toilet types by user interface is as follows: 11 facilities (35%) rely on pour flush, 10 facilities (32%) have pit latrines with washable slabs, 9 facilities (29%) feature cistern flush, and 1 facility (3%) uses a SaTo pan. For containment systems: 11 (35%) are connected to sewer lines, 9 (29%) have lined pit latrines, 7 (23%) utilise septic tanks, and 4 (13%) operate with unlined pit latrines. Additionally, 10 facilities have more than one type of toilet user interface. Most facilities (25) implement gender-segregated toilets. Particularly, while pour flush systems are prevalent, many of them utilise cistern flush systems with faulty cisterns, leading to the use of alternative methods such as buckets for flushing. This highlights the urgent need for renovations in these facilities to restore proper functionality.

Out of 31 facilities surveyed, approximately 45% (14 facilities) had a user-to-stance ratio below the recommended threshold of 20 users per stance, while the remaining 55% (17 facilities) had higher ratios. This indicates a need for an additional 83 toilet stances across healthcare facilities to meet recommended standards.

Public toilets

In Kisumu, there are 134 public toilets, with 83 functional and 51 non-functional. Management varies: 46% by individuals, 28% by county government, 18% by community organisations, 6% by private companies, with the remainder managed by schools or unknown entities. The disposal systems are diverse: 58% flush to sewer, 26% to septic tanks, 15% are pit latrines, and 1% use bio-digesters. Facilities often include separate male and female stances, with numbers ranging from 2 to 6 per gender, and 51% feature urinals. Cleaning frequencies vary, but 50% are cleaned three to four times daily.

2.2.2.2 *Faecal Sludge Emptying and Transport*

Households

Based on the baseline survey, approximately 24% of households with toilets have had their pit or septic tank filled up before. Among them, about 75% of households empty and remove the waste, 17% empty and bury it on-site, and 11% abandon and build a new one.

Exhauster trucks are the most commonly used method for emptying filled-up toilets (55%), followed by manual emptying (34%), semi-manual methods like PuPu pumps or gulpers (8%), and 3% were unsure of the method used (Figure 6). The majority of households reported their pits filling up once (36%) or more than twice (35%), often in toilets shared by more than 5 families. Seventeen percent reported filling up twice, 7% never, and 5% were unsure of the frequency.

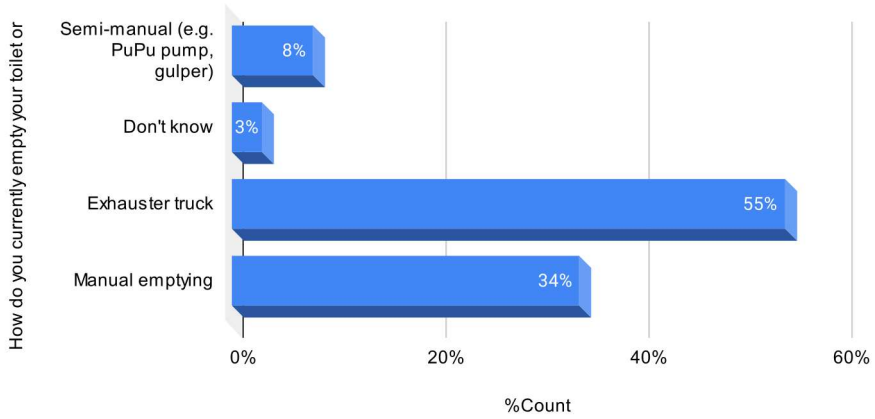


Figure 6: Methods of emptying household toilets.

The cost of emptying reported by households who emptied their toilets ranged from 3,000 to 5,000KES (median, 4,000KES/ around 31USD) per trip using an exhauster truck, 3,650 to 4,750KES (median 4,500KES/ about 35USD) using semi-manual methods (e.g., PuPu pump, gulper), and 1,500 to 3,500KES (median 2,500KES/ circa 19USD) using manual emptying. The majority (72%) of households whose toilets were emptied reported that the payment was made by the landlord, 23% by the family, and a few by private operators (2%), City/Municipality (2%), and tenants (1%).

Furthermore, 74% of households who had emptied their toilets reported that during the emptying process, the operators wore special equipment such as rubber boots, gloves, or masks. Approximately 54% reported no spillage or leakage of excreta during emptying, indicating adherence to standard operating procedures (SOPs).

Regarding the disposal of excreta, most households (52%) whose waste was emptied and taken away reported not knowing where it was taken. Of those who knew where excreta were taken, approximately 77% reported that the waste was disposed of in a designated waste disposal site, 13% emptied into a sewage system, and 10% utilised as fertiliser after appropriate treatment.

The faecal sludge emptying and transportation system in Kisumu is well established, with exhausters and manual pit emptiers holding major market shares of 55% and 34%, respectively. It is remarkable that manual pit emptiers are recognised by the County

Government and KIWASCO, allowing them to operate without prejudice or restriction as part of the Faecal Sludge Management (FSM) service delivery chain. Furthermore, manual pit emptiers are permitted to discharge faecal sludge at the Nyalenda Treatment Plant for free, which is a significant achievement towards improving FSM in the city. This recognition and operational support provide an economic alternative for low-income households and help ensure that most untreated faecal sludge is not discharged into the environment.

Schools

Only 25% (10 out of 40) of public primary schools and 27% (3 out of 11) of secondary schools reported their pit/septic tank had filled up before. All secondary schools with filled pits reported removing the waste. Among primary schools, approximately 60% emptied the waste, while 40% abandoned and built new ones. The practice of abandoning toilets in primary schools should be abolished due to land wastage and financial inefficiency. Lined toilets that are reusable are recommended. Half of the primary schools used semi-manual methods (e.g., PuPu pump, gulper) for emptying, 33% used exhauster trucks, and 17% employed manual emptying. In secondary schools, exhauster trucks were predominant (67%), while 33% used semi-manual methods. Most toilets (56%) were emptied more than twice in the last 2 years. The cost of emptying ranged from 15,000KES to 40,000KES (Median=20,000KES/ 153USD) per job using exhauster trucks, and 5,000KES (38USD) per trip using semi-manual methods. Generally, the cost was estimated at 5,000KES per trip and 20,000KES per job. Half of the schools funded emptying through government allocations, while the rest relied on contributions from parents, parents, or board members.

Healthcare facilities

Among the healthcare facilities surveyed, 4 out of 31 (13%) had experienced their pit/septic tank filling up before. Those with unfilled pits attributed this to factors such as connection to sewer systems and low population. Of those with filled pits, all reported emptying and removing the waste. The prevalent technologies used for emptying were semi-manual methods (e.g., PuPu pump, gulper) and exhauster trucks. Most facilities experienced pit filling either once or twice in the past 2 years. The cost of emptying was around 6,000KES (46USD) per trip using an exhauster truck and 7,000KES (54USD) per trip using semi-manual means, covered by government-allocated funds.

