Municipal Wastewater Management in Kawempe Division, Kampala Capital City Authority

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This research was carriedout in Kawempe one of the Divisions that make up Kampala, the capital city of Uganda. My gratitude goes out to the Public Health Department of KCCA in Kawempe and to all Local Leaders in Kawempe Division for the cooperation they extended towards me throughout the entire period of this research.

Again I sincerely acknowledge the guidance of my supervisor Hilda Szabo who tirelessly guided me through this research and further appreciation goes out to all Bachelor of Environmental Engineering colleagues and friends for the understanding, cooperation and encouragement they gave me especially during the difficult times in my studies at Tamk UAS.

Lastly, Success is not the absence of problems, but the presence of God's power; above all I thank the Almighty God-my provider, who always makes a way where there seems to be no way. Through the darkest night, his light will shine because God is good and he is so good at all times!

ABSTRACT

A cross-sectional study to assess the management of municipal wastewater in Kawempe division with 5% population connected to the sewer system was undertaken. It employed both qualitative and quantitative methods of data collection. Study units of a hundred household respondents were randomly sampled proportionate to the population sizes of the six zones selected from the Division. The major objective was to generate information, which could subsequently be applied by stakeholders to improve management and protection of the environment, and promote the health of Kawempe community. Majority of the people in Kawempe use different containers (basins and cut jerry cans) to collect wastewater. Others discharge their wastewater into drainage channels, on open ground indiscriminately. Only a small fraction use septic tanks and soak pits. Poor drainage and odors were some of the many problems resulting from mismanagement of wastewater. More than half of the respondents had suffered from malaria in the last three months prior to this study as a result of mosquitoes breeding in the wastewater. Interventions that are in place mainly come from NGOs whereas KCCA and LCs are commended for spraying drainages, and sensitizing the communities.

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ABBREVIATIONS AND NOTATIONS

AEE	-	African Evangelist Enterprises
BNR	-	Biological Nutrient Removal
BoD	-	Burden of Disease
BOD	-	Biochemical Oxygen Demand
COD	-	Chemical Oxygen Demand
DDs	-	Diarrheal Diseases
FC	-	Feacal Coliform
IEC	-	Information Education and Communication
KCCA	-	Kampala Capital City Authority
LC	-	Local Council
MoH	-	Ministry of Health
MWW	-	Municipal Wastewater
NDHS	-	National Demographic Health Survey
NEMA	-	National Environmental Management Authority
NWSC	-	National Water and Sewerage Cooperation
PHA	-	Public Health Act
UNEP	-	United Nations Environment Program
UNEPI	-	United Nations Expanded Program on Immunization
WHO	-	World Health Organization

OPERATIONAL DEFINITIONS

Collection: The gathering of municipal wastewater from the various points where it is generated for disposal.

Disposal: This means some form of treatment of municipal wastewater (where necessary) before it is released in the natural environment of reused.

Gray water: Domestic wastewater other than that from sanitary conveniences.

Human excreta: A combination of human feaces and urine.

Municipal Waste Water: Wastewater discharged from small/medium industrial and commercial establishments, food premises and dwellings (domestic wastewater) including storm water/surface runoff.

Re-use: Utilization of the properties of municipal wastewater that are beneficial such as its high nutrient value of agricultural productivity.

Septage: Septic tank effluent

Treatment: Changing of some of the characteristics of municipal wastewater in order to make it less hazardous to health and the environments where it finally ends.

1. INTRODUCTION

Wastewater management is one of the many basic strategies for keeping the environment clean and safe for human habitation. Wastewater generated from industries, institutions, commercial establishments, and dwellings should be properly collected, transported, and treated (where necessary) before it is released back into the natural environment.

According to the WHO report on Environment and Sanitation (1998), it was reported that in most of the peri-urban areas around the world, an increase in population, water consumption, and a rapid increase in waterborne diseases stresses on the need of wastewater disposal. The released wastewater generally ends up in open and vacant lands resulting in the creation of smelling stagnant water ponds which in many cases affect those in contact with them such as children among others.

Health risks are increased by the fact that households and surface water drainage systems are always combined, resulting in the impurification of floodwater with excreta. Diseases like malaria are transmitted by mosquitoes that breed in block drains and ponds. This issue is particularly persistent, in locations where piped water is brought before digging drainage channels.

The insufficient physical, organizational structures and facilities for managing wastewater have resulted into extensive pollution of surface and groundwater thus worsening issues related to environmental health. The greatest impacts have been felt by poor communities, who often inhabit low-lying and marginal lands, such as wetlands and along channels.

In addition to the above, decline in the availability of water resources mainly due to a rise in demand for the same has left farmers in peri-urban areas with no option but to use untreated wastewater for their irrigation and aqua farming. While some wastewater re-use has been in accordance with the usual requirements, the majority which is in most cases not treated is re-used without formality. Therefore, this effect poses a serious health risk for communities working under such agricultural settings and even those feeding on the products obtained under similar conditions.

According to the NEMA report on water pollution (1999), municipal wastewater contains pollutants, heavy metals, disease-causing organisms, nutrients and other contaminants. When discharged into the environment without any safety precautions it ends up contaminating other water sources, creating stagnant pools of filthy water, which become breeding grounds for disease vectors and odors. Wastewater containing high BOD, COD and

nutrients brings about unwanted plankton growths in storm water channels, which in the long run get clogged. Clogging of storm water channels leads to heavy flooding during rainy seasons, which floods further carry contaminants to dwellings in the low laying areas and into water sources. In addition, there are high morbidity and mortality rates resulting from malaria emanating from mosquito breeding grounds. Malaria is the number one killer disease in Uganda and the entire tropical African region with around 23% fatality rate among children under 5 years, accounts for 25-40% of patient visits at health facilities and almost 20% of hospital admissions in Uganda (Morgan, 1998).

In this study, focus was on municipal wastewater, its sources, methods of collection and disposal, and the effects of poor wastewater management, which range from socio-economic to health risks or hazards. Health and Sanitation was highlighted first to enable the readers relate disease transmission to the proper collection and disposal of municipal wastewater.

