KYAMBOGO UNIVERSITY

COMMUNITY PERCEPTIONS AND PRACTICES TOWARDS WASTE MANAGEMENT AND EFFECTS ON WATER QUALITY IN LANDING SITES ALONG LAKE ALBERT:A CASE OF KITEBERE LANDING SITE, KAGADI DISTRICT

BY

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DECLARATION

I hereby declare that the work presented in this study for the award of the degree of Master of Conservation and Natural Resources Management represents my own work and has not previously been submitted for a degree or any other qualification at this or any other University.

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APPROVAL BY SUPERVISORS

This research report has been submitted for examination with the approval of the following supervisors;

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DEDICATION

I dedicate this dissertation to my mother Mrs. Adong Caroline for her great support spiritually, and financially, Kayongo Geoffrey and Nalumansi Maureen, who unconditionally stood by me during the tedious data collection process for this research. My supervisors Dr. Santa Maria Asio and Dr. Justine Otaala for their knowledgeable guidance and time rendered to me during in this research. May the almighty God bless you all.

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May God bless you abundantly!

LIST OF ACRONYMS AND ABBREVIATIONS

APA	American Psychological Association
AS	Adege's shop
BOD	Biochemical Oxygen Demand
CED	Centre for Environment and Development
CK	Central Kitebere
COD	Chemical Oxygen Demand
DS	Drainage channel at the shores
DDP	District Development Plan
DRC	Democratic Republic of Congo
EA	Environment Awareness
E.Coli	Escherichia coli
EE	Environmental Education
ENR	Environment and Natural Resources
EtW	Energy to Waste
EU	European Union
FY	Financial Year
GDP	Gross Domestic Product
GIS	Geographical Information System
GMO	Genetically Modified Organisms
GPS	Global Positioning System
IUCN	International Union for the Conservation of Nature
KCCA	Kampala Capital City Authority

LC	Local Councilors
MSWM	Municipal Solid Waste Management
MTN	Mobile Telephone Network
MSW	Municipal Solid Waste
MBT	Mechanical and Biological Treatment
NDP II	Second National Development Plan
NEMA	National Environment Management Authority
NOM	Near Old Market
NSDS	National Service Delivery Survey
PET	Polyethylene Terephthalate
PPP	Public Private Partnership
SDG	Sustainable Development Goal
SWM	Solid Waste Management
SPSS	Statistical Package for the Social Sciences
UBOS	Uganda Bureau of Statistics
UNBS	Uganda Bureau of statistics
UK	United Kingdom
UNCED	United Nations Conference on Environment and Development
UNESCO	United Nations Educational, Scientific and Cultural Organization
US	United States
WB	World Bank
WM	Waste Management
WtE	Waste to Energy

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ABSTRACT

This study sought to find out Kitebere residents' perceptions and practices towards waste management (WM) and investigates the effects of the practices on water quality. To achieve this aim, the study's main objective was to assess community perceptions and practices towards waste management and its effects on water quality in Kitebere landing site.

The descriptive survey design and cross sectional research design was used with quantitative and qualitative research approaches. These were administered to the households to collect information about perceptions, waste management practices, wastes generated and attitudes, or behaviours. Focus group guides were used to collect data from both women and men. Two gendered FGDs were held among fishermen, fish mongers and boat owners. Information regarding waste collection and disposal practices in the market area and general community were collected. Semi structured questions were administered to key informants including District departments, local councils, health inspectors, traders and area councilors. Key data that were collected included existence of Environment Awareness (EA). Transect walks or guided community walks were conducted with the guide of the area councilor. The purpose of the transect walks was to observe waste management practices and types of wastes generated. Additionally, a handheld camera was used to capture the status of open defecation, waste in the drainage channels, makeshift toilets and urinals draining directly into the lake.

The GPS was also used to capture locations of dumpsites, toilets and urinals including their distance from the open water. Secondary data from archival sources, books, articles, reports, internet, newspapers, journals among others were reviewed. The data reviewed was related to environmental health, public health and waste management in communities in regards to their perceptions and practices.

A total of 95 participants participated in the study. Systematic and purposive sampling was used to select participants. Interview schedule was used to collect data from 95 residents and the interview guide was used to collect data from the district and sub county representatives. Observation guides and transect walk methods were used to ascertain some responses from participants. Data collected were analysed using Statistical Package for the Social Sciences (SPSS), excel and descriptive statistics were used to analyse the raw data.

The results revealed that participants had negative perceptions and practices towards WM resulting into indiscriminate dumping hence affecting the quality of water in the lake.

Samples from the dumpsites, effluent from drainage channels, and lake water sample were collected systematically in calibrated containers and in-situ and ex-situ analysis were done.

The findings further showed that the water quality of the lake had extremely deteriorated due to contamination as a result of poor waste management. The lake was contaminated mostly by E.*coli* with most concentration at shores where the community collects domestic water from.

On the basis of the findings it was concluded that people's negative perceptions and lack of a proper system for waste collection negatively affected the situation in the area.

Based on the findings, the study recommends that Kitebere local council provides waste management services, introduces by-laws on waste management, and conducts continuous sanitation campaigns and environmental awareness.

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CHAPTER ONE: INTRODUCTION

1.0 Introduction

This chapter presents detailed discussions of the background of the study, problem statement, objectives, and research questions. The significance of the study as well as justification and scope of the study are layed in here.

1.1 Background

Waste is introduced into the environment due to the day-to-day activities of humans. Waste management refers to the many methods and processes of dealing with waste at every stage from generation and collection through to final disposal. Waste needs to be managed in order to prevent contact with humans or their immediate environment. Therefore, the main purpose of waste management is to isolate waste from humans and the environment, and consequently, safeguard individual, family and community health. In addition, the aesthetic value of a better outlook and a clean physical environment is important for our emotional wellbeing (Ethiopian federal ministry of health 2011).

The common practice for household refuse disposal in rural areas is to dump solid wastes openly in backyard gardens or in open space. Such indiscriminate disposal is an environmental hazard and can threaten human health and safety. Solid waste that is improperly disposed of can result in a number of problems. It can create a breeding ground for pathogenic microorganisms and vectors of disease, and cause a public nuisance due to unsightliness and bad smell. It can cause contamination of surrounding soil, groundwater and surface water, and it can also create fire hazards, physical hazards and have poisoning effects (from pesticides and insecticides). However, these problems can be avoided by using appropriate management techniques. For all waste management issues, authorities should engage community members and families in awareness of waste problems in their area and try to change their behaviour. In doing so, it should be possible to have a clean, attractive and sustainable environment. (Ethiopian federal ministry of health 2011). Waste management entails the following different components;

Generation: Generation of solid waste is the stage at which materials become valueless to the owner and since they have no use for them and require them no longer, they wish to get rid of them. Items which may be valueless to one individual may not necessarily be valueless to

another. For example, waste items such as tins and cans may be highly sought after by young children.

Today, the total amount of waste generated annually worldwide (municipal, industrial, hazardous) is more than 4 billion tons. Almost 45% of it is considered as municipal solid waste, while the rest is industrial waste, including the hazardous one. Both the increase of population and the capita growth in developing countries will create new tremendous amounts of municipal, industrial and hazardous waste (Veolia, 2009). It has been estimated that globally, urban food waste is going to increase by 44% from 2005 to 2025. As a global measure of the expected impacts, if the present waste management trends are maintained, landfilled food waste is predicted to increase the landfill share of global anthropogenic emissions from 8 to 10.5% (Adhikari *et al.*, 2006). Per capita waste generation increases with both the development level (expressed by the Human Development Index) and the income level (capita) of the country (Wilson *et al.*, 2012).

Storage: Storage is a system for keeping materials after they have been discarded and prior to collection and final disposal. Where on-site disposal systems are implemented, such as where people discard items directly into family pits, storage may not be necessary. In most landing sites, it is likely that the affected population will discard domestic waste in poorly defined heaps close to dwelling areas due to lack of land or adequate funds. Improved storage facilities may include: Household containers, plastic bins, communal bins, oil drums, shallow pits and fenced-in areas. In determining the size, quantity and distribution of storage facilities the number of users, type of waste and maximum walking distance must be considered. The frequency of emptying must also be determined, and it should be ensured that all facilities are reasonably safe from theft or vandalism.

Collection: Collection simply refers to how waste is collected for transportation to the final disposal site. Any collection system should be carefully planned to ensure that storage facilities do not become overloaded. Collection intervals and volumes of collected waste must be estimated carefully.

Transportation: This is the stage when solid waste is transported to the final disposal site. There are various modes of transport which may be adopted and the chosen method depends upon local availability and the volume of waste to be transported. Types of transportation can be divided

into three categories that is; human powered, animal powered and motorized means of transportation.

Disposal: The final stage of solid waste management is safe disposal where associated risks are minimised. There are four main methods for the disposal of solid waste: Land application, composting, burning or incineration and recycling (Peter Harvey *et al*., 2002). Based on different ways of assessment, it was estimated that the global population without access to Elementary Waste Management (meaning sound waste collection and removal out from the residential areas, and at least controlled disposal in "engineered" landfills) is more than 3.5 billion or more than 52% of the 2008 Earth's population (D-Waste, 2012a).

The problem of solid, liquid, and toxic-waste management in Africa has come with urbanisation in the developing world. An important feature of the urbanisation of the developing world is the rapid growth of cities and metropolitan areas. The high rate of urbanisation in African countries implies a rapid accumulation of refuse. Social and economic changes that most African countries have witnessed since the 1960s have also contributed to an increase in the waste generated per capita (Wilson *et al.*, 2012). As a result, municipal waste management constitutes one of the most crucial health and environmental issues facing managers of African cities. A study conducted in Nigeria showed that the perception of domestic waste disposal indicates that people's attitudes about and perceptions of sanitation issues contribute to the waste management problems (Borja *et al.,* 2018). Similarly, a study done in Khulna, Bangladesh found that city dwellers think because they pay taxes it is the sole responsibility of the city authority to provide them with a nuisance-free habitable city (Yoada *et al.,* 2014). Typically, local governments are responsible for the collection and disposal of the wastes generated within their jurisdiction, as well as for the operation and maintenance of their equipment. However, local governments usually lack the authority and resources to provide a satisfactory and economically viable service. In addition to the above, there is a growing perception that inadequate education about the importance of proper sanitation account for poor waste management practices. Other factors accounting for this situation are poor attitudes and lack of concern about environmental issues, high levels of poverty and misguided waste disposal practices (Yoada *et al.,* 2014).

Uganda, just like any other developing countries, is facing rapid urbanisation of 5.1% per annum according to T. Mukama *et al*. (2016). This increase in urbanisation has led to overcrowding and

the development of slums in urban areas that are inadequately provided with basic infrastructure and services like waste collection bins, vehicles for transporting wastes among others. All these factors escalate poor waste management.

According to the state of Environment report 2016/2017, Kampala's population is estimated at 1.5 million inhabitants while the Greater Kampala Metropolitan area population is estimated at 3.2 million State of Environment report (2017). It is estimated that 70% of the national Gross Domestic Product (GDP) is generated within this metropolitan area (KCCA, 2014). The population in Kampala metropolitan area also generates the bulk of the waste (both commercial and domestic) in the country. Each person in Kampala is estimated to generate about 1 kg of waste per day which translates to 45,000 tons of waste per day and this was projected to increase by 43 per cent to 60,000 tons in 2017 (KCCA, 2014).

This leads to numerous environmental and health risks including contamination of the surface and groundwater, ecosystem degradation, and soil pollution as well as greenhouse gas emissions by anaerobic decomposition of waste. In many of these communities in Uganda, poor management of solid waste contributes to flooding, air and water pollution, spread of diseases and health conditions such as respiratory ailments and diarrhea, giving rise to severe economic and social losses. The problems are particularly severe in slums of developing towns where the solid waste management systems are inadequate according T. Mukama et al. (2016). Municipal solid waste collection is currently one of the most critically lacking public services in slum areas in Uganda and its low coverage has caused public outcry T. Mukama *et al*. (2016).

In Kitebere landing site, the main factors that have escalated poor waste management include inaccessibility, family size, education level, unaffordability where the service is expected to be paid for, and poor sanitation, residents' attitudes, perceptions and practices.

Waste management still remains a major concern in Kitebere landing site because of the large volumes of wastes generated as a result of economic growth, life choices and population influx from within the country and the neighbouring Democratic Republic of Congo. It is estimated that 4,000 kg/day of wastes are generated per day and all these remain in the community uncollected and transported to designated landfills.