Public toilets

Only 19% of public toilets surveyed had been emptied previously, mainly using private exhauster trucks (13%). The rest were either sewer-connected or hadn't filled up, with minor methods including KIWASCO exhauster trucks (3%) and manual or semi-manual techniques (2%), while 1% abandoned and rebuilt toilets.

2.2.2.3 Faecal Sludge Treatment

Currently, Kisumu City lacks a dedicated facility for treating faecal sludge. Instead, faecal sludge is emptied from pits and transported to the Nyalenda Wastewater Treatment Plant, where operators using exhauster trucks are charged a tipping fee of 15,000KES (117USD) per month (WSUP, 2024). Operators using semi-manual and manual methods are not charged. Based on interviews with pit emptiers, all sub-locations in Kisumu are within a 20km radius from the treatment plant, making pit emptying a viable business in the city. However,

emptiers adjust their costs based on factors like distance from the treatment plant. The County Government or KIWASCO should regulate pit emptying prices based on the relative distance of sub-locations to treatment plants. This would ensure fairness and affordability while promoting efficient waste management and sanitation standards.

Although the Nyalenda Wastewater Treatment Plant serves as a temporary dumping site for faecal sludge, it lacks the capacity to treat the highly concentrated pit waste. This has led to issues such as increased solids in the ponds, which overload the anaerobic ponds at the plant. Therefore, there is a pressing need for either a designated treatment plant for faecal sludge or the construction of a pre-treatment unit at the Nyalenda Treatment Plant to stabilise the faecal sludge effectively.

2.3 SFD Matrix

The selection grid of the sanitation systems in households in Kisumu is shown in Figure 7.

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	T1A1C6				Not Applicable
Septic tank					T2A2C5 T1A2C5					
Fully lined tank (sealed)					Significant risk of GW pollution Low risk of GW pollution					T1A3C10
Lined tank with impermeable walls and open bottom	Significant risk of GW pollution Low risk of GW pollution	Significant risk of GW pollution Low risk of GW pollution	Significant risk of GW pollution Low risk of GW pollution	Significant risk of GW pollution Low risk of GW pollution	Significant risk of GW pollution Low risk of GW pollution					Significant risk of GW pollution Low risk of GW pollution
Lined pit with semi-permeable walls and open bottom	Not Applicable									Significant risk of GW pollution Low risk of GW pollution
Unlined pit										T2A6C10 T1A6C10
Pit (all types), never emptied but abandoned when full and covered with soil										Significant risk of GW pollution Low risk of GW pollution
Pit (all types), never emptied, abandoned when full but NOT adequately covered with soil										
Toilet failed, damaged, collapsed or flooded										
Containment (septic tank or tank or pit latrine) failed, damaged, collapsed or flooded										
No toilet. Open defecation	Not Applicable							T1B11 C7 TO C9		Not Applicable

Figure 7: Selection grid.

The SFD matrix for Kisumu is shown in Figure 8.

Kisumu, Nyanza, Kenya, 9 Mar 2024. SFD Level: 3 - Comprehensive SFD
Population: 519909
Proportion of tanks: septic tanks: 100%, fully lined tanks: 100%, lined, open bottom tanks: 100%

Containment								
System type	Population	WW transport	WW treatment	WW transport	WW treatment	FS emptying	FS transport	FS treatment
	Pop	W4a	W5a	W4c	W5c	F3	F4	F5
System label and description	Proportion of population using this type of system (p)	Proportion of wastewater in sewer system, which is delivered to centralised treatment plants	Proportion of wastewater delivered to centralised treatment plants, which is treated	Proportion of wastewater in open sewer or storm drain system, which is delivered to treatment plants	Proportion of wastewater delivered to treatment plants, which is treated	Proportion of this type of system from which faecal sludge is emptied	Proportion of faecal sludge emptied, which is delivered to treatment plants	Proportion of faecal sludge delivered to treatment plants, which is treated
T1A1C1 Toilet discharges directly to a centralised combined sewer	6.0	47.0	90.0					
T1A1C6 Toilet discharges directly to open drain or storm sewer	1.0			0.0	0.0			
T1A2C5 Septic tank connected to soak pit	3.4					24.0	58.0	90.0
T1A3C10 Fully lined tank (sealed), no outlet or overflow	20.0					24.0	58.0	90.0
T1A6C10 Unlined pit, no outlet or overflow	39.0					24.0	58.0	90.0
T1B11 C7 TO C9 Open defecation	4.0							
T2A2C5 Septic tank connected to soak pit, where there is a 'significant risk' of groundwater pollution	4.6					24.0	58.0	90.0
T2A6C10 Unlined pit, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	22.0					24.0	58.0	90.0

Figure 8: SFD matrix.

Modelling of the Survey Sanitation Systems According to SFD-PI Methodology

To develop the SFD graphic, the various technologies acquired from the baseline survey were modelled to align with those in the SFD Promotional Initiative (SFD-PI) methodology. Table 2 presents the corresponding matches. The SFD graphic focused on households and did not consider schools, healthcare facilities, and public toilets to avoid double counting, as the total population already includes people who visit these facilities. The assumptions made in developing the SFD graphic 2024 are presented in section 2.4.

Table 2: Types of containment in households in Kisumu and their equivalence to the SFD-PI.

Containment	%	Recategorised as SFD	System	%
Sewer line	6%	Toilet discharges directly to a centralised combined sewer	T1A1C1	6%
Discharge into open field	1%	Toilet discharges directly to open drain or storm sewer	T1A1C6	1%
Septic tank	8%	Septic tank connected to soak pit	T1A2C5 and T2A2C5	8%
Lined pit latrine + UDDTs	20%	Fully lined tank (sealed), no outlet or overflow	T1A3C10	20%
Unlined pit latrine	61%	Unlined pit, no outlet or overflow	T1A6C10 and T2A6C10	61%
Open defecation NA	4%	Open defecation	T1B11 C7 TO C9	4%
TOTAL				**100%**

Risk Assessment of Groundwater Contamination

In section 1.4, it is noted that the mean groundwater level in Kisumu is approximately 6 metres, with higher levels reaching depths of up to 3 metres in informal areas like Usoma (Bandari), Manyatta, and Nyalenda. Low-lying areas such as Manyatta A, Manyatta B, Bandari, Kogony, Nyawita, Nyalenda B, and Nyalenda A, were analysed to assess the risk of groundwater contamination from septic tanks and unlined pit latrines, utilising the groundwater risk assessment tool. The analysis considered sandstones/limestones fractured rock types[1] in the unsaturated zone, where the groundwater table was assumed to be below 5m, posing a significant risk of contamination. The percentage of sanitation facilities located within 10m of groundwater sources was estimated to be less than 25%, while those uphill of groundwater sources were considered greater than 25%, both indicating significant contamination risks. Despite 87% of households relying on piped water, with only around 6% using groundwater sources, the overall risk of groundwater contamination for humans was deemed low. However, significant environmental risk was identified due to faecal matter contaminating groundwater and potentially leading to lake eutrophication, as Kisumu's terrain facilitates runoff to the lake. Given that KIWASCO sources its water from Lake Victoria and the Kibos River, environmental contamination was prioritised, rendering septic tanks and unlined pit latrines in low-lying areas as high-risk contributors to groundwater contamination in the SFD graphic development.

