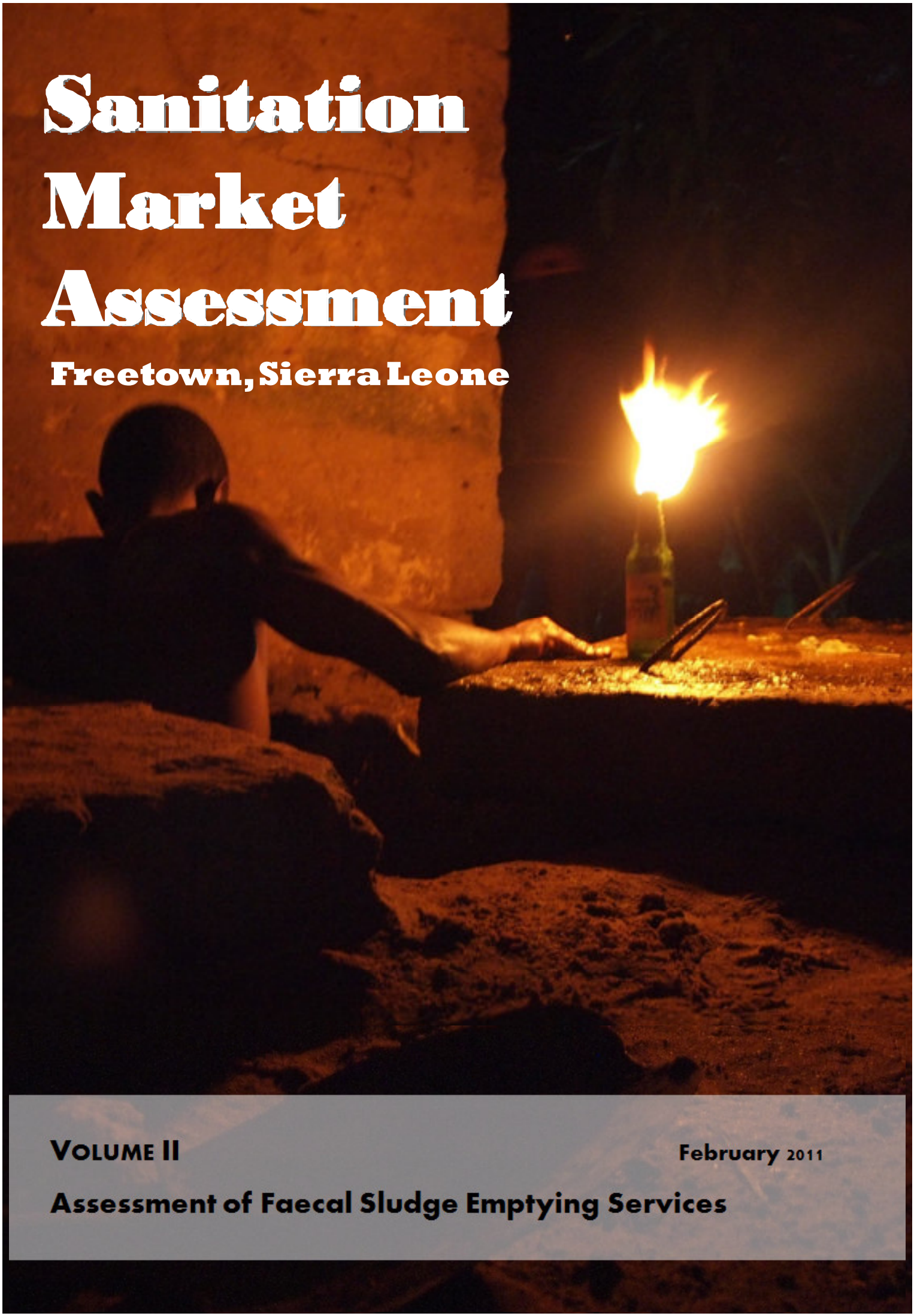

Sanitation Market Assessment

Freetown, Sierra Leone

VOLUME II

February 2011

Assessment of Faecal Sludge Emptying Services

SANITATION MARKET ASSESSMENT

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Contents

Acronyms

BPD	-	Building Partnerships for Development
CBO	-	Community Based Organisation
Eawag	-	Swiss Federal Institute of Aquatic Science and Technology
EC	-	European Commission
FCC	-	Freetown City Council
FSM	-	Faecal Sludge Management
FWMC	-	Freetown Waste Management Company
HCES	-	Household-Centred Evnvironmental Sanitation
INGO	-	International Non-Governmental Organisation
MoEWR	-	Ministry of Energy and Water Resources (Sierra Leone)
MoHS	-	(Sierra Leone) Ministry of Health and Sanitation
PHO	-	Public Health Officer
PPE	-	Personal Protective Equipment
RSLAF	-	Republic of Sierra Leone Armed Forces
UK-DFID	-	United Kingdom Department for International Development
WASH	-	Water, Sanitation and Hygiene

Exchange Rates and Cost of Living

1 US$	=	3,900 Leones (July 2010)
1 Rice Bag	=	600 – 1,000 Le (Sierra Leone Web, 2010)
School Fees	=	60,000 – 75,000 Le (Sierra Leone Web, 2010)

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Executive Summary

This report was commissioned by GOAL Sierra Leone to assess the sanitation market in the vulnerable communities of Freetown, Sierra Leone. It is intended to contribute to and support GOAL's activities under the Freetown Urban Water, Sanitation and Hygiene (WASH) Consortium programme funded by UK Department for International Development (UK-DFID). This second of two volumes is focused on evaluating supply of faecal sludge emptying services in Freetown.

The evaluation was based on interviews with 10 faecal sludge emptying operators between June and July 2010. All three (3) private mechanical operators found to be providing emptying services in Freetown were interviewed, as well as the only formal public operator, Freetown City Council (FCC). The remaining six (6) operators based in the central and eastern wards of Freetown provided manual emptying services.

These manual operators worked in informal groups averaging about (5) persons; one person being the leader. Both as a group and as individuals, the operators provided other labour-type services to supplement their primary source of income, sludge emptying.

Regardless of where they were based, the manual operators offered their services anywhere in Freetown, and at times, beyond. However, in one exceptional case, a group operating from Susan's Bay provided emptying services to their community only - specifically to the three (3) public toilets in that community.

Potential customers of the manual operators would request the emptying service by calling upon the operators in person or through a third party. After evaluating the sludge containment structure and the amount of work required, the operator and customer agree on a fee and a disposal site. The sludge is most commonly buried in pits nearby the structure; alternatively, it is disposed in a drain (especially in the rainy season) or some other surface water body. If burial is selected, operators dig the disposal pit during the day and then return in the evening to empty the containment structure. The emptying process is performed under the cover of darkness (between 22h00 and 06h00) to avoid alerting the customers' neighbours to the nuisance caused by the odour.

Before and during the process, manual operators drank alcohol and smoked tobacco to increase their tolerance for the physically and mentally challenging job ahead. They then added kerosene and/or a wood preservative to reduce the effects of the smell, followed by water to increase the fluidity and ease of removing the sludge. After removing the top layer of sludge with shovels and/or buckets, one of the group members would step inside the pit and bail out more of the sludge. It is not uncommon for operators to be chin-deep in the sludge.

One bucket at a time, the sludge is transferred from the containment system to the disposal pit or drainage ditch. Buckets are either passed along by a human chain or carried by head between the two points. Once the concrete or hardened bottom is reached, the job is completed by cleaning up the general work area and - if one were used - covering up the disposal pit with the excavated soil. The operators would then wash themselves with soap and water and wait until daylight to return home.

The entire emptying process would be done with basic equipment: pick axe, bucket, shovel and rope. While some personal protective equipment was reportedly used, it was observed that operators were in fact just about naked during the process. All these conditions lead to significant physical, chemical and biological health hazards resulting in serious injuries, and one reported death. Some of the reported injuries included: major cuts and bruises from sharp objects in the sludge, blisters and skin rashes, diarrhoea and worms attaching to the skin.

Manual operators however are simply responding to market demand by providing a service which takes into account the existing realities and constraints (physical, financial, regulatory, etc.). In the household survey discussed in Volume I of this report, it was estimated that approximately 60% of households surveyed had hired the service of manual operators. Demand however was seasonal; emptying services were requested much more frequently in the rainy season than the dry season due to the infiltration of groundwater into pits. On the other hand, the group in Susan's Bay reported the opposite effect with more emptying jobs being completed in the dry season due to the increased use of public toilets and the reduction in open defecation.

The general public's substantial dependence on the manual operators though did not translate to sustained gratitude. Customers on the receiving end of a manual operator's service were thankful; however their sentiment was short-lived. Operators were insulted and/or assaulted by the public for the nuisance created by their work, even by prior customers. The embarrassment felt by some operators impelled them to keep secret their occupation from their families. However, while far from satisfied, some accepted what they did as long as they were compensated for their hard work.

Depending on the size of the job, the average compensation given to a manual emptying group was approximately US$ 50 per job. This was divided equally among the group, although the leader was usually given a small additional sum to compensate for organising the job and purchasing equipment. Compared to other select African cities, this fee resulted by far with the highest ratio of emptying fee to gross domestic product (GDP) per capita (5.6%). The group at Susan's Bay were reportedly only given US$ 26 for each job. As a result of the lack of financial or operational records being kept by the groups, it was impossible to perform accurate financial analysis of their operations.

To a certain extent, it could be argued that the psychological hazards of this job are more harmful than the physical ones. Regardless, the dangerous and degrading conditions endured by manual operators could be significantly mitigated by eliminating the need for them to be in the pit.

At 39%, mechanical operators had a smaller share of the market than did the manual ones. Only three (3) private operators were found to provide emptying services in Freetown and one public operator, Freetown City Council (FCC). The operators were in possession of a total of five (5) vacuum tankers, all purchased second hand from Europe. Two (2) of the private businesses operated from offices in the central part of Freetown, while the other one and FCC operated from the eastern part. All operators had a manager working at the office, a heavy vehicle driver, and two (2) or more labourers to complete the job.

Customers would generally go to the offices of the operators to request their service, negotiate and pay the full cost, the value of which was mainly dependent on the volume of sludge to be removed. While the private operators offered their service to any type of containment system, FCC refrained

from emptying traditional latrines due to the limited suction capacity of their equipment. Unlike manual operators, mechanical ones provided their service during the day between the hours of 07h00 to 19h00.

On the agreed date, operators commonly drove through congested traffic and narrow, unfit roads to reach the customer's location. Once there, they open the access point to the containment structure, clean it from any non-faecal matter using a rake, and then add water if necessary to release any clogging. If the covering of the containment structure were to be broken to gain access to it, operators were not held responsible for replacing it. They then attached pieces of hose together and laid them down from the containment structure to the vacuum tanker. The vacuum pump would then be turned on and the structure emptied of its contents. During this process, labourers were given gloves, rain boots and sometimes overalls to wear for protection, although this was not always the case.

Once the vacuum tanker was full or the containment structure empty – whichever came first – the operators cleaned and removed the hose and cleaned the general area if soiled. They then transported the sludge, once again through congested traffic and derelict roads, to the sole sludge disposal site in Freetown at the Kingtom dumpsite. The roads at the dumpsite consisted of compacted solid waste which in the rainy season becomes treacherous and muddy. The hauled contents are then disposed onto the top of an overflowing, non-operable drying lagoon.

Predictably, the hazards, injuries and illnesses experienced by the mechanical operators are much less in quantity and severity than those reported by the manual operators. These included for example a fractured leg from a dropped concrete slab, nausea, vomiting and headaches due to sludge odour and gases, and diarrhoea and typhoid due to improper hygiene practices.

The trends in market demand for mechanical and manual operators were however similar; the rainy season seeing highest demand and the dry season much less. This seasonality in demand experienced by the businesses of both the manual and mechanical operators created a timid environment for investment. One additional trend encountered was the high demand during the holidays (Ramadan and Christmas) in preparation for visitors. In an effort to increase demand, operators advertised their service by giving out flyers, displaying their coordinates on their vehicles, and in some cases advertising on the radio.

The public did not view the type of work done by vacuum tankers operators in much higher regard than the manual ones, although they did not assault or provocation them. The workers did not have a union and the businesses – other than the occasional sub-contracting job - did not form any formal alliances with one another. As a matter of fact, the atmosphere of competition was higher than would be expected considering the relatively low number of mechanical operators in the city.

Most but not all private operators seemed to keep records of their operational and basic financial transactions; none of which were made available for this study. FCC however kept and shared records of its operations and revenues confirming the reported trends in demand. Since expenditure data was not provided by the mechanical operators, it was not possible to produce a reliable financial analysis of their businesses.

According to the household survey (see Volume I), the average fee for emptying a household's containment system with a vacuum tanker was US$ 73. Compared to other select African cities, this fee resulted in the highest percentage of emptying fee to GDP per capita (8.2%).

Faecal sludge emptying service providers are required to work within an institutional context that directly impacts their work. These include the Ministry of Energy and Water Resources (MoEWR) which, as a result of the decentralisation process, is the national government entity responsible for providing policy, technical guidance and monitoring of the sanitation sector. Within Freetown, FCC is responsible for the provision of sanitation services, enforcement of public health, and provision of treatment services at the Kingtom disposal site through the Freetown Waste Management Company. On a more community-based level, ward and WASH committees play a generally supportive role in mobilising their communities and engaging them to improve their sanitation conditions.

International funding organisations have played a role historically in supporting public mechanical emptying services by providing equipment and infrastructure for the treatment of faecal sludge. On the other hand, no programmes directed at supporting emptying service providers by International non-governmental organisations were reported.

Any future support to the supply of faecal sludge emptying services in Freetown would benefit from an intervention strategy based on the Strategic Sanitation Approach (SSA) and the Household-Centred Environmental Sanitation's (HCES's) 10-step process is recommended. Some of the suggested steps for this strategy include:

1. assessment of the priorities of the service providers;
2. identifications of potential options or solutions;
3. evaluation of feasible service combinations;
4. consolidate service plans;
5. implementation; and
6. internal monitoring, evaluation and feedback.

Starting with the collected data and the assessed priorities, it is recommended that an examination and identification of potential options be undertaken. The options could then be evaluated based on some of the following criteria: short and long-term financial profitability of the operations, improvements in health and safety, technological appropriateness, and institutional and political viability.

After the completion of the first step of the proposed strategy, some potential options which should be revisited include:

1. piloting technologies for manual operators that limit contact with faecal sludge;
2. improving the faecal sludge disposal practices of manual operators;
3. transforming emptying activities of manual operators into a business;
4. reducing household disposal of solid waste into containment systems;
5. involving WASH committees in faecal sludge emptying;
6. establishing a union for manual operators;
7. increasing demand for mechanical operators through innovative marketing strategies;

8. building partnerships between manual and mechanical operators;
9. training mechanical operators for preventative equipment maintenance;
10. training on financial and operational management; and
11. pursuing partnerships between mechanical operators and trusted foreign parts suppliers.

The operators would greatly benefit from the involvement of national and International institutions and organisations in any intervention. Some of the suggested options include:

1. private sector support and regulation by local government;
2. partnership between different governmental institutions and funding organisations in rehabilitating existing infrastructure and redesigning its management systems; and
3. the clarification of sanitation roles and responsibilities on a national and local level.

1 Introduction

This document is the second of a two-volume report commissioned by GOAL Sierra Leone (GOAL) and funded by the UK Department for International Development (UK-DFID) to evaluate the sanitation market in the vulnerable communities of Freetown, Sierra Leone. This volume provides an assessment of the faecal sludge emptying services in Freetown.

2 Background

GOAL is a member of the INGO Urban Water, Sanitation and Hygiene (WASH) Consortium of Freetown, hereafter referred to as WASH Consortium. The other members of the consortium include Oxfam GB, Action contre la faim (ACF), Save the Children and Concern Worldwide. The WASH Consortium was established in 2009 to undertake a three-year WASH programme, funded by UK-DFID, targeting vulnerable communities in Freetown. GOAL was mandated to conduct its activities in 22 of Freetown's 63 sections, hereafter referred to as the project area.

The two-volume report is in partial fulfilment of Output 1, Activity 3 of GOAL's Activity Plan under the WASH Consortium (Box 1). The report is intended to provide the necessary information to support activities 4 and 5 of the same output. The two volumes are:

- Volume I: Demand Assessment for Sanitary Facilities and Services
- Volume II: Assessment of Faecal Sludge Emptying Services

BOX 1:

[Excerpt from GOAL's Activity Plan]

OUTPUT 1: Men, women and children in the target population have increased access to, and make optimal use of, safe and appropriate water and sanitation facilities, and take action to protect themselves against threats to public health.

- **Activity 3:** Work with stakeholders to map the current sanitation situation and gaps in provision and service delivery.
- Activity 4: Implement social marketing of sanitation and develop the hardware supply chain.
- **Activity 5:** Support the development of systems and structures for faecal sludge management at the community level.