1.1 Literature Review

The early 1980's saw a refocusing of Health and Water Authorities around the world on to soil as an effective natural wastewater treatment and disposal mechanism. The challenge was to identify those factors that restricted use of soil as a treatment mechanism and develop techniques to remedy those restrictive factors.

Comparative studies done on a variety of both off-site and on-site excreta and sullage disposal systems have shown that on-site disposal systems are cheaper than the off-site ones in developing countries (WHO, 2001).

In order to protect adults and children, WHO (1998) established guidelines which have standards that wastewater must meet before its re-use. A bacterial guideline of 103 FC/100ml or 104 FC/100ml where the available resources are not favorable to attain 103 FC/100ml but other protection measures should then be put into consideration. A nematode egg guideline of 0.1 ova/litre was proposed but in situations where children are not in direct contact with the wastewater, a 0.2 ova/litre is allowable. The risk of diarrheal infection among children between 5 and 14 years is high so is calicivirus infection among adults using water with a less than 1 ova/litre for their irrigation purposes.

Diarrhoeal diseases, which are closely associated with poor excreta disposal and lack of access to clean water, food, and personal hygiene, account for three million deaths annually. Poor quality of the environment is estimated to be directly responsible for 25% of all preventable ill health in the world today. Up to two-thirds of preventable diseases occurs among children (WHO, 1986). Groundwater studies in Nigerian major cities of, Lagos, Ibadan, Warri, Benin, Aba, Kano and Jos indicated that the quality of waters in some

instances fell far below the quality requirements of WHO. Nitrate, lead and coliform bacteria levels were found to exceed those set by the WHO. Additionally, some water was found to have high levels of iron and low PH values. Water in Lagos was found to possess some form of salt most especially at the coastal areas. The low standards of ground water were as a result of sullage or grey water, indiscriminate defecation, dumping of household refuse, industrial and hazardous wastes in those areas. Other reasons given included among others: Lead from locally produced gasoline, heavy road traffic in urban areas, insufficient governmental policies and strategies, and communities' attitudes towards the environment. (Sridhar, 2000).

Wastewater treatment should broadly integrate the aspects of urban hygiene, environmental protection and development of a sustainable society as a whole. This involves reducing energy demand and increasing the material recovery. Biological Nutrient Removal (BNR) systems have been widely applied in nutrient recovery. Urine, which is a component of wastewater, contains both nitrogen (N) and phosphorus (P) nutrients. To save energy in centralized BNR systems, separate collection and treatment of wastewater would improve effluent quality. BNR processes are not optimal to treat water with very low nitrogen concentration. Nutrient removal through sludge production, methanation of the sludge, and digestion of effluent leads to more effective and sustainable wastewater treatment (Wilsenach et al, 2003).

There are several reasons for keeping sullage separate from excreta. First, there may be a system for on-situ disposal of excreta that cannot accept large volumes of water. Alternatively, the sullage may be transported away from the site by a small-diameter pipe that could not handle feaces. A third reason might be to reduce the hydraulic loading on a septic tank by diverting the sullage away from it (Bradley, 1983).

Poor drainage also favors the breeding of mosquitoes, and hence the transmission of mosquito-borne infections. Transmission can especially be immense in urban areas where there are relatively few animals to divert the vector species of mosquitoes from human blood meals. Anopheline do not usually breed in heavily polluted water, but can multiply in swamps, pools, streams and storm water canals in which there is standing water. Anopheline mosquitoes breeding in poorly drained low-income areas can transmit to adjacent parts of a town. A particular danger of malaria transmission in a city is the large amount of population movement to and from it. Which increase the risk of importation of new and possibly drug-resistant strains of the disease (Cairncross, 1986).

Drainage contraction is an effective mosquito control measure. It requires one-time capital investment, followed by recurrent costs for maintenance, which may be minimal if a good level of community participation can be obtained. In many cases, the initial investment

cost is less than one's supply of insecticide. The difference will become even more pronounced in the future with the continuous increase of insecticide resistance and consequently need for more expensive compounds. Compared to chemical control programmes, environmental modifications such as drainage systems are much less affected during periods of political, social or economic instability. There is increasing awareness of the need to include drainage improvements in wastewater management programs in rural areas (Muir, 1986).

Stagnant pools of water around or nearby habitable places provide appropriate breeding grounds for mosquitoes. In 12 out of 13 pilot districts surveyed during the burden of disease exercise in 1996, malaria was the single most causer of deaths (UNDP, 2005). Records of the Public Health Department, KCCA-Kawempe Division (September. 2003) and reports compiled from field visits indicate that residents discharge wastewater from bath rooms, kitchens and laundries, effluent from septic tanks, car-wash bays, garages and other business premises into public road or the immediate surrounding environment indiscriminately which vice poses a serious health risk (Practical experience during field practice).

1.2 Background information

Municipal wastewater which carries with it human excreta disposal, is always referred to as "blackwater". Any other domestic wastewater apart from blackwater is often referred to as "grey water". It is important that the two are collected and disposed of separately. This study discusses both, black and grey water.

The characteristics of municipal wastewater discharged vary from one location to another depending on the population, industrial sector served, land uses, groundwater levels, and degree of separation between storm water and sullage. Sullage includes wastes from kitchens, bathrooms, and laundry, as well as any other wastes that people may accidentally or intentionally pour down the drain. It also consists of domestic wastewater as well as discharges from commercial, institutional, and food establishments. The nature of the sullage is influenced by factors such as diet, methods of washing clothes and utensils, personal hygiene habits and bathrooms and other facilities (Bradley, 1983).

In Africa, the smaller proportion of population with in-house water supplies, tend to generate more gray water per capita. The more wealthy communities are the more gray water they generate.

In the largest peri-urban settlement of Nairobi known as Kibera, drainage is virtually non-existent, and during rain seasons of around April, May and December, these areas can hardly be accessed because of storm water and sewage.

The report findings Published by NEMA- Uganda in 1999 on municipal wastewater collection and disposal in the 5 divisions of Kampala City indicated that Nakawa Division had 7% of the population connected to the central sewer and 9% had septic tanks, Makindye Division had 3% of the population connected to the central sewer system and 6% had septic tanks, Lubaga Division is not connected to the central sewer and 0% of its population used septic tanks. Kawempe Division had 5% of the population connected to the central sewer system and 4% had septic tanks.