2.4 Summary of Assumptions

1. The proportion of faecal sludge in septic tanks, fully lined tanks and all types of pits were all set to 100% (step two of the Graphic Generator), as per the guidance given in the Frequently Asked Questions (FAQs) in the Sustainable Sanitation Alliance (SuSanA) website.

[1] According to Wright et al., 2013, groundwater in Kisumu is typically stored in weathered surfaces between lava flows

2. 57% of the septic tank connected to soak pit (8%) are in areas where there is a 'significant risk' of groundwater pollution. These are septic tanks in the low-lying areas of Manyatta A, Manyatta B, Bandari, Kogony, Nyawita, Nyalenda B and Nyalenda A. Thus, value of the population on relying low risk (T1A2C5) and high risk (T2A2C5) septic tanks was set to 3.4% and 4.6% respectively.
3. 36% of the unlined pit with no outlet or overflow (61%) are in areas where there is a 'significant risk' of groundwater pollution. These are the unlined pit latrines in the low-lying areas of Manyatta A, Manyatta B, Bandari, Kogony, Nyawita, Nyalenda B and Nyalenda A. Thus, value of the population on relying low risk (T1A6C10) and high risk (T2A6C10) unlined pits was set to 39% and 22% respectively.
4. 47% of the wastewater is delivered to the treatment plant, since only 47% of the sewer network is functional. This corresponds to the value of variable W4a selected for wastewater systems.
5. 90% of the wastewater delivered to the treatment plant is treated, because the combined BOD removal efficiency for the Kisat and Nyalenda wastewater treatment plants is 90%. This corresponds to the value of variable W5a selected for wastewater systems.
6. 90% of the faecal sludge delivered at Nyalenda was safely treatment, since this is the plant's BOD treatment efficiency. The BOD treatment efficiency was considered because it is a direct measure related to the biological decomposition of organic matter (such as excreta) in the water. This corresponds to the value of variable F5 selected for all onsite systems.
7. 24% of the faecal sludge in the onsite systems is emptied. This corresponds to the value of variable F3 selected for all onsite systems.
8. 58% of the emptied faecal sludge is delivered to the treatment plant. This calculation is derived from the fact that 75% of households remove waste, and among those aware of waste disposal locations, around 77% reported using designated waste disposal sites. Thus, value for variable F4 is set to 58% for all onsite sanitation systems.
9. For toilets discharging directly to open drains or storm sewer (system T1A1C6), all wastewater generated is discharged untreated into the environment and hence, value for variables W4c and W5c were both set to 0%.

2.5 SFD Graphic

The SFD graphic of Kisumu is illustrated in Figure 9. The SFD graphic indicates that 61% of the faecal matter in Kisumu is safely managed. Over 39% of the faecal matter is unsafely managed, remains within the environment and is potentially contaminating water sources.

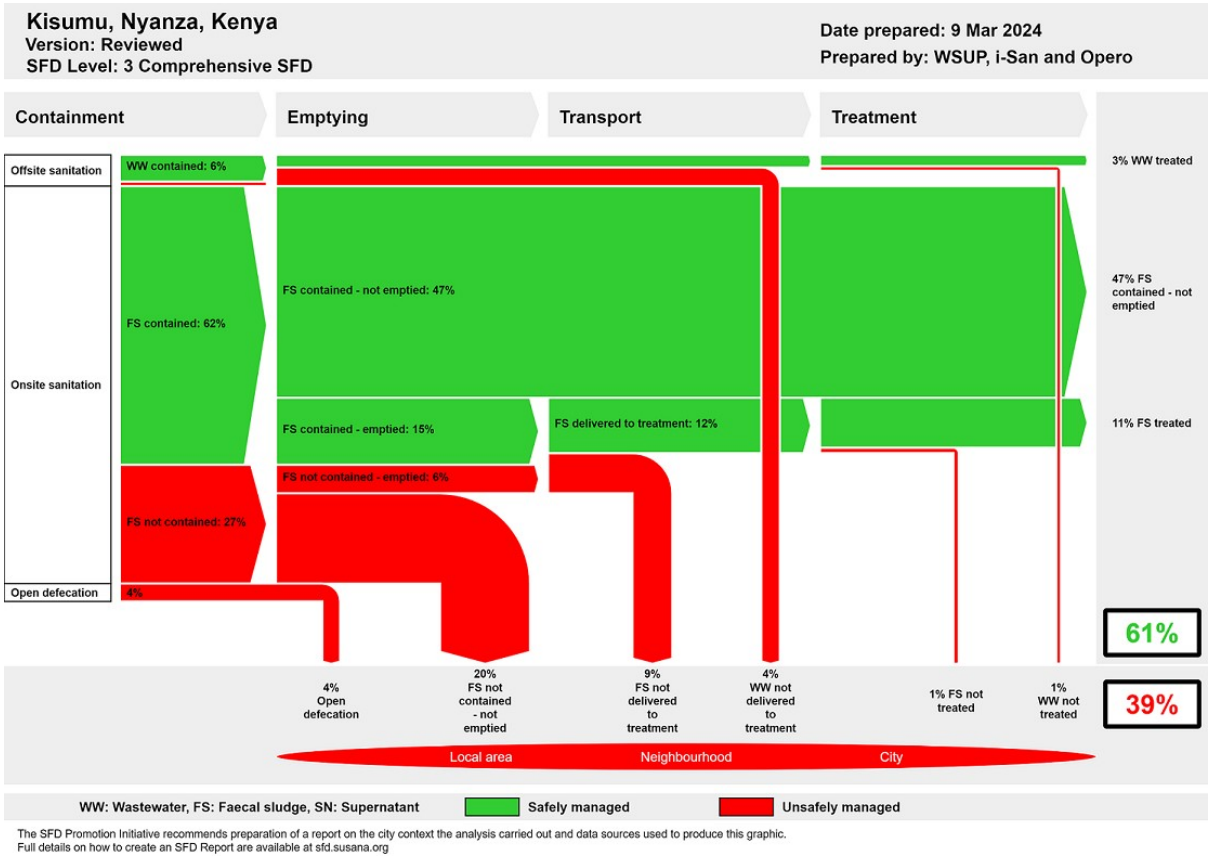


Figure 9: SFD for Kisumu.