1.2 **Problem statement**

The large volumes of wastes produced in Kitebere landing site as a result of economic growth, life choices and population influx has led to indiscriminate disposal of wastes. This has posed a threat to the health of the public through increasing deterioration of water quality and environmental pollution. Waste management has not been given priority by the local leaders both at village and district level. Due to these reluctances coupled with poor perceptions, lack of awareness and sensitization and cultural beliefs, wastes have continuously accumulated in Kitebere landing site affecting the quality of water in the lake (Situational analysis by NIRA, 2018). No effort or intervention by either the local or central government has been made to improve on waste management services in the study area.

It is therefore against this background that a research was undertaken to assess community perceptions and practices towards waste management and its effects on water quality of the lake. The end objective will be to identify possible intervention measures and strategies to enhance a clean and healthy environment for all in Kitebere landing site. This will help improve on waste management services, awareness and sensitisation of the fisher community on sanitation and hygiene hence promoting Sustainable Development Goals (SDGs) three (3) and six (6).

1.3 Objectives

1.3.1 General objective

Assessing community perceptions and practices towards waste management and effects on water quality in Kitebere landing site

1.3.2 Specific objectives

1. To assess the perceptions of the people of Kitebere towards waste management
2. To assess the waste management practices at Kitebere community
3. To investigate the effects of poor waste management on water quality.

1.4 Research questions

1. What are the people's perceptions about waste management?
2. What are the types of wastes generated and the various waste management practices in Kitebere landing site?
3. How has poor waste management at the landing site affected the quality of water in the lake?

1.5 Significance of the research

1. The research study findings will add new knowledge and information to the already existing literature through publication.

2. The research will be used to fulfill Sustainable Development Goals three (SDG 3); ensure healthy lives and promote well-being for all at all ages and SDG 6; ensure availability and sustainable management of water and sanitation for all.

3. The study will point out the impact of poor waste management on water quality and the findings will be used to sensitise and raise awareness towards proper waste management

4. In practical terms, the findings of the research will help identify more environmentally friendly ways to deal with wastes. This will reduce on the occurrence of unhygienic diseases like cholera, dysentery and typhoid through imploring the community construct toilets, boil drinking water, use of designated dump site for wastes, practice compulsory community sanitation clean ups, among others.

5. The research findings will help in household sanitation campaigns where family's hygiene will be improved hence reduction of sanitation diseases at household level.

6. To the fishermen at the landing site, the research findings will help in changing their perceptions on open defecation both in the lake and terrestrial surrounding and also change their cultural mindset and belief towards using toilets

7. In addition, the findings of the research will be used to inform policy makers, environmental managers, health managers and other development partners on critical investment options in regards to health, livelihood improvement and waste management.

1.6 Justification of the research

Perceptions towards waste disposal and sanitation issues contribute to the waste management and water quality problems in most of the fish landing sites along the shores of Lake Albert (Situational analysis by NIRA, 2018). Landing site dwellers think because they pay taxes it is the sole responsibility of the local government to provide them with a nuisance-free habitable landing site (Yoada *et al.,* 2014). In addition to the above, there is a growing perception that inadequate education about the importance of proper sanitation account for poor waste management practices in Kitebere. Other factors accounting for this situation are poor attitudes

and lack of concern about environmental issues, cultural beliefs, high levels of poverty and misguided waste disposal practices (Environment and social scoping report in Kitebere landing site by Ministry of Water and Environment, 2018).

It is therefore against this brief background that the study assessed community perceptions and practices towards waste management and its effects on water quality in Kitebere landing site.

1.7 Conceptual framework

Independent variable

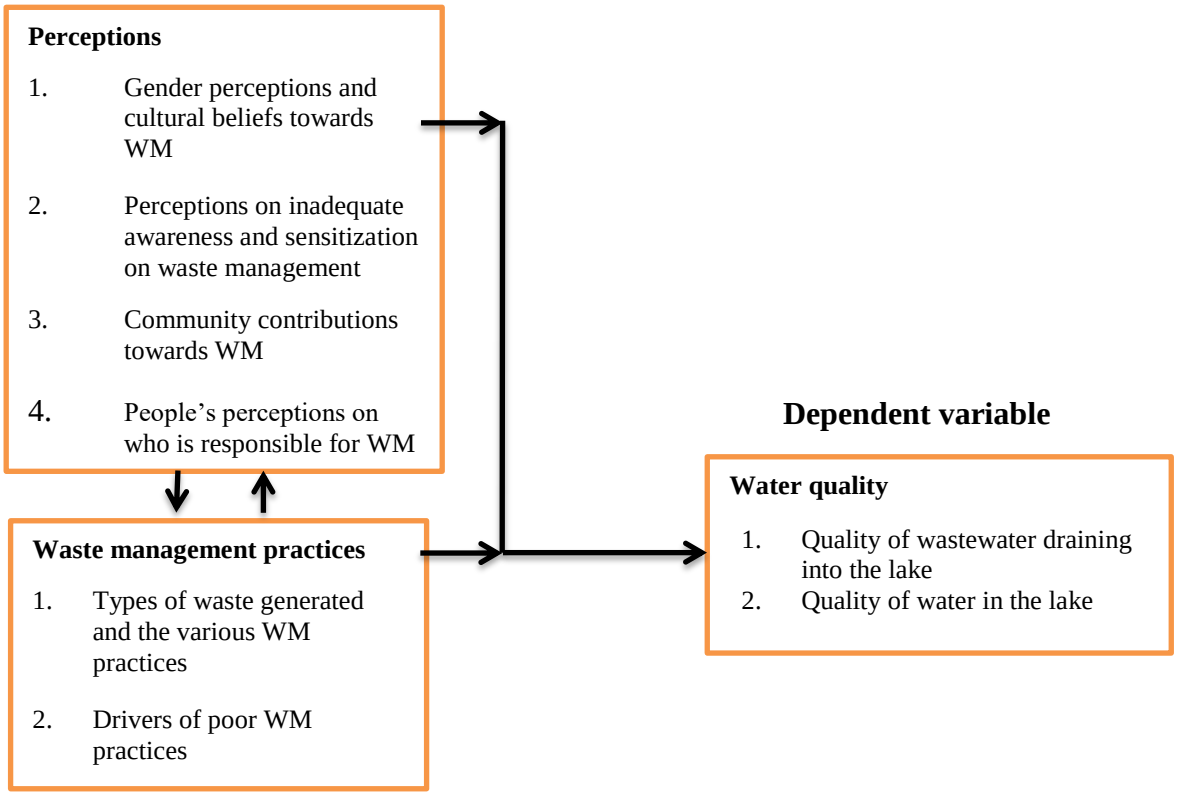


Figure 1: Shows the conceptual framework

Inclusion of both women and men would provide lasting solutions towards poor WM and this would further mitigate the negative impacts of poor waste management practices on water quality.

Reducing indiscriminate waste disposal would best be enhanced through community contributions towards WM as a major solution to poor WM. This can also be supported through a participatory approach and support from the government.

1.8 Scope of the study

This study was restricted to Kitebere landing site, Ndiaga sub county, Kagadi district. The scope of the study was limited to assessing community perceptions, practices, waste generated, the effects of poor waste management, and the role of environmental awareness in addressing waste management issues in Kitebere landing site.

The study was conducted from February to May 2019.

CHAPTER TWO: LITERATURE REVIEW

2.0 Introduction

In this section, the theoretical perspectives on people's attitudes, perceptions, behaviours and practices in solid waste management are discussed. The factors that affect human attitudes in terms of physical environment and policy are also discussed.

The relevant literature to the study are described in more details in terms of developed and developing countries, the National Development Goal II, Sustainable Development Goals, Waste Management Regulation 1999 and the Uganda Green Growth Strategy.

2.1Perceptions on Waste Management

Perceptions examine the opinions people express when they are asked in various ways to characterise and evaluate issues that may be of value towards problem solving, and save people from potential risk (Centre for Environment and Development-CED, 2003). Longe *et al.,* (2009) quoted Holland and Rosenberg 1996 saying, perceptions of one's capability is said to set a limit to what to do and ultimately what can be achieved. The influence of perception which describes how a person views oneself and the world around them and how it tends to govern behaviour is explained by the Anomie theory. It explains that deviance can arise by accepting culturally determined goals without the acceptability of cultural means (Longe *et al.,* 2009). In the case of waste management, it translates to either paying for waste management services and participation or the rejection of its cost recovery methods and even community involvement.

This situation may be due to difficulties posed by the institutionalised means (Longe *et al.,* 2009) or deviance may arise due to lack of understanding of the effects that ill-disposed waste may pose to their health. In this, wise people's perception of environmental problems and their effects will influence the cultural values, responses and success of any system. Therefore, people's perceptions on fees, waste collection procedure and health effects of ill-disposed waste are important for their willingness to pay, and even in exercising environmentally friendly waste behaviours. Longe *et al.* (2009) stated that when it is perceived by the people that waste services are paid for through taxes or even considered as a social service to be paid for by the government, unwillingness to pay could lead to elicit burning and careless dumping. It is for this

reason that Pfeffer & Sutton (2000), contend that what people think about waste is a significantly important aspect of waste management which requires examination.

Surrounding the individual in the social-ecological model is the social environment. The social environment comprises the relationships, the culture and the society with whom the individual interacts. The social environment has a significant influence on waste management behaviour. The social environment includes cultural background, socioeconomic status of the community, institutions and organizations, such as schools. Waste management is one of the activities where community participation is important for success. Communities are made up of different mixes of students, age groups, income levels and cultures. Therefore knowledge of the communities is paramount to design programmes that meet their specific needs. Tucker & Speirs (2003) stated that negative attitudes towards waste management activities were the common discriminations of behaviour in household waste management. They further state that if residents have negative attitudes towards management of waste, their practices will be poor. Attitudes may be positively influenced through awareness building campaigns and education about the negative aspects of inadequate waste collection with regard to public health and environmental conditions, and the value of effective disposal. Although there are a number of literatures on solid waste management, and associated problems in Uganda, the practical impact of people's perceptions and the role that Environment Education (EE) could play some what has been given little attention. This study thus tries to fill this research gap.

2.2 Waste Generation

The reviewed literature shows that the process of living, eating and dying all use consumer products whose production and use generate waste (Tammemagi, 1993, Ddungu, 2004). With the progress of civilisation, the waste generated became of more complex in nature. At the end of the 19th century the industrial revolution saw a rise of the world of consumers. Not only did the air become more polluted but also the land itself became more polluted with the generation of non-biodegradable solid waste (Karpagam, 1999).

Waste generation, both domestic and industrial, continues to increase world-wide in line with growth in consumption. A study carried out by Richard, (2002) entitled "Study on solid waste management options for Africa" revealed that in developed countries, per capita waste generation increased nearly 3-fold over the last two decades, reaching a level five to six times

higher than that in developing countries. With increases in population and living standards, waste generation in developing countries is also increasing rapidly, and may double in volume in a decade (Richard, 2002). Richard, (2002) further states that if current trends continue, the world may see a five-fold increase in waste generation by the year 2025. The high generation of waste entails that source reduction as a waste management strategy is important hence the need to change peoples' perceptions and practices through Environmental Awareness (EA). As a result, environmental education and awareness in the areas of pollution control and waste management became increasingly important from a global perspective of resource management (Agunwamba, 1998). It is for this reason that, Mamatha, (2011), states that without proper education, orientation and public awareness at all levels of society, it would be difficult to manage solid wastes. This creates the need to develop an integrated approach where the public, private and community sectors work together to develop local solutions in promoting sustainable waste management.

Today the most important subject that affects and worries mankind is the issues concerned with waste management. Waste management practices especially the municipal solid waste can differ for developed and developing nations, for urban and rural areas, and for residential, commercial and industrial producers. After a number of conferences held on the environment from Rio de Janeiro earth summit in 1992 which marked the beginning of persistent environmental campaigns across the world (UNCED, 1992), most of the countries put in place measures to reduce environmental problems. One of the measures was to implement the environmental awareness campaigns among their citizens (Strong, 1998). This was seen as the most vital tool in changing community perception and willingness towards waste management. Household to household waste management campaigns is the single most important mechanism towards attaining a clean and healthy environment.