3 Scope

This volume provides a summary and analysis of interviews with faecal sludge service providers and key informants in Freetown conducted between June and July 2010. The reported data and analysis within this volume are intended to support the development of a sanitation marketing plan for the project area.

4 Methodology

The supply of faecal sludge emptying services was examined through interviews with and observation of mechanical and manual service providers. The field work was completed between June and July 2010. Below is a brief description of the methodology followed.

4.1 Semi-Structured Interviews

4.1.1 Design

Semi-structured interviews were used to collect predominantly qualitative data on the operators' activities. A total of 81 questions, most open-ended, was put to each operator in Krio. The English version of the questions is provided in Annex A. Each of the questions fell within one of the following nine (9) topics:

1. Interviewee Information
2. Organisation Information
3. Human Resources
4. Operational Information
5. Material Resources
6. Market, Marketing and Customer Satisfaction
7. Perceptions, Knowledge and Hygiene Practices
8. Enabling Environment
9. Finances and Resources

4.1.2 Interviewee Selection

Manual operators appeared to be abundant throughout Freetown, however only six (6) groups were selected for interviewing - they included:

1. a group in Susan's Bay and another in Magazine (both Central Freetown); and
2. four (4) groups, one in each of Shell, Rokupa, Industrial Estate, and Bottom Oku sections (all in Eastern Freetown).

On the other hand, only a few mechanical operators carried out faecal sludge emptying activities in Freetown:

1. three (3) private operators; and
2. two (2) public operators: Freetown City Council (FCC) and Republic of Sierra Leone Armed Forces (RSLAF).

All were selected for interviewing except for the RSLAF due to the apparent informal and irregular nature of their operations.

4.2 Observation

One observation event was completed with a mechanical operator on June 24, 2010, and another with a manual operator on July 17, 2010. Pictorial summaries of these events are provided in Annexes B and C respectively.

4.3 Limitations

Certain limitations in the collection methods and analysis of faecal sludge emptying service providers were apparent. Firstly, the participants might have strategically misrepresented their true circumstances in the hopes of reaping certain benefits. The household survey as well as the observation of the emptying process helped reduce some discrepancies. Certain information might have also been lost during the process of translating the questions from English to Krio or the answers from Krio to English.

Furthermore, some operators were not willing to share certain pieces of information, particularly the financial and operational data of mechanical operators. This did not allow for a financial analysis of the businesses or an accurate evaluation of the market.

Finally, important underlying nuances might have been missed by the interviewer due to cultural differences. To mitigate this, a discussion arose after each interview between the interviewer and the facilitator/translator to reveal any of these issues.

5 Manual Operators

Six (6) groups offering manual emptying services were interviewed between June 30 and July 9, 2010. The data collected from the semi-structured interviews with these groups, the observation of one emptying job, and relevant interviews with key informants are summarised in this section.

5.1 General Profile

All the interviewed groups were private, unregistered and informal entities that have been providing emptying services from between 6 months and 16 years. Historically, persons providing manual emptying services predominantly belonged to the Loko tribe, however this is no longer the case. Most groups were driven into this sector by the concurrence of unemployment and their community's need for emptying services.

The number of people in each of the selected groups ranged from three (3) to eight (8). Each of the groups had a leader and in most cases a deputy leader, both of whom helped to organise emptying jobs and the purchasing of equipment. The remaining group members were labourers who performed whatever task was required to complete the job. Most of the groups' members were friends from the same neighbourhood.

Almost all of the groups provided regular or irregular services in other sectors, including construction and solid waste management. However, the faecal sludge emptying sector was their primary source of income. On an individual level, most of the group members had other sources of income either from the private or public sector.

BOX 2:

[Summary Profile of Interviewed Manual Emptying Service Providers]

Status:
informal, unregistered

Operational Base:
Susan's Bay, Magazine, Shell, Rokupa, Industrial Estate, and Bottom Oku

Years of Operation:
0.5 to 16 years

Average Number of Members:
5

Other Group Services:
construction (homes, wells, septic tanks), solid waste management, clearing drains

Alternative Individual Sources of Income:
comedian, policeman, security officer, seaman, driver, labourer, communal toilet caretaker, grave digger

5.2 Management of Operations

5.2.1 Geographic Reach

Except for the group operating from Susan's Bay, the manual operators do not limit the provision of their emptying service to a prearranged geographic location but rather meet demand wherever it is required. The group from Susan's Bay - a densely populated coastal slum characterised by only a handful of public toilets, many hanging toilets and rampant open defecation - only empty the three (3) public toilets in their community.

5.2.2 Service Requisition

Households requiring the service of the manual operators are required to either inform one of the members of the group in person or through a third-party who knew them. In some cases, customers would seek the group members in places they were known to frequent (e.g. bar or cemetery). None of the groups reported having a contact phone number or fixed place of business.

5.2.3 Service Delivery

Manual operators most commonly operate under the cover of darkness, between the hours of 22h00 and 06h00. One of the reasons for this is to mitigate the nuisance to neighbours created by the sludge's odour. They provide this service any day of the week or year.

The major factor determining the amount of time required to complete a job depends on the size of the containment structure. Generally speaking, most jobs are reported to have been completed in one night.

While friends or recurring customers received some priority, in general customers are served on a first come, first served basis. Jobs in close proximity to each other are sometimes served at the same time; however this was not a common circumstance.

5.3 Emptying Process

Apart from the group in Susan's Bay, the emptying process of the manual operators is commonly completed in three main stages (1) preparation, (2) emptying, and (3) clean-up. These stages are explained in detail below, while the steps followed by the group in Susan's Bay are provided subsequently. Annex B provides a chronological illustration of the process.

5.3.1 Preparation Stage

Step 1 - Sludge Characterisation: The first step of this stage is to estimate the volume of sludge to be removed and to check its contents for non-faecal matter which could be harmful to the operators (e.g. glass objects). One group claimed to do this visually, although most used a stick for this purpose. The dimensions of the containment systems varied greatly with the maximum depths and volumes reported being approximately six (6) metres and 90 m^3 respectively.

Step 2 – Planning Sludge Disposal: Arrangements are then made with the customer for a sludge disposal site, which in most cases is a burial pit near the original sludge containment structure. This pit - sometimes limited in depth by the surface geology – is commonly dug in daylight using pick-axes, shovels and buckets. In cases of limited land availability and especially during the rainy season, faecal sludge is disposed of in streams, drainage ditches or the ocean. There is a higher probability of disposing the sludge in these water-bearing bodies if they are in close proximity to the original containment system.

Step 3 – Operator Adaptation: On the evening of the emptying, group members participating in the emptying process remove all their clothing (or down to their undergarments)[1] and consume alcohol prior to and during the emptying process.

[1] Interviewees suggested that if any clothes or protective equipment were to be worn, mobility would be restricted and the odour of faeces would persist regardless of how well the cloths were washed. Replacement of clothing after each job was financially an inappropriate option.

Some of the reasons given for the alcohol consumption include:

- motivation to work harder;
- to reduce shame;
- to reduce the burning sensation in the eyes from the gases produced in the containment structure;
- to reduce nausea caused by the odour and disgust; and
- to help the body tolerate the changes in temperature from exposure to the faecal sludge.

Furthermore, one group member reported the use of cannabis in an effort to "feel stronger".

BOX 3:

[Non-Faecal Matter in Pits]

The presence of glass, needles and pieces of cloth used by women for their menstruation cycles were reported to be ubiquitous, particularly in traditional latrine pits. These objects are physically harmful to manual operators and can damage the equipment of mechanical operators.

Step 4 – Conditioning of Faecal Sludge: After removing or breaking the cover of the faecal sludge containment structure with a pick axe, kerosene and/or locally produced carbolineum - a wood preservative known locally as "carbolium" – is poured into the sludge and mixed with a stick or rake to reduce the sludge's odour. Some groups require the customers to purchase these chemicals while others purchase them themselves. A locally produced hook with a long handle is used by one group to help locate and remove rags and other non-faecal material from the pit prior to emptying it.

To facilitate sludge removal, at times water is added to and stirred within containment systems with relatively low liquid content, such as those which have not been emptied in many years or traditional unlined pits.

5.3.1.1 Challenges

Some of the difficulties experienced during this stage include:

- removing or breaking the concrete cover which at times can be very large and heavy; and
- digging disposal pits in rocky terrain.

5.3.2 Emptying Stage

Step 5 – Preliminary Maintenance: In cases where a toilet facility is completely filled or overflowing, the top 10 to 30 centimetres of the sludge is removed and disposed of by using a shovel or metallic bucket.

Step 6 – Sludge Removal: Once the contents are too deep for a shovel, a group member, hereafter referred to as the "*bailer*"[2], stands inside the containment structure (sometimes on a piece of wood) and bails the sludge out using a bucket. It is not uncommon for the *bailer* to be chin-deep in the sludge. Another group member, hereafter referred to as the "*retriever*", stands just outside the structure and retrieves the bucket from the *bailer*. Kerosene, carbolineum and/or water are added to the sludge as required to aid in reducing the odour and maintaining a high liquid content.

[2] The nomenclature provided for each of the tasks is proposed by the author to allow a simpler narration of the operations.

When the sludge becomes too deep for the passing of a bucket to the *retriever*, a ladder is placed inside the sludge to allow the *retriever* to partially descend into the containment structure. Alternatively, the *retriever* remains outside the structure and pulls the bucket out using a rope.

One or more members, hereafter referred to as "*porters*", then transport the bailed sludge from the containment structure to the disposal location. The distance between these two points is crucial in determining the number of *porters* required to complete a job. Distances of less than two (2) metres require only one *porter*, while longer distances require more; some of whom can be hired from outside the group if necessary.

When transporting over relatively large distances (more than about 20 metres) it is common for *porters* to carry the buckets on their heads. Some groups own wheelbarrows and use them, when conditions permit, to transport the sludge over relatively large distances (up to 200 metres).

Step 7 - Concluding Emptying Process: A containment structure is considered empty when a concrete/hard surface is reached and no more sludge can be removed with a bucket. However, in some cases where sludge has solidified, pick-axes and shovels can be used to remove the hardened material. The customer is then called to verify the satisfactory completion of the job.

BOX 4:

[Illumination]

Working at night required the operators to illuminate the area with a homemade kerosene lamp (locally known as a "*cambo*"). Alternatively, battery powered torches (some designed to fit on the head) have been reportedly used by some groups.

[Drinking Alcohol]

As previously mentioned, throughout the emptying process, group members drank alcohol to help them complete the job. As would be expected, the operators lost some of their coordination and seemed to be more prone to accidents because of their state.

[Smoking Cigarettes]

The interviewed groups reported smoking up to two (2) packs of cigarettes per person throughout each emptying job. The stated reasons for smoking cigarettes included: reducing the feeling of nausea, coping with the bad odour, and taking the mind off the reality of the job being done.

5.3.2.1 Challenges

Some of the challenges reported during this stage are:

- entering a hazardous environment that lacks sufficient oxygen, high concentrations of harmful gases produced by the sludge (methane);
- nuisance and irritation of the eyes due to the smoke produced by the kerosene lamps, the addition of chemicals into the sludge (i.e. kerosene and carbolineum), and gases produced by the sludge;
- encountering pests such as rodents and insects (mosquitoes and cockroaches);
- encountering and getting injured by hazardous substances (such as glass bottles, metal nails, syringes and knives) being thrown into the containment structures;
- buckets and ropes wearing out quickly and breaking causing spills;
- cold climate in the rainy season;

- muscle pain due to lifting of heavy loads and being in a restrictively small space for long periods of time;
- insults and/or attacks by the neighbours or community due to the bad odour emitted;
- assault and/or thievery by criminals due to the lack of security at night in some areas; and
- police interrogations due to being mistakenly identified as criminals.

5.3.3 Clean-up Stage

Step 8 – Resealing the Containment Structure: The third and final stage of the emptying process is the termination of all operations and the cleaning up of the area. The containment structure's cover is replaced, or if broken, abandoned. The operators are not usually held responsible for a broken slab or concrete cover, but can be hired to build a replacement.

Step 9 – Clean-up of Disposal Location: If a disposal pit is utilised, the excavated soil is then used to cover the sludge. In some cases, more kerosene is added to the disposal pit so as to reduce future odours. If sludge is disposed in a drainage ditch, water is then used to clean up any remaining residues. The area around and between the containment structure and the disposal point is also cleaned up of faecal residue using water. One group reported putting kerosene in and around the containment system as an additional odour suppressant.

Step 10 – Personal Cleansing: Finally, group members wash themselves using soap and water provided either by the customer or in a nearby stream. Often, operators are forced to stay at the customer's location until sunrise when it is safer to travel back to their respective homes.

5.3.4 Emptying Process of the Susan's Bay Group

The manual operators in Susan's Bay are responsible for emptying three (3) of the community's public toilets. The corresponding sludge containment structures are above-ground septic tanks located in very close proximity to the coastline. The tanks have a 20-centimetre diameter effluent pipe that is approximately one (1) metre above the tanks' floor slabs. While the pipe was designed to allow for the draining of sludge directly into the ocean, a few homes have been built between the tanks and the coastline, resulting in the soiling of these homes during emptying.

Step 1 - Preparation: During the day and when a septic tank is found to be full, the manual operators dig a drainage ditch (or clean an existing one) from the effluent pipe, around the existing homes, and into the ocean.

Box 5:

[Public Toilets in Slums]

Public toilets have been built in Freetown's slums by governmental or non-governmental organisations in an attempt to cope with the unsanitary practices of open defecation, flying toilets and the use of hanging latrines. However, due to a lack of planning by the implementers and the apparent lack of capacity by the regulators, once these toilets have been filled, communities find themselves having to empty and dispose of the collected sludge in ways which are unhygienic to those emptying, destructive to the environment, and financially unsustainable. Such infrastructure might be a community's ascent up the so-called "sanitation ladder", however it falls short of providing an appropriate long-term solution.

Step 2 – Draining the Tank: Once the trench is completed, a stick is used to unplug the effluent pipe and allow the sludge to flow to the ocean. It takes approximately 2 to 3 days for the septic tank to drain the part of its contents above the level of the effluent pipe. At this stage the poorly located homes would become soiled due to splashing of the sludge coming out of the pipe.

Step 3 – Manual Emptying: The remaining one (1) metre of sludge below the level of the effluent pipe is emptied manually. This is done in a similar fashion to that of the other groups and can take approximately one night's worth of work to complete.

Step 4 – Clean Up: During the clean up stage the group does not seal the effluent pipe, but rather allows rags and other materials left at the bottom of the septic tank to block it. They then clean themselves in the ocean followed by a quick rinse in some freshwater.

5.4 Material and Equipment

All material and equipment used by the operators can be found at most local building material shops in Freetown. The main complaint was the inconvenience caused by the failure of this low-durability equipment (e.g. spills) and the compounding cost of having to frequently replace it. Below is a list of the equipment reportedly used:

- **Equipment:** brooms, buckets, shovels, pick-axes, handles for shovel/pick-axe, hoes, hooks, ladders (locally made), rakes, ropes, torches and wheel barrows
- **Consumables:** batteries, carbolineum, kerosene and soap

5.4.1 Personal Protective Equipment

As previously mentioned, some groups reported working naked or in undergarments only. Some groups also reported purchasing personal protective equipment (PPE); however due to the limited finances, they were not always capable of replacing them. PPE reportedly used included:

- **PPE:** boots, gloves, hard hats, regular hats, masks, overalls and rain coats.

5.5 Health

Health issues reported by the manual operators as a direct result of their emptying activities include:

1. major/minor cuts and bruises
2. blisters/skin rashes
3. swelling of the face/feet
4. muscle cramps/pain
5. loss of appetite
6. nausea, vomiting and headaches
7. diarrhoea
8. small worms attached to the skin
9. irritation of the eyes
10. common flu (cold)

Table 5.1 is a list of some of the more significant hazards of manual emptying and their potential impacts on an operator's health (not a comprehensive list). If unattended to - either by prevention or treatment - the ultimate consequence of many of these impacts is death, at least one incident of which was reported by the interviewed groups.

Table 5.1 - Major hazards of manual emptying of faecal sludge

Hazards	Examples of Potential Impacts
Biological Hazards	
- direct oral and skin exposure to urine and faecal sludge - indirect oral exposure to faecal sludge and as a result of improper hygiene practices	- Bacteria-related diseases including diarrhoea, leptospirosis, typhus, typhoid, shigellosis, cholera - Virus-related diseases including poliomyelitis, enteritis, hepatitis - Protozoa-related diseases including amoebiasis and giardiasis - Helminth-related diseases including roundworm, liver fluke, hookworm, schistosomiasis, tapeworm, whipworm (Action contre la faim, 2005)
Chemical Hazards	
- direct oral and skin exposure to hydrocarbons - indirect oral exposure to hydrocarbons as a result of improper hygiene practices	- redness and skin inflammation, rashes, blisters, nausea, vomiting - long-term exposure could result in skin (skin contact), lung (inhalation), bladder and gastrointestinal cancers (ingestion), asthma-like symptoms (inhalation), lung function abnormalities (inhalation), chronic bronchitis (inhalation) and decreased immune function.