The unsafely managed excreta (in RED) originated from wastewater not delivered to treatment (4%), wastewater not treated (1%), Faecal Sludge (FS) both contained and not contained - not delivered to treatment (9%), FS not treated (1%), FS not contained - not emptied (20%) and people practising open defecation (4%).

The safely managed excreta (in GREEN) originate from wastewater treated (3%), FS treated (11%) and FS contained - not emptied (47%). This 47% includes the FS stored in containments without significant risk to groundwater pollution. Thus, the safely managed percentage of FS generated by this 47% of the population is temporary until the FS from the containments is emptied. Therefore, these systems will require emptying services in the short and medium term as they fill up.

2.6 Comparison with the SFD Report from 2018

Table 3 provides a comparison of the data sources and results produced with respect to a previous SFD report published in 2018, which was prepared by WEDC (WEDC, 2018).

Table 3: Comparison of data gathered in the two SFD reports.

	SFD report (2018)	SFD report (2024)
Sources of data	The SFD is based on the data from the 2009 census, desk-based research, 8 KIIs, no FGDs	The SFD is based on the data from a household survey, 13 KIIs conducted
Service delivery context description	Limited information on policy, legislation and regulation of the sanitation service delivery chain is provided	Detailed information on policy, legislation and regulation of the sanitation service delivery chain is provided
Data validation	Desk-based research, no field visits	Several field visits
Finding's validation	No validation	A High-level Stakeholder Workshop was convened to present and validate the Baseline Assessment and Shit Flow Diagram (SFD) Reports with key decision-makers from Kisumu County

Table 4 depicts a comparison of the SFD graphic percentages in the city according to the two SFD reports.

Table 4: Comparison of the SFD graphic percentages according to the two SFD reports.

SFD graphic percentages	SFD report (2018)	SFD report (2024)
Wastewater not delivered to treatment	1%	4%
Wastewater not treated	4%	1%
FS both contained and not contained - not delivered to treatment	51%	9%
FS not treated	-	1%
FS not contained - not emptied	6%	20%
People practising open defecation	5%	4%
Wastewater treated	15%	3%
FS treated	7%	11%
FS contained - not emptied	11%	47%
SFD graphic outcome	**33% safely managed excreta 67% unsafely managed excreta**	**61% safely managed excreta 39% unsafely managed excreta**

As seen in Table 3 and Table 4, it is well noticed that the depth of the data gathered by this report is greater. The main differences rely on the disaggregation of the data related to the sanitation options, the household survey, and the greater number of KIIs and field visits carried out. As a consequence, the SFD graphic outcome is also different. The previous SFD graphic had a value of 33% on safely managed excreta whereas the SFD graphic from this report has a value of 61% on safely managed excreta. The improvement from 33% in 2018 to 61% is attributed to, among others, the County Government and KIWASCO's initiatives for safe disposal at Nyalenda ponds and the adoption of Fresh Life's UDDTs/container-based toilets, ensuring proper treatment plant disposal. Additionally, there have been improvements in access to lined and improved toilets through the various projects, notably FINISH Mondial and the Western Kenya Sanitation Project (WKSP).

3 Service Delivery Context

3.1 Policy, Legislation and Regulation

3.1.1 Policy

National Level

Laws

The **Kenyan Constitution, 2010** guarantees the right to sanitation and a clean environment, mandating the state to enact measures for their realisation and allocate resources accordingly. County governments are tasked with providing water and sanitation services within their jurisdictions, while the national government focuses on policy and standards formulation.

Legislation such as the **County Governments Act, 2012** and the **Public Health Act, 2012** encompasses sanitation services, with county governments mandated to deliver services within their designated areas. The Public Health Act defines and regulates sanitation-related nuisances, ensuring proper construction and maintenance of facilities to safeguard public health.

The **Water Act, 2016** establishes rights to clean water and sanitation, empowering county governments to establish Water and Sanitation Service Providers (KIWASCO) for service provision. It also defines sewerage and water services, clarifying responsibilities for infrastructure development and management.

The **Environmental Management and Co-ordination Act, 2015** addresses effluent discharge and licensing, regulating waste from domestic, agricultural, trade, and industrial sources. It highlights the importance of proper waste management to protect the environment and public health.

The **Sustainable Waste Management Bill, 2019** aims to establish a legal framework for efficient waste management in alignment with environmental and constitutional provisions. It emphasises the transition to a green economy and the realisation of a clean environment for all citizens.

Policies

The **Kenya Environmental Sanitation and Hygiene Policy (KESHP), 2016-2030** aligns sanitation efforts with constitutional rights, devolution, and global commitments such as the Sustainable Development Goals (SDGs). It provides a comprehensive framework for improving sanitation and hygiene practices across the country.

The **National Sanitation Management Policy** sets the stage for universal access to sustainable sanitation services, offering guidance to stakeholders involved in service delivery. It emphasises equitable and sustainable sanitation practices to improve public health and environmental outcomes.

Plans, strategies, and guidelines

The **Kenya Vision 2030** prioritises water and sanitation infrastructure development as key components of economic and social progress. It aims for universal access to water and

improved sanitation by 2030, with a focus on inclusive development and environmental sustainability.

Kenya lacks formal national standards for on-site sanitation, faecal sludge, and safe reuse of sludge/wastewater. However, there are existing standards for wastewater outlined in the **Guidelines on Drinking Water Quality and Effluent Monitoring 2008**, and efforts are underway to enhance the regulatory framework. The guidelines aim to ensure consistent and transparent monitoring of water quality and effluent by stakeholders such as Water Service Boards and Providers. While they primarily focus on drinking water quality, they also address wastewater, particularly industrial effluent monitoring.

The **Guidelines for Inclusive Urban Sanitation Service Provision, 2020** promote safe and sustainable sanitation technologies and service delivery mechanisms. They emphasise community participation, cost-effectiveness, and gender and social inclusion in sanitation initiatives.

The **National Water Master Plan (NWMP) 2030** aims to ensure universal access to improved water and sanitation, including on-site treatment facilities. It prioritises infrastructure improvements and regulatory measures to address sanitation challenges and achieve sustainable development goals.

Local level

Policy

The **Kisumu County Environmental Sanitation and Hygiene Policy, 2018** acknowledges various sanitation options but lacks quality standards. Hence, there is an urgent necessity to formulate standardised designs for safely managed toilets and disseminate this information widely to the public.