2.2.1 Generation and Characteristics

A clear appreciation of the quantities and characteristics of the waste being generated is a key component in the development of robust and cost-effective solid waste management strategies.

Although amongst some of the more developed countries within the region the quantification and characterisation of waste forms the basis for management and intervention, elsewhere little priority is given to the systematic surveying of waste arising's and the quantities, characteristics,

seasonal variations and future trends of waste generation that are poorly understood (United Nations, 2013). Though there is a lack of comprehensive or consistent information, at the country level, some broad trends and common elements are discernible. In general, the developed countries generate much higher quantities of waste per capita compared to the developing countries of the region. However, in certain circumstances the management of even small quantities of waste is a significant challenge. For example, in the small islands of the South Pacific sub-region, small populations and modest economic activity have ensured that relatively low quantities of waste are generated. However, many of these countries, particularly small countries such as Kiribati, Tuvalu and the Marshall Islands, face considerable waste management challenges due to their small land areas and resultant lack of disposal options (United Nations, 2013).

The principal sources of solid waste are residential households and the agricultural, commercial, construction, industrial and institutional sectors. A breakdown of solid waste types and sources is provided in Table 2.1.

Table 2.1: Types of wastes, source and generators

Source	**Typical waste generators**	**Types of solid wastes**
Residential	Single and multifamily dwellings	Food wastes, paper, cardboard, plastics, textiles, leather, yard wastes, wood, glass, metals, ashes, special wastes (e.g. bulky items, consumer electronics, white goods, batteries, oil, tyres), and household hazardous

		wastes
Industrial	Light and heavy manufacturing, fabrication, construction sites, power and chemical plants	Housekeeping wastes, packaging, food wastes, construction and demolition materials, hazardous wastes, ashes.
Commercial and institution	Stores, hotels, restaurants, markets, office buildings, etc. Schools, hospitals, prisons, government centres	Paper, cardboard, plastics, wood, food wastes, glass, metals, hazardous wastes
Construction and demolition	New construction sites, road repair, renovation sites, demolition of buildings	Wood, steel, concrete, dirt.
Municipal services	Street cleaning, landscaping, parks,	Street sweepings, landscape and tree trimmings, general

	beaches, other recreational areas, water and wastewater treatment plants	wastes from parks, beaches, and other recreational area, sludge
Agriculture	Crops, orchards, vineyards, dairies, feedlots, farms	Spoiled food wastes, agricultural wastes, plastics hazardous wastes (e.g. pesticides and herbicides)

Source (World Bank, 1999)

Available data on the quantity and types of solid waste generated, and the methods employed in the treatment and disposal of generated waste, are incomplete, inconsistent and unreliable due to wide variations in data recording, definitions, collection methods and seasonal variations (World Bank, 1999).Whilst at a regional level this mitigates against a clear view of the overall status and trends, at the local level the lack of robust data acts as a barrier to the development and implementation of efficient and cost-effective waste management practices.

2.2.2 Waste management practices

2.2.2.1 Solid Waste Management in Developed Countries

Urban authorities world over are facing increasing problems in the collection of solid waste (Robert, 1996). In developed countries solid waste problems usually centre on the high costs of disposing the large quantities of waste generated by households and businesses. The United States, with only 4.7% of the world's population, produces about 33% of the world's solid waste (Miller, 2003). About 97.5% of this solid waste comes from mining, oil and natural gas production, agriculture and industrial activities used to produce goods and services to consumers.

Another 1.5% of solid waste produced is municipal solid waste (MSW) from homes and businesses in or near urban areas. The amount of MSW, currently produced in the United States each year amounts to about 200 million metric tons, almost twice as much as in 1970 (Miller, 2003). This is the world's highest per capita solid waste production and many times the rate in developing countries. However, the solid waste generated is managed in different ways. Examples of waste handling systems include:

Reuse- is a form of waste reduction that extends resource supplies. It keeps high-quality matter resources from being reduced to low matter-quality waste. Two examples for reuse are refillable glass beverage bottles and refillable soft drink bottles made of polyethylene terephthalate (PET) plastics. Denmark led the way by banning all beverage containers that cannot be reused. In Finland, 95% of the soft drink, beer, wine and spirit containers are refillable, and in Germany, 73% are refillable (Miller, 2003). Unlike recyclable cans and bottles, refillable beverage bottles create local jobs related to their collection and refilling.

Recycling- is another waste management strategy in developed countries. In 1999, about 28% of United States' municipal solid waste was recycled or composted. The US has more than 8,800 municipal curb side recycling programmes serving 51% of the population. One advantage of recycling and composting is that they are land serving and pollution reducing strategies (Miller, 2003). Studies have shown that one of the best ways to encourage recycling is pay- as- you throw programme that bases garbage collection on the amount of waste a household generates for disposal and materials sorted out for recycling are hauled away free. In Australia, for instance the recycling rate is high and is increasing, with 99% of households reporting that they had recycled or reused some of their waste within the year 2002, up from 85% in 1992 (Miller, 2003). This suggests that Australians are in favour of reduced or no land filling and the recycling of waste. The advantage of recycling and reuse is that they prevent creation of waste at source and reduce amount of waste thrown into community dustbins or disposal sites.

Incineration- in the United States, about 16% of the mixed trash in municipal solid waste is combusted in about 170 mass-burn incinerators (Miller, 2003). However, since 1985, there has been a decrease in the use of incineration for treating wastes in some parts of the world because of high costs, health threats from air pollution and intensive citizen opposition. Incineration is carried out both on a small scale by individuals and on a large scale by industry. Incineration is

common in countries such as Japan where land is scarcer, as these facilities generally do not require as much land as landfills.

Waste-to energy (WtE) or energy from waste (EfW) are broad terms for facilities that burn waste in a furnace or boiler to generate heat, steam and/or electricity. Incineration is a controversial method of waste disposal due to such issues as emission of gaseous pollutants. On the other hand, this method produces heat that can be used as energy.

Landfill- disposing of waste in a landfill involves burying waste, and this remains a common practice in most countries. In a sanitary landfill, solid wastes are spread out in thin layers, compacted and covered daily with a fresh layer of clay or plastic foam. About 54% by weight of the MSW in the US is buried in sanitary landfills compared to 90% in the UK, 80% in Canada, 15% in Japan, and 12% in Switzerland (Miller, 2003). Good waste management begins with preventing waste being produced. Waste prevention is closely linked to improving manufacturing methods and influencing consumers so that they demand greater products and less packaging, (EU, 2010). This can only be achieved by running awareness- raising campaigns to educate the public and encourage consumers to demand goods that produce less waste and drive the creation of a more resource-efficient market. Therefore, environmental education is necessary in raising awareness programs.

2.2.2.2 Solid Waste Management in Developing Countries

The reviewed literature observes that in most developing countries solid waste management is still a problem. The problems are more to do with collection (Roberts, 1996). Solid waste management is a municipality's responsibility in nearly all developing countries. A lot of solid waste is however, uncollected due to municipalities' financial and administrative capacity constraints. It is for this reason that Heeramum (1993) argues that waste collection and disposal in developing countries has been left to individuals or communities. This has led to garbage pilling up almost everywhere in townships, urban centers and along the roadsides (Heeramum, 1993). Heeramum (1993) further observed that less than 50% of solid waste is collected and the common land disposal method is the open dumping. In developing countries where there are a lot of capacities constraints, costs of collecting waste tend to be high compared to income and in comparison to collection costs in developed countries.

The involvement of the private sector has been seen as the only way forward in the improved delivery of public services (Hampwaye, 2005). Roberts (1996) also states that more rigid environmental standards and increased costs often make private involvement the only solution available for governments. The public private partnership (PPP) enhances community participation in planning and operation, protecting users' rights and even considers community groups as contractors in the delivery of infrastructure and services. Hampwaye (2005) highlights a number of success stories concerning PPPs in the delivery of solid waste, such as the increased amount of solid waste collected in Kuala Lumpur by 2.8 tons more per vehicle per day. This study does not highlight the opinions of the residents in willingness to pay the waste management services.

Indonesia (Jakarta)

The studies done in Jakarta revealed that with an average of 1400m^3 of rubbish being thrown into Jakarta's rivers every day, it was evident that the problem of waste management was not simply a matter of garbage collection but also of environmental awareness. Realising the importance of environmental education, Jakarta bay project embarked on environmental awareness programs among the people living in the area. After a number of awareness programs, people in Jakarta started carrying out some composting, although not in large quantities since they prefer to recycle and sell paper (Pasang *et al.,* 2007).Careless dumping due to lack of Environmental Awareness (EA) was observed in this study and the role environmental awareness played in source reduction of waste through recycling but did not bring out the views of people on the roles they were supposed to play in SWM.

Kenya- Nairobi

Karanja (2005) study revealed that in Nairobi waste management was a problem as waste was found all over urban areas. He states that the main fractions in the waste comprise plastic bags of all sizes and colours. He further states that these were found dotting the landscape in Nairobi. Karanja (2005) observed that fragile and thin plastic bags used lend them to inadvertent littering which has become a serious problem in the urban centres the world over. Increasing food packaging, bottling and the use of tins are common phenomenon today in the cities and beyond (Karanja, 2005). The current general trend towards increasing non-biodegradable materials is attributed to the growing tendencies towards globalisation of the economy (Karanja, 2005). This

highlights the issue of waste management but does not provide solutions to the waste management problems, peoples' perceptions and practices to manage wastes.

Uganda

The increasing amount of solid waste is the most disturbing problem in public places in Uganda. A study carried out by Komakech *et al.* (2014) shows that in Kampala, Uganda, about 28,000 tons of waste is collected and delivered to a landfill every month.

Kampala Capital City Authority (KCCA) records show that this represents approximately 40% of the waste generated in the city. The remaining uncollected waste is normally dumped in unauthorised sites, causing health and environmental problems. However, the organic fraction of domestic waste can provide an opportunity to improve livelihoods and incomes through fertilizer and energy production. This study characterised the municipal waste generated in Kampala and delivered to Kiteezi landfill. The study did not describe the perceptions and practices of waste management within the communities.

A study conducted by Abdulfatah Abdu Yusuf *et al*. (2019) showed that the waste generated from the Munkono Municipal Council (MMC) and the immediate catchment constitute of over 33.3% plastics especially at low-density polyethylene with the rest (glass, clinical debris, waste paper, vegetable food, wood savings, ash, and clothes) comprising about 66.7%. Currently, the MMC releases waste on an open gazetted ground, about 15 hectares of land at Katikolo village. The societies around the Municipality and its nearest neighbourhood that do not have the opportunity to handle waste infrastructure, dispose these wastes along the road side verges and channels. The waste segregation is not practiced. This community has low support and facilities for efficient utilisation of waste generated, hence the delays in waste collection and disposition. The current solid waste management practice is weak as it is characterised by indiscriminate dumping of waste and non-separation of the garbage constituent at both source and final disposal unit. The authors cite the primary source of solid waste in Mukono Municipality to include; households, shops, offices, institutions, religious places, schools, colleges and marketplaces and proffer strategies in the conclusion section on waste organising and management. This study however does not present community perceptions and attitudes towards solid waste management.

A study conducted by WaterAid in partnership with National Water and Sewage Cooperation (NWSC) and Community Integrated Development Initiatives (CIDI), (2016) on the current state of urban solid waste management practices in Kampala slum revealed that; collection, transportation and disposal of solid waste in Kampala are the responsibility of Kampala Capital City Authority (KCCA), Municipalities and its agents or appointed private collectors. It also revealed that it is the sole responsibility of the person at any dwelling unit (home), industrial or institutional establishments of the city where solid waste is generated to collect and manage the wastes until it is collected by the council.

The study revealed that per capita solid waste generation per person is 1.28Kg per day and is a function of income levels. The high income households generate more wastes than low income households but accumulation is higher in low income areas compared to high income settlements. Therefore income earning is a great factor in the chain of solid waste management. This study showed that great potential exits income generation which is untapped regarding solid waste as art and craft, briquette making, artisan and metal works, garbage transportation and waste picking. It showed that such activities are seldom unrecognised, unsupported, nor promoted by urban authorities as approaches to support SWM in the area despite having advantages. Some of these are reducing costs of the disposal facilities, prolonging the site span, and also reducing the environmental impact of disposal sites. This study however does not present community perceptions and attitudes towards solid waste management.