- working in a confined spaces in the presence of harmful gases (methane, ammonia, etc.) and in an oxygen deficient environment	- methane: tiredness, drowsiness, asphyxiation, explosive atmosphere
	- ammonia (Canadian Centre for Occupational Health & Safety, 2006):
	  - irritation of the eyes when exposed to over 134ppm ammonia gas
	  - severe respiratory tract irritation for exposure over a short period of time (10 minutes) to 100 and 500ppm ammonia gas
	  - pulmonary edema (potentially fatal) for brief exposure to above 1,500ppm ammonia gas; symptoms include tightness in the chest and difficulty breathing
	- oxygen deficiency (Canadian Centre for Occupational Health & Safety, 2006):
	  - 12-16%: breathing and pulse rate are increased, with slight muscular incoordination
	  - 10-14%: emotional upsets, abnormal fatigue from exertion, disturbed respiration
	  - 6-10%: nausea and vomiting, inability to move freely, collapse, possible lack of consciousness
	  - below 6%: convulsive movements, gasping, possible respiratory collapse and death

- excessive alcohol consumption	- cardiovascular disease, malabsorption, chronic pancreatitis, alcoholic liver disease, infertility, cancer, and damage to the central nervous system and peripheral nervous system
Physical Hazards	
- exposure to sharp objects (glass, metal, syringes) in the sludge	- cuts, skin and blood infections and various diseases resulting from bio-hazardous syringes
- carrying heavy loads in confined spaces	- strains, sprains, long-term back pain

PPE is irregularly used by the operators as a preventative measure and in an effort to reduce potential personal harm or injury. Washing with soap, a practice adopted by all groups, is the most common form of prevention. Smoking tobacco and alcohol consumption are reported to be mental adaptation measures to reduce nausea, vomiting and irritation of the eyes.

Medical treatment however seemed to be the method of choice for all health-related issues. Seeking to articulate this, one group stated that "doctors take all our money". Both oral drugs and injections were reportedly used for pain relief, common colds and swelling.

5.6 Market Demand

Households are the operators' predominant type of customers, followed by public institutions (schools, hospitals) and businesses. In the case of the group from Susan's Bay, they only empty their community's public toilets.

Market demand was reported to be highly dependent on seasonal variations. During the months of June, July and August (the official rainy season being between May and October) operators experienced the highest demand due to the flooding of containment structures. This translated to anywhere from 8 to 20 jobs per month. During the dry season, demand dropped to only two (2) to four (4) jobs per month.

A spike in demand was also observed during the holiday seasons (Ramadan and Christmas) when Freetown residents tended to clean their homes and empty their pits/septic tanks in preparation for visiting relatives. Although relatively less predictable, weekly demand peaked on the weekends because it allowed households to rest the next day after monitoring the emptying process during the night.

The operators in Susan's Bay however experienced the opposite seasonal effect whereby the emptying frequency for the public toilets increased in the dry season. This was reportedly due to their community being drawn to public toilets in the dry season and away from defecating in streams and drainage ditches when the rains are no longer available to wash their excreta away. All households interviewed for the sanitation survey (see Volume I) in this area either practised open defecation or used public toilets. The manual operators reported emptying the toilets once a month in the dry season and once every two (2) months in the rainy season.

Box 6:

[Prevalence of On-Site Sanitation]

The sewerage network in Freetown is limited to 4 kilometres of sewers in the central ward. The vast majority of residents rely on on-site sanitation, a solution which requires periodic emptying.

[Impact of Seasonal Demand]

The variation in seasonal demand in the sludge emptying market has a destabilising impact on these small business operators. Similar to other seasonal occupations, securing an alternative source of income during the low-season is necessary. This uncertainty already is and could potentially be one of the reasons operators hesitate in investing in their businesses.

Some potential approaches to encouraging further investment in the emptying business include:

- registration with local government authorities, a strategy favoured by some operators;
- devise marketing techniques to increase demand in the dry season; and
- providing microfinance solutions that take into consideration the seasonality of the business.

5.7 Marketing Strategy

The interviewed operators were content with their current marketing strategy of "word of mouth" and providing a good service. Some suggested that their services could be advertised on signboards or the radio. Due to their unique circumstances, the operators in Susan's Bay did not need to market their services since they had no desire to empty other containment systems nor did they have to compete for those which they emptied.

5.8 Perceptions

5.8.1 Public Perception

The public's perception is dependent on their position relative to the service being provided at a certain moment in time. A household having their containment structures emptied is usually very grateful for and pleased by the service, while their neighbours tend to provoke, assault, abuse and insult the service providers. However, when this household becomes the neighbour of another customer receiving the emptying services, the household then joins the general public in their verbal and physical abuse of the operators. Some of the verbal provocation includes calling the operators such names as "kaka bailer" or "shit man".

5.8.2 Family Perception

Some operators hide the nature of their jobs from their families. Others find complete support from their families but would prefer an alternative safer job which is less dirty and harmful to the health.

5.8.3 Operators' Perception

The public and family perceptions of manual operators' job can at times be an annoyance or an embarrassment to the operators. However, many are at least partially adapted to and are content with performing the job as long as they are financially compensated for the work that is done.

5.9 Alliances

None of the group members belong to an organised union nor was a union reported to have existed. Some groups collaborate with up to three (3) other groups within the same general community. The nature of this collaboration is limited to subcontracting surplus jobs and getting together to discuss job-related issues. Some groups suggested that an alliance among manual operators would provide them with recognition and more influence with the local government as well as potentially becoming an entity that would provide permanent employment with a regular income.

Informal relationships were reported to exist between some operators and Public Health Officers (PHO) from the Ministry of Health as well as with the Environmental Health and Sanitation Department of Freetown City Council (FCC). PHOs would reportedly collect a fee from households contravening public health laws for an overflowing toilet and hire operators to empty the toilet at a prearranged rate.

5.10 Laws and Regulations

Most operators are unaware of the nuisance by-law recently passed by FCC (see section 7.1.2) or of any other laws which could potentially have an impact on their businesses. National and local government authorities, including the police, are generally not reported to harass the operators during the provision of their services. Operators suggested that government entities could support them by:

- requiring households to empty their latrines on a regular basis;
- allowing for and requiring manual operators to register their businesses; and
- discouraging households, through public awareness campaigns, from disposing of solid waste into latrines.

5.11 Financial Management

The groups interviewed reported not having any financial records of their faecal sludge emptying activities. As such, unit rate data regarding their revenue and expenditure were collected in order to gain a general understanding of their finances.

5.11.1 Revenue

Service fees charged by the operators varied according to the following criteria:

- volume of sludge to be emptied or size of the containment structure;
- degree of soiling outside the structure;
- presence of non-faecal objects inside the structure;
- perceived customer income and/or relationship to the operators; and
- travelling distance from operator's community to the customer.

According to the operators, fees vary between Le 150,000 and Le 1,000,000 (US$ 38 and US$ 256) per customer, which is within the range reported in the household survey (see Volume I). The average fee charged was reported to be Le 350,000 (US$ 90), approximately 80% higher than the average fee reported by households (Le 194,000, US$50).

In general, a 50% deposit is made by the customer after the digging of the disposal pit. If the sludge is to be disposed of in a stream, the deposit has to be made prior to commencement of the emptying work. The balance is then paid once the job is complete and the customer satisfied.

The collected payments are usually distributed equally among the group members who participated in the job, while the leader is given a relatively larger portion to compensate him for management and purchasing of equipment. One of the groups gives additional compensation to the member who found the job. With the exception of one group whose primary work was in construction, manual emptying was considered to be more profitable than the other jobs held.

Due to the unusual operational circumstances of the group in Susan's Bay, their income is based on donations from the community, community leaders, and those managing the communal toilets. For each containment system emptied, the group of three (3) collects an average of Le 100,000 (US$ 26) to share amongst each other.

5.11.2 Expenditure

The lack of any financial or operational records did not allow for a reasonable estimation of the operators' expenditure. The best available indication of expenditure was a listing of the type of equipment used, its average cost, and its replacement frequency as seen in table 5.2. It must be noted that each group owns a different combination of the listed items. All the equipment used by the group in Susan's Bay was reportedly donated by the community.

Table 5.2 - Estimated unit cost and replacement frequency of manual operator equipment

ITEM	COST PER UNIT		REPORTED REPLACEMENT / REPAIR FREQUENCY
1. Batteries (2 batteries)	Le 3,000	US $ 0.77	7 days
2. Boots	Le 32,000	US $ 8.21	60 days – 1 year
3. Broom	Le 1,000	US $ 0.26	1 day
4. Bucket	Le 19,000	US $ 4.87	12 – 90 days
5. Carbolineum (1 gal)	Le 50,000	US $ 12.82	1 day
6. Gloves	Le 14,000	US $ 3.59	7- 60 days
7. Hard Hat	Le 40,000	US $ 10.26	1 year
8. Hat	Le 10,000	US $ 2.56	60 days
9. Handle	Le 4,000	US $ 1.03	30 – 90 days
10. Hoe	Le 4,000	US $ 1.03	183 days
11. Hook	Le 20,000	US $ 5.13	90 days
12. Kerosene (1 gallon)	Le 16,500	US $ 4.23	1 day
13. Local Ladder	Le 37,000	US $ 9.49	30 days – 1 year
14. Mask	Le 8,000	US $ 2.05	60 days – 1 year
15. Overalls	Le 30,000	US $ 7.69	21 – 60 days
16. Pick-axe	Le 33,000	US $ 8.46	60 days – 3 years
17. Raincoat	Le 45,000	US $ 11.54	183 days
18. Rake	Le 20,000	US $ 5.13	30 – 120 days
19. Rope (1 yard)	Le 3,000	US $ 0.77	30 – 183 days
20. Shovel	Le 24,000	US $ 6.15	30 – 90 days
21. Soap	Le 1,000	US $ 0.26	1 day
22. Stick	Le 4,000	US $ 1.03	30 – 90 days
23. Torch	Le 7,000	US $ 1.79	7 days – 1 year
24. Wheelbarrow	Le 60,000	US $ 15.38	5 years
Average	**Le 20,200**	**US $ 5.19**	**191 days**

5.11.3 Loans

As a group, none of the operators have applied for or received any loans or micro-credit. Some considered doing so in the future, the funds for which would be used for purchasing more equipment.

5.11.4 Financial Analysis

In order to acquire a general understanding of the manual operators' finances, a rough interpretation of their revenue and expenditure, as provided during their interviews, was calculated. A summary of this is provided in table 5.3, the details of which can be found in Annex D. Due to the unique conditions of the group at Susan's Bay, they were not included in the analysis.

All the groups divide the collected revenue among themselves as soon as it was paid. Any investment in equipment has to be provided by the leader of the group or shared among group members from the compensation already provided. As such, the profit line provided in the table below represents the compensation which would be shared among group members after expenses were taken into account. Each group member was estimated to earn between US$ 33 and US$ 145 per month.

While the lack of financial management plays a direct role in affecting the groups' ability to purchase equipment, their business could be considered to be relatively stable. This is indicated by a high return on investment (between 110 and 350%) and relatively high revenue collected in a short period of time.

Table 5.3 - Financial analysis of manual operators interviewed

	Group 1 (6 ppl)	Group 2 (3 ppl)	Group 3 (8 ppl)	Group 4 (5 ppl)	Group 5 (6 ppl)
1. Initial Investment	$ -	$ -	$ -	$ -	$ -
2. Annual average number of clients	98	39	48	58	65
3. Average fee per client	$ 77	$ 179	$ 128	$ 90	$ 64
4. Annual gross revenue	$ 7,500	$ 7,000	$ 6,154	$ 5,205	$ 4,167
5. Annual expenses	$ 2,662	$ 1,706	$ 2,924	$ 2,364	$ 927
5.1 taxes, insurance, rent	$ -	$ -	$ -	$ -	$ -
5.2 maintenance and fuel	$ -	$ -	$ -	$ -	$ -
5.3 equipment	*$ 2,662*	*$ 1,706*	*$ 2,924*	*$ 2,364*	*$ 927*
5.4 marketing	$ -	$ -	$ -	$ -	$ -
6. Annual profit	$ 4,838	$ 5,294	$ 3,230	$ 2,841	$ 3,240
7. Daily profit	$ 13	$ 15	$ 9	$ 8	$ 9
8. Return on Investment	182%	310%	110%	120%	349%

6 Mechanical Operators

6.1 General Profile

Three (3) private mechanical sludge emptying service providers currently operate in the Freetown area, and they are:

1. [No Official Name]: Hannah Benka Coker Street, Brookfields, West Ward
2. *Quality Waste Services*: 26 John Street, Sanders Brook, West Ward
3. *F.M. Environmental Sanitation*: 47 Bai Bureh Road, Kissy Bye Pass II, East Ward

The business at Hannah Benka Coker Street was reportedly the first to operate a vacuum tanker in Freetown in 2001, while the other two launched their services more recently in March and November 2009. The owners of the businesses and/or vehicles are reported to be living overseas while family members or friends manage the day-to-day operations of the business. Two (2) of the businesses are reportedly registered with Freetown City Council, while the third is currently not.

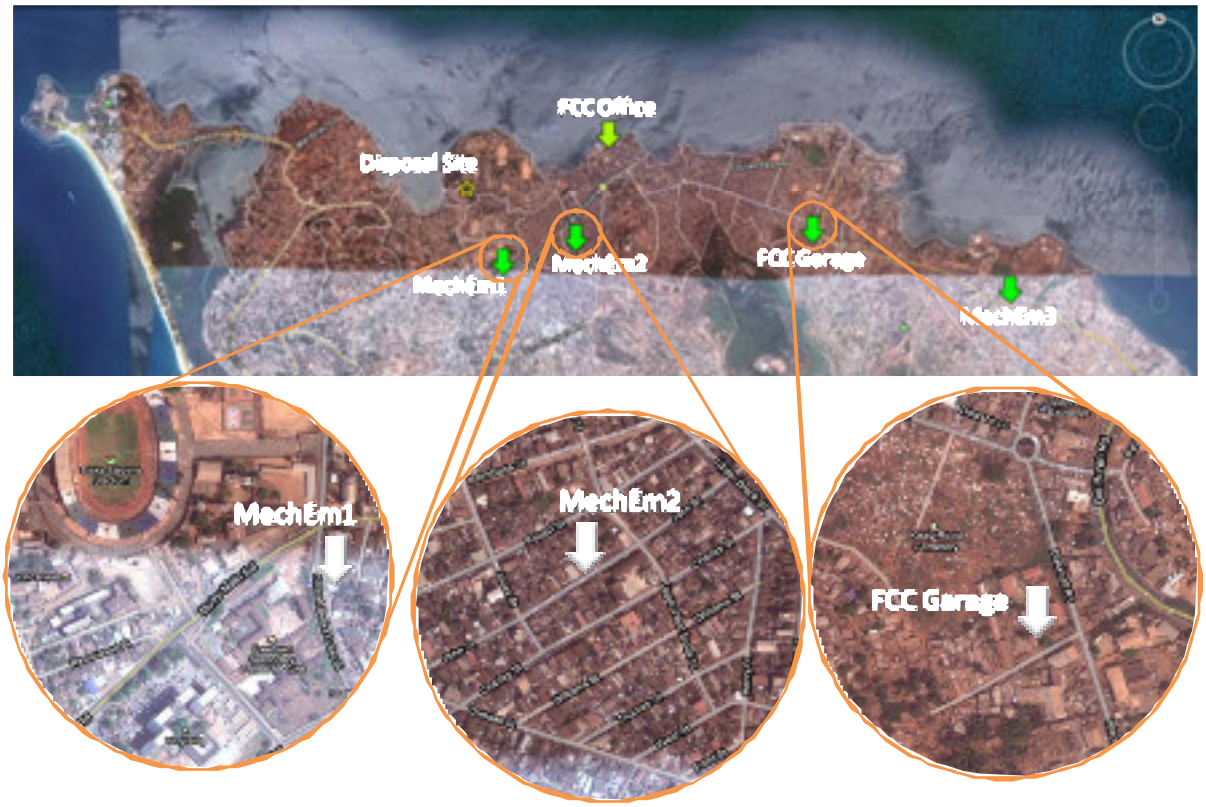

Figure 6.1 - Location of mechanical operators and the disposal site in Freetown, Sierra Leone

The operators employ between five (5) and nine (9) employees, with each business having one (1) manager and one (1) driver. Other positions include senior labourer / supervisor, junior labourer and mechanic (one of whom also worked as a driver). All employees are permanent and receive a monthly salary. However, when a vehicle is not operational for many months as was the case for one of the businesses, employees are not paid their wages during that period.