It was discovered that Kawempe Division's inhabitants generally find it expensive to hire cesspool emptiers to empty their septic tanks when filled up, and for that reason, the effluent tends to flow out on the surface. In addition, the Public health Office at the Division established that people in Kawempe Division discharge wastewater from bathrooms, kitchens, laundries, car-washing bays, garages and other business premises into the public road and immediate surroundings indiscriminately.

In many developing countries, the provision of piped water supplies has proceeded without sufficient consideration for the adequate treatment and disposal of the resulting wastewater. Poor municipal wastewater management is a common problem in urban centers and therefore, poses a serious risk of spreading sanitation-related diseases especially among densely populated communities (Cairncross, 1986).

According to the Uganda National Household Survey (2002/2003) 1% of Uganda's households use flush toilets, 86% have pit latrines and 13% go to the bush. The 1991 Census report revealed that approximately 86% of Kampala population had no access to improved domestic sanitation facilities, 71% shared pit latrines, 12% used tradition pit latrines while 2% had no sanitation facilities at all. In Kampala, approximately 9% of all households are connected to the sewer system and 5% were served by septic tanks.

The Division has constantly had streams of filthy running water crossing roads and filling pot holes, leading to breeding grounds for malaria spreading mosquitoes. Malaria is the leading killer disease in Uganda and ranks first among the Burden of Disease in Kawempe Division. Swarms of flies attracted by odors also contribute in transmitting other diseases like diarrhea which ranks second in the burden of diseases at the District.

In spite of the frequent inspection by the Public Health staff from the Division, issuing of nuisance notices and prosecution of offenders, this problem continues to exist. More valuable resources will continuously be spent unnecessarily on remediation measures unless this issue is addressed effectively and sustainably.

Municipal wastewater often containing high BOD, COD and nutrient concentrations especially in septic tank effluent brings about unwanted plankton growths in water channels that in the long run, gets clogged. Clogging of these water channels causes heavy flooding during rainy seasons; floods carry contaminants to dwellings in low laying areas and into water sources.

Other diseases often transmitted in cases where untreated irrigation water is used include among others; infections such as schistosomiasis, ascaris and hookworm, beef and pork tapeworms this is so in instances where the irrigated land is used for grazing and non-latent feacal–oral infections, particularly those that require a low infective dose. Consequently, there are concerns about health issues related to such practices and therefore, there is need to introduce a range of preventive measures to alleviate the risks. These might include among others restrictions on the crops grown, a choice of methods for waste application to the crops, and control of human exposure to wastes through wastewater treatment.

The July 2012, outbreaks of Cholera in Kasese District that claimed the lives of four people and left over 150 fighting for their dear lives, highlights the need to study the current status of municipal wastewater management so as to gather information that shall be used to draw up strategies for improving the prevailing system. (Masereka, 2012)

Whereas little is known about why such practices exist in most peri-urban settings, this study will generate information on collection and disposal of municipal wastewater in Kawempe Division. The findings of this study will provide data necessary for planning, implementating, and evaluating various activities involved in developing a safe and sustainable municipal wastewater management system.

2. AIM OF THE RESEARCH.

The study aimed at assessing municipal wastewater management in Kawempe Division by gathering information that could be applied by the Division Health Planners in alleviating Health issues in this area. Secondly, communities' level of awareness about the implications associated with poor management of municipal wastewater was also another area of interest to the researchers. In addition, the research was also interested in identifying the prevailing wastewater management aspects such as those entailing its collection and disposal. Further still, determination of the prevalence of disease common with municipal wastewater mismanagement was another area of interest. Lastly, this research also aimed at Identifying counter measures that have been put in place to improve the management of municipal wastewater.

3. MATERIALS AND METHODS.

3.1 Methodology

First and foremost, study was conducted in Kawempe Division, Kampala Capital City Authority. Kawempe Division is a peri-urban setting mainly made up of small and medium sized commercial establishments, which among others include pubs, shops, markets, fuel stations, garages and residential houses. The Medical Officer is in charge of Health issues and works with the Public Health staff at the Division. Kawempe Division is subdivided into 19 zones. The Division has an average population of about 123,502, males and 138,663 females giving a total population of 262,165, and a total of 68,952, households. (Uganda bureau Of Statistics, 2002).

Secondly, both qualitative and quantitative methods of data collection were employed during the study. The study population consisted of residents of Kawempe Division and key informants. Additionally, study unit was a hold in Kawempe Division whereas the respondents were household heads or any other member above 15 years.

Thirdly, focus was also put on both independent and dependent variables, where the dependent variable was malaria prevalence among residents of Kawempe. Independent variables on the other hand were: demographic characteristics of the study population such as age, educational level, sex of respondent, and occupation of respondent, awareness, attitude and practices of the study population concerning wastewater management in the area, presence of mosquito breeding sites and lastly, Municipal wastewater management inspections of households by health workers.

The sample size formula by Kish and Leslie for cross-sectional studies (1965) was used in calculating and determining the sample size needed to be representative of the given population and is given as:

$$n = \frac{Z^2 P (1-P)}{d^2}$$

Where Z = score corresponding to 95% confidence interval = 1.96

P = the study assumed a population proportion of 50% since this would provide the maximum sample size.

P = 50%

Q = 1 – P

d = precision (+/-10%)

$$n = \frac{(1.96 \times 1.96) \times (0.5 \times 0.5)}{(0.1)\quad(0.1)} = 96$$

n = 96 = 100

But for purposes of easy computation of proportionate samples, a round figure of 100 responds was adopted.

The study population consisted of six zones, which were selected by simple random sampling from the 19 zones of Kawempe and respondents were determined by proportional representation. Zone I, had a proportional representation of 1,600 which was then divided by an overall total of 13200 and multiplied by 100% giving a percentage of 12. This criterion was subsequent applied to all the following zones that is, from I up to the last one – Zone IX.