Lakes are the final recipient of human and municipal wastes and eroded soils from natural and human-initiated processes in the basin. The proper handling and disposal of domestic waste in rural areas are not adequately developed. Domestic waste is usually dumped without much thought to pollution implications. In a survey in the rural parts of the Lake Albert catchment, Uganda indicated that only 30 to 40% of garbage is collected and considerable amount of garbage is burnt. About 60%-70% of the garbage remains uncollected and therefore contributes to the pollution of the lake. The burning of garbage can lead to acidification of rain and can expose the population to inhalation of potentially toxic gaseous and particulate emissions.

Most wastes have a very high biological oxygen demand (BOD) that depletes oxygen from the lake causing anaerobic conditions. This causes most aerobic organisms to migrate or die. It can

also cause eutrophication of water bodies, leading to algal blooms and invasion of the water body by aquatic weeds. Wastes introduce disease-causing pathogens into the lakes, infecting aquatic organisms such as fish and snails, which are later transmitted to man. (Situational analysis by NIRA, 2018).

Fishermen in the districts of Kalangala, Rakai and Masaka have expressed concern over the appalling sanitation conditions at the landing sites. This follows failure by their respective districts local governments to construct enough toilet facilities to match the ever-increasing population. The LC1 chaipersons and committee members of Beach Management Units at the fishing villages led by John Kamoga said that the 25% of the revenue given back to their LCs is misused and people on the landing sites don't benefit from this money. The fishermen say that the districts' leadership failed to construct improved toilets and garbage dumping facilities as a strategy to control the number of people dumping the refuse in the lake. They are worried that if nothing is done, diseases like cholera and typhoid could easily break out at the landing sites. They also said that drawing water directly from the lake could cause bilharzia which could lead to water borne diseases. About ten landing sites in Masaka and Kalangala have heaps of decomposing garbage, human wastes, polythene bags, domestic animals like pigs, goats and cows looming all over the areas. The landing sites included Kitobo, Nakatiba in Kalangala district, Kyabasimba, Lukunyu in Rakai and Kabasese, Kachanga, Kaziru, Kisuku, and Kamuwunga, Nakigga landing sites in Masaka. Last month, one landing site in Rakai district, Kasensero was temporarily closed due to poor hygienic conditions (Issa Aliga, 2006). The author accented on the need to have improved toilet facilities and dumpsites in the landing sites but did not provide immediate solution for proper waste management.

The Commandant of the Fisheries Protection Unit in Eastern Uganda Captain Joseph Ssebukera has closed Wanyage landing site in Mafubira Sub County in Jinja district citing poor hygiene. The landing site, which is home to around 400 people, lacks functional toilets. The four stanza public latrine that was constructed with funding from Jinja District Fisheries Department in 2012 filled up more than two years ago. As a result, residents ease themselves directly in Lake Victoria. According to Ssebukera, they tasked the fishermen to construct a pit latrine in vain. "I have held several meetings with these people and I ordered them to construct a pit latrine one year ago but, my advice has been ignored. Unless they improve on their hygiene, this landing site

will remain closed," he said. Adding that, "They sell fish to the public and if their hygiene is poor our people might fall sick in the long run, so it is either hygiene first or no landing site." (The independent, Fisheries unit commander closes landing site over poor sanitation, November, 7, 2018 accessed on https://www.independent.co.ug). This article shows that there is a big gap in changing landing site community to embrace the need of having toilets. The fishermen in the landing sites have poor perceptions about toilets which the author did not hint on and how to address it.

2.3 The effects of poor waste management on water quality

The lack of adequate solid waste collection and disposal systems in developing countries causes health problems resulting in diseases, which aggravate poverty leading to negative consequences such as loss of income due to illness, increased spending on health care, and the deprivation of the poor's capacity to live in a safer environment (World Bank- WB, 2001). It is important to recognise that, the fulfilment of human needs depends on environmental factors such as availability of pure water, clean air, and adequate living space and in many circumstances the people's ability to maintain a spirit in cultural and aesthetic relation with their environment (Panneerselvam & Ramakrishnan, 2005).

The major problem with open dumping is that decaying garbage can give rise to poisonous chemical substances, which leach into the surrounding soil and contaminate ground water, rivers and streams; some produce methane which is a harmful greenhouse gas to the atmosphere is hence escalating the impacts of climate change. The study does not provide best practices for waste disposable.

2.3.1 Water quality in Lake Albert

Lake Albert and its river inflows differ markedly in the concentration of their major ions. The electrical conductivity of Lake Albert is higher than its inflow rivers by a factor of 7. Hence the lake is classified as moderately saline and alkaline, with moderate hardness. The combined effect of low concentration of the major ions i.e. Na^{+}, K^{+}, Ca^{2+}, Mg^{2+}, HCO^{3-}, SO_4^{2-} and Cl^{-}, low alkalinity and the absence or negligible carbonate in the rivers makes them to be classified as dilute fresh water. The difference between the chemical constitute of Lake Albert and its inflows is attributed to the difference in the geology of the parent rocks they drain. While the rivers have

a catchment of the highly leached ferretalic soils, the lake is surrounded by mineral rich volcanic soils of the rift valley. Furthermore, the lake has limited outflow (internal drainage) and evaporation far supersedes inflow leading to salt accumulation (Matagi, 2002). Pristine aquatic environments are known to have BOD and COD below 2mg/l and 20mg/l respectively. Both lake and river waters exceed these limits. The rivers are getting considerable organic pollution from surface runoff, while the lake is having organic accumulation, an indication of eutrophication. TSS is high in both river and lake waters. In the case of rivers this is an indication of deforestation, poor methods of cultivation and siltation, while in the lake it is due to algae, an indirect indicator of eutrophication. Nitrate (NO3-) and phosphate (PO42-), the major algal macronutrients, are low in both river and lake waters. Sulphate (SO42-) is negligible or absent in the rivers. The low levels of nutrients in the lake may be attributed to the rapid uptake by algae. The composition of the phytoplankton community confirms an emerging dominance of blue-green algae, an empirical evidence of eutrophication.

Both river and lake waters are contaminated by faecal coliforms, an indication of poor sanitary facilities and open defecation. This explains the prevalence of water borne diseases in the catchment, particularly cholera which is endemic at the lake shore. (World wide fund, 2005).

When a biodegradable organic waste is discharged into an aquatic ecosystem such as a stream, estuary or lake, oxygen dissolved in the water is consumed due to the respiration of microorganisms that oxidise the organic matter (Davies and Walker, 1986). The more biodegradable a waste is, the more rapid is the rate of its oxidation and the corresponding consumption of oxygen. Because of this relationship and its significance to water quality (dissolved oxygen levels in the water), the organic content of waste waters is usually measured in terms of the amount of oxygen consumed during its oxidation, termed the Biochemical Oxygen Demand (BOD). In an aquatic ecosystem, a greater number of species of organisms are supported when the dissolved oxygen (DO) concentration is high. Oxygen depletion due to waste discharge has the effect of increasing the numbers of decomposer organisms at the expense of others. When oxygen demand of a waste is so high as to eliminate all or most of the dissolved oxygen from a stretch of a water body, organic matter degradation occurs through the activities of anaerobic organisms, which do not require oxygen (Meertens *et al.,* 1995). Not only does the water then become devoid of aerobic organisms, but anaerobic decomposition also results in the formation of a variety of foul smelling volatile organic acids and gases such as hydrogen

sulphide, methane and mercaptans (certain organic sulphur compounds). The stench from these can be quite unpleasant and is frequently the main cause of complaints from residents in the vicinity.

Chemical Oxygen Demand (COD) is the measure of the total quantity of oxygen required to oxidize all organic material into carbon dioxide and water. It does not differentiate between biologically available and inert organic matter. COD values are always greater than BOD values, but COD measurements can be made in a few hours while BOD measurements usually take five days (BOD_5). The study elaborates the general water quality components of Inflow Rivers and the lake however the study is not site specific. Water quality varies along and within the lake depending on the inflows and activities within its immediate catchment.

Nutrients

The availability of plant nutrients, particularly nitrogen and phosphorus are important determinants of the biological productivity of aquatic ecosystems. Nutrient deficient aquatic environments are called "oligotrophic" and those rich in nutrients, "eutrophic". Young lakes are generally oligotrophic (Nyanda, 2000), but they naturally accumulate nutrients over time, derived from drainage and sediment run off from its catchments. When human activities greatly accelerate nutrient enrichment of water bodies, the process is called "cultural eutrophication". Sewage, animal wastes and many industrial effluents contain high levels of nitrogen and phosphorus. Another major source is fertilizer run off from urban and agricultural catchments. While in the long term, cultural eutrophication accelerates the natural successional progress of aquatic ecosystems towards a terrestrial system; in the short term problems arise due to cyclic occurrences of algal blooms and decay. In warm weather, nutrients stimulate rapid growth of algae and floating aquatic weeds. The water often becomes opaque and has unpleasant tastes and odours (Katima and Masanje, 1994). When these organisms die they become food for decomposer bacteria. Depletion of dissolved oxygen leads to anaerobic conditions and a general decline in the ecological and aesthetic qualities of the water body. According to Perry *et al*, (2007), nitrogen, phosphorus, or both may cause aquatic biological productivity to increase, resulting in low dissolved oxygen and eutrophication of lakes, rivers, estuaries, and marine waters. Besides adding to nutrient-content of the water, addition of some forms of nitrogen and phosphorus will increase BOD and COD (Mahdieh and Amirhossein, 2009). Increased nitrogen levels adversely affect cold-water fish more than they do warm water fish.

Phosphates enter waterways from human and animal waste, laundry cleaning, industrial effluents, and fertilizer runoff. These phosphates become detrimental when they over fertilize aquatic plants and cause stepped up eutrophication. If too much phosphate is present in the water, the algae and weeds will grow rapidly, may choke the waterway, and use up large amounts of precious oxygen (in the absence of photosynthesis and as the algae and plants die and are consumed by aerobic bacteria). The result may the death of many aquatic organisms (USEPA, 1986) such as the zooplankton and fish. The net result of the eutrophic condition and excess growth in water is the depletion of oxygen in the water due to the heavy oxygen demand by microorganisms as they decompose the organic material. The study elaborates the sources of nutrient load in water bodies however it does show how activities of landing sites increase major nutrients like nitrogen and phosphorous in the lake.

Turbidity

Turbidity is an expression of the optical property that causes light to be scattered and absorbed rather than transmitted in straight lines through a water sample (Smith and Davies, 2001). Turbidity in water is caused by the presence of suspended matter such as clay, silt, finely divided organic and inorganic matter, plankton, and other microscopic organisms. Turbidity units are supposed to correspond to total suspended solids (TSS) concentrations, but this correlation is only approximate. Waters with turbidity in excess of 50 NTU are quite cloudy, and waters with turbidities exceeding 500 NTU are downright muddy. Suspended sediment is a ubiquitous water pollutant, with a multitude of environmental impacts on water bodies, including transport of other pollutants such as adsorbed nutrients and toxic materials. Effects on aquatic organisms include benthic smothering once sediment settles out of the water column (Smith and Davies, 2001). However, the most visually and ecologically significant, impact of suspended sediment is optical/increased light attenuation through water, decreasing algal growth, and low algal productivity can reduce the productivity of aquatic invertebrates, a food source of many fish. High turbidity levels affect fish feeding and growth. Light attenuation by suspended particles in water has two main types of environmental impact: reduced penetration into water of light for photosynthesis and reduced visual range of sighted animals and people. High turbidity also due to total suspended solids supports high numbers of foreign microbiota in the water body, accelerating microbial pollution. The study does not specify how increased development and clearance of lake buffers increases sediment load in the lakes.