Laws and by-laws

Complementing the Kisumu County Environmental Sanitation and Hygiene Policy (2018), the Kisumu County Environmental Health and Sanitation Act, 2022, and the Kisumu County Water Act, 2023, establish legal frameworks for sanitation and water services, delineating responsibilities and regulatory measures.

The **Kisumu County Environmental Health and Sanitation Act, 2022**, delineates powers and functions for environmental health and sanitation matters, setting the stage for regulation and management. It establishes institutional frameworks for promoting environmental health and sanitation services, including the formulation of county policies and standards. Additionally, the **Kisumu County Water Act, 2023**, provides a comprehensive legal framework for water services, empowering the County Executive Committee Members to formulate strategies and plans, and establishing County Water Service Providers for urban and rural areas.

The **Kisumu County Faecal Sludge Management Regulations, 2024**, currently under development, aim to provide a legal framework for faecal sludge management. Once approved, these regulations will ensure proper containment, transportation, treatment, and safe disposal of faecal sludge, enforcing compliance across the city and its surroundings.

Plans, strategies, and guidelines

The **Kisumu County Integrated Development Plan (CIDP) 2023–2028** sets strategic priorities for both sewered and non-sewered sanitation. The interventions focus on adopting appropriate technologies for sanitation, promoting hygiene awareness, implementing communal sanitation blocks, constructing faecal sludge transfer stations and treatment plants, establishing regulatory frameworks, providing technical assistance, extending sewer networks, and developing sanitation data management systems.

The **Kisumu City Sanitation Plan (KCSP) 2022–2027** aims to improve safely managed sanitation access up to 65% by 2027. The plan highlights sanitation challenges in Kisumu including low access, waste disposal issues, faecal water contamination, inadequate technology, capacity gaps, poor coordination, and data scarcity. Plans involve infrastructure expansion, demand generation, technology adoption, stakeholder engagement, partnership building, knowledge management, fund establishment, strategic development, oversight committees, capacity building, and improved marketing.

Aligned with the CIDP and KCSP, the **KIWASCO Strategic Plan 2023-2028** targets increased sanitation coverage and access. Initiatives include infrastructure expansion, adoption of ecological technologies, and capacity-building efforts to enhance sanitation management. Activities encompass supporting toilet construction, piloting reuse innovative solutions, developing sewer connections, acquiring vacuum truck exhausters, and reviewing marketing strategies, among others.

The Kisumu Sewer Connection Strategy involves constituting a multi-agency team to lead efforts in increasing sewer connections, followed by sensitisation campaigns. The strategy includes investing in sewer main construction, data collection for active connections, enforcement, and executing sewer connection works efficiently, especially in informal settlements. Monitoring and evaluation are key to track successes and weaknesses, while interagency collaboration ensures effective coordination and joint monitoring of actions and activities.

The Water Resources and Wastewater Master Plan for Kisumu County 2021, aims to improve sanitation by upgrading existing networks and treatment plants, extending sewerage to dense areas, and implementing on-site technologies where necessary. It emphasises faecal sludge management, tailored solutions for informal settlements, and institutional capacity building.

3.1.2 Institutional Roles

The institutional mapping of the Kisumu sanitation sector, categorised by functional attributes of the enabling environment, is depicted in Table 5.

The **Kisumu Joint Intergovernmental Sanitation Committee** (KIJISC) serves as a coordination platform for all stakeholders for CWIS initiatives.

The **County Government of Kisumu**, through its Public Health and Sanitation, and Water Departments, leads sanitation planning and policy formulation, as outlined in the Kenya Environmental Sanitation and Hygiene Policy (KESHP) 2016–2030. Additional support in policy formation comes from other relevant departments - Departments of Environment and Natural Resources, and Gender and Youth Affairs. The County Government's responsibilities

include stakeholder mobilisation, guideline development, public toilet maintenance, and enforcement of by-laws. Departments like Education and Tourism address sanitation needs in schools and tourism sites. The Department of Physical Planning ensures proper sanitation system integration within approved plans.

The **City of Kisumu** oversees sanitation services within the city, relying on funding from the County Government.

The **Kisumu Water and Sanitation Company Limited (KIWASCO)**, mandated by the County Government, manages water and sanitation services within Kisumu City. Its responsibilities include water supply, maintenance of public toilets, sewer networks, and treatment plants.

The **Lake Victoria South Water Works Development Agency (LVSWWDA)** delivers water and sanitation infrastructure within Kisumu, contracting with KIWASCO for operation and maintenance – in line with Water Services and Regulatory Board's (WASREB) regulations.

Water Services Regulatory Board (**WASREB)** regulates water and sewerage services, evaluating tariffs, monitoring strategy implementation, and providing annual public reports.

The **Water Sector Trust Fund (WaterFund)**, established by the Water Act of 2016, is mandated to provide both conditional and unconditional grants to counties and support the development and management of water and sanitation services in marginalised and underserved areas.

The **National Environment Management Authority (NEMA)** oversees water pollution control and hazardous waste management, requiring pit emptiers to obtain permits. Additionally, NEMA regulates effluent discharge from KIWASCO treatment plants.

The **private sector** significantly contributes to sanitation services, including toilet construction and emptying, through various agreements. Besides the pit emptiers and masons, private sector actors in Kisumu include, among others, Sanivation, Elphrods Services LLP, and Opero Services Limited.

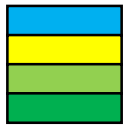
NGOs, Community-Based Organisations (CBOs), and households also contribute to sanitation efforts through programs, awareness campaigns, and maintaining facilities. The NGOs in Kisumu include, among others, UNICEF, Habitat for Humanity in Kenya (HFHK), Western Kenya Sanitation Project (WKSP), Fresh Life, Water and Sanitation for the Urban Poor (WSUP), FINISH Mondial, Practical Action, Kisumu Urban Apostolate Programme (KUAP), Safe Water & AIDS Project (SWAP), Care International Kenya, STADA, and Kenya Red Cross.

Key **development partners or donors** include, among others, French Development Agency, European Investment Bank, KfW, Sanitation Hygiene Fund (SHF) for Kenya, and Government of Kenya.

Table 5: Institutional mapping of the Kisumu sanitation sector according to functional attributes.