Zone I = $\frac{1,600}{13200} \times 100 = 12$

Zone II= $\frac{18,000}{13200} \times 100 = 14$

Zone IV= $\frac{2,800}{13200} \times 100 = 21$

Zone V= $\frac{2,600}{13200} \times 100 = 20$

Zone VII= $\frac{2,400}{13200} \times 100 = 18$

Zone IX = $\frac{2,000}{13200} \times 100 = 15$

Total ---------- 100

17

The standing point for selection of a household was the central point in each Local Council division selected. The direction in which to proceed was chosen by spinning a pen on the ground. The first household in the direction pointed by the nib was selected for interview plus every third household in the zone.

Data collection was done using quantitative and qualitative tools. Under quantitative Tools structured questionnaires were administered through face-to-face interviews. This helped to come up with the social-demographic characteristics of the study population as well as awareness levels and practices in management of municipal wastewater. An observational

checklist was also used in order to help determine the physical conditions, characteristics of municipal wastewater and its management at household level.

Where as under qualitative Tools key informant interview guides were used to get data from informants who were more knowledgeable about the issues of wastewater management. These informants were purposively sampled and included Local Council officials, Health Inspectors and Chiefs.

3.2 Data management and analysis

All quantitative data was filed-edited and coded, after which it was cleared and checked for consistency. Coding was done to clearly identify the required variables for analysis. Finally, analysis of data was done; frequencies, tables, graphs and pie charts generated.

Secondly, the qualitative data, which was obtained from key informants, was manually analyzed and the findings integrated during presentation of findings and analysis.

3.3 Quality control

Data collectors were trained and continuously assessed so as to collect good quality. Translation and back translation instruments were provided to overcome factor of language barrier. Study instruments were pre-tested and necessary adjustments made for the main fieldwork.

3.4 Ethical consideration

Permission to carry out the study was obtained from Makerere University Institute of Public Health and a letter of introduction was obtained from the Director of the Institute of Public Health and presented to the Local Leaders where the study was conducted. In Kawempe, permission was sought from local leaders including both civic and political. Interviews were carried out only from those people who consented after the objectives of the study had been explained to them. Questionnaires were handled confidentially and numbers instead of names were used to ensure privacy.

3.5 Dissemination

Copies of this report have been disseminated to, Tampere University of Applied Sciences as a requirement for the award of Bachelors Degree in Engineering and to KCCA-Kawempe Division.

4. RESULTS

4.1 Socio-demographic characteristics of the respondents

The study findings about social demographic characteristic of the respondents are detailed in Table 4.1 below: -

Table.1: Socio-demographic characteristics of the respondents

Score	Frequency (n=100)	Percentage (100%)
SEX		
Males	30	30
Females	70	70
AGE		
11-20 years	13	13
21-30 years	58	58
31-40 years	18	18
41-50 years	6	6
51-60 years	2	2
Above 60 years	3	3
EDUCATION		
No education at all	7	7
Lower primary (P1-P4)	6	6
Upper primary (P5-P7)	22	22
O-level & above	65	65
OCCUPATION		
Wage earners	17	17
Salary earners	8	8
Business persons	23	23
Unemployed	32	32
Others (wives, students)	20	20
RELIGION		
Catholics	23	23
Anglicans	41	41
Pentecostals	19	19
Moslems	13	13
SDAs	2	2
Others (Earthiest)	2	2
Number of people		
1-5	5	5
6-10	82	82
More 10	8	8
MARITAL STATUS		
Single	24	24
Married	54	54
Divorced	9	9

Widowed	7	7
LAND TENURE		
Landlord	16	16
Tenant	75	75
Owner occupied	9	9

The study comprised of 70% females and 30% males, 58% were aged between 21-30 years. Up to 7% of the respondents had not gone to school at all while 65% had at least reached 'O' level and beyond. Wage and salary earners totaled up to 25% while 32% were unemployed. Anglicans' percentage was 41% compared to other religions. 54% of respondents were married while 86% lived 6-10 people per household, 75% being tenants.

4.2 Awareness

The majority 84% (84/100) of the respondents were aware that there are dangers associated with poor management of municipal wastewater. The details are as shown in Table 6.2 below.

Table.2: Dangers associated with poor management of wastewater.

Danger	Frequency	Percentage
Mosquito breeding sites (n=100)	80	80
Risk factor for disease out breaks (n=86)	82	82
Source of bad odors (n=86)	37	37
Unsighted ness (n=86)	23	23
Leads to flooding (n=86)	3	3
Maggots (n=100)	9	9
Flies (n=100)	56	56
Malaria (n=100)	76	76
Diarrhea diseases (n=100)	51	51
Cholera (n=100)	22	22
Vomiting (n=100)	3	3
Typhoid (n=100)	9	9
Intestinal worms (n=100)	20	20
Did not know (n=100)	8	8

There was high level of awareness of up to 95% (82/86) concerning risk for disease outbreak; up to 80% (80/100) of the respondents said wastewater was providing breeding sites for mosquitoes and 76% (76/100) of the respondents attribute malaria to poor management of wastewater.

4.3 Attitude

The attitude of the respondents towards the currents status of wastewater management is summer summarized in Table 6.3 below;

Table.3: Attitude of respondents towards municipal wastewater management

Factor influencing attitude (negative)	Frequency	Percentage
Bad odors (n=100)	87	87
Ineffectiveness (n=92)	45	49
Non-participatory (n=92)	10	11
Unsafe (n=80)	31	39
Indifferent attitude of the people (n=92)	37	40

The majority of the respondents 87% disliked the bad odors that accrued from wastewater, close to half of the respondents 49% (45/92) not satisfied with the management system while 40% (37/92) attributed the short-comings in wastewater management system to the indifferent attitude of the people.

4.4 Management of municipal wastewater

Findings on the collection and separation of wastewater at household level are summarized in Table 6.4 below:

Table.4: Collection and separation of municipal wastewater at household level.

Means of collection	Frequency (n=100)	Percentage
Soak pit	16	16
Septic tank	2	2
Containers	77	77
Drainage channel	28	28
Open discharge	23	23

The majority, 77% of the respondents use different containers such as basins, cut jerry cans and buckets, 28% use the immediate drainage channel while 23% pour their wastewater on open ground.