Electrical Conductivity (EC)

Electrical conductivity is a function of total dissolved solids (TDS) known as ions concentration, which determines the quality of water (Tariq *et al.,* 2006). Electric Conductivity or Total Dissolved Solids is a measure of how much total salt (inorganic ions such as sodium, chloride, magnesium, and calcium) is present in the water (Mosley *et al.,* 2004), the more ions the higher the conductivity. Conductivity itself is not a human or aquatic health concern, but because it is easily measured, it can serve as an indicator of other water quality problems. If the conductivity of a stream suddenly increases, it indicates that there is a source of dissolved ions in the vicinity. Therefore, conductivity measurements can be used as a quick way to locate potential water quality problems. All natural waters contain some dissolved solids due to the dissolution and weathering of rock and soil. Some but not the entire dissolved solids act as conductors and contribute to conductance. Waters with high TDS are unpalatable and potentially unhealthy. According to Nadia (2006) discharge of wastewater with a high TDS level would have adverse impact on aquatic life, render the receiving water unfit for drinking and domestic purposes, reduce crop yield if used for irrigation, and exacerbate corrosion in water networks. The study does not state how poor drainage of wastewater from communities within landing sites and urinals affect conductance of receiving waters.

pH

The pH is a measure of the acid balance of a solution and is defined as the negative of the logarithm to the base 10 of the hydrogen ion concentration (UNESCO, WHO & UNEP, 1996). In waters with high algal concentrations, pH varies diurnally, reaching values as high as 10 during the day when algae are using carbon dioxide in photosynthesis. pH drops during the night when the algae respire and produce carbon dioxide. As reported in Salequzzaman *et al*, (2008), pH changes can tip the ecological balance of the aquatic system and excessive acidity can result in the release of hydrogen sulfide. The pH of water affects the solubility of many toxic and nutritive chemicals; therefore, the availability of these substances to aquatic organisms is affected. According to Mosley *et al.,* (2004), water with a pH > 8.5 indicates that the water is hard. Most metals become more water soluble and more toxic with increase in acidity. Toxicity of cyanides and sulfides also increases with a decrease in pH (increase in acidity). The content of toxic forms of ammonia to the untoxic form also depends on pH dynamics. The studies reveal that pH is a

determinant of water quality since its affects the solubility of many toxins and chemicals. This however does not state the acceptance levels of pH in lake water.

Drinking Water Quality Standard

Chemicals of Health Significance as described by World Health Organization Guidelines (WHO) for Drinking-water Quality in fourth edition (2011)

Table 2.2 Drinking water quality standards

PARAMETER	UNIT	WHO 4TH EDITION (2011) GUIDELINE VALUE
CHLORINE	mg/L	5
COPPER	mg/L	2
FLUORIDE	mg/L	1.5
LEAD	mg/L	0.01
MERCURY	mg/L	0.006
NITRATE (AS NO3-)	mg/L	50
NITRITE (AS NO2-)	mg/L	3
SODIUM	mg/L	40

Other Water Quality Parameters

Table 2.3 Water quality parameters

PARAMETER	EXISTING STANDARD
PH AT 25^0 C	8.2 – 8.8
COLOUR	Not exceeding 5 Hazen
TURBIDITY	Not exceeding 1.5 NTU
IRON AS FE	Not exceeding 0.1 mg/L
MANGANESE AS MN	Not exceeding 0.05 mg/L
ALUMINUM AS AL	Not exceeding 0.10 mg/L
FREE RESIDUAL	0.5 - 1.5 mg/L
TOTAL COLIFORMS & E.COLI (NO./100ML)	Absent

2.3.2 Landing sites/fishing villages

All of the landing sites and associated fishing villages lack adequate sanitation facilities. In many

cases they are entirely absent. With the growing population there is an ever increasing quantity of untreated sewage entering the lake. There is also an absence of disposal facilities for fish waste and this is generally thrown straight back into the lake.

This is both a pollution input to the lake as a whole as well as creating a localized pollution hotspot (Situational analysis by NIRA, 2018). The analysis states the causes and the impacts of wastes on the community and aquatic life but does not provide or investigate the status of water quality in relation to the different parameters and standards.

2.3.3 Pathogenic Organisms

Many serious human diseases such as cholera, typhoid, bacterial and amoebic dysentery, enteritis, polio and infectious hepatitis are caused by water-borne pathogens. In addition, malaria, yellow fever and filariasis are transmitted by insects that have aquatic larvae.

Faecal pollution of water resources by untreated or improperly treated sewage is a major cause for the spread of water-borne diseases (Mott and M & E Associates, 2001). To a lesser extent, disease causing organisms may also be derived from animal rearing operations and food processing factories with inadequate waste water treatment facilities.

In most developed nations, the spread of water-borne infectious diseases has been largely arrested through the introduction of water and sewage treatment facilities and through improved hygiene. But in many developing countries, such diseases are still a major cause of death, especially among the young. A strong correlation exists between the infant mortality rates of various countries and the percentage of the population with access to clean water and sewage disposal facilities. The study does not relate how fecal matter eroded by water and wind from the landing sites pollute is aquatic ecosystems and does not state the minimal amounts of fecal coli and *E.coli* in drinking or lake water.

CHAPTER THREE: METHODS AND MATERIALS

3.0 Introduction

This chapter presents an overview of the study area, study population, research design, sampling procedure, sample size, research instruments, data collection procedures, data analysis and ethical considerations used in the study.

3.1 Study Area

The study area is located in Kitebere parish, Ndaiga sub-county, Kagadi district. The sub-county has 4 villages and these include Nyamasoga, Songaraho, Buyaga and Kitebere. The villages are close to each other and one village leads to another along the lake.

Figure 2: **Map showing villages in Ndaiga Sub-county**

It is approximately 15km from the sub county headquarters accessible by a small walk path. The only means of transport is by motorcycle or bicycle to the landing site and can also be accessed through Ntoroko by water through Lake Albert. Kitebere landing site has a population of about 10,000 (ten thousand) people according to the sub-county chief as of 2018, however according to the available recorded data as per District Development Plan; it indicates that the population was 3,158 people (DDP, 2014).

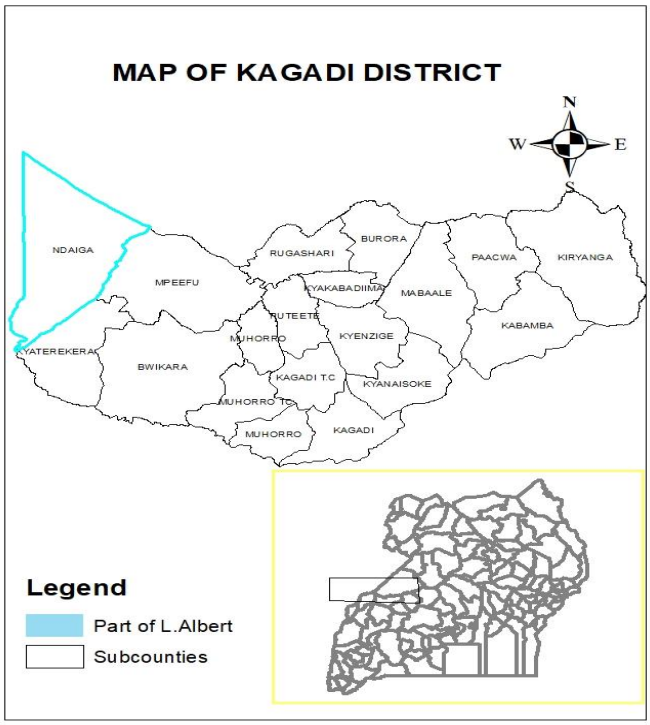


Figure 3: Map of Kagada district

The landing site is characterised by a high population influx of immigrants from the neighbouring DRCongo and internally from neighbouring districts (Nebbi, Pakwach, Ntoroko, Buliisa, Hoima, Arua among others), villages (Nyamasoga, Kamina, Sangaraho and Kanara) and towns (Kagadi town, Ntoroko town, Hoima town among others). It's estimated that over 600 Congolese who have relatives at the landing site have migrated and have integrated into the community while others are renting in the area. On a weekly basis new immigrants from within the country flock in from the above-mentioned districts and villages making Kitebere one of the most populated landing sites along Lake Albert. Kitebere landing site is characterised by multi ethnicity. Alur is the dominant ethnic tribe. The other ethnic tribes in the area include; Bagungu, Banyoro, Batooro, Bakonzo, Bakongo, Baganda and Congolese.

Table 3.4: Population and demography of the study area

Sub-County	Parish	Males	Females	Total	Households	% of female headed HH
Ndaiga	Kamina	761	725	1486	420	18.6
	Kitebere	1628	1530	3158	723	24.8
	Ndaiga	1084	971	2055	519	20.0
	Nyamasoga	1025	936	1961	452	16.4
Sub-county total		**4498**	**4162**	**8660**	**2114**	**20.6**

(Source: DDP 2014)

Kitebere landing site was selected purposively because of the level of population influx, its transboundary nature, the rate of economic development and the high prevalence of cholera and dysentery. This is in addition to lack of safe drinking water, poor sanitation and hygiene, and being the landing site with the lowest toilet coverage in the entire country. It attracted attention for this research study to look at possible ways of reducing poor waste disposal and aim at identifying ways to improve sanitation and hygiene through environmental education and awareness. The study aims at promoting resource reuse and recovery from household wastes, waste separation at point of generation, composting for biodegradable wastes, and reuse for plastics. The landing site is congested and unplanned, characterised by poor access to social amenities, poor SWM practices, and inhabited by people of low socioeconomic status.

Plate 1: Transport network

Plate (a) shows the mode of transport (bodaboda) on the right and plate (b) shows the type of road network in the study area.

3.1.1 Administrative structure of Kitebere village

Kitebere landing site is headed by the local council 1. Under the LC1, there are other structures which include the secretary to the LC, defence, youth representatives, women representatives, landing site chairperson, publicity personnel and treasurer. The office of the LC1 is responsible for solving conflicts amongst the people of Kitebere, allocating land for residents including immigrants, announcing important information to the people and mobilisation, collecting tax among others.

3.1.2 Education facilities and Literacy Level

There are 5 (Nursery and Primary) schools which are in deplorable state as pupils sit under trees. There are no government aided schools in the study area, leaving only private schools in operation of which are very expensive between 50,000 to 100,000 Uganda shillings. This has caused many pupils to drop out and take on fishing business to make a living. The nearest secondary school is in Mpofu sub-county which is about 27km form the study area. According to the data collected during the study, 98% of the community members have not made it past the primary level of education, therefore the population is majorly illiterate. Lack of education facilities coupled with the negative attitudes of parents towards education has rendered most children illiterate. Parents in the study area said they were poor and most of them are single parents. They say government should provide Universal Primary Education for their children if

they want them to go to school. Given the fact there are so many video halls in the study area, pupils often prefer watching movies to schooling.

3.1.3 Access to safe water and sanitation

The only source of water is the Lake Albert. Drinking water is at times boiled while the water used for other domestic chores like bathing and washing utensils is consumed in its raw form.

The local government has not made any attempt to provide the landing site with clean and safe water. At times safe water is imported from Ntoroko through the lake and it's very expensive to buy. A cup of imported water is 2,000 Uganda shillings which makes it unaffordable so people resort to taking lake water which is extremely contaminated with wastes.

The area lacks sanitation and hygiene facilities (toilets and waste dump areas) with an alarming 10% coverage of latrines (State of Environment Report, 2010). The only public ECOSAN toilet that was constructed by RED Cross collapsed and is no longer operational. Due to lack of toilets at the landing site, the community members freely practise open defecation which makes them prone to various hygienic related diseases.

Plate 2: The state of sanitation and hygiene in the study area

Plate (1) shows some of the community members fetching water from the lake for domestic use and at the same time animals are drinking from the same source, plate (2) shows open defecation in the study, plate (3) shows water contamination by people in the community through washing chores and bathing and plate (4) describes the state of the immediate community surrounding with filthy drainage channels within the households.

3.1.4 Housing/residence conditions

Most houses in the sub-county are of semi-permanent materials and are of mud and wattle and thatched with iron sheets, papyrus and grass. A small population has permanent houses of brick, sand and cement. However, the population growth and demand for materials has put pressure on the natural environment and has led to degradation. Changes in life style have also led to generation of municipal wastes which is chocking the landing site.

About 43.2% of the residents do not own a permanent house meaning that they rent. Most of the rental residents do not have sanitary facilities forcing the occupants to defecate in polythene bags, in the open fields (bushes) and in lakes especially fishermen who spend most of their time in the lake.

In the study area, majority of households have between 6-10 occupants (44.2%) of the total households. This helped to analyse how much waste is generated per household. Majority of these residents do not have toilets and dumpsite pits in their backyards. This means that the wastes generated by each person in the household is littered within the corridors and feaces are disposed of either in polythene bags (kaveras) or in the nearby shrubs (open fields).

3.1.5 Fish handling/processing facilities

Kitebere landing site has no fresh fish handling shed for the fresh fish landing from the waters. There are drying racks that are constructed out of the reeds available locally and there are fish smoking kilns at the homesteads. Some artisanal fish processors use charcoal stoves to smoke fish as shown in the figure below.