Vacuum emptying services are also provided by two (2) public entities: Freetown City Council (FCC) and the Republic of Sierra Leone Armed Forces (RSLAF) stationed at Murray Town Barracks. RSLAF provide the desludging service informally and irregularly to a relatively select group of households. On the other hand, FCC runs a formal service from its Environmental Health and Sanitation Department at Government Warf. The Environmental Officer or acting environmental officer manages the operations, while a driver and two (2) labourers deliver the service.

6.2 Management of Operations

6.2.1 Geographic Reach

Both public and private operators provide emptying services to the city of Freetown, and infrequently in the country's districts (e.g. Kenema, Bo and Tonkolili). Unlike the private operators however, FCC limits its operations to areas that are not very mountainous to avoid steep roads that their vehicle is unable to navigate.

6.2.2 Service Requisition

To request the operators' service, customers are expected to visit their respective offices. The service will only be rendered once a payment in full has been made. Most private operators will provide the customer with a receipt (as seen in Figure 6.2) and collect the contact number and location of the containment system to be emptied. The two new private operators as well as FCC keep a record book of their operations, while the operator on Hannah Benka Coker does not. Only FCC is willing to share this collected data.


F. M. ENVIRONMENTAL SANITATION

RECEIPT

Figure 6.2 - Sample invoice from a mechanical operator

6.2.3 Service Delivery

Generally speaking, customers are served on a first come, first served basis. One private operator suggested that his business gives priority to public institutions such as hospitals or clinics due to the significance of their role. Otherwise, the following strategies are sometimes used by one or more operators in an effort to increase efficiency:

- if relatively small containment systems are close to each other, they can be scheduled for emptying at about the same time as long as the combined volume of their contents does not exceed the capacity of the vehicle;
- septic tanks are given priority over traditional unlined pits due to the relative ease and short period of time required to empty the former;
- to avoid heavy traffic (especially in the morning or when going from one ward to another), operations are concentrated around the general area of where the vehicle is typically stationed;
- in places in or nearby market areas, some private operators work during the early morning hours (05h00 – 06h00) to avoid the blocked/congested roads once the markets open; and
- in some cases work is done at night, however it was not reported as being a preference or a strategy to increase efficiency.

All private operators generally work during the day (07h00 to 19h00) from Monday to Saturday but are willing to provide emergency services at any time.

Private operators are willing to empty faecal sludge from any accessible containment system, while FCC empties from septic tanks only. FCC does not service traditional pits because the sludge's water content is too low for the limited suction capacity of the vacuum tanker.

6.3 Emptying Process

Once an emptying job is scheduled, the field crew consisting of the driver, supervisor and labourer(s) travel to the client's location and prepare to empty the containment system. Annex C provides a chronological illustration of the emptying, transport and disposal processes of these mechanical operators. The following is a description of the process:

1. manoeuvre the tanker into a position that is close enough for the available hose to reach the containment system;
2. remove the hose from the vehicle and connect the different pieces together with a camlock fitting or a locally purchased PVC pipe, plastic bags or rubber inner tubes (no other accessories are used or devised to prevent solids from entering the hose);
3. if the area surrounding the containment structure is littered with faecal or non-faecal matter, remove it using shovels/buckets and bury on-site or transport it in a plastic bag and dispose of it at Kingtom dump site;
4. remove the cover of the containment structure by lifting or breaking it using a metal rod;
5. [optional] if the sludge is of high water content, use a rake to remove non-faecal matter from the top portion of the containment structure, add some water and stir its contents;
6. [optional] if the sludge is of low water content, a lot more water needs to be added and stirred with a rake to remove non-faecal matter and decrease the sludge's viscosity for easier removal;
7. connect one end of the hose to the vacuum tanker and insert the other end into the opening of the containment structure;
8. turn the vacuum tanker's engine on, enable the suction pump and remove the sludge;
9. add water as necessary to decrease viscosity and ease removal;
10. monitor the level of sludge inside the tanker to avoid spills;
11. once the containment structure is empty or the vacuum tanker is full, remove the hose;
12. to clean the inside of the hose, apply suction to a container containing water and carbolineum (optional);
13. turn off the suction pump; and
14. clean the outside of the hose with water, unfasten its different parts and pack back onto the vehicle.

While different teams might have slightly different variations of the above steps, this is generally the procedure followed. The manager of the business established in 2001 reportedly received training from the Ministry of Health and Sanitation (MoHS) and helped train some of those currently working in the other businesses.

The time it takes to empty a containment structure depends on the size of the structure, the ease with which it can be accessed, the degree of soiling, and the nature of its contents. Generally speaking however, and while the volume of each operator's tanker is different, it was reported that the average time taken to fill up a tanker in an ideal situation is approximately 20 to 30 minutes.

The following challenges were reported during the emptying process:

- locating the provided address could take up considerable time, especially when the emptying team are unable to reach the customer using the provided contact information;
- containment systems located too far from the road for the tanker's hose to reach;
- blocking roads can sometimes be necessary which can distress commuters;
- the containment structure's cover can at times be very heavy and difficult to remove/break;
- the containment structures can sometimes be overflowing and heavily soiled;
- the containment structures contain a lot of non-faecal substances such as plastic bags, bottles and sanitary rags which can cause the hose to block and break causing spills;
- sludge in unlined pits or faulty containment structures is difficult to remove due to the low water content and high viscosity (sometimes even solid);
- broken containment structures contain soil which after getting sucked into the vehicle settles at the back of the tanker and blocks the effluent pipe during emptying;
- operators have a feeling of isolation as a result of customers avoiding them; and
- provocation by the public.

6.4 Transportation

Access to some communities in Freetown is considered to be a challenge due to the lack of appropriate road infrastructure represented by the poor road conditions (muddy, unpaved, critically uneven), narrow roads and/or steep slopes (see Annex C). Once the vacuum tanker is full, it proceeds to the only available faecal sludge disposal site in Freetown at the Kingtom solid waste dump site, in the western area of the city (Figure 6.1).

According to the drivers, heavy traffic can result in a 2 to 4 hour drive from the eastern outskirts of Freetown to the disposal site in the west, a distance that does not exceed 20 kilometres. This would suggest a range of travelling speeds between 5 and 10 kilometres per hour. Travelling from a job site in the western area of the city to the dumpsite is slightly less challenging with an average speed ranging from 10 to 20 kilometres per hour. These low speeds result in high fuel consumption, lost potential revenue and increased expenses for the operators.

Figure 6.3 - Mechanical tanker (left) stuck in traffic

Another challenge experienced during transport is the occasional repair cost of private or public structures accidentally damaged due to inadequately designed roads.

6.5 Disposal

As mentioned in the previous section, the only official faecal sludge disposal site in Freetown is found at the Kingtom dumpsite. While the site was designed to offer faecal sludge treatment facilities in the form of drying lagoons, the facility's management and proper operation have been neglected (Atkins, 2008). When a tanker arrives at the disposal site, it is driven to the disposal point on an unpaved and muddy path formed by a pile of solid waste. Once at the disposal point, the tanker's effluent valve is opened either manually or mechanically and the sludge is allowed to drain for 5 to 10 minutes.

During the disposal stage, a tipping fee of Le 10,000 (US$ 2.56) per load is made to a site manager. The collected funds are reportedly transferred to the Freetown Waste Management Company (FWMC) (Kamara, 2010). According to one private operator, the inside of a tanker is cleaned once a week at the dump site using water from the neighbouring creek (Congo Creek). No designated cleaning facilities were observed at the site.

The following issues and challenges were reported regarding sludge disposal:

- access to the site is hampered by a deficient access road causing time delays when vehicles get trapped in the mud during the rainy season and more importantly suffer significant damage;
- tipping fees are perceived as an unjustified tax due to the lack of visible reinvestment in the site infrastructure; and
- the effluent valve is at times blocked by soil or other solid objects in the tanker.

As well as the poor state of the dump site, the faecal sludge treatment facility has been neglected and was thus non-operational. During a visit, no sign of any treatment infrastructure was observed. The tankers would dispose of their sludge onto a flat area already filled with refuse and faecal sludge. Much of that sludge then drains down through a series of troughs and discharges into the Congo Creek and White Man's Bay (see Figure 6.1).

Despite this, and based on several sources (operators, government officials, independent sources), there was no evidence, reports or any indication of illegal or indiscriminate dumping of faecal sludge by the mechanical operators. Potential reasons for this include:

- **Enforcement of Laws:** While FCC has limited capacity to enforce laws, it seems to have interest in doing so. Operators reported attempting to keep their vehicles clean and dumping their loads at Kingtom out of fear of being arrested by the Freetown Metropolitan Police. One labourer was apparently arrested as a result of a spill caused by a blocked hose.
- **Public Pressure:** With 9,600 persons per square kilometre, Freetown is a densely populated city with many of its inhabitants residing on its coast (Demographia, 2010). Illegal dumping of sludge into the ocean might be met with anger and protest by the communities. Public complaints related to the sanitation sector are commonly referred to the Environmental Health and Sanitation Department (Kamara, 2010). Complaints are recorded and followed up with by the Public Health Officers. Parties suspected of breaking the law may be fined or prosecuted.

6.6 Material and Equipment

The number of operational tankers in Freetown is constantly changing. In June 2010, only three (3) of the four (4) usually operational private vehicles were functioning, and that of FCC was not. By mid-July all the vehicles were reportedly running. The business established in 2001 was reported to be operating their fourth vehicle; the first three of which were consecutively retired when no longer functional. The details of Freetown's operational vacuum tanker fleet as of July 2010 are provided in Figure 6.4.

All of the private tankers - except that at Hanna Benka Coker Street – were purchased second-hand from England in 2009. The one at Hannah Benka Coker Street was also purchased second-hand but imported from Germany in 2010. The private vehicles were all purchased by expatriate family members or friends of those managing the businesses. These vehicles were not shipped with spare parts. The second-hand FCC vehicle was purchased by a Sierra Leonean expatriate in the UK in approximately 2003. While the vehicle was shipped with some spare parts, the stock has reportedly been exhausted.

The capacity of the vehicle at *Hannah Benka Coker* is 18,000 litres, while another at *Quality Waste Service* is 6,800 litres. *FM Environmental Sanitation* has the smallest capacity with the narrowest vehicle width. Each of the operators has imported between 90 and 180 metres of 4-inch diameter hoses. In addition to the vacuum trucks, the following equipment is used by the mechanical operators to aid them in the removal of the sludge: rake, shovel, bucket, metal rod, and pick-axe.

NO NAME	QUALITY WASTE SERVICES	QUALITY WASTE SERVICES	FM ENVIRONMENTAL SANITATION	FREETOWN CITY COUNCIL
				
Map ID: *MechEm1* **Location:** *5 Hannah Benka Coker* **Vehicle Info:** *1984 Benz, 10-wheel* **Origin:** *Germany* **Capacity:** *18,000 litres*	**Map ID:** *MechEm2* **Location:** *26 John St.* **Vehicle Info:** *DAF, 6-wheel* **Origin:** England **Capacity:** *Unknown*	**Map ID:** *MechEm2* **Location:** *26 John St.* **Vehicle Info:** *1999 DAF, 6-wheel* **Origin:** *England* **Capacity:** *6,800 litres*	**Map ID:** *MechEm3* **Location:** *43b Bai Boureh Road* **Vehicle Info:** *Leyland DAF, 6-wheel* **Origin:** England **Capacity:** *Unknown*	**Map ID:** *FCC* **Location:** *FCC Yard, Blackhall Rd* **Vehicle Info:** *~1993 BMC, 6 wheel* **Origin:** *England* **Capacity:** *Unknown*

Figure 6.4 - Information on vacuum tanker fleet in Freetown

Some of the challenges faced by some operators with their equipment include:

- high vehicle repair costs due to lack of preventative maintenance;
- long periods of vehicle breakdown (up to one year) due to the lack of skilled mechanics and/or spare parts;
- large vehicle size preventing access to many areas; and
- absence of a secure area to store the vehicles overnight; this made them vulnerable to theft and/or vandalism.

Operators partially adapted to some of these challenges by:

- manufacturing a durable, customized and locally made rake for the removal of non-faecal objects in a containment structure;
- manufacturing spare parts locally (e.g. vacuum pump's fan blades) or using parts from non-functional tankers for repairs; and
- sleeping in the vehicle overnight to discourage vandalism.

6.6.1 Personal Protective Equipment

The most commonly used PPE is gloves and rubber boots. Managers reported supplying additional equipment including raincoats, masks, safety glasses and coveralls. Labourers claimed that because some of the PPE can be restrictive and uncomfortable in high temperatures, it is not always worn.

6.7 Health

Mechanical operators expectedly reported fewer health issues - both in quantity and severity - than did the manual operators. These issues include:

- fractured leg resulting from a dropped concrete slab;
- muscle pain and cramps due to mixing of the sludge and heaving lifting;
- nausea, vomiting and headaches due to sludge odour and other gases; and
- diarrhoea and typhoid due to improper hygiene practices and not using PPE.

The most significant hazards faced by mechanical operators include:

- Biological Hazards: direct/indirect oral/skin exposure to urine and faecal sludge;
- Chemical Hazards: direct/indirect oral/skin exposure to hydrocarbons; and
- Physical Hazards: strain of carrying and potential for dropping heaving objects.

For more information on potential impacts of these hazards, see table 5.1 in section 5.5.

6.8 Market Demand

Households constitute the greatest proportion of the mechanical operators' customers (70 to 80%). The remainder being from public or private institutions (schools, hospitals, businesses, and organisations) and factories (e.g. flour mill factory).

Box 7:

[Customer Motivation & Behaviour]

Based on the household survey (Volume I), only 39% of households have used the services of a vacuum tanker. Potential reasons why mechanical operators do not play a larger role in this market include:

1. services provided are more expensive than those of manual operators
2. they do not have the ability to access many containment structures
3. requesting the service of local manual operators is more convenient (less travel)

Customers who hire mechanical operators generally do so because they prefer:

1. a faster emptying process
2. professional service and behaviour
3. off-site sludge disposal
4. no odours during removal

Similar to the situation faced by manual operators, demand for mechanical emptying services was highest during the months of highest rainfall (June, July and August) and the holidays (Ramadan and Christmas). While most mechanical operators appeared to have records of their emptying activities, none except for FCC were willing to share this information.

The information provided by FCC is illustrated in Figure 6.5. The data reveal the number of trips completed each day for 329 days between September 22, 2008 and August 17, 2009. The "x" denotes the number of trips per day, the dashed blue line represents a moving monthly average (30 days) and the solid red area represents the average number of trips for each month of the year. Peak demand was seen in December during the Christmas holiday and in the months of May, June and July of the rainy season. The average number of trips during the examined period was 32 per month. Of the 329 days on record, 130 reported at least one load being completed, 47 were Sundays, and the remaining 152 had no evidence of work being done. This translates to a downtime percentage of 46% due to lack of demand, vehicle breakdown, or some other unknown reason.

The average demand estimated by the private mechanical operators was three (3) jobs per day in the rainy season and two (2) per day in the dry season. The range was from zero (0) to five (5) jobs per day.

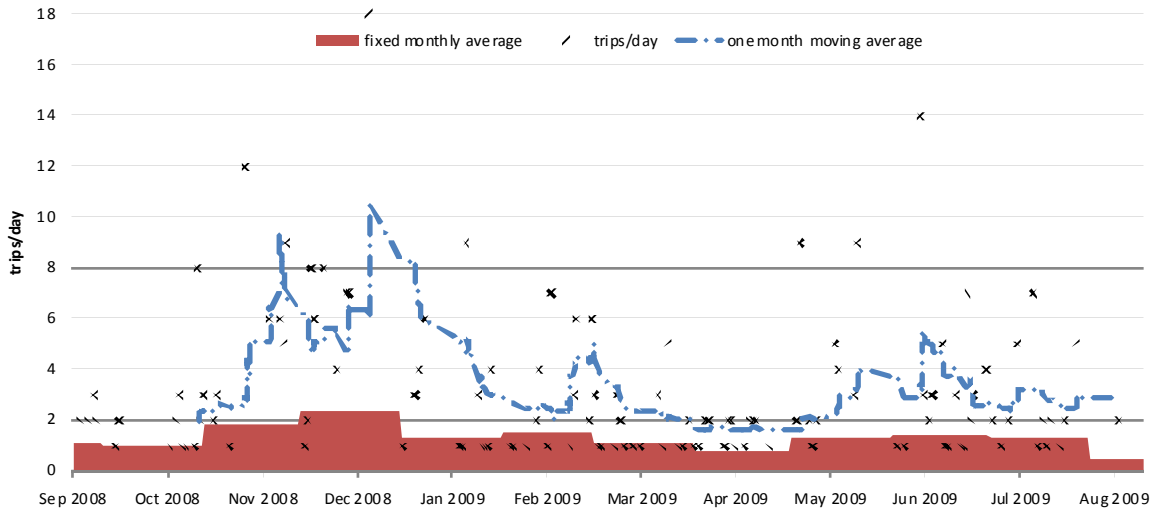

Figure 6.5 - Chart of the number of trips recorded by FCC from September 2008 to August 2009

6.9 Marketing Strategy

Some of the marketing techniques pursued by the private operators include:

- distribution of flyers (Figure 6.6);
- radio advertising; and
- displaying details on tankers.