Separation of domestic wastewater from storm water at household level is as shown in figure 6.1 below:

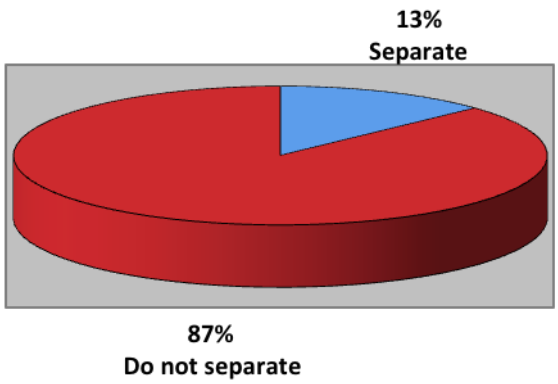


Figure.1: Separation of domestic wastewater from storm water.

Only 13% of the respondents separate their wastewater from storm water through means of septic tanks, the majority 87% do not separate it.

Information about communal wastewater collection facilities:

Majority 65% (65/100) of the respondents have a communal wastewater collection facility as shown in Table 6.5 below:

Table.5: Type of communal municipal wastewater collection facility used.

Facility	Frequency (N=65)	Percentage
Soak pit	17	26.2
Open space/ground	4	6.2
Drainage channel	44	67.7

The majority 67.7% (44/65) pour their wastewater in communal drainage channels.

Distance from the communal municipal wastewater facility:

The study established that 75.4% (49/65) of the respondents lived within a distance of 10 meters from the communal facility and the other 24.6% (16/65) lived within 10-50 meters from it.

The results showing the means of conveyance of wastewater from it various points of generation to communal collection facilities are shown in Figure 6.2 below:-

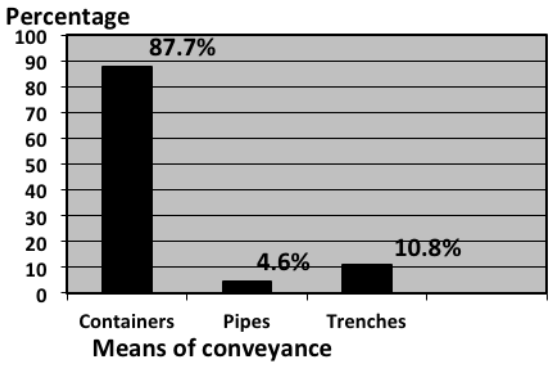


Figure.2: Conveyance of municipal wastewater to the communal collection facilities.

The majority 87.7% (57/65) of the respondents used containers to carry wastewater to the communal collection facilities.

The responsibility of conveying wastewater to communal facilities is shared as shown in Table 6.6 below:

Table.6: Who is responsible for wastewater conveyance to the communal facility?

Responsibility	Frequency (n=63)	Percentage
House wife	11	17.5

Children	10	15.9
Worker	4	6.3
Anyone	42	66.7

Information about use of septic tanks:

The study established that 17% (17/100) of the respondents had septic tanks.

The details on the use of septic tanks are summarized in Table 6.7 below:

Table.7: Information about emptying of septic tanks:

Rate of emptying	**Frequency (n=17)**	**Percentage**
Every 4-6 months	5	29.4
Every 7-12 months	6	35.3
Every 1-2 years	2	11.8
Never emptied at all	4	23.5

Concerning the disposal of effluent from septic tanks, 47.1% *8/17) left it to ooze out and flow to the drainage channel, 41.2% (7/17) channel the effluent to soak pits while 11.8% (2/17) did not know where their effluent ends/goes.

Information about maintenance of wastewater facilities is as shown in Table 6.8 below:

Table.8: Maintenance of wastewater facility:

In charge	Frequency (n=38)	Percentage
Landlords	14	36.8
Local Council	8	21.1
NGOs	1	2.6
Household heads	12	31.6
Do not know	4	10.5

Most of the maintenance work on the facilities is carried out by Local Councils in collaboration with individual households and their property owners.

Information about discharge of wastewater at household level is summarized in Table 9 below:

Table.9: Discharge of wastewater:

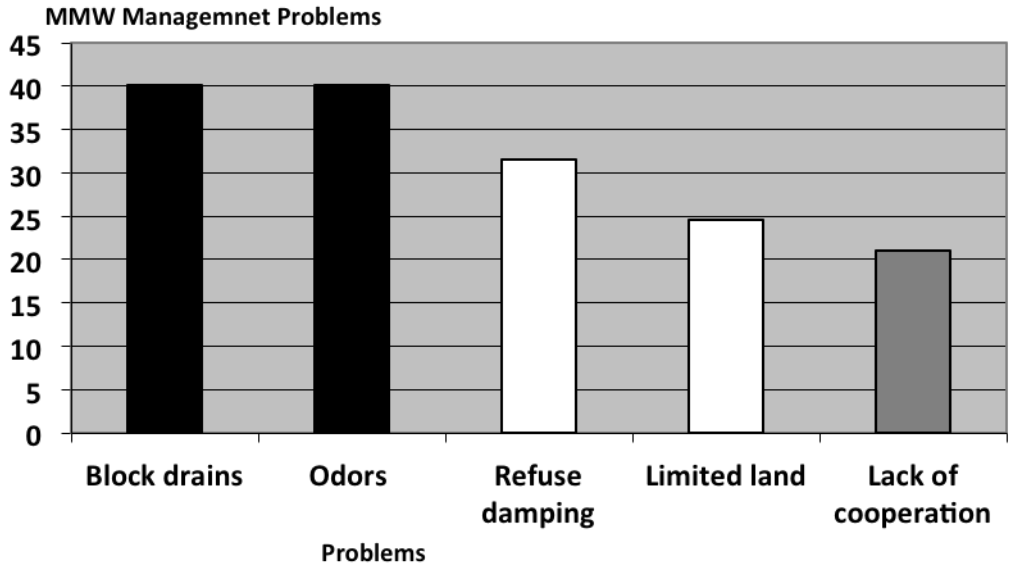
Facility	**Frequency (n=40)**	**Percentage**
Soak pits	7	17.5
Septic tanks	1	2.5
Road	1	2.5

Trench	11	27.5
Open ground	25	62.5

The majority of respondents 62.5% (25/40) discharge their wastewater on open ground; only 17.5% (7/40) have soak pits at their homes.