Fish drying racks

charcoal stove used for fish smoking

Plate 3: The fish handling and processing facilities

Plate 3 shows a fish drying rack that is made of reeds and the top is covered with a mosquito net for drying fish especially the silver fish (mukene) species while the charcoal stove is used for smoking fish. This is one of the other ways of preserving fish in the study area.

3.1.6 Land use pattern

Land is in private ownership though the entire dry land is within the 200m buffer zone of the lake. Many fishermen and 'others' rent or have small plots with a semi-permanent house. The landing site is densely populated with an influx in form of Congo refugees. Some of the refugees who have relatives at the landing site are easily integrated into the community while those that don't have rent houses for settlement. There are no agricultural activities within the landing site.

The landing site is characterised by extremely poor waste disposable practices rendering the land un-useful for other activities other than settlement.

3.1.7 Health centres and common diseases in the area

There are neither hospitals nor clinics at Kitebere landing site. The closest health centre in the area is Ndaiga Health centre II located in Ndaiga sub-county which is approximately 15km from Kitebere. There are approximately 10 drug shops in the area that provide health services to the community and these are operated by unprofessional individuals. According to the community, in case of severe illness, patients are taken to either Ntoroko but most commonly to Congo. The distance to DRC is quiet long for boats without engines (which are mostly used in Kitebere). It is therefore common that patients die along the way in transit to DRC or Ntoroko.

According to the community, the most common disease in the area is malaria while other diseases include bilharzia, typhoid, diarrhoea, cholera, HIV/AIDS, dysentery and pregnancy complications among pregnant women.

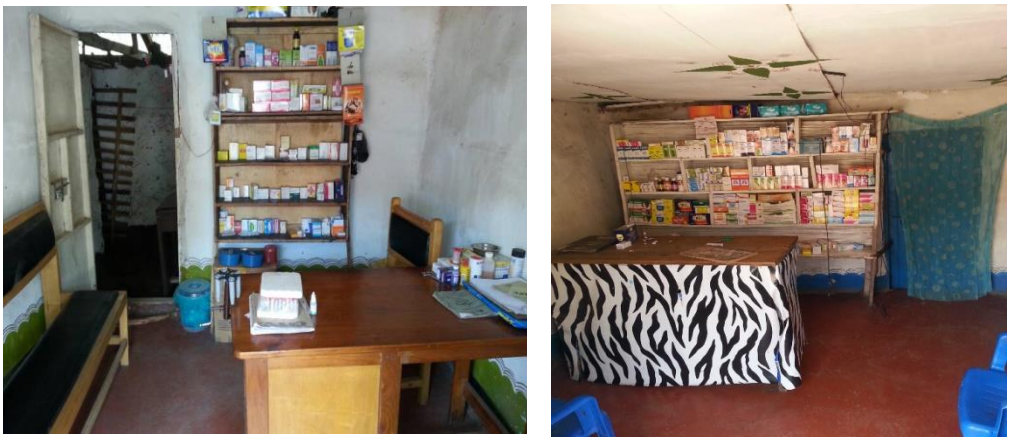


Plate 4: Status of drug shops in Kitebere landing site

3.2 Research Design

In this study, both quantitative and qualitative designs were used. The cross-sectional research design and descriptive survey research design were used to collect data from the participants. The survey was used to collect information about people's perceptions, attitudes, opinions, habits, values or any social issues (Cresswell, 1994) and various methods of WM employed by the people of Kitebere. The survey design facilitates the collection of data that provides a detailed description of phenomena, group or community as they naturally occur. The research assistants used the surveys to collect data from households within the study area, and household heads found in a particular household were purposively selected and interviewed in their native language to ensure that the participants understood the context and questions being asked. Where the household head was absent, the next of kin or the eldest individual was interviewed. The descriptive survey design was very effective since all the participants were given equal opportunity to respond to the questions without any bias.

In this study, quantitative data were collected. Quantitative data is data that is presented in numerical values from which statistical inferences are made. This was important in collecting numeric data, for example the number of participants who perceived waste management as a major problem in the study area, among others.

Cross-sectional research design was also used to collect data on the types of waste generated in the area including the various waste management practices employed in the study area.

3.3 Sampling procedure

The study area has a total population of 3,158 residents and a total number of 723 households (DDP, 2014). The research chose to use the number of households in this study and only interview household heads in order to get their opinion on SWM including generation and management practices. In order to have a fair and equal representation of the participants from each household, the simple random sampling method was used to select households for the study. The following steps were undertaken to arrive at the required sample size;

3.4 Determining the number of households

Statistics were obtained from the district development plan 2014, and the households lists were obtained from the local council 1 offices. The sampling frame was N=723

3.4.1 Choosing the sample size

The sample size was chosen with limitations of the researcher's budget and the time available to distribute questionnaires to the participants. The researcher chose sample size of 100 households (n=100).

3.4.2 Acquiring lists of households and assigning units

The researcher presented an introductory letter from the university to the area local council chairman to obtain data on households in the study area. To select a sample of 100 households, the researcher identified all the 723 households through transect walks within the community and verified the number in the list.

3.4.3 Finding random numbers

Since the sampling frame was manageable, lottering method of sampling was used where households were assigned numbers from 1-723. The numbers were mixed thoroughly in a bowel and 100 assigned numbers were picked randomly. The households selected through simple random sampling where surveyed during the study.

3.4.4 Selection/recruitment of research assistants

Purposive selection was used to select research assistants from Kitebere and was based on the level of education. All research assistants (8) selected were university graduates with the ability to interpret the questionnaires into their local language. The research assistants were supervised by a sociologist and a chemist.

They were trained to collect data on the first day before setting off to the field. Individual assessment and evaluation of the individual research assistant was done to ensure that quality data was collected.

Questionnaires were administered and translated to the native local language by the research assistants. Filling of the questionnaires took approximately ten (10) minutes. The participants filled the questionnaires individually and where they would not write or read, the research assistants read out the questionnaire in their local language, and their opinions were captured by filing in the questionnaire.

3.5 Target Population

The target population of the study comprised Kitebere landing site residents. The study focused on total numbers of 100 household heads who were considered for this study though only 95 household heads responded and were sampled. Kagadi Local Government technical staff formed part of the key informants for the study.

3.6 Data collection methods and tools

The study used the following types of data collection methods and tools;

3.6.1 Survey

Structured questionnaires were administered during the study to the households to collect information about perceptions, waste management practices, impacts, wastes generated and attitudes, or behaviours. It is an economical way of accumulating information and has a wide coverage. It is economical both for the researcher and for the participant in time, effort and cost. The cost of conducting the study with the help of the questionnaire method is very low as compared to other tools. Besides it is the best way of collect information on people's perceptions, attitudes and behaviour.

3.6.2 Focus group discussion (FGD)

Focus group guides were used to collect data from both women and men. Two gendered FGDs were held among fishermen, fish mongers and boat owners. Information regarding waste collection and disposal practices in the market area and general community were collected. The interviewer asked questions and the group discussed in details. The research assistant took the responsibility for taking minutes of the discussions.

Each focus group discussions took thirty minutes during which the researcher probed and prompted the participants to exhaustively understand how the community perceived issues related to WM at the landing site.

Plate 5: Women during focus group discussion

3.6.3 Key informant interview

Semi structured questions were administered to key informants including District departments, local councils, health inspectors, traders and area councilors. Key data that were collected included existence of Environment Education (EE). Traders were selected purposively because they are the greatest drivers of waste generation in Kitebere landing site. Accordingly, health inspectors were interviewed to collected data on how EE has impacted on the mindset change on waste management.

3.6.4 Transect walks

Transect walks or guided community walks were conducted with the guide of the area councilor. The purpose of the transect walks was to observe WM practices and types of wastes generated.

Additionally, a handheld camera was used to capture the status of open defecation, waste in the drainage channels, makeshift toilets and urinals.

GPS was also used to capture locations of dumpsites, toilets and urinals including their distance from the open water. Additionally, the GPS was used to record coordinates for water sampling points i.e drainage channels and the lake.

3.6.5 Characterisation of solid wastes

In order to characterise the solid wastes generated in Kitebere landing site, a detailed survey of the area was undertaken through transect walks to observe the different wastes generated within the homesteads. Solid wastes were collected from different zones/dump sites and drainages, i.e., residential, commercial and mixed zone. From the dump sites, wastes characterisation was done through observing the different wastes at the surface. A 0.5m hole was dug through the hip to collect compost and other solid wastes for characterisation. Samples were picked from four dump sites of 2kgs each in polythene bags. The total quantity of wastes collected, were thoroughly mixed and sorted for characterisation.

3.6.6 Water quality sampling procedure

In environmental monitoring, information from chemical, biological and physical characteristics is used to evaluate the quality of an environment. The water's chemical composition plays a fundamental role for the biota living in it. In turn, it is influenced by other factors and tends to fluctuate or vary within different temporal and spatial scales.

Schedule

Sample collection took place between February (dry season) and May 2019 (rainy season) and was preceded by a week of preparative work during which all locations were visited. Coordinates of the sampling locations were registered with a GPS device. Field work was alternated with laboratory work to ensure that the physicochemical parameters samples are processed within maximum one day after sampling. For microbiology, samples were prepared using membrane flirtation methods. Samples were filtered and transferred to filtration units and kept in an incubator for 15 hours. This is important to prevent samples from degrading, i.e. chemical concentrations to change from true field concentrations, and macroinvertebrates to die and decompose. Within the same day, other physical characteristic like temperature, EC, turbidity,

TSS, DO, temperature, DS taken and recorded. Nutrient parameters ie ammonium (NH4), nitrite (NO2), nitrate (NO3) and phosphate (PO_4) were taken to the laboratory for analysis.

3.6.6.1 Chemical Oxygen Demand (COD)

Chemical oxygen demand (COD) is the amount of oxygen required to completely oxidize the organic matter in waste water by use of a strong oxidant and to convert it to carbon dioxide and water. Potassium dichromate was used in this test because of its superior oxidizing ability. A known quantity of water sample was mixed with a known quantity of standard solution of potassium dichromate (K2Cr2O7) and the mixture heated. The organic matter was oxidized by the potassium chromate in the presence of sulphuric acid (H2SO4) and the oxygen used in oxidizing the water was determined.

3.6.6.2 Biochemical Oxygen Demand (BOD)

Biochemical oxygen demand (BOD) was determined by conventional methods according to Association of Official Analytical Chemists (AOAC), 2002. A sample of the solution (50 ml) was placed in a 500 ml BOD bottle and filled to the mark with previously prepared dilution water. A blank solution of the dilution water was similarly prepared and placed in two BOD bottles. A control solution without dilution water was also prepared and placed in a BOD bottle.

The bottles were stoppered, sealed and incubated for five days at room temperature. BOD was calculated from the relation: BOD= (D1-D2)/P, where D1= dissolved oxygen 15 minutes after preparation, D2= dissolved oxygen in diluted sample after incubation and P= amount of sample used.

3.6.6.3 Bacteriology

Membrane filtration method

A known volume of sample passed through filtration media cellulose ester membrane with a diameter of 47mmeter

The pore size of the membrane allows water and restrain suspended particles.

The membrane is placed in peri dish with the lauryl membrane sulphate broth media saturated in absorbent membrane pad.

The samples are incubated at an appropriate temperature.37^{O}C or 44^{O}C for 15 hours to allow the replication of the indicator organisms. Visually identifiable colonies are formed and counted, and the results are expressed in numbers of "colony forming units" (CFU) per 100ml of original sample.

Plate 6 Collect of waste water samples form drainage channels

Plate 6 (a) and (b) depict the process of collecting waste water samples from drainage channels from within the community draining directing in the lake.

Plate 7 Collection of lake water samples and preparing samples for analysis

Plate 7 (1) shows the research team preparing to pick water samples from the lake and measuring the physical parameters using the multiprobe. Plate 7 (2) shows preparation of collected water samples for the analysis of microbes in the samples.

3.6.7 Document review

Secondary data from archival sources, books, articles, reports, internet, newspapers, journals among others were reviewed. The data reviewed was related to environmental health, public health and solid waste management in communities in regards to their perceptions and practices.