Functional attributes	Behavioural aspects	Toilets				Conveyance		Treatment/ Disposal
	Hygiene promotion	Household sanitation	Schools/ educational institution	Healthcare facilities	Public facilities	Faecal sludge collection/ transport	Sewerage network	Treatment and disposal of faecal sludge and wastewater
Enabling								
Policy	CGK/ DoHS	CGK/ DoHS	CGK/ DoHS	CGK/ DoHS	CGK/ DoW	CGK/ DoW	CGK/ DoW	CGK/ DoW
Regulations	CGK/ DoHS	CGK/ DoHS	CGK/ DoE	CGK/ DoHS	WASREB	WASREB	WASREB	NEMA
Financing	CGK/ DoHS		CGK/ DoE	CGK/ DoHS	CGK/ DoW	Private sector (F) CGK/ DoW	CGK/ DoW	CGK/ DoW
Capacity development	CGK/ DoHS	CGK/ DoHS	CGK/ DoHS	CGK/ DoHS	CGK/ DoW	CGK/ DoW	CGK/ DoW	CGK/ DoW
Developing								
Planning	CGK	CGK	CGK	CGK	CGK	CGK	CGK KIWASCO/ LVSWWDA	CGK KIWASCO/ LVSWWDA
Infrastructure provision	CGK/ DoHS	Households WSTF	CGK/ DoE	CGK/ DoHS	CGK/ DoW LVSWWDA WSTF	Private sector (I) Private sector (F) KIWASCO/ LVSWWDA	KIWASCO/ LVSWWDA	KIWASCO/ LVSWWDA
Sustaining								
Enforcement	CGK	CGK	CGK	CGK	CGK	CGK NEMA	KIWASCO/ LVSWWDA	KIWASCO/ LVSWWDA
Asset management	CGK	Households	Schools	Healthcare facilities	CGK	Private sector (F)	KIWASCO/ LVSWWDA	KIWASCO/ LVSWWDA
Service delivery	CGK	Private sector (I)	Private sector (F)	Private Sector (F)	Private Sector (F)	Private sector (I) Private sector (F) KIWASCO/ LVSWWDA	KIWASCO/ LVSWWDA	KIWASCO/ LVSWWDA
Monitoring and evaluation	CGK	CGK	CGK	CGK	CGK	WASREB	WASREB	NEMA WASREB

Legend
Government organisation –
Parastatal agency –
Private sector ('I' - informal) –
Private sector ('F' - formal) –



DoHS – Department of Health and Sanitation
DoE – Department of Education
DoW – Department of Water
CGK – County Government of Kisumu
KIWASCO – Kisumu Water and Sanitation Company Limited
LVSWWDA – Lake Victoria South Water Works Development Agency
NEMA – National Environment Management Authority
WASREB – Water Services Regulatory Board
WSTF – Water Sector Trust Fund

3.1.3 Service Provision

The delivery of sewered and non-sewered sanitation services in Kisumu is governed by a comprehensive legislative framework, including the Kisumu County Environmental Health and Sanitation Act (2022) and the Kisumu County Water Act (2023). Despite the robustness of this legislative framework, its limited publicity reduces its effectiveness. Specifically, non-sewered sanitation services face challenges with awareness and enforcement of regulations, including the Kisumu County Faecal Sludge Management Regulations (2024).

3.1.4 Service Standards

Service standards for both sewered and non-sewered sanitation services in Kisumu are established but inconsistently enforced. For sewered sanitation, household connections to the sewer network are not rigorously monitored, resulting in suboptimal service coverage. Non-sewered sanitation solutions, while technically sound, often fall short of required quality and safety standards due to weak enforcement mechanisms. Stricter compliance and enforcement of these standards are needed to ensure that all sanitation services meet acceptable quality and safety benchmarks.

3.2 Planning

3.2.1 Service Targets

Kisumu's Wastewater Master Plan and Sanitation Plan delineate clear service level targets for both sewered and non-sewered sanitation. These targets aim to enhance accessibility and service quality throughout the sanitation value chain. However, inadequate budget allocations and planning deficiencies frequently impede the realisation of these targets. Effective implementation requires aligning budget allocations with the outlined service targets and addressing existing planning gaps.

3.2.2 Investments

Investment plans for sanitation in Kisumu encompass both hardware and software components necessary to achieve the set service targets. Annual funding allocations, however, are insufficient, particularly for sewerage operations and maintenance. Non-sewered sanitation investments also fall short, with limited funds allocated for community sensitisation, marketing, faecal sludge emptying, and treatment. Increasing funding and optimising investment strategies are crucial for meeting service demands and achieving sanitation goals.

3.3 Equity

3.3.1 Current Choice of Services for the Urban Poor

Sanitation services available to the urban poor in Kisumu are limited. While there are ongoing efforts to introduce small bore sewers and simplified sewer systems in low-income areas, their impact remains uncertain. Affordable and adaptable technologies for non-sewered sanitation exist but face low uptake among the urban poor due to financial

constraints and inadequate outreach. Expanding access to affordable sanitation services and improving outreach initiatives are vital for addressing the needs of the urban poor.

3.3.2 Plans and Measures to Reduce Inequity

Policy documents emphasise inclusive sanitation services, but this commitment is weakly reflected in planning and budgeting processes. Specific funding mechanisms, primarily through development partners, aim to extend sewer services to underserved areas. However, these initiatives provide little support for the actual connection costs incurred by poor households. Measures to reduce inequity in non-sewered sanitation are similarly underfunded and poorly coordinated, necessitating more robust financial support and coordination efforts.

3.4 Outputs

3.4.1 Capacity to Meet Service Needs, Demands, and Targets

KIWASCO, the main service provider, struggles to meet service needs due to staffing and technical gaps. The utility's wastewater department lacks adequate staffing and technical expertise necessary for the proper operation and maintenance of sewerage and treatment facilities. Non-sewered sanitation services face even greater institutional capacity limitations, with poorly defined roles and insufficient staffing levels hindering effective service delivery. Enhancing technical capacity and increasing staffing levels are essential for meeting service demands and achieving targets.

3.4.2 Monitoring and Reporting Access to Services

Monitoring and reporting mechanisms for sanitation services are in place but are not fully effective. Institutions like LVSWWDA and WASREB monitor sewerage performance, while NEMA oversees environmental standards. However, compliance monitoring is incomplete, and enforcement of household connections to the sewer network is weak. For non-sewered sanitation, performance standards are monitored but rarely enforced, leading to inconsistent service quality. Strengthening monitoring and enforcement mechanisms is necessary to ensure reliable and high-quality sanitation services.

3.5 Expansion

3.5.1 Stimulating Demand for Services

Active outreach programs promote sewer connections and safe sanitation practices, but their effectiveness is inconsistently assessed. The demand for sanitation services, particularly in low-income areas, is stimulated through projects like Up-scaling Basic Sanitation for the Urban Poor (UBSUP) and Western Kenya Sanitation Project (WKSP). However, financial constraints of both service providers and households often limit the uptake of these services. Evaluating and enhancing the effectiveness of outreach programs, along with addressing financial barriers, is critical for stimulating demand for sanitation services.