Results on problems associated with municipal wastewater management are summarized in Figure 6.3 below:

Figure.3: Municipal wastewater management problems:

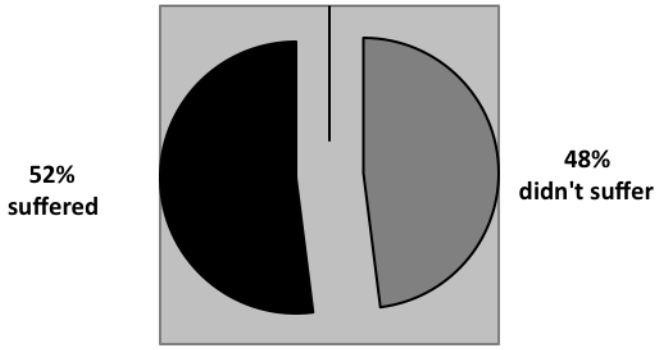


Poor drainage and bad smells were the major problems affecting 40.1% (23/57) of the respondents while refuse damping in storm drains affected up to 31.6% (18/57) of the respondents

4.5 Disease prevalence:

Details associated with Malaria prevalence are summarized in Figure 6.4 below:

Figure.4: Prevalence of malaria in the last 3 months prior to the study



52% of respondents had suffered from malaria in the last 3 months prior to the study.

The study established that 60% of the malaria cases were male and 40% female.

Ages of malaria cases that occurred in the last 3 months prior to the study are indicated in Figure 6.5 below:

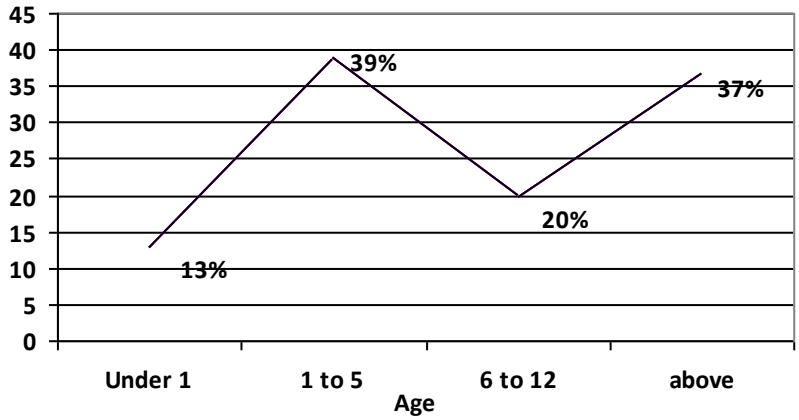


Figure.5: Ages of malaria cases

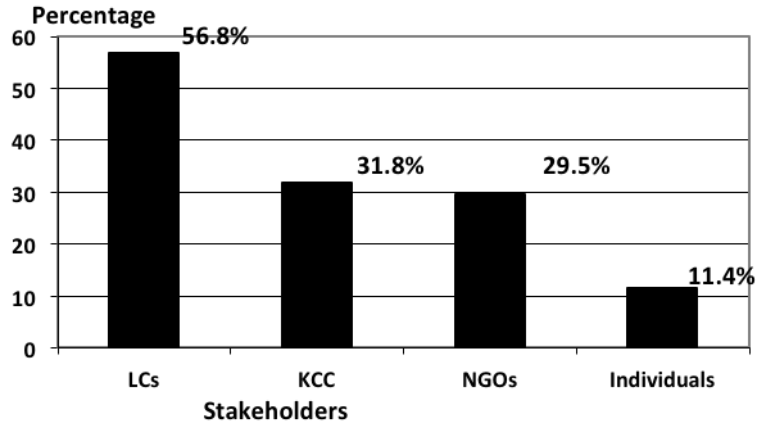
The greatest number of malaria cases occurred among children aged 1-5 years with up to 39%.

4.6 Interventions:

Up to 44% (44/100) of the respondents agreed that there was one effort to alleviate wastewater issues, however, 42% (42/100) said nothing had been done at all, whereas 14% (14/100) did not know. In addition, 17% (6/36) said soak pits had been dug, 61% (26/42) said spraying of some storm drains had been done, while 48% (20/42) said de-silting of storm drains is usually done.

Information on the interventions showing input of each of the stakeholders is summarized in Figure 6.6 below:

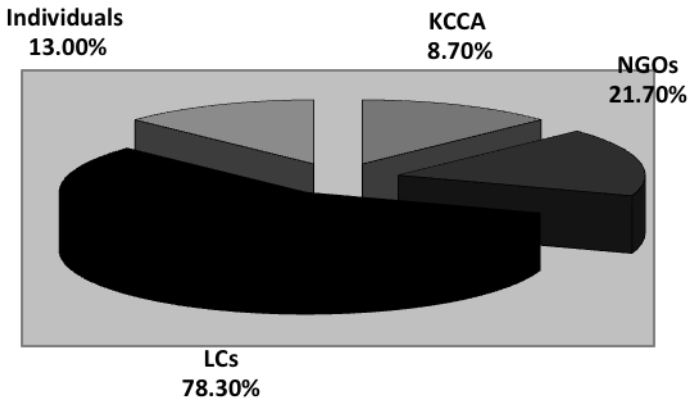
Figure.6: Interventions.



LCs contribute the most in the maintenance of facilities that are already in existence, KCCA has mainly contributed towards larvaecida spraying of storm drains while NGOs contribution was towards the construction of storm drains, they include among others: African Evangelistic Enterprises (AEE), Concern Worldwide and Plan International, while individuals' contribution is seen in cases of maintenance of facilities and provision of soak away pits.

Information on community sensitization about safe wastewater management showed that it was insufficient as shown by the 71.6% (58/81).

Figure.7: Showing who did the sensitization.



78.3% (18/23) of the sensitization was done by LCs. 47.8% (11/23) was done through public lectures, 30.4% (7/23) through health talks, 33.3% (6/18) door-to-door and 30.4% (7/23) during LC meetings, while 4.3% (1/23) through posters.