FCC does not perform any marketing beyond the labelling of its vehicle with the council's name.

Figure 6.6 - Sample marketing flyer of a mechanical operator

6.10 Public Perceptions

Mechanical operators believe that the public perceives their job to be a very useful but dirty one. Of those who operate the vacuum tanker, some of them do not want their families to see them doing this job. They are referred to as "kaka bailers" and are harassed by the public. While this embarrasses them, operators sense they have no other viable job opportunities.

6.11 Alliances

There is no official alliance between the private mechanical operators, although they all know each other and during times of high demand or breakdown, sub-contract jobs to one other. Generally speaking however, the market was reported to be very competitive and relationships between the different parties were not described as particularly strong. FCC was also considered to be a competing provider but at times sub-contracted jobs to the private entities.

An alliance with the wider environment of faecal sludge emptying was reported between FCC and some manual operators. This relationship is informal and is sometimes called upon for customers who cannot be accessed by vacuum tankers.

6.12 Laws and Regulations

The following laws were reported to be relevant to the operation of the vacuum tanker business:

- vehicles and businesses have to be registered and up-to-date;
- vehicles and working areas should be kept clean to avoid creating a public health hazard;

One business reported that some of their employees were arrested by authorities for spilling faecal sludge. Similar to manual operators, the mechanical operators were not aware of the by-law recently passed by FCC.

6.13 Financial Management

While most mechanical operators appeared to have records of their emptying activities, none - except for FCC - were willing to share this information. As such, unit rate data regarding their revenues and expenditures were collected in order to gain a general understanding of their finances.

6.13.1 Revenue

In general, private operators charge customers on a "per load" basis; in one case half a load was possible. However, this fee is not set or based on advertised prices but rather fluctuated according to some of the following criteria:

- distance from Kingtom disposal site or from vehicle operational base;
- water content of the sludge (traditional unlined pits with typically lower water content are charged more than septic tanks with high water content); and
- presence of non-faecal objects (e.g. rags, plastic, glass, metal, etc.) inside the structure.

In addition to the above relatively subjective criteria, the fact that each private operator has a different sized tanker and runs their service from a different location increases the difficulty faced by customers looking for the best price for the most convenient service.

That being said, the operators reported fees per load ranging from Le 150,000 to Le 300,000 (US$ 38 to US$ 77) with the average fee being Le 240,000 (US$ 62) per load. According to the household

survey (Volume I) the average fee mechanical operators charge households (which could be for one or more loads) is Le 286,000 (US$ 73).

On the other hand, the public operator, FCC, charges a fixed fee of Le 150,000 (US$ 38) per load for areas within the city and Le 170,000 (US$ 44) for areas on the outskirts or beyond Freetown. The total income reported by FCC during the period between September 2008 and August 2009 was Le 65,770,000 (US$ 16,864).

6.13.2 Expenditure

Due to the lack of access to much of the financial data of the mechanical operators, the general financial impression remains fragmented and ambiguous. As such, a complete financial analysis of capital and operational expenses cannot be performed based on the available data. Table 4.6 below summarizes the expenses interpreted from some of the semi-structured interviews.

Table 6.1 - Some interpreted expenses of mechanical operators

	DESCRIPTION	UNITS	VALUE	
			LEONES	US$
1.	**Equipment**			
	Vacuum Truck	*Unit*		*US$ 12,000*
	Hose	*100 yards*		*US$ 1,500*
	Clearance and Customs	*Unit*	*Le 2,000,000*	*US$ 513*
	Shipping	*Unit*		*US$ 6,100*
2.	**Taxes**			
	Tax (local council)	*Annual*	*Le 250,000*	*US$ 64*
	Tipping Fees	*Load*	*Le 10,000*	*US$ 2.56*
3.	**Salaries**			
	Manager	*Le/month*	*Le 400,000*	*US$ 103*
	Driver	*Le/month*	*Le 250,000 – Le 500,000*	*US$ 64 – 128*
	Site Supervisor	*Le/month*	*Le 200,000 – Le 300,000*	*US$ 51 – 77*
	Labourer	*Le/month*	*Le 180,000 – Le 300,000*	*US$ 46 – 77*
4.	**Maintenance and fuel**			
	Fuel Consumption	*Le/day*	*Le 132,000*	*US$ 34*
5.	**Equipment**			
	Ladder	*Unit*	*Le 20,000*	*US$ 5.13*
	Bucket	*Unit*	*Le 10,000*	*US$ 2.56*
	Rake	*Unit*	*Le 15,000*	*US$ 3.85*
	Shovel	*Unit*	*Le 15,000*	*US$ 3.85*
	Gloves	*Unit*	*Le 5,000*	*US$ 1.28*

6.13.3 Loans

None of the mechanical operators reported ever applying for loans or credit from a bank. Those who were considering doing so in the future expected to use the funds to purchase extra minor equipment. FCC on the other hand expressed interest in using such funds in purchasing another vacuum tanker.

7 External Stakeholders

7.1.1 National Government

Many national government entities have a direct impact on the work of the manual and mechanical operators in Freetown, the first of which is the ministry responsible for sanitation; a portfolio which has been held by several ministries in the past, including the Ministry of Education, Youth and Sports and the Ministry of Health and Sanitation (MoHS) (Mahayei, 2010). The MoHS operated mechanical emptying services in the past which have now been devolved to FCC as a result of the decentralisation process (see Box 8). The ministry also monitored household sanitary conditions with the help of Public Health Officers (PHOs), a role which is in the process of being transferred to FCC.

Currently, the Ministry of Energy and Water Resources (MoEWR) is responsible for sanitation (Mahayei, 2010). As a result of the 2004 Local Government Act on decentralisation, the functions of the MoEWR are limited to providing policy, technical guidance and monitoring (Government of Sierra Leone, 2004). In 2010, a water supply and sanitation policy for Sierra Leone was being drafted by the MoEWR with the support of UK-DFID. Whether or not the MoEWR has a positive impact the work of desludging operators through this process has yet to be seen.

Finally, the Sierra Leone Roads Authority (SLRA) has a significant but indirect role to play in providing the appropriate road infrastructure to reduce traffic congestion in Freetown. The areas of most concern to mechanical operators are the central wards. Some projects are currently underway, including the widening of Wilkinson Road in the western wards.

Box 8:

[Roles of National and Local Government in Sanitation after Decentralisation]

With the support of such donors as the World Bank and the DFID, the Government of Sierra Leone initiated the decentralisation process in 2004 with the passing of the Local Government Act. The act was put in place to "provide for the decentralisation and devolution of functions, powers and services to local councils" (Government of Sierra Leone, 2004). The following short extract from the act highlights the main powers and functions devolved to the local councils, including FCC:

> *Section 20, Subsection (1): "A local council shall be the highest political authority in the locality and shall have legislative and executive powers to be exercised in accordance with this Act or any other enactment, and shall be responsible, generally for promoting the development of the locality and the welfare of the people in the locality with the resources at its disposal and with such resources and capacity as it can mobilise from the central government and its agencies, national and international organisations, and the private sector." (Government of Sierra Leone, 2004)*

In effect, the process provides FCC with the responsibility for regulation, implementation and delivery of sanitation services in Freetown. While the MoEWR would be responsible for policy, planning, monitoring and financing.

7.1.2 Local Government Entity

According to the Local Government Act of 2004, Freetown City Council (FCC) through its Environmental Health and Safety Department is responsible for providing sanitation services to the residents of the city. The council has also recently (February 2010) passed nuisance by-laws that would enable its own Public Health Officers (PHO) and Metropolitan Police to ultimately arrest and prosecute any person who is responsible for:

> *"Any pool, ditch, gutter, watercourse, cistern, sanitary convenience, cesspool, drain, dung pit or ash fit, so foul or in such a state as to be prejudicial to health or a nuisance to the inhabitants of any neighbourhood within the Freetown City" (FCC, 2010)*

Accordingly, FCC has already hired seven (7), from the target number of 37, PHOs to enforce the by-law.

FCC also provides a mechanical emptying service to the residents of the city. Their role in this sector is discussed in the previous section on mechanical emptying. As previously mentioned, for those households or institutions whose faecal sludge containment systems are not accessible by vacuum tanker, FCC hires manual operators to do the job (Kamara, 2010). There is no known law that prohibits or regulates manual emptying of faecal sludge, although the disposal practice of burial might be interpreted as illegal by the new by-law.

The city council is also financing some, if not all, of the operational expenses of the Freetown Waste Management Company (FWMC) including salaries and vehicle operation and maintenance (Kamara, 2010). While currently FWMC is a parastatal private company with primarily public shareholders, it is envisaged to become fully financed by FCC in the future (Hydratec SA., 2008). As part of its functions, FWMC is responsible for running the Kingtom Dump Site and the corresponding faecal sludge treatment facility (Kamara, 2010).

7.1.3 Ward Committees

Ward committees were established as a result of the Local Government Act of 2004. Each ward committee consists of the elected councillors in the ward along with ten (10) non-paid residents of the ward, no less than five (5) of which should be women (Government of Sierra Leone, 2004). One (1) of the elected councillors is elected as the chair of the committee. While assumed to be a government entity, the powers of the committee are generally limited to mobilisation of residents. One of the functions of the committee is to "organise communal and voluntary work, especially with respect to sanitation" (Government of Sierra Leone, 2004).

7.1.4 WASH Committees

Water, Sanitation and Hygiene (WASH) Committees in Freetown are community-based organisations (CBOs) which were established to help support and improve the WASH conditions in their respective communities. They have been playing an increasingly more important role in assessing and managing the WASH needs of their communities through a community-based approach. WASH Committees could potentially play a role in supporting faecal sludge emptying operators and the provision of their services.

7.1.5 External Donors

Several international funding organisations have supported projects which directly or indirectly impact faecal sludge emptying operators in Freetown. Some of these projects and their funders are summarised in table 7.1.

Table 7.1 - Activities of international funding organisations in Sierra Leone

	ACTIVITY	ORGANISATION	SOURCE OF INFORMATION
1.	Construction or rehabilitation of existing faecal sludge treatment facility at Kingtom Dump Site	UK-DFID, UNDP	(Hydratec SA., 2008)
2.	Decentralisation	UK-DFID, EC, World Bank	(Gayma, 2010) (Hydratec SA., 2008)
3.	Water and Sanitation Policy and Strategy Development for Sierra Leone	UK-DFID	(Mshana, 2010)
4.	Providing Emptying Equipment (e.g. vacuum tanker)	Government of Libya, UK-DFID, UNICEF	(Gayma, 2010) (Atkins, 2008)
5.	Establish current sanitation situation, design strategic frameworks and development plans	UK-DFID, EC	(Atkins, 2008) (Hydratec SA., 2008)
6.	INGO Sanitation Projects (see next section on INGOs)	UK-DFID, EC	(Atkins, 2008) (Hydratec SA., 2008)

Comprising 42% of all external donor funding, the EC and UK-DFID were the two largest donors to Sierra Leone in 2007, with UK-DFID being the largest bilateral donor (EC, 2007). Furthermore, both organisations have shown recent interest in the development of a sanitation plan for Freetown through their support of the following reports, both of which contain information on faecal sludge management in Freetown:

- *Strategic Water Supply and Sanitation Framework* by Atkins (2008); and
- *Freetown Development Plan: Pre-identification Study* by Hydratec SA. (2008).

7.1.6 International Non-Governmental Organisations

Only a handful of INGOs have any type of sanitation-related projects currently running or planned for Freetown residents. Virtually none are working with manual or mechanical sludge removal operators. Two (2) INGOs, GOAL and Oxfam GB, have plans to work directly with operators by:

1. supporting sanitation infrastructure development and management;
2. mapping the current sanitation situation and gaps in provision and service delivery,
3. supporting development of systems and structures for faecal sludge management at the community level;
4. piloting sludge removal low-cost techniques in target locations;
5. rehabilitating and constructing household/ communal latrines; and
6. setting up/improving caretaker management of communal sanitation facilities.

8 Discussion and Analysis

This section places greater focus on and allows for the discussion and analysis of some topics discussed in previous sections.

8.1 Operator Challenges

Both manual and mechanical operators in Freetown face complex challenges during the delivery of their services. For the manual operators, the most prominent of these are:

- the execution of physically and emotionally offensive work in humiliating conditions;
- the high risk of injury or illness due to the exposure to a hazardous environment, and even more so when under the influence of alcohol;
- the inadequacy of personal protective equipment given that they have to get into the containment structures to remove the sludge;
- assault and provocation by some members of the public; and
- seasonal variation in demand.

The humiliating conditions manual operators are forced to endure in order to empty a household's latrine cannot be overstated. It could be argued that the psychological hazards of this job are more harmful than the physical ones. Regardless, the dangerous and degrading conditions of this job could be significantly mitigated by eliminating the need for the operators to be in the pit.

As for the mechanical operators, the most prominent challenges facing their businesses include:

- low and seasonal variation in demand;
- high transit times resulting in higher operating costs and delayed service delivery;
- poor road infrastructure at the faecal sludge treatment site causing damage to vehicles;
- lack of spare parts and skilled mechanics for repairing vehicles;
- unfair competition with the low-cost public provider; and
- a limited market due to lack of access to some customers.

8.2 Meeting the Demand

Atkins estimated that the amount of faecal sludge produced in Freetown in 2008 was 466 m^3 per day, or equivalent to approximately 26 loads of the largest vacuum tanker in Freetown (18,000 litre capacity). Compared to Dakar, another West African city, Freetown has one tenth the ratio of persons per vacuum tanker (Mbéguéré, Gning, Dodane, & Koné, 2009) (see Box 9). Moreover, the minor sewerage network currently installed is not expected to expand over the entire city in the short to medium-term. All this would suggest that while the current demand for the services of mechanical operators is low, the market for faecal sludge emptying services is substantial, stable and growing.

Currently, the majority of demand for faecal sludge emptying is being met by the manual operators. Mechanical operators would have to overcome the following external barriers to gain a greater share of the market:

- lack of access to faecal sludge containment systems due to deficient road infrastructure;
- competition by the lower-cost services of manual operators and Freetown City Council;
- seasonal variation in demand;
- poor operational and financial management of faecal sludge disposal infrastructure; and
- increased expenses and lost potential revenue due to traffic congestion.

The internal challenges are:

- absence of a marketing strategy;
- lack of preventative maintenance;
- basic skills in financial and operational management of a business; and
- lack of incentives for managers to achieve higher profits.

Box 9:

[Vacuum Tanker Ratio]

FREETOWN:

- Population (2008): 1,173,000 persons
- Vacuum Tanker Fleet: 5 vehicles
- **Ratio: 234,600 persons per vehicle**

DAKAR, SENEGAL:

- Population (2009): 2,9300,000
- Vacuum Tanker Fleet: 130 vehicles
- **Ratio: 22,500 capita per vehicle**

Source: (Mbéguéré, Gning, Dodane, & Koné, 2009)

8.3 Comparing Emptying Fees

Based on the household survey (see Volume I), the average service fee paid by a household to empty their faecal sludge containment system is US$ 73 for a mechanical operator and US$50 for a mechanical operator. To compare these values to other cities in Africa, data is collected from different studies and reported fees were adjusted for inflation using average consumer prices for 2009. The details of this analysis and comparison are provided in Figure 8.1 and Table 8.1.