3.5.2 Strengthening Service Provider Roles

Strengthening the roles of service providers is crucial for improving sanitation services. KIWASCO operates autonomously but lacks the technical and financial capacity to address priorities effectively. Non-sewered sanitation services see limited and unorganised private sector involvement. Capacity-building initiatives for private service providers are implemented periodically, often facilitated by NGOs. Establishing more structured and comprehensive capacity-building programs is necessary to enhance the efficiency and effectiveness of service providers across the sanitation value chain.

In conclusion, while the legislative and policy frameworks for sanitation services in Kisumu are generally robust, there are significant gaps in funding, staffing, and enforcement. These gaps hinder the ability to provide safe and equitable sanitation services, particularly to poor and vulnerable populations. Strengthening institutional capacity, improving financial allocations, and enhancing enforcement mechanisms are essential steps towards achieving better sanitation outcomes in Kisumu.

4 Stakeholder Engagement

Desk review

Documentation related to sanitation in Kisumu City was thoroughly collected and reviewed. This included 22 documents focusing on policies, laws, plans, strategies, and guidelines for water supply, sanitation, wastewater, and solid waste management (excluded from SFD report). Additionally, 12 past assessments of city sanitation were analysed. One key document reviewed was the Shit Flow Diagram (SFD) report produced in 2018 by WEDC (WEDC, 2018). The review aimed to identify sanitation trends, develop strategies for challenges, and perform legal and institutional analyses for the City Service Delivery Assessment (CSDA). The results of the CSDA analysis were formatted to cover Chapter 3 of this report.

Survey in households, public schools and healthcare facilities and public places

A set of research tools, including questionnaires for households and institutions, an observation checklist, and templates for focus group discussions and key informant interviews, was developed. The draft questionnaires were refined in collaboration with KIWASCO, and the final version was digitised using the *mWater* web application.

The sample household population for the survey was determined using systematic random sampling method, with a confidence level of 95% and a margin of error of 5%, considering a projected population of 149,196 households in Kisumu for 2024. This led to a minimum required sample size of 384 households to meet the desired statistical constraints. The distribution of this sample across 25 sub-locations was determined based on the percentage of population inhabiting each location. Ultimately, the sample size was increased to 491 households to ensure at least 10 households were surveyed in the sparsely populated sub-locations for comparative reasons and representativeness. This increase in the sample to 491 households, representing 0.4% of the total households, reduced the margin of error to 4%.

Households in the field were selected using random sampling techniques, with deliberate omission for households to ensure uniform distribution across the area. Data collection involved interviewing households and observing sanitation facilities. Utilising the mWater Surveyor mobile App facilitated seamless data collection. KIWASCO staff and four Area Chiefs (Kondele Chief, Chiga Chief, Kolwa Central, and Mayenya) provided guidance throughout the data collection process.

From February 13 to 16, 2024, the 491 household surveys were conducted, each lasting approximately 10 minutes on average. Various challenges arose during data collection. Households with indoor toilets were hesitant to allow photography, while mapping discrepancies in Kisumu's boundary areas[2] caused confusion. Additionally, households were reluctant to disclose income information, and enumerators faced difficulty accurately identifying toilet structures. Consequently, a thorough data cleaning process was initiated, involving meticulous review of toilet photographs and emptying frequency data to ensure

[2] The administrative boundary between Northern and Southern sub-locations couldn't be drawn on the Google Map. Thus, the data collected on Northern integrates the Southern sub-location.

accuracy. Similarly, bathroom water drainage data was cross-checked to align with toilet interface and containment details, resolving any discrepancies encountered.

For public schools and healthcare facilities, the data collection exercise took place between March 26 and March 28, 2024, covering the total of 82 institutions—51 schools and 31 healthcare facilities—in Kisumu City. The data on public toilets presented in this report was sourced from a previous survey conducted by KIWASCO.

Key informant interviews

Furthermore, to better understand the sanitation service delivery landscape across the sanitation value chain in the city, 14 Key Informant Interviews (KIIs) were conducted with government officials, utility representatives, NGOs, and private sector stakeholders such as toilet contractors and pit emptiers. These interviews took place from January 23 to March 28, 2024, utilising both in-person and online formats. For further insights, please refer to Appendix 1 for stakeholder identification and Appendix 2 for a detailed overview of the conducted interviews.

Data analysis and documentation

The collected data from households, institutions, and the private sector was compiled and subjected to analysis. The situational analysis focused on the entire sanitation value chain, encompassing containment, emptying & transport, treatment, and disposal or reuse, addressing sewerage, faecal sludge, solid waste management, greywater, and stormwater management. Eventually, solid waste, greywater and stormwater management were excluded from this SFD report to ensure a focus on faecal matter.

A detailed examination of existing private sector service providers was conducted, highlighting both challenges and opportunities for the inclusion of market-based sanitation (MBS) services. Findings from the baseline survey were synthesised into a comprehensive report, which included the creation of a Shit Flow Diagram (SFD) for Kisumu, produced in accordance with the Shit Flow Diagram Promotion Initiative (SFD-PI) Manual. Furthermore, responses obtained from Key Informant Interviews (KIIs) and literature review were scored and integrated into the CSDA graphic. The CSDA graphic was also excluded from this report as it was targeted towards local stakeholders.

A High-level Stakeholder Workshop was convened on June 20, 2024 at Sarova Imperial Hotel, Kisumu to present and validate the Baseline Assessment and Shit Flow Diagram (SFD) Reports with key decision-makers from Kisumu County, notably Kisumu Joint Intergovernmental Sanitation Committee (KIJISC). Feedback obtained during the workshop was carefully considered and incorporated into the final reports. Both the baseline report and this SFD report pinpoint the significant sanitation challenges facing Kisumu City, along with their potential underlying causes.

5 Acknowledgements

This report was produced with funding from the Kenya Market-Based Sanitation (KMBS) initiative, led by Water and Sanitation for the Urban Poor (WSUP) and supported by the Sanitation Hygiene Fund (SHF) for Kenya. We extend our gratitude to the Kisumu Joint Intergovernmental Sanitation Committee (KIJISC) for their vital support in the conceptualisation of the baseline assessment, assistance during the surveys, and validation of the findings. We are also thankful to the County Government of Kisumu, the City Board of Kisumu, the Lake Victoria South Water Works Development Agency (LVSWWDA), the Kisumu Water and Sanitation Company Limited (KIWASCO), as well as all non-governmental organisations and private sector stakeholders who contributed to this survey through interviews, data provision, and references. Our sincere appreciation goes to the enumerators, whose efforts were essential for the completion of the baseline survey. Finally, we thank Susana Shit Flow Diagram Promotion Initiative (SFD-PI) for their review of this report.

6 References

Agong, S., Odino, P., & Wanga, J. 2014. Baseline survey on governance, policies and knowledge of urban sustainability in the Kisumu local interactions.