Outcome of the sensitization:

The majority, 62.7% (37) of respondents became more aware of municipal wastewater management issues, 52.5% (31/59) the sensitization helped improve domestic hygiene and sanitation in general and for 51.7% (31/60) the sensitization guided management of municipal wastewater while 20.0% (12/60) it helped prevent disease outbreaks.

5. DISCUSSION

First and foremost, more than half of the respondents were female and majority were aged between 21-30 years, with a greater percentage of them having attained at least primary education while others, secondary level education. This indicated that the high literacy level can be helpful in planning of information, education and communication material (IEC).

Secondly, there was a relatively high proportion of unemployment since most of the respondents were female; they looked after their homes while their husbands went to work. A good number of the respondents had small daily-income generating activities; others included students. Generally there were more Christians compared to Muslims while Traditionalists were relatively very few. Almost half of the sampled population was single while the majority was more than 5 persons per household, renting between1and2 rooms.

Furthermore, the study established that there was a high level of awareness among the respondents concerning dangers associated with poor management of municipal wastewater; and the outcomes of the mismanagement of the same as analyzed in the study done by Cairncross and Feachem (1986) in which poor drainage was found to favour mosquito breeding and thus the transmission of malaria. It is for this fact that adequate drainage is emphasized as an environmental engineering measure for controlling mosquito-borne infections. Besides mosquitoes causing malaria, a good number of respondents also associated flies with wastewater, being responsible for spreading communicable disease such as diarrhea. Other diseases cited included cholera, typhoid fever, intestinal worms, nausea and vomiting. This is in line with the results of a study presented to WHO as proposed by Mexican wastewater re-use standards (WHO, 1998) which indicated that there is need for a bacterial guideline of 103 FC/100ml to protect adults and especially children in direct contact with wastewater.

In addition to the above, most respondents were offended by the bad smells that came from the poorly maintained wastewater collection facilities. The unsightly appearance of wastewater facilities especially for those which were less than 10 meters from the house entrances, contained maggots, bred flies and other nuisances. A greater proportion of the respondents agreed that management of wastewater in the area was ineffective and that there was risk of disease out break if nothing was done quickly to alleviate the situation. This fact was also highlighted in a study done by World Health Organization (1986) where it was noted that up to two-thirds of preventable ill health is due to environmental conditions and affects mostly children.

At household level, most of the respondents collect wastewater in containers such as cut jerry cans, basins and buckets. It is only a very small proportion of respondents that have septic tanks for their water-borne systems that use direct pipe and are connected to the soak pits. Some pipes discharge effluent from septic tanks into storm drains; as people find it expensive to hire cesspool emptier to empty their septic tanks when full. This leads to gross contamination of both surface and ground water as established by Sridhar (2000) in a study on ground water in Nigeria urban centers-problems and options. Relatively few of the respondents have soak away pits mainly due to land scarcity.

At communal level, the majority of respondents poured their wastewater in drainage channels while others on open ground, worse still, during rainy seasons storm water is contaminated with wastewater and Feacal matter and mainly floods to low laying areas.

With respect to the dispose of municipal waste water, the study established that most respondents did not dispose of their domestic wastewater and storm water separately. This indiscriminate disposal of solid waste and excreta into drainage channels grossly polluted the otherwise less contaminated storm water. This was in line with the UNEP (2003) studies where similar waste water management systems contributed to extreme surface and groundwater pollution. The problem was further found to be a contributant to the worsening environmental health conditions that heavily impacted the health and livelihoods of poor communities, occupying low-lying lands and those adjacent to wetlands and alongside drainage channels.

In addition to the above issues, problems of drainage channel blockage leading to stagnant pools of wastewater for mosquitoes breeding, flies and odors all leading to health hazards are cited by Mur (1986) in the study on waterlines in Northern Pakistan.

With respect to the prevalence of malaria, the study established that in the last three months prior to this study, more than half of the respondents had suffered from malaria. The major victims were mainly those under five years and while males were more affected than females. This is supported by the Ministry of Health records concerning on malaria in Uganda (MoH, 2003).

Interventions in place include construction of drainage channels funded by NGOs such as African Evangelistic Enterprises (AEE), Concern Worldwide and Plan International. KCCA in collaboration with LCs often sprays insecticide along storm drains and de-silting. In addition, the local councils together with Division Development Committee are directly responsible for maintenance of these facilities. From one of Key informant it was established

that in some zones such as zone II households, were asked some little money for management of their wastewater, however, this has been frustrated by lack of cooperation among the people, arguing that it's expensive and that they were not involved in the deliberations. This assertion is supported by Mur (1986) about waterlines in Northern Pakistan.

LCs carried out sensitization through public lectures and home visits; this was aimed at those respondents who did not find time to attend council meetings. It was further established that those who attended meetings were more informed and helped in passing information to their neighbors. As a result of this sensitization, there has been increased awareness among the people about issues related to waste water.

6. CONCLUSIONS AND RECOMMENDATIONS.

First and foremost, the level of awareness is high among respondents concerning dangers associated with poor management of municipal wastewater such as breeding grounds for disease vectors, sicknesses and poor health.

Secondly, Management of municipal wastewater in the area is ineffective resulting into situations of bad odors in the area.

In addition to the above, different containers such as basins, cut jerry cans and buckets are used to collect wastewater at household level and these are the same items that residents use to discharge their wastewater into drainage channels and open ground indiscriminately.

Furthermore, Malaria, which is associated with poor management of wastewater, continues to seriously affect the community and the available interventions are from NGOs, KCCA and LCs.

In conclusion therefore, KCCA Kawempe Division Public Health Department should organize in depth health education programmes for the community and these should aim at helping people change their social behaviors. The education should explain clearly and precisely the health risks associated with mismanagement of waste water. LCs should in addition, mobilize the community to identify and destroy all breeding sites for mosquitoes where ever they are found. Kawempe Division in collaboration with LCs should enforce construction of soak pits to help in handling sullage and septic tank effluent that leads to odors. Health Inspections should increase in the community inorder to ensure that people manage their wastewater in a satisfactory manner.

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APPENDIX I: STRUCTURES QUESTIONNAIRE

City: Kampala

Division: Kawempe

Ward/Parish:

Date of interview: …….2012

Interviewer:……..