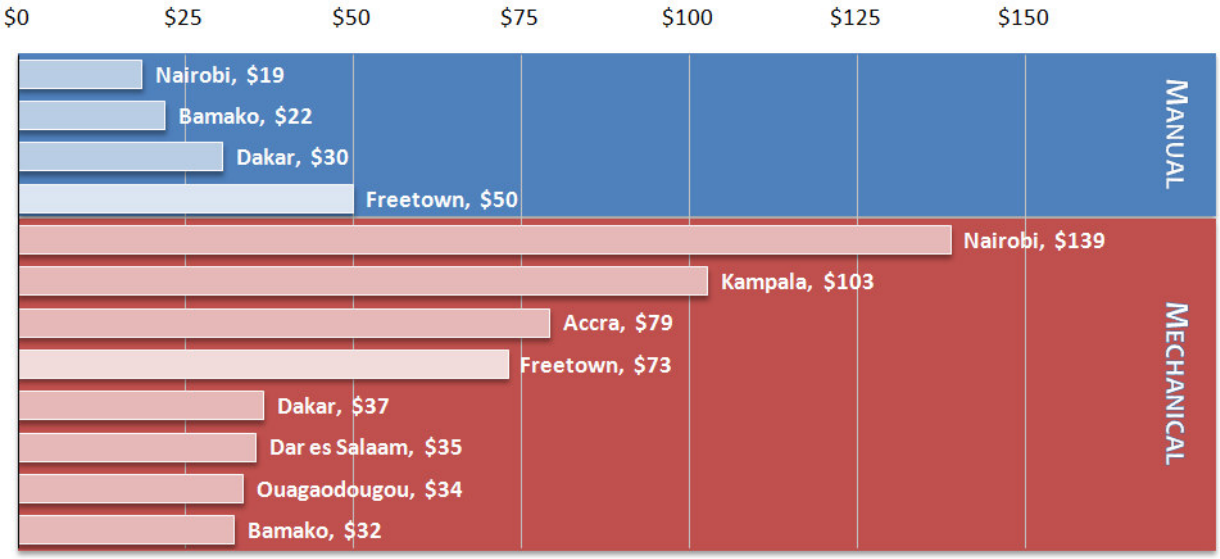

Figure 8.1 - A comparison of emptying fees in different African cities

Table 8.1 - Comparing emptying fees of select cities in Africa

	Index Year	Inflation[1], Average Consumer Prices (2009)	Reported Cost (Index Year)	Calculated Cost (2010)	Source
MECHANICAL OPERATORS					
Nairobi, Kenya	2000	231.514	US$ 60	US$ 139	(Collignon & Vézina, 2000)
Kampala, Uganda	2000	171.171	US$ 60	US$ 103	(Collignon & Vézina, 2000)
Accra, Ghana	2007	138.954	US$ 57	US$ 79	(Boot, 2007)
Freetown, Sierra Leone	**2010**	**100.000**	**US$ 73**	**US$ 73**	**(Mikhael, 2011)**
Dakar, Senegal	2000	121.815	US$ 30	US$ 37	(Collignon & Vézina, 2000)
Dar es Salaam, Tanzania	2005	141.957	US$ 25	US$ 35	(BPD, 2005)
Ouagaodougou, Burkina Faso	2000	134.311	US$ 25	US$ 34	(Collignon & Vézina, 2000)
Bamako, Mali	2000	129.120	US$ 25	US$ 32	(Collignon & Vézina, 2000)
MANUAL OPERATORS					
Freetown, Sierra Leone	**2010**	**100.000**	**US$ 50**	**US$ 50**	**(Mikhael, 2011)**
Dakar, Senegal	2000	121.815	US$ 25	US$ 30	(Collignon & Vézina, 2000)
Bamako, Mali	2000	129.120	US$ 17	US$ 22	(Collignon & Vézina, 2000)
Nairobi, Kenya	2000	231.514	US$ 8	US$ 19	(Collignon & Vézina, 2000)

[1] **Source: (Stanley St Labs, 2010)**

The fees charged by mechanical operators in Freetown are in the middle to upper range of what is reportedly charged in other African cities for a similar service. Despite such fees and possibly due to poor management, Freetown's oldest private mechanical operator at Hannah Benka Coker Street seems financially weak and unable to recover capital costs and reinvest. The two (2) other private mechanical operators have been operating for too short of a period to make a conclusive evaluation.

As for manual operators, the average fees they charge are considerably higher than any of the reported cities. There was no indication that Freetown's manual operators provided additional services that those in the referenced cities did not. Additionally, while they did possess the advantage of monopoly in areas not accessible to vacuum tankers, this was not a unique advantage that other operators in other cities did not have (BPD, 2005). If cost of living could justify this, in July 2010 Freetown was ranked 166th based on the cost of living index; Dakar, ranking 98th, had a higher cost of living (Xpatulator, 2010). Potential reasons for this considerably higher fee in Freetown are:

- less competition among manual operators;
- Freetown residents place a higher value on latrine emptying and the manual labour required to complete it; and/or
- containment systems in Freetown are larger than those in other countries.

Potentially a more suitable indicator for the comparison of fees among the different African cities is the percentage of the average emptying fee to the gross domestic product (GDP) per capita for the year the fee was reported (adjusted for inflation). Compared to the selected cities, Freetown tops the list for having the highest service fee compared to GDP/capita for both manual and mechanical emptying. The complete results of the analysis are provided in table 8.2 below.

Table 8.2 - Comparing the percentage of emptying fee to GDP per capita in select African cities

	City	Base Year	GDP/capita (inflation-adjusted) US$ [a]	Emptying Cost, US$	Percentage Emptying Cost to GDP/capita (%)	Source of Emptying Cost
Manual	Freetown	2010	894	50	5.6%	*Mikhael*
	Bamako	2000	855	17	2.0%	*Collignon & Vézina*
	Dakar	2000	1,511	25	1.7%	*Collignon & Vézina*
	Nairobi	2000	1,318	8	0.6%	*Collignon & Vézina*
Mechanical	Freetown	2010	894	73	8.2%	*Collignon & Vézina*
	Kampala	2000	881	60	6.8%	*Mikhael*
	Nairobi	2000	1,318	60	4.6%	*Collignon & Vézina*
	Accra	2007	1,310	57	4.4%	*Boot*
	Bamako	2000	855	25	2.9%	*Collignon & Vézina*
	Ougadougou	2000	1,001	25	2.5%	*Collignon & Vézina*
	Dar es Salaam	2005	1,018	25	2.5%	*BPD*
	Dakar	2000	1,511	30	2.0%	*Collignon & Vézina*

a. Source: Gapminder, 2010

9 Conclusions

The existing supply of faecal sludge emptying services in Freetown appears to just about meet the current market demand. The relatively ubiquitous manual informal operators retain a majority share of the market (59%), leaving three private and one public mechanical operator to compete over what remains.

The convenience of hiring their service, its low-cost, and their ability to access all households provides manual operators with a major advantage over their mechanical counterparts. Private mechanical operators face the extra interconnected hurdles of high operational costs, low demand and high transit times due to heavily congested roads. These realities appear to dissuade operators from any type of formal cooperation between each other.

Possibly due to a lack of confidence in the market, the sector falls short of any significant innovations. Intermediate technologies between the hazardous low-cost bucket emptying method and the high-capital cost vacuum tanker are absent; a gap which should be the target of any intervention. Marketing strategies lack ambition and focus; they are limited to word of mouth or distribution of flyers.

The public perceives manual operators as being unprofessional, disgraceful, and “dirty” people. The shame or embarrassment operators feel, particularly the manual ones, is overshadowed by their need for an income.

The fees charged by the manual operators are much higher than those reported in other African cities. Mechanical operators on the other hand charge above average fees compared to their African peers. These relatively high prices allude to moderate or relatively low market competition and a limited number of service providers.

Potentially due to limited capacity, national government bodies have rarely shown interest in regulating the market; whereas local government has been actively competing with it by offering subsidised low-cost services. International funders have invested and re-invested in presently non-operational treatment infrastructure, and donated emptying equipment and training to national government.

10 Recommendations

This section will propose an intervention strategy for improving the current conditions surrounding faecal sludge emptying in Freetown. The strategy will be supported by a list of potential solutions for specific issues faced by operators.

10.1 Proposed Intervention Strategy

The intervention strategy proposed for supporting desludging operators in Freetown incorporates elements of the Strategic Sanitation Approach (SSA) and the Household-Centred Environmental Sanitation (HCES) 10-step process (Wright, 1997) (Eawag, 2005). The steps of this strategy – with some descriptions – are provided in Figure 10.1. In general, the strategy should be demand-based and incentive-driven while considering Freetown as a whole, the faecal sludge management chain in its entirety, and the existing political and administrative context.

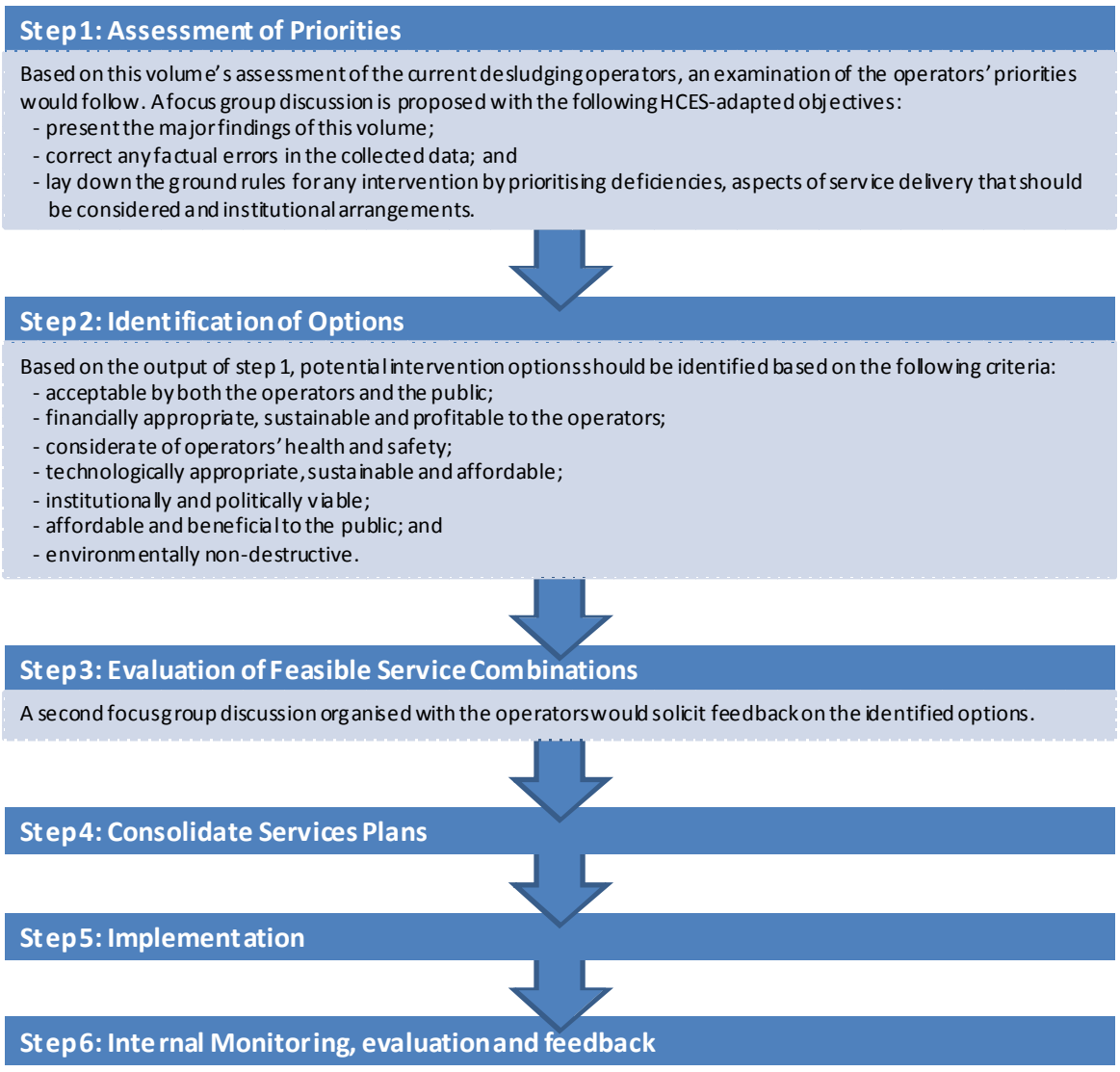

Figure 10.1 - Proposed intervention strategy for manual and mechanical operators

10.2 Potential Solutions

Based on the output of Step 1 of the proposed strategy, options for a successful intervention would be identified. This section offers some potential solutions that should be re-evaluated after the priorities have been assessed.

10.2.1 Manual Operators

Manual emptying of faecal sludge is not considered the ideal solution for filled latrines. However, existing realities require operators, governments and organisations to work within a certain framework. The following is a list of recommendations for manual operators which could potentially improve their current conditions. Many of these recommendations are interpretations of solutions offered by the operators themselves during the semi-structured interviews:

1. **Piloting Technologies that Limit Contact with Faecal Sludge**
   Operators should drastically limit their contact with faecal sludge by eliminating the need to be inside the containment structure when emptying. Limiting this contact will help mitigate hazards (see section 5.5) and the degrading conditions under which operators work as well as potentially allowing them to work during the day. Some of the existing manually or mechanically powered pumps that could be piloted by GOAL are:
   - Sludge Gulper by the London School of Hygiene and Tropical Medicine (LSHTM);
   - Diaphragm hand pump by Chemineers (http://www.diaphragmhandpump.com/); and
   - Commercially available trash pumps
   - Vacutug by UN-HABITAT and Manus Coffey and Associates Ltd.

   Certain adaptations can be developed to supplement these technologies so as to enhance the user experience and consider the local context. More information on the advantages and disadvantages of each of these technologies can be found on the website of Practical Action under the technical brief entitled “Pit Emptying Systems”.

   If and when there are sufficient incentives for manual operators to transport removed sludge to an official disposal or transfer point rather than bury it nearby, and depending on the type of emptying technology piloted, sludge could be transported over a short distance using different types and sizes of non-spill containers (plastic containers, metal drums, etc.). Depending on the conditions of each area and the location of the designated transfer point, containers could then be transported as is to the final disposal location or emptied and transported in another larger vessel - such as a vacuum tanker - to that disposal location (see Figure 10.2).

2. **Involving the Community in Establishing Transfer Points**
   If transfer points were seen as a potential solution, innovative partnerships would be required between the manual emptying and transport operators and the community. Communities interested in a cleaner space could do so by eliminating unsafe practices of faecal sludge disposal (burial or into a water body) and instead promoting off-site disposal through the use of transfer points. The communities, possibly with the support of WASH

Committees, would be responsible for designating and enforcing the use of these transfer points.

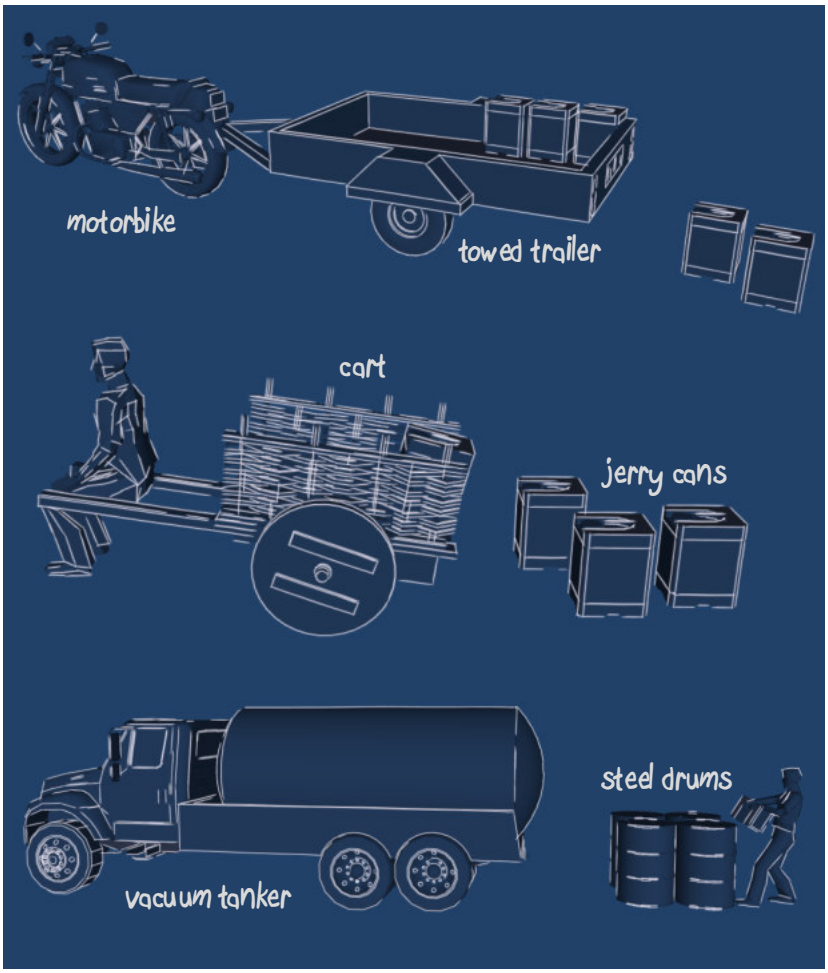

Figure 10.2 - Potential options for transfer and transport of faecal sludge

3. **Developing and Linking with the Reuse Market**

Developing the current market for reuse of faecal sludge as fertiliser and linking it with the manual operators could become a powerful incentive for discouraging inappropriate disposal. There was reportedly a relatively small and informal market for this product (reported by field managers of the Kingtom disposal site), however manual operators did not appear to benefit from the market nor did they perceive much financial or economic value of the product. Evaluating and engaging the reuse market could allow for innovative market-based solutions that draw manual operators into it.