3.7 Research/data collection procedure

During data collection, an introduction letter was obtained from the University, department of Biology introducing the researcher to the study area. The introduction letter was distributed at the district to the Chief Administrative Officer, the Environment Officer, District Community Development Officer and District Health Officer. This was undertaken to ease obtaining and collecting data at the district level. At the lower government level, a copy was also given to the sub-county chief, Ndaiga Health center II administrator and the area local council 1 introducing the research team to the community.

Data collection was carried out in the month of February, 2019 (dry season) and month of May 2019 (rainy season). This was mainly to collect samples on water and effluent quality. Perceptions and practices of the community towards waste management were only conducted in the month of February. The research used two research assistants (one Sociologist from Makerere University, a Biologist from Kyambogo University as well as eight graduates selected purposively from the community). The above procedures were undertaken to collect data to meet the specific objectives of the study;

3.8 Data Analysis

Data analysis refers to examining what has been collected in a research and making deductions and inferences (Kombo & Tromp, 2006). Quantitative data from residents was analysed using SPSS to produce frequencies, graphs, pie-charts and percentages. Qualitative data from interviews and observation was analysed and interpreted into themes by comparing responses from individual respondents, and meanings established to lay the foundation of codification. Creswell (1994) states that thematic analysis categorises related topics, and major concepts or themes are identified to produce rich deep description of the phenomena being studied. Kombo & Tromp (2006) state that qualitative data such as finding out views of respondents on a certain issue are not always computable by arithmetic relations: the responses were categorised into various classes and identifying patterns among the categories. The purpose of interviewing was to find out what is in and on someone else's mind (Creswell, 1994).

3.8.1 Surveys

Data obtained using the questionnaires were entered into excel, cleaned and transferred to SPSS for analysis. Variables were entered into the SPSS, and the questions and responses were

captured in numbers of 1-6. A mixture of descriptive statistics and graphs were used. Chi square statistics were also used to analyse and compare the significant difference between the correspondents.

3.8.2 Focus group discussions (FGD)

Data obtained from the FGD were recorded as detailed notes. In certain cases, a tape recorder was used. For this data, a simple descriptive narrative used to analyse the data. The frequency with which an idea or description appeared was used to interpret the importance or emphasis of the issue.

3.8.3 Document analysis

Document analysis was undertaken as described by (Bowen, 2009). Document analysis is a form of qualitative research in which documents are interpreted by the researcher to give voice and meaning around an assessment topic (Bowen, 2009). Analysing documents incorporates coding content into themes similar to how focus group or interview transcripts are analysed (Bowen, 2009). A rubric can also be used to grade or score document.

In order to seek convergence and corroboration, qualitative researchers usually use at least two resources through using different data sources and methods. The purpose of triangulating is to provide a confluence of evidence that breeds credibility (Bowen, 2009). Corroborating findings across data sets can reduce the impact of potential bias by examining information collected through different methods.

3.8.4 Transect walks and observations

The findings were documented and the data collected was analysed through descriptive narrative.

A geographical information system ArcGIS mapping software system was used to map out the unofficial temporary dumping sites. The location points for each temporary storage site were recorded using a geographical positioning system (GPS). The stored data on the GPS captured were in Universal Transverse Mercator (UTM) readings.

3.8.5 Water quality analysis

Sample collection and preservation procedures are based on the Uganda Standards US 201, Drinking (potable) water, (UNBS 2008). On-site measurements were done with Horiba

multiparameter probes U-50 series), equipped with sensors for temperature, electric conductivity (EC), pH, dissolved oxygen (DO) and turbidity. The sensors were calibrated weekly with commercially available standard solutions. On site, the measurements were done in a sample inside the lake water by dipping the multiprobe to a depth of 0.8m at the shores and 6.32m from 20m to 220m in the open waters.

For variables that could not be measured in the field, especially waste water from drainage channels, water samples were collected for analysis in the laboratory at the National Reference laboratory in Entebbe. This was done for ammonium (NH4), nitrite (NO2), nitrate (NO3), phosphate (PO_4) COD and BOD. The samples were analyzed spectrophotometrically, using Hach Lange® cuvette tests within 24h of sampling. E.coli, and Total coliform were also analyzed. Visually identifiable colonies are formed and counted, and the results are expressed in numbers of "colony forming units" (CFU) per 100ml of original sample.

Each of the parameters were analyzed against the national effluents standards

3.9 Ethical considerations

The following ethical considerations were put into place for the research period:

1. The dignity and wellbeing of the community and correspondents were protected at all times. The study did not infringe on participants' privacy and their anonymity was paramount at all times

2. Voluntary participation of respondents in the research was important. Participants had the rights to withdraw from the study at any stage if they wished to do so.

3. Participants participated on the basis of informed consent.Participants were informed about the nature of the study. All of the aspects of the research that were likely to affect their willingness to participate were disclosed.

4. The use of offensive, discriminatory, or other unacceptable language was avoided in the formulation of Questionnaire/Interview/Focus group questions.

5. Acknowledgement of works of other authors used in any part of the dissertation with the use of APA 6th edition referencing system according to the Dissertation Handbook was adhered to.

CHAPTER FOUR: PRESENTATION OF RESEARCH FINDINGS

4.0 Introduction

Chapter four presents the findings of the research in terms of people's perceptions towards solid waste management, the various types of wastes generated, residents' practices and impacts and the role of environment awareness in addressing waste management issues. The main aim of the research was to assess community perceptions and practices towards solid waste management in Kitebere landing site. The specific research questions that were used to achieve this aim were;(1)What are the people's perceptions about waste management, (2) What are the types of wastes generated and the various waste management practices in Kitebere landing site?, (3), How has poor waste management at the landing site affected the quality of water in the lake?

4.1 The first objective was set to assess the perceptions of the people of Kitebere towards waste management

In order to achieve the first objective, background characteristics of the study population had to first be assessed. In view of this, the findings on these variables are presented below;

4.1.1 Background characteristics

The data collected from the residents provided the background characteristics of the study population which included gender, age categories, level of education and household size. The rationale for collecting this data was to identify the socio-demographic characteristics of the people involved in waste management in Kitebere landing site. In view of this, the findings on these variables are presented in table 6 below;

Table 4-1: showing demographic characteristics of the participants

Demographic characteristics	**Frequency**	**Percent (%)**
Gender		
Male	31	32.6
Female	64	67.4
Age categories		
18-35 years	48	50.5

36-49years	32	33.7
50-60 years	15	15.8
Level of education		
Primary	47	49.5
secondary	26	27.4
Tertiary	3	3.2
None	19	20.0
Household size		
1-5	37	38.9
6-10	42	44.2
10-15	9	9.5
15-20	7	7.4
Household monthly income		
Less than 100,000	46	48.4
100,000-400,000	30	31.6
More than 400,000	19	20.0

Source: Author, 2019

The results from Table 4.1 indicate that out of the 95 participants, females constituted the majority 67.4% (n=64) and males constituted 32.6% (n=31). The age of participants ranged from 18 to 60 years with the mean age being 36.7 implying that the participants were old enough to give well thought out responses to the study questions. Overall, participants within the age cohorts 18-35 constituted the majority 50.5% (n=48) and this can be attributed to the fact that about 80% of the Ugandan population are youth. There is a perception that younger people in the study area generate more waste than the old.

The study also revealed that majority 49.5% (n=47) of the Participants reported that they had attained primary education as their highest level of education, about 27.4% of the participants reported that they had attained secondary education as their highest level of education and 20.0% (n=19) of the participants reported that they had not attained any level of education. Only 3.2% of the participants reported that they had attained tertiary level of education. The low education level can be attributed to the high school dropouts at the landing site because of need for quick money. One can infer from the results of the findings above that the educational status of most of the respondents is low. Therefore, most of them may not have much awareness of the effects of poor solid waste disposal to their health and the environment.

The household size in Kitebere range between 6-10 occupants constituting the 44.2% while 15-20 constituted the lowest with 7.4%. According to the study, it was revealed that a household between 6-10 generated the most amount of wastes. It was revealed that 48.4% of households in the study are involved in income generating activities and therefore it can infer that majority can afford to pay for waste management services.

4.1.2 Gender perceptions and cultural beliefs towards waste management

From table 4.1 above, it can be seen that out of the 95 participants, females constituted the majority 67.4% (n=64) and males constituted 32.6% (n=31). The selection of more females than males in a study of this nature was influenced by the common knowledge that in the African traditional setting, WM in a household is the responsibility of the females.

In order to capture perceptions of the people towards waste management in Kitebere landing site, two gender focus group discussions were held. During the discussions, the community was asked questions in regards to how the perceived issues related to waste management in the area.

Table 5-2: Perceptions of the gender focus group

Questions	**Response**
What are your perceptions towards WM	"There has been no awareness and sensitisation towards WM therefore we don't know the implications," *FGD men* "Our landlords give houses without toilets therefore we prefer using bushes as toilets or

when we go fishing, we use the lake,*' FDG men*

"Most of the residents do not have enough land to construct dumpsites in their backyard therefore they litter wastes anywhere,' *FGD women*

"Majority of the participants said that the state of WM in the area is very poor and this has caused death, and cholera in the area.' *FDG women.* It should be noted however that the same response was aired out by the FDG for men therefore the concern is cross cutting.

"Most of the residents have a perception that WM is entirely the government's responsibility since they pay tax for the services.' This response was cross cutting among the FDG for both women and men.

"Most of the resident perceive that poor leadership is the main cause of poor waste management in the area,' *FDG men*

"Others perceive that cultural beliefs are the main issues related to WM' for example;

"Pregnant women are not encouraged to use toilets because they believe their unborn babies may fall in the pit,'

"Fishermen believe that when you use the toilet, you do not capture fish,'

"Children may fall in the toilet therefore they

use open fields.' These responses were cross cutting among the two genders.

4.1.3 Community contributions towards waste management services

Community contributions towards waste management services at Kitebere landing site is important for both residents and service providers in waste management programmes. During the study, the researcher asked the participants whether they would be willing to pay for waste management services. A significant majority 70.4% of the participants reported that they would not be willing to pay for the services. Only 29.6% of the participants reported that they would be willing to pay.

By disaggregating the data by household monthly income, it was discovered that majority of the participants who were not willing to pay for waste management earned less than 100,000/=. This was statistically insignificant at 5% level of significance (X^2=2.243[a], P>0.05).

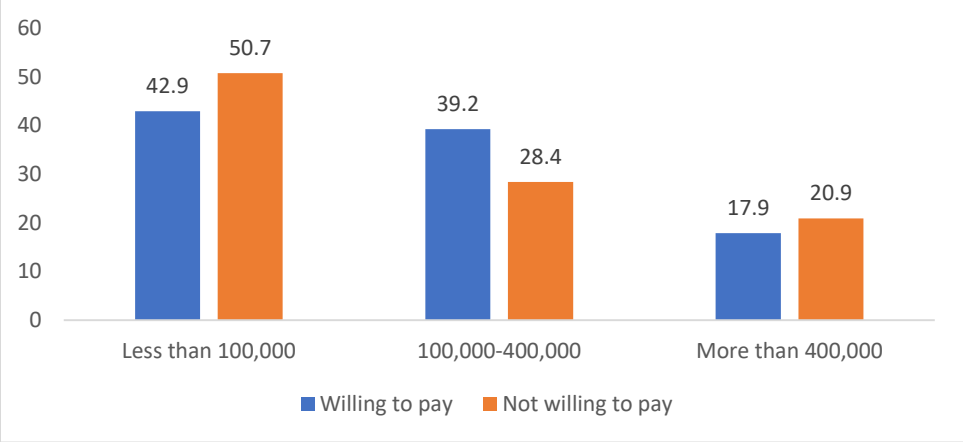


Figure 4-1: Community contribution towards waste management services

Source: Author, 2019

4.1.4 Participants' participation in waste management awareness and sensitisation campaigns

During the study, the researcher was interested in knowing how often the awareness campaigns are carried out in the study area. It was revealed that the campaigns are carried out three times a year constituting 42.6% (n=20) of the correspondents. 34% constituted annual campaigns while Bi-annually was the least with 23.4%.

Table 6: Showing how often awareness campaigns are carried out

How often awareness campaigns are carried out	Frequency	Percent(%)
Annually	16	34.0
Bi-annually	11	23.4
Three times in a year	20	42.6
Total	**47**	**100**

Source: Author, 2019

4.1.5 Methods used in sensitisation

During the survey, it was revealed that majority 85.1% of the participants reported that community meetings were the most common method used to raise awareness on waste and environmental management at the landing site. This is followed by 10.6% door to door campaigns. The other means of reaching out to the people on waste management awareness are radio talk shows, poems and debates.