LC/Zone……

Questionnaire number ☐☐☐

Section One: Demographic characteristics of the respondent:

101) Sex of the head of household:

1 = Male
2 = Female ☐

102) Age of head of household in years

1 = 11 – 20 years
2 = 21 – 30 years
3 = 31 – 40 years
4 = 41 – 50 years ☐
5 = 51 – 60 years
6 = Above 60 years

103) Highest level of education attained

1 = None
2 = Lower Primary (P1-P4)
3 = Upper Primary (P5-P7)
4 = 'O' Level
5 = 'A' Level ☐
6 = Tertiary

104) Major occupation of head of household

1 = Wage earner
2 = Salary earner ☐
3 = Businessperson
4 = Unemployed
5 = Other (specify)……

105) What is your religious affiliation?

1 = Catholic
2 = Anglican (CoU)
3 = Islam ☐

4 = Pentecostal (Mulokole)
5 = SDA
6 = Other (specify)……

106) What is your marital status?

1 = Single
2 = Married
3 = Separated
4 = Divorced
5 = Widowed

107) How many people live in this household?

1 = Less than 5 members
2 = 5-10 members
3 = Above 10 members

108) What is the nature of your land tenure?

1 = Landlord
2 = Tenant
3 = Owner occupied

Section Two: Awareness

201) Do you know any dangers associated with poor management of municipal wastewater?

1 = Yes
2 = No
If no, go to question 203

202) If yes, which ones?

……

203) What disease vectors is/are associated with wastewater in this area?

1 = Mosquitoes
2 = Flies
3 = Others (specify)……

204) Which diseases may be transmitted as a result of poor management of municipal wastewater?

1 = Malaria
2 = Diarrhea
3 = Worms
4 = Others (specify)……

Section Three: Attitude

301) Does the odor of the discharged municipal wastewater offend you?

1 = Yes
2 = No ☐

302) Are you impressed about the state of management municipal wastewater in your locality?

1 = Yes ☐
2 = No

303) Explain why

……

Section Four: Management of municipal wastewater:

401) How do you collect wastewater at your household?

1 = Septic tank
2 = Just pour it on surface ☐
3 = Soak away pit
4 = Others (specify)……

402) Do you dispose of your wastewater separately from storm water?

1 = Yes
2 = No ☐

403) Do you have a central collection facility for wastewater in the vicinity?

1 = Yes ☐
2 = No If No, go to question 411

404) If yes, what kind of central collection facility for wastewater is in use?

1 = Stabilization pond
2 = Soak away pit ☐
3 = Open discharge or surface
4 = Drainage channel

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411) If you do not have a central collection facility, how do you dispose of your wastewater?

1 = Wastewater soak away pit
2 = Open discharge on the surface ☐
3 = Irrigate vegetables
4 = Others (specify)……

412) which problems do you encounter when collecting, storing and disposing of your wastewater?

1 =Lack of land for disposal
2 = Poor Drainage ☐
3 = Limited funds to make a disposal facility
4 = Others (specify)……

Section Five: Prevalence of diseases associated with poor management of municipal wastewater.

501) Has any member of your family suffered from malaria within the last 3 months?

1 = Yes
2 = No

☐

502) Age of one who suffered?

1 = < 1 year
2 = 1 – 5 years
3 = 5 – 12 years
4 = 13 – 35 years
5 = 35 – 60 years
6 = Above 60 years

☐

503) Sex of one who fell sick in (502) above?

1 = Male
2 = Female

☐

Section Six: Interventions

601) Has anything been done to ensure proper management of wastewater in this area?

1 = Yes
2 = No
3 = I don't know

☐

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602) If Yes, what has been done?

……

603) Who did it?

1 = KCCA
2 = NGOs/Private Sector
3 = LCs
4 = Others (specify)……

☐

604) Have you ever been sensitized about safe municipal wastewater management?

1 = Yes
2 = No

☐

605) If Yes, by who?

1 = KCCA
2 = NGOs
3 = LCs
4 = Others (specify)……

☐

606) How was it done?

1 = By mass media
2 = By health talks
3 = By public lectures
4 = By posters
5 = Others (specify)……

607) Do you think you will benefit from this exercise? Explain

……

APPENDIX II: KEY INFORMANT DISCUSSION GUIDE

(LCs, Local authorities, councilors at all levels, Health workers at all levels, etc…….)

City: **Kampala**
Division: **Kawempe**
Ward/Parish:
Date of interview: …….2012
Interviewer:……..
LC/Zone……

Municipal Wastewater Management

1. Which authorities are concerned with municipal wastewater in this area?

2. What proportion of the budget is allocated to municipal wastewater management?

3. What municipal wastewater management facilities do you have in this area? (Soak pits, wastewater, storm drains etc)

4. Who are the providers of these facilities?

5. Which organization/institution is contributing most towards the provision of this facility in this area?

6. How can Local Authority (LC I, II, III, Town Council, Municipal Council) support municipal wastewater management?

7. What constrains are associated with the management of municipal wastewater?

8. In your opinion, what options are there for resource recovery in wastewater management?

9. What role does the private sector play in wastewater management in the division?

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APPENDIX Ill: OBSERVATION CHECKLIST

Observations (wastewater disposal facilities)

Time of observation_____Date_____

LCI_____LC II_____

Wastewater collection/disposal facility

1. Kind of facility
   1 = Communal soak pit
   2 = Private soak pit
   3 = Communal storm water drainage channel
   4 = Open discharge on ground

2. Measurement of the soak pit (estimate)
   Length……..meters
   Width……meters
   Height……..meters

3. Functionality of the facility
   1 = Satisfactory
   2 = Blocked
   3 = Smelly
   4 = Others (specify)_____

4. State of the surrounding environment
   1 = Clean
   2 = Dirty, water logged
   3 = Smelly
   4 = Evidence of indiscriminate wastewater discharges from the neighbourhood
   5 = Others (specify)_____

5. Safety of the users
   1 = Safe no bush, secure, has cover from surface runoff
   2 = No cover from surface runoff, placed in line of foot path, generally unsafe
   How many users do you see _____
6. How many soak pits are there _____