4. **Improving Faecal Sludge Disposal Practices**

Operators and communities that choose not to transport the sludge to remote locations would benefit from safe burial practices. It is recommended that operators be educated on safe disposal practices which would include issues such as:

- locating the disposal pit far from drinking water sources; and

- providing sufficient soil cover.

5. Transforming Emptying Activities into a Business

Transforming the manual emptying activities into a legitimate business is required to provide both the operators and potential investors (e.g. micro-credit) with the confidence to invest. As such, the operators would benefit from:

- registering with Freetown City Council and being recognised as a legal and legitimate business enterprise; and
- training on keeping operational and financial records of their activities.

6. Reducing Solid Waste Disposal in Containment Systems

The disposal of solid waste into faecal sludge containment structures is detrimental to both manual and mechanical operators. Any type of pumping system piloted by the operators would also find difficulties operating in such an environment. Operators have devised rake-type tools to remove these objects, however there has been no attempt to discourage households from disposing of the solid waste in the first place.

A two-tiered approach is proposed: a public awareness campaign coupled with financial incentives. Ideally, the public awareness campaign would be implemented by local government with the technical and financial support of INGOs. The campaign would highlight the importance of having a "clean toilet"; described as one that is not completely full of faeces and does not contain rags, bottles and sharp objects in its pits. Unambiguous financial incentives (e.g. rebates) would be given by the operators for households with "clean toilets". In the campaign, it would be important to select local expressions that discourage households from doing otherwise but are not seen as being degrading.

7. Involving WASH Committees in Faecal Sludge Emptying

WASH committees could play a role in providing a decentralised support system for the manual operators and the emptying market in general. This would allow for the provision of customised solutions for specific areas while sharing ideas with other WASH committees. Some examples of support include:

- becoming points of contact for households requiring emptying services;
- supporting poorer households who cannot pay for emptying through cross-subsidies (e.g. from water point revenue); and
- allocating transfer areas or decentralised treatment and disposal facilities.

8. Establishing a Union

A centralised and operator-controlled option might be preferred as an alternative or supplement to the decentralised option of partnering with WASH Committees. Manual operators could opt to form a union to support their activities and increase their negotiating influence with local government.

10.2.2 Mechanical Operators

As for the mechanical operators, the following options are proposed to improve the current conditions:

1. **Increasing Demand Through Innovative Marketing Strategies**

   Based on the available information, the current demand for private mechanical operators provides revenues that barely cover operational costs and are too low to allow for reinvestment. As a matter of fact, revenue appears to be so low that efficiency is not yet a priority. Issues such as lengthy transport periods due to traffic congestion and periodic downtimes due to breakdowns (to a certain extent) are secondary to the low demand.

   Several challenges previously mentioned (Chapter 6) have been preventing these businesses from increasing demand and the lack of willingness of users to pay higher service fees. Some potential innovative marketing strategies operators should consider include:

   - regulation and publication of private operator service fees to avoid unnecessary competition among the sector;
   - advertising discounted fees to customers who refer friends or neighbours;
   - advertising discounted fees for emptying during the low season;
   - emphasizing the advantage of faster response times than the public provider;
   - emphasizing the advantage of "no burial" as compared to manual operators;
   - hiring local agents on commission to solicit jobs and collect fees directly from households thus overcoming their need to go to the operator;
   - partnering with manual operators (see point 2 below); and
   - mapping demand for a more targeted marketing approach.

2. **Building Partnerships with Manual Operators**

   To say the least, manually emptying a septic tank or pit is unpleasant and extremely difficult work. It might be possible for mechanical operators, at the right price, to relieve manual operators of this burden while increasing their customer base. To do so, mechanical operators would have to explore partnerships with manual operators by providing them with an acceptable commission in return for referring accessible customers.

3. **Training for Preventative Equipment Maintenance**

   Simple periodic preventative maintenance of vacuum tankers could result in reduced downtimes and considerable long-term savings for the mechanical operators. Training would have to be provided by qualified technicians.

4. **Training on Financial and Operational Management**

   As with the manual operators, in order to increase the confidence of investors, mechanical operators should collect financial and operational data on their activities. Training for interested operators could be provided by GOAL.

5. **Reducing Solid Waste Disposal in Containment Systems**
   As with the manual operators, solid waste in containment systems is a nuisance and causes damage to the mechanical equipment being used. Mechanical operators could support the same two-tiered program suggested for the manual operators.

6. **Pursuing Partnerships with Trusted Foreign Parts Suppliers**
   Mechanical operators find it difficult to repair and locate affordable spare parts for their second-hand vehicles when they break down. Using their international networks, GOAL could support operators by seeking foreign parts suppliers with which to form direct partnerships. By removing the need for several intermediate agents, operators could potentially secure more affordable spare parts in a shorter period of time.

10.2.3 Institutional Arrangements

The following suggestions relate to the institutional arrangements that could be made to improve the faecal sludge emptying sector:

1. **Private Sector Support and Regulation**
   Currently FCC is providing mechanical emptying services to the Freetown population in line with its mandated responsibilities. Its low-cost fees however prove to be a source of competition for private mechanical providers. FCC should instead be promoting and supporting the small-scale private sector represented by the manual and mechanical operators in line with the national Poverty Reduction Strategy Paper (Government of Sierra Leone, 2005).
   FCC should also encourage and facilitate the registration of manual operators as a business. Their recognition would give legitimacy to their activities, increase internal and external confidence in the value of the business, and potentially mitigate public harassment. From the local government's perspective, this could become a potential long-term opportunity to help regulate and monitor the sector's activities in order to protect public health.

2. **Rehabilitating Existing Infrastructure and Redesigning its Management Systems**
   Prior to the development of any new infrastructure (e.g. decentralised treatment), the existing infrastructure at the sole disposal site of Kingtom should be rehabilitated. This would require considerable investment by the national government and/or funding agencies to provide an access road to the site and restore the currently buried treatment lagoons.

   Meanwhile, a more appropriate management system of the lagoons should be designed. For example, instead of expecting heavy equipment to remove the dried sludge from the Kingtom lagoons, manual operators would be hired by FWMC to safely empty the lagoons when full.

3. **Restructuring and Coordinating Responsibilities**
   At the national level, the responsibility for policy, planning, monitoring and financing in the sanitation sector is currently shared by the Ministry of Energy and Water Resources

(MoEWR) and the Ministry of Health and Sanitation (MoHS). Steps should be taken to mitigate the fragmented and overlapping responsibilities of the sector.

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List of Annexes

ANNEX A: SEMI-STRUCTURED INTERVIEW QUESTIONS FOR FAECAL SLUDGE EMPTYING OPERATORS

FREETOWN, SIERRA LEONE

1 INTRODUCTION

As we previously mentioned, we are from the organisation GOAL and are conducting a study to explore and understand the opportunities and threats facing those working in the emptying business. It is crucial for our work as an organisation to obtain your opinion to provide you with appropriate services.

We plan to conduct about 10 interviews to produce a report for the direct use of our organisation. People interviewed will not be identified and will remain anonymous. While a limited amount of the information and opinions provided by the interviewee will be published in a report, the interviewee's identity will be protected and not shared with the reader. Do you have any questions?

2 INTERVIEWEE INFORMATION

1. **Name of Interviewee(s):** _____
2. **Job Title of Interviewee(s):** _____
3. **Telephone of Interviewee:** _____
4. **Date of Interview** _____
5. **Start Time** _____

3 ORGANISATION INFORMATION

6. **Organisation Name:** _____
7. **Type of Organisation:** _____
   e.g. formal, informal, economic interest group (EIG), limited liability company (LLC)
8. **Office Location in Freetown:** _____
9. **Year Established or Activities Commenced:** _____
10. **How many people do your job in your area?** Number: _____ Area: _____
11. **Name and contacts of known competitors** _____

4 HUMAN RESOURCES

12. Total Number of Employees: _____

13. Staff Positions _____

e.g. operational director, marketing specialist, secretary, accountant, mechanic, driver, team leader, labourer

_____

_____

_____

_____

14. Staff Categories _____

e.g. permanent, temporary, day labourers
NOTE: DETERMINE ETHNIC BACKGROUND OF STAFF IF POSSIBLE

_____

_____

_____

5 OPERATIONAL INFORMATION

15. Services Provided

a. Describe type of services offered by your organisation
e.g. faecal sludge or industrial emptying, disposal of waste & storm water, maintenance of sewerage, transportation of water, etc.

b. percentage of time spent or revenue collected from each service (☐time/ ☐revenue)

16. Management

a. what sections or wards do you frequently operate in?

b. how do customers request your business?
e.g. call your phone, come to your home or business, word of mouth, etc.
Also, is it usually done through an agency or by the customer themself?

c. otherwise, how do you manage your business operations?
e.g. first come first serve, try to empty many customers in one location, team of emptiers, etc.

d. what are your usual business hours?
e.g. Monday to Saturday, 12am to 7am

17. Emptying Process

a. describe the faecal sludge containment systems you usually empty from
e.g. buckets/pans, latrine pits (what kind of latrines?), buckets, septic tanks, cesspits, etc.

b. estimate the volume emptied from each type of containment system
e.g. one (1) rubber from pan, 10 (ten) rubbers from pit

c. describe the emptying process
provide the details of each step in chronological order and the time each step takes

d. what challenges do you face during emptying?
e.g. social stigma, harassment by government officials (who?), working at night, safety, breaking latrine slabs

focus on emptying only!

e. when a pit is emptied, how much of it is emptied and describe the consistency of the sludge removed
e.g. ¼, ½, ¾, or all the pit;
e.g. consistency: hard, like dry soil, or muddy

18. Transportation

a. describe the transportation method or vehicle used and the road/path condition
e.g. bucket, trolley, truck, etc.
e.g. dirt, paved, steep, narrow, wide, etc.

b. describe the challenges faced during transport
e.g. traffic congestion, bad road conditions, steep slopes, safety, spillage

c. estimate the amount of time spent in transport of faecal sludge to disposal location
hours per day

19. Disposal

a. how do you locate a disposal point?
e.g. nearest open space, farthest point from public, same plot as latrine, government regulated area, etc.

b. if disposal is concentrated in a certain location, which disposal points do you frequent?
e.g. ocean, rainfall drains, garbage dumps, official disposal facility (King Tom)

c. describe the disposal process
e.g. dig a hole to bury the waste in, simply empty onto surface of ground, etc.

20. Treatment or Reuse

a. if there is a faecal sludge market, describe it
is the market weak or strong? who are the clients and where are they located?

6 MATERIAL RESOURCES

21. Basic Equipment

a. describe equipment you use
type, condition, quantity and manufacturer name
have any improvements been made to the original equipment? if yes, what?

b. who are your equipment or material suppliers?
e.g. local stores, other countries
if international, did you use an importer? provide name and address of importer

c. describe the stock of equipment or spares available, if any
type and quantity

d. what are the strengths/weaknesses of the available equipment?
- equipment technical limitations,
- challenges of importation,
- barriers to increased service

e. what other emptying equipment do you know of?

f. estimate downtime due to equipment malfunction
use units of days per month or percentage of time

22. Personal Protective Equipment

a. describe protective equipment used and who uses it
type, quantity
e.g. boots, mask, safety glasses, gloves

b. do you feel safer when using it? why?

c. what are the barriers that discourage you from using the following protective equipment: gloves, mask, glasses, boots, gloves?
e.g. too hot, restrict movement, uncomfortable, etc.

7 MARKET, MARKETING AND CUSTOMER SATISFACTION

23. describe the typical type of customers you have

e.g. 20% individual low-income customers, 40% individual medium-income customers and 40% businesses or institutions

24. estimate the number of customers you have per time period

e.g. 5 per day, or 25 per week, or 100 per year;

25. describe change in demand throughout the year

e.g. high demand after or just before rainy season starts, low demand in dry season

why is there this change in demand?

26. what are the challenges to increasing the number of jobs you do?

e.g. low demand, lack of labour, transportation takes too much time, equipment is not good, etc.

27. how do you think you can increase the number of jobs you do?

e.g. better equipment available in the market, working together with other groups, etc.

28. **describe any service promotion techniques followed**
e.g. word of mouth, advertising on equipment, etc.

29. **request information of recent customer to evaluate customer satisfaction**

8 PERCEPTIONS, KNOWLEDGE AND HYGIENE PRACTICES

30. Public Perception

a. what do people think of your job?
understand social stigma

b. how does that impact you or make you feel, and why?

c. what solutions can you suggest to increase public acceptance of your job?
e.g. recognition by the government, public awareness campaign, etc.

31. Personal Perceptions

a. how did you end up working this job?
try to understand the motivation for choosing this job: money? family already does it? etc.

b. what aspects of the job do you not like?

32. Health and Hygiene

a. does your job harm your health?
e.g. diarrhea, lacerations, skin infections, worms, fungus, etc.

b. what do you do to reduce the potential for getting harmed?
hygiene practices: e.g. wash body with soap and water, wear protective equipment, etc.

9 ENABLING ENVIRONMENT

33. Policy and Regulation

a. what government entities have impacted your work? how?
this can be in a positive or negative way, e.g. district councillors, chiefs, police, FCC, importing department, etc.

b. what complaints do you receive from government entities?
e.g. disposal location

c. do you know of laws or regulations which impact your business? what are they?

d. what type of laws or regulations could benefit your business?

34. Organisation of Sanitation Service Providers

a. do you know of or belong to a union of workers that do a similar job as yours? describe
year established, leader, number of members, helpful or harmful laws, etc.

b. do you know of or belong to an alliance of sanitation services providers or a group of shared interests? describe
year established, leader, number of members, laws, etc.

c. if there is an organised alliance of service providers, are areas allocated to each of them? describe

35. Infrastructure

a. what major infrastructure impacts your operations and how?
e.g. roads, electricity, communications, disposal locations, etc.

10 FINANCES AND RESOURCES

36. Basic Financial Data

a. how much is charged per emptying?

Minimum: _____ Le

Maximum: _____ Le

Average: _____ Le

b. how does the charge vary and what is it affected by?
e.g. season, distance from disposal point, type of customer (family or institution), income of the family, etc.

c. how does profit from emptying compare to profit from other activities you or your family perform?
e.g. a bit lower, much higher, if possible provide percentage

d. do you have any ideas on how to increase your revenue?

e. if faecal sludge is sold, for how much?
e.g. 4,000 leones/50 kg bag

f. how do you manage customer payments?
e.g. payment prior or after service delivery, invoices, one receipt, copied receipt, bookkeeping, etc.

g. how do you manage payments to employees or hired labour?
- monthly payments, payment per job
- higher payments for team leaders, driver, lower payments for temporary labour

h. how much do you pay each employee or hired labour?
e.g. 400,000 Le per month

37. Balance Sheet *(if possible, request financial records or balance sheets)*

a. describe initial capital investment and estimated replacement frequency
e.g. shovel (50,000 Le), bucket (10,000 Le), truck (25,000 US$)

Item and Replacement Frequency	Total Cost

b. describe annual revenue in 2009 or first months of 2010 for **faecal sludge emptying only**
*provide either **annual revenue** or estimated **monthly revenue** during low and high season*

Period (☐ year / ☐ month)	Income

c. describe total annual revenue in 2009 or first months of 2010 for **all your business activities**
*provide either **annual revenue** or estimated **monthly revenue** during low and high season*

Period (☐ year / ☐ month)	Income

d. summarise expenses in 2009 or first months of 2010 for faecal sludge emptying only
*provide either **annual expenses** or estimated **monthly expenses** during low and high season*

Period (☐ year / ☐ month)	Expenditure

e. describe capital and non-capital expense items and estimated value
e.g. material, fuel, maintenance, taxes, fines, insurance, payroll, etc.

Item	Value

38. Funding: Loans and Grants

a. have you ever applied for loans or grants? describe
from where/who, how much, when, terms; this can be from family members, national or international organisations

b. have you ever received external funding (loans or grants)? describe
from where/who, how much, when, terms; this can be from family members, national or international organisations

c. do you get credit from suppliers?
from where/who, how much, when, terms;

d. are you planning to apply for loans or grants in the near future? for what?
from where/who, how much, when, terms; this can be from family members, national or international organisations

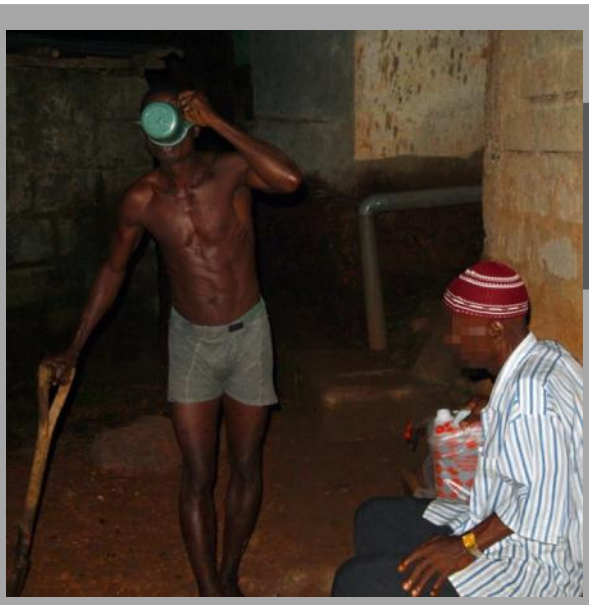
39. Customer Credit

a. do you provide credit to customers? describe
when, how much, terms;

b. if not, what alternatives do customers have if they don't have money to empty?
do it themselves, empty during flooding, etc.