BRL ingénierie & ISEP. 2021. Water Resources and Wastewater Master Plan in Kisumu County Under LVWATSAN Programme

Climates to Travel. 2024. Kisumu climate: weather by month, temperature, rain. Retrieved from https://www.climatestotravel.com/climate/kenya/kisumu. Last accessed on 3 July 2024.

Günther, I., Niwagaba, C.B., Lüthi, C., Horst, A., Mosler, H.J. and Tumwebaze, I.K. 2012. When is shared sanitation improved sanitation? - the correlation between number of users and toilet hygiene.

Kenya National Bureau of Statistics., December, 2019. 2019 Kenya Population and Housing Census Volume II: Distribution of Population by Administrative Units (Report). Kenya National Bureau of Statistics. Last accessed on 4 March 2024.

Kwiringira, J., Atekyereza, P., Niwagaba, C., Günther, I. 2014. Gender variations in access, choice to use and cleaning of shared latrines; Experiences from Kampala slums, Uganda. BMC Public Health 14 (1), 1180.

LVSWWDA. 2024. Kisumu City Sanitation Coverage Report

Maoulidi, M. 2010. A water and sanitation needs assessment for Kisumu city, Kenya.

Meteoblue. 2024. Weather Kisumu. Retrieved from https://www.meteoblue.com/en/weather/week/kisumu_kenya_191245. Last accessed on 3 July 2024.

Odwar, J, O., Norman, C. & Nyambweke, E. 2017. The Kisumu Port - The Challenges and Promise of a Port City on Lake Victoria. Retrieved from https://macleki.org/stories/the-kisumu-port/. Last accessed on 6 March 2024.

Office of the Auditor-General. 2018. Performance Audit Report on Provision of Sewerage in Major Towns in Kenya: A Case Study of Kisumu City

Opisa, S., Odiere, M.R., Jura, W.G., Karanja, D.M. and Mwinzi, P.N. 2012. Faecal contamination of public water sources in informal settlements of Kisumu City, western Kenya. Water Science and Technology, 66(12), pp.2674-2681.

UN-Habitat. 2005. Situation analysis of informal settlements in Kisumu. United Nations Settlement Programme, Nairobi. Retrieved from https://unhabitat.org/situation-analysis-of-informal-settlements-in-kisumu. Last accessed on 6 March 2024.

Weather and Climate. 2024. Kisumu, KE Climate Zone, Monthly Weather Averages and Historical Data. Retrieved from https://weatherandclimate.com/kenya/kisumu. Last accessed on 3 July 2024.

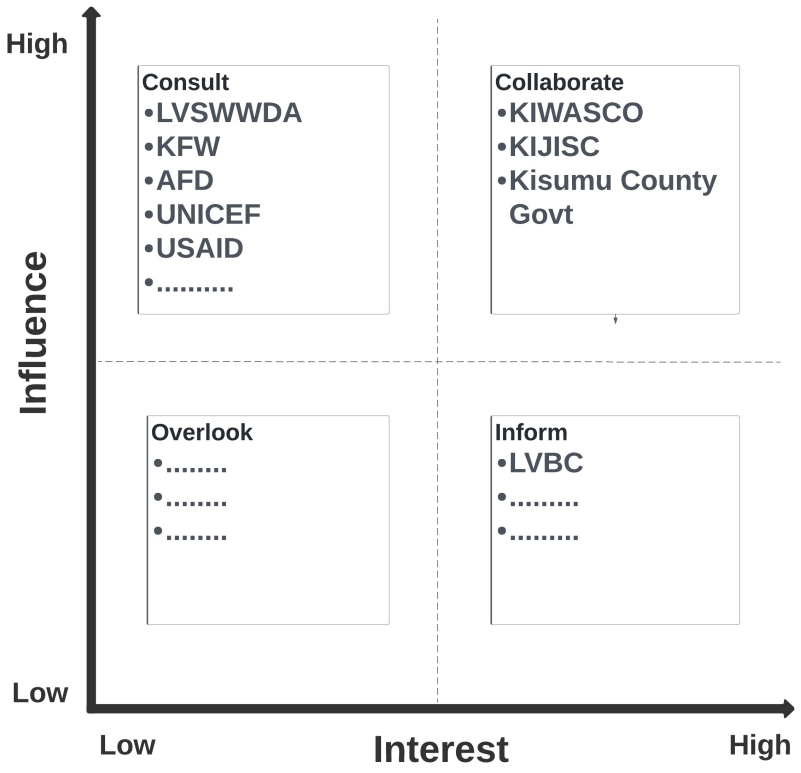
WEDC, 2018. Shit Flow Diagram (SFD) report for Kisumu, Kenya.

Wright, J.A., Cronin, A., Okotto-Okotto, J., Yang, H., Pedley, S. and Gundry, S.W. 2013. A spatial analysis of pit latrine density and groundwater source contamination. Environmental monitoring and assessment, 185, pp.4261-4272.

WSUP. 2024. Onsite Sanitation Capacity Assessment Report for Kisumu Water and Sanitation Company Limited (Draft Report).

7 Appendix

7.1 Appendix 1: Stakeholder Identification



7.2 Appendix 2: Tracking of Engagement

No.	Name	Position	Organisation	Date of interview	Mode of interview
1	Florence Mwikali	Operations Manager	Fresh Life Toilets	23.01.2024	Physical
2	Fredrick Odhiambo Oluoch	Director of Health and Sanitation	County Government of Kisumu	23.01.2024	Physical
3	Jeremiah Ongwara	County Public Health Officer	County Government of Kisumu	23.01.2024	Physical
4	Getrude Shisanya	County Sanitation Extender	County Government of Kisumu	23.01.2024	Physical
5	Joshua Adongo	City Director Public Health	City of Kisumu	23.01.2024	Physical
6	Jason Ochola	Head of Commercial	KIWASCO	23.01.2024	Physical
7	Phelix Okuta	Civil Engineer	LVSWWDA	24.01.2024	Physical
8	Caroline Omolo	Waste Water Operations Manager	KIWASCO	24.01.2024	Physical
9	Brian Orwa	Station Head Wastewater	KIWASCO	24.01.2024	Physical
10	Kibos Sugar Factory	Truck Driver	Kibos Sugar Factory	20.02.2024	Physical
11	Moses	Manager	SaniWise	20.02.2024	Physical
12	Collins	Manager	Mayaya	20.02.2024	Online
13	Dickens Ochieng	Manager	Gasia Poa Enterprise Limited	20.02.2024	Online
14	Shem Otieno	ICT Manager	KIWASCO	28.03.2024	Physical

SFD Kisumu, Kenya, 2024

Produced by: WSUP, i-San Consulting and Opero Services

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