End Time

ANNEX B: STAGES OF MANUAL EMPTYING OF FAECAL SLUDGE FREETOWN, SIERRA LEONE



1 Drinking alcohol before and during work in order to remain in a state of intoxication

2 Manoeuvring into position after opening cover, inserting kerosene and *carboleum*, and mixing

3 Bailing out first bucket of faecal sludge while sitting on top of structure opening

4 Forming a chain and passing on bucket

5 Passing bucket to disposal point

Disposing contents of bucket into pre-dug disposal pit 6

7 Smoking throughout process to reduce effects of odour

Getting into pit to bail sludge out as sludge gets deeper (body used to mix contents) 8

9 Two people getting into structure as sludge gets even deeper, one bailing sludge

and another passing it out of structure 10

11 Washing face with water due to irritation of eyes from gas and faecal sludge

Sealing disposal pit with removed soil once containment structure is empty 12

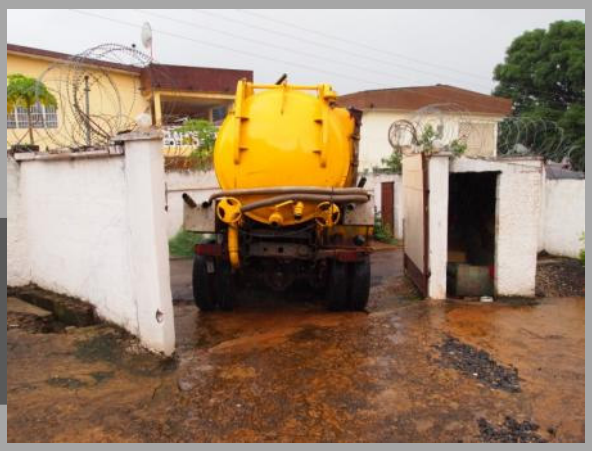
13 Replacing cover of containment structure

Washing with soap and water in a nearby creak 14

A "cambo" is a glass bottle filled with kerosene used to illuminate working area at night

ANNEX C: STAGES OF MECHANICAL EMPTYING OF FAECAL SLUDGE, FREETOWN, SIERRA LEONE

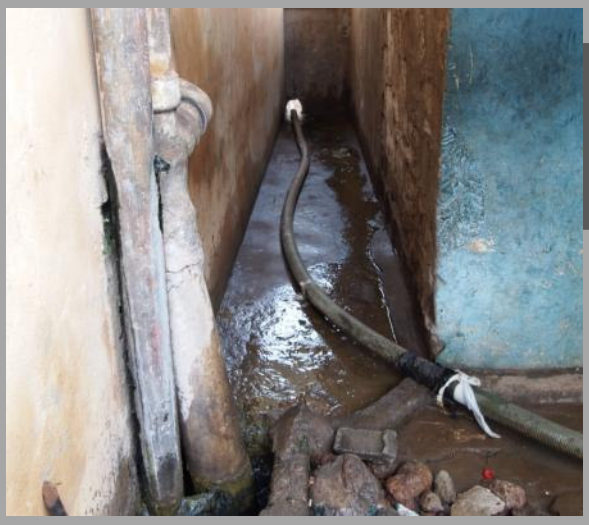
1 Driving narrow roads to reach customers



Manoeuvring into position once at the customer's address 2

3 Breaking the concrete slab cover with a metal rod

Connecting the various pieces of 10cm-diameter hose together with a PVC pipe 4



5 Laying down the pipe from the containment system (right) to the vehicle (center behind wall)

Starting the suction pump and adding water to facilitate the removal of faecal sludge 6

7 After the containment system is empty, cleaning the inside and outside of the hose with water

Cleaning hands with water 8

9 Driving to disposal site through small roads shared with pedestrians

Arriving at Kingtom dumping site and driving through unpaved roads to disposal point 10

11 Opening effluent valve once at the disposal point

Disposing of faecal sludge 12

ANNEX D: FINANCIAL ANALYSIS OF MANUAL EMPTIERS

	G1 - Group of 6 persons	Unit Rate	Conversion Unit Rate	Unit	Quantity	Frequency (days)	Annual Total	Summary
1.	**Initial Investment**							**$ -**
2.	**Annual average number of clients[a]**			**clients/week**	**5**			**97.5**
3.	**Average fee per client**	**300,000 Le**	**$ 77**	**per client**				**$ 77**
4.	**Annual gross revenue**							**$ 7,500**
5.	**Annual expenses**							**$ 2,662**
	5.4 Equipment					Subtotal:	$ 2,662	
	Boots	*50,000 Le*	*$ 12.82*	*per unit*	*6*	*60*	*$ 467.95*	
	Bucket	*10,000 Le*	*$ 2.56*	*per unit*	*4*	*21*	*$ 178.27*	
	Gloves	*10,000 Le*	*$ 2.56*	*per unit*	*6*	*7*	*$ 802.20*	
	Local Ladder	*20,000 Le*	*$ 5.13*	*per unit*	*1*	*30*	*$ 62.39*	
	Pick Axe	*30,000 Le*	*$ 7.69*	*per unit*	*4*	*30*	*$ 374.36*	
	Rake	*15,000 Le*	*$ 3.85*	*per unit*	*3*	*30*	*$ 140.38*	
	Rope	*2,500 Le*	*$ 0.64*	*per yard*	*10*	*60*	*$ 39.00*	
	Shovel	*15,000 Le*	*$ 3.85*	*per unit*	*4*	*90*	*$ 62.39*	
	Soap	*1,000 Le*	*$ 0.26*	*per unit*	*40*	*7*	*$ 534.80*	
6.	**Annual profit (including return to owner)**							**$ 4,838**
7.	**Daily profit**							**$ 13.26**

Notes:

[a] It is assumed that the average number of clients provided per week represents high-season demand (13 weeks between June and August). The annual demand assumes a low season demand between September and May (39 weeks) that is 1/6th of the high-season demand.

ANNEX D: FINANCIAL ANALYSIS OF MANUAL EMPTIERS

	G2 - Group of 3 persons	Unit Rate	Conversion Unit Rate	Unit	Quantity	Frequency (days)	Annual Total	Summary
1.	**Initial Investment**							**$ -**
2.	**Annual average number of clients[a]**			**clients/week**	**2**			**39**
3.	**Average fee per client**	**700,000 Le**	**$ 179**	**per client**				**$ 179**
4.	**Annual gross revenue**							**$ 7,000**
5.	**Annual expenses**							**$ 1,706**
	5.4 Equipment					Subtotal:	$ 1,706	
	Bucket (Steel)	*30,000 Le*	*$ 7.69*	*per unit*	*2*	*14*	*$ 401.10*	
	Gloves	*15,000 Le*	*$ 3.85*	*per unit*	*3*	*14*	*$ 300.82*	
	Hat (wool)[b]	*10,000 Le*	*$ 2.56*	*per unit*	*3*	*60*	*$ 46.79*	
	Mask[b]	*5,000 Le*	*$ 1.28*	*per unit*	*3*	*60*	*$ 23.40*	
	Overalls	*35,000 Le*	*$ 8.97*	*per unit*	*3*	*21*	*$ 467.95*	
	Pick Axe	*30,000 Le*	*$ 7.69*	*per unit*	*2*	*60*	*$ 93.59*	
	Boots[b]	*25,000 Le*	*$ 6.41*	*per unit*	*3*	*60*	*$ 116.99*	
	Shovel	*25,000 Le*	*$ 6.41*	*per unit*	*3*	*30*	*$ 233.97*	
	Stick for Pick Axe and Shovel	*3,500 Le*	*$ 0.90*	*per unit*	*2*	*30*	*$ 21.84*	
6.	**Annual profit (including return to owner)**							**$ 5,294**
7.	**Daily profit**							**$ 14.50**

Notes:

[a] It is assumed that the average number of clients provided per week represents high-season demand (13 weeks between June and August). The annual demand assumes a low season demand between September and May (39 weeks) that is 1/6th of the high-season demand.

[b] Data regarding the price and/or frequency of replacement of this item was not provided during the interview. Figures from other interviews are being used intsead.

ANNEX D: FINANCIAL ANALYSIS OF MANUAL EMPTIERS

	G3 - Group of 8 persons	Unit Rate	Conversion Unit Rate	Unit	Quantity	Frequency (days)	Annual Total	Summary
1.	**Initial Investment**							**$ -**
2.	**Annual average number of clients[a]**			**clients/week**	**2.5**			**48**
3.	**Average fee per client**	**500,000 Le**	**$ 128**	**per client**				**$ 128**
4.	**Annual gross revenue**							**$ 6,154**
5.	**Annual expenses**							**$ 2,924**
5.4	Equipment					Subtotal:	$ 2,924	
	Batteries	*2,200 Le*	*$ 0.56*	*per unit*	*4*	*7*	*$ 117.66*	
	Bucket	*15,000 Le*	*$ 3.85*	*per unit*	*8*	*12*	*$ 369.23*	
	Carboleum	*50,000 Le*	*$ 12.82*	*per gallon*	*1*	*-*	*$ 615.38*	
	Cigarettes	*2,000 Le*	*$ 0.51*	*per pack*	*16*	*-*	*$ 393.85*	
	Head Torch	*5,000 Le*	*$ 1.28*	*per unit*	*4*	*7*	*$ 267.40*	
	Kerosene	*16,500 Le*	*$ 4.23*	*per gallon*	*1*	*-*	*$ 203.08*	
	Pick Axe	*40,000 Le*	*$ 10.26*	*per unit*	*4*	*1,095*	*$ 13.68*	
	Rope	*2,000 Le*	*$ 0.51*	*per yard*	*20*	*30*	*$ 124.79*	
	Rum	*21,000 Le*	*$ 5.38*	*per gallon*	*1*	*-*	*$ 258.46*	
	Shovel	*30,000 Le*	*$ 7.69*	*per unit*	*8*	*60*	*$ 374.36*	
	Soap	*1,000 Le*	*$ 0.26*	*per unit*	*8*	*-*	*$ 98.46*	
	Stick	*2,000 Le*	*$ 0.51*	*per unit*	*12*	*30*	*$ 74.87*	
	Wheel Barrow	*60,000 Le*	*$ 15.38*	*per unit*	*4*	*1,825*	*$ 12.31*	
6.	**Annual profit (including return to owner)**							**$ 3,230**
7.	**Daily profit**							**$ 8.85**

Notes:

[a] It is assumed that the average number of clients provided per week represents high-season demand (13 weeks between June and August). The annual demand assumes a low season demand between September and May (39 weeks) that is 1/6th of the high-season demand.

ANNEX D: FINANCIAL ANALYSIS OF MANUAL EMPTIERS

	G4 - Group of 5 persons	Unit Rate	Conversion Unit Rate	Unit	Quantity	Frequency (days)	Annual Total	Summary
1.	**Initial Investment**							**$ -**
2.	**Annual average number of clients[a]**			**clients/week**	**3**			**58**
3.	**Average fee per client**	**350,000 Le**	**$ 90**	**per client**				**$ 90**
4.	**Annual gross revenue**							**$ 5,205**
5.	**Annual expenses**							**$ 2,364**
	5.4 Equipment					Subtotal:	$ 2,364	
	Batteries	*1,000 Le*	*$ 0.26*	*per pair*	*5*	*-*	*$ 74.36*	
	Boots	*25,000 Le*	*$ 6.41*	*per unit*	*5*	*90*	*$ 129.99*	
	Broom (small)	*500 Le*	*$ 0.13*	*per unit*	*5*	*-*	*$ 37.18*	
	Bucket	*20,000 Le*	*$ 5.13*	*per unit*	*10*	*21*	*$ 891.33*	
	Gloves	*15,000 Le*	*$ 3.85*	*per unit*	*5*	*30*	*$ 233.97*	
	Hat (Ski Mask)	*10,000 Le*	*$ 2.56*	*per unit*	*5*	*60*	*$ 77.99*	
	Head Torch	*10,000 Le*	*$ 2.56*	*per unit*	*5*	*30*	*$ 155.98*	
	Hook	*20,000 Le*	*$ 5.13*	*per unit*	*2*	*90*	*$ 41.60*	
	Local Ladder	*45,000 Le*	*$ 11.54*	*per unit*	*1*	*60*	*$ 70.19*	
	Overalls	*25,000 Le*	*$ 6.41*	*per unit*	*5*	*60*	*$ 194.98*	
	Pick Axe	*35,000 Le*	*$ 8.97*	*per unit*	*5*	*120*	*$ 136.49*	
	Rope	*1,000 Le*	*$ 0.26*	*per yard*	*20*	*30*	*$ 62.39*	
	Shovel	*25,000 Le*	*$ 6.41*	*per unit*	*5*	*60*	*$ 194.98*	
	Stick[b]	*2,000 Le*	*$ 0.51*	*per unit*	*10*	*30*	*$ 62.39*	
6.	**Annual profit (including return to owner)**							**$ 2,841**
7.	**Daily profit**							**$ 7.78**

Notes:

[a] It is assumed that the average number of clients provided per week represents high-season demand (13 weeks between June and August). The annual demand assumes a low season demand between September and May (39 weeks) that is 1/6th of the high-season demand.

[b] Data regarding the price and/or frequency of replacement of this item was not provided during the interview. Figures from other interviews are being used intsead.

ANNEX D: FINANCIAL ANALYSIS OF MANUAL EMPTIERS

	G5 - Group of 6 persons	Unit Rate	Conversion Unit Rate	Unit	Quantity	Frequency (days)	Annual Total	Summary
1.	**Initial Investment**							**$ -**
2.	**Annual average number of clients[a]**			**clients/week**	**1.25**			**65**
3.	**Average fee per client**	**250,000 Le**	**$ 64**	**per client**				**$ 64**
4.	**Annual gross revenue**							**$ 4,167**
5.	**Annual expenses**							**$ 927**
	5.4 Equipment					Subtotal:	$ 927	
	Batteries	*5,000 Le*	*$ 1.28*	*per pair*	*4*	*7*	*$ 267.40*	
	Boots	*25,000 Le*	*$ 6.41*	*per pair*	*6*	*365*	*$ 38.46*	
	Bucket (34 cm)	*17,000 Le*	*$ 4.36*	*per unit*	*2*	*90*	*$ 35.36*	
	Gloves	*15,000 Le*	*$ 3.85*	*per pair*	*6*	*60*	*$ 140.38*	
	Hard Hat	*40,000 Le*	*$ 10.26*	*per unit*	*6*	*365*	*$ 61.54*	
	Head Torch	*5,000 Le*	*$ 1.28*	*per unit*	*4*	*365*	*$ 5.13*	
	Hoe	*4,000 Le*	*$ 1.03*	*per unit*	*1*	*183*	*$ 2.05*	
	Local Ladder	*45,000 Le*	*$ 11.54*	*per unit*	*1*	*365*	*$ 11.54*	
	Mask (Rubber)	*10,000 Le*	*$ 2.56*	*per unit*	*6*	*365*	*$ 15.38*	
	Pick Axe	*30,000 Le*	*$ 7.69*	*per unit*	*2*	*365*	*$ 15.38*	
	Rain Coat	*45,000 Le*	*$ 11.54*	*per unit*	*6*	*183*	*$ 138.46*	
	Rake	*25,000 Le*	*$ 6.41*	*per unit*	*1*	*120*	*$ 19.50*	
	Rope	*5,000 Le*	*$ 1.28*	*per yard*	*10*	*183*	*$ 25.64*	
	Shovel	*25,000 Le*	*$ 6.41*	*per unit*	*2*	*90*	*$ 51.99*	
	Soap	*1,000 Le*	*$ 0.26*	*per unit*	*6*	*-*	*$ -*	
	Stick	*5,000 Le*	*$ 1.28*	*per unit*	*19*	*90*	*$ 98.79*	
	Water Drum	*0 Le*	*$ -*	*per unit*	*2*	*365*	*$ -*	
6.	**Annual profit (including return to owner)**							**$ 3,240**
7.	**Daily profit**							**$ 8.88**

Notes:

[a] It is assumed that the average number of clients provided per week represents high-season demand (13 weeks between June and August). The annual demand assumes a low season demand between September and May (39 weeks) that is 1/6th of the high-season demand.