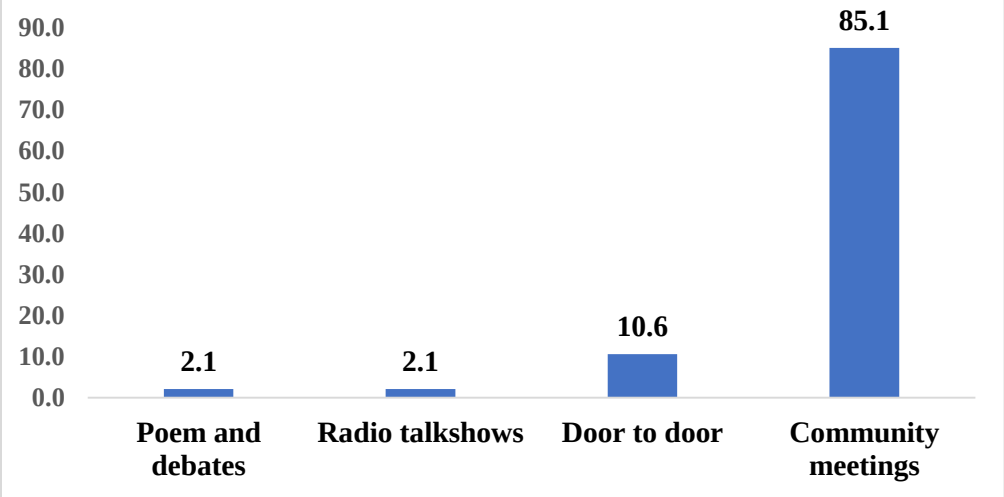


Figure 2: The methods used for sensitising community on WM

Source: Author, 2019

4.1.6 The effectiveness of the awareness campaigns

According to the participants, 54% said the campaigns have not caused any improvement on the way residents manage their wastes while 32% said there has been an improvement.

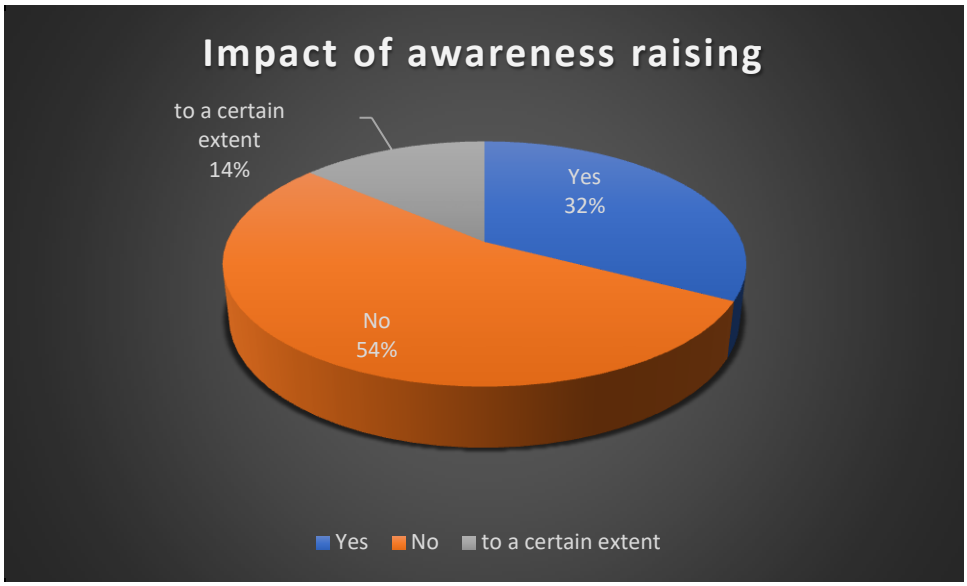


Figure 3: Impact of awareness rising on waste management

Source: Author, 2019

4.1.7 Hinderances in effective awareness campaigns

47% of the participants interviewed said the greatest challenge they encounter is lack of government support, followed by ignorance of the residents towards waste management.

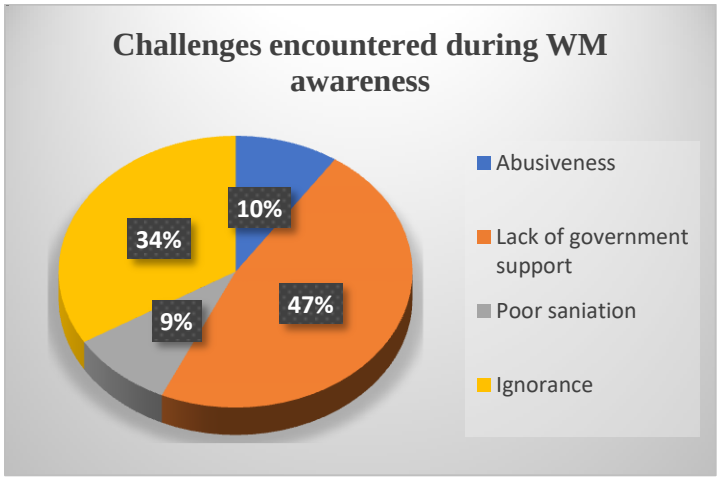


Figure 4: Challenges encountered during awareness in raising

Source: Author, 2019

4.1.8 People's perceptions on who is responsible for waste management in the community

During the study, the researcher was interested in knowing people's perceptions on who is responsible for waste management in their community. It was revealed that majority 74.7% (n=71) of the participants reported that it's the responsibility of government to manage waste in the community. This finding implies that majority of the people rely on government to manage waste in the community. This was followed by 13.7% (n=13) of the participants who reported that they think it is the resident's responsibility to manage waste in the community. It was further revealed that about 10.5% (n=10) of the participants think that it's the responsibility of Non-Governmental Organisations to manage waste in the community. However, 1.1% of the participants reported that they do not know who is responsible for waste management in the community.

From the qualitative analysis, key informants also claimed that it's the responsibility of the government to manage waste in the community since it even collects revenue from the people. One of the participants said, *"Sub counties are funded and paid by the government to manage waste in the community, besides they also collect revenue from fishermen that would pay some people to clean."* Another key informant said that "*It is the sole responsibility of government to keep us in a clean and healthy environment because they collect tax from us."*

Table 4-4: Showing people's perceptions on who is responsible for waste management in the community

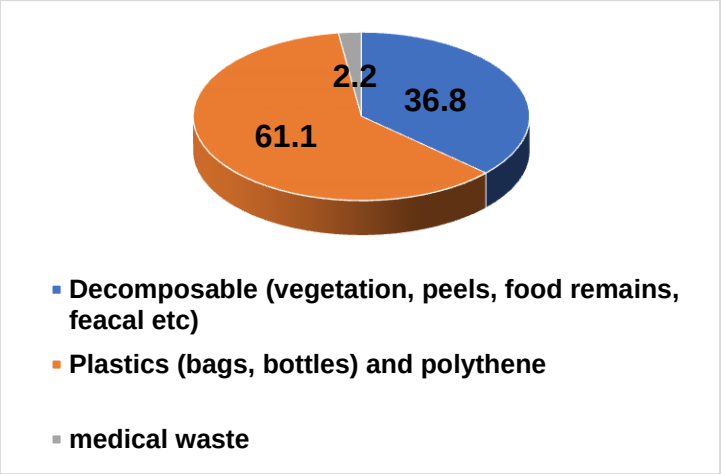
People's perceptions on who is responsible for waste management in the community	**Frequency**	**Percent(%)**
Government	71	74.7
I don't know	1	1.1
Myself or Community	13	13.7
NGOs	10	10.5
Total	**95**	**100**

Source: Author, 2019

4.2 The second objective was set out to assess the waste management practices at Kitebere community

4.2.1 Types of wastes generated

During the study, Participants were asked the most common waste generated at Kitebere landing site. From the table below, it was revealed that the most generated waste in Kitebere landing site are plastics which includes polythene papers, bottles and bags as reported by 61.1% of the respondents. This was followed by 36.8% of the respondents who reported that the most common generated waste at Kitebere landing site is decomposable materials which included vegetation, peels, food remains, human feaces and many others. About 2.2% of the participants reported medical wastes as the most common generated waste at Kitebere landing site.



Source: Author, 2019

Figure 4-2: Shows the most common types of wastes generated in Kitebere landing site

The following common wastes generated in the study were observed within the community backyards and from four (4) different dumpsites. The table below presents the findings of the observation from both the dumpsites and within the community.

Table 4-5: Types of wastes generated in the study area

	Dumpsite 1 **GPS coordinates** **E 0237016** **N 0120430**	**Dumpsite 2** **GPS coordinates** **E 0237182** **N 0120797**	**Dumpsite 3** **GPS coordinates** **E 0237151**	**Dumpsite 4** **GPS coordinates** **E 0237074**	**Community backyard**

			N 0120785	**N 0120350**	
Wastes generated	Polythene bags, plastics, fishing nets, charcoal, fish gills, electronic wastes, mosquito nets, paper, feaces, food wastes (NB the most prominent waste generated at the surface is charcoal and polythene at the bottom).	Fishing nets, threads, bones, plastic bottles, tins, glass, medical wastes, chicken feathers, clothes, metal, sack bags, rubber, polythene bags, feaces, goose wire, charcoal, construction wires (NB the most common wastes were observed as polythene bags and bottles)	Polythene, charcoal, seeds, human hair, gills scales, fishing nets, condoms, threads, clothes, rubber, feaces, construction materials like DPC polythene, fishing nets. (NB the most prominent waste generated here was fishing nets	Chicken feathers, plastics bottles, bags, paper, medical wastes, feaces, mosquito nets, fishing nets, jerricans, clothes. (NB the most common waste is feaces)	Polythene bags, plastic bottles, food remains, feaces, urine, grey water from bathrooms, fish intestines, gills, scales, fishing nets.

Source: Author, 2019

Non-biodegradable wastes were observed to be dominant in all the four dumpsites. Only fecal matter, food remains, vegetable peeling and fish gut were observed as decomposable waste in the dump sites with minimal qualities as compared to non-biodegradable.

Plate 8: Observable wastes generated in the study area

Plate 8 above shows various waste generated in the area. They include plastic bottles, containers, fish nets, polythene bags (kavera), rubbers, feaces, metals, needles, chicken feathers, fish scales and guts among others.

4.2.2 Waste management practices

4.2.2.1 Handling or disposing the wastes generated

The issue of handling or disposing waste varies from person to person and household to household, hence the researcher asked the participants to indicate the different ways in which they dispose wastes. The figure below revealed that majority 42.1% of the respondents reported that they burn waste. This was closely followed by 32.4% who reported that they throw wastes in the lake. About 10.5% of the respondents reported that they throw the waste in the bush.

Waste management in Kitebere landing site

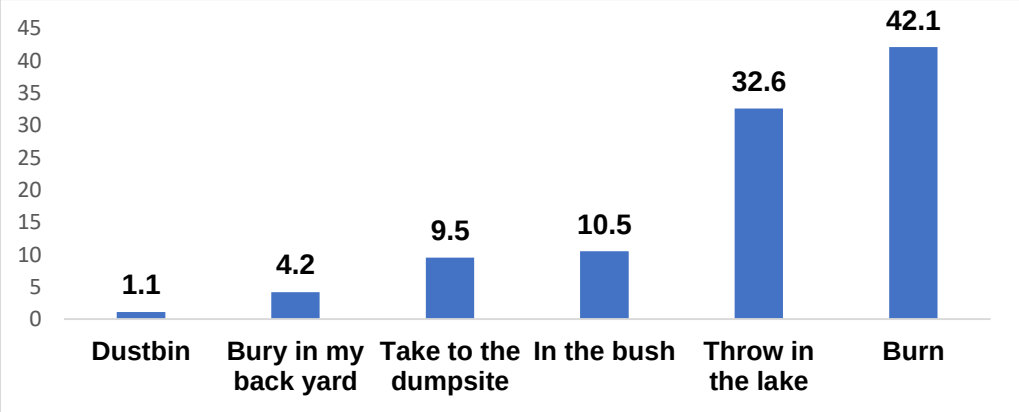


Figure 4-3: Shows waste management practices in Kitebere landing site

Source: Author, 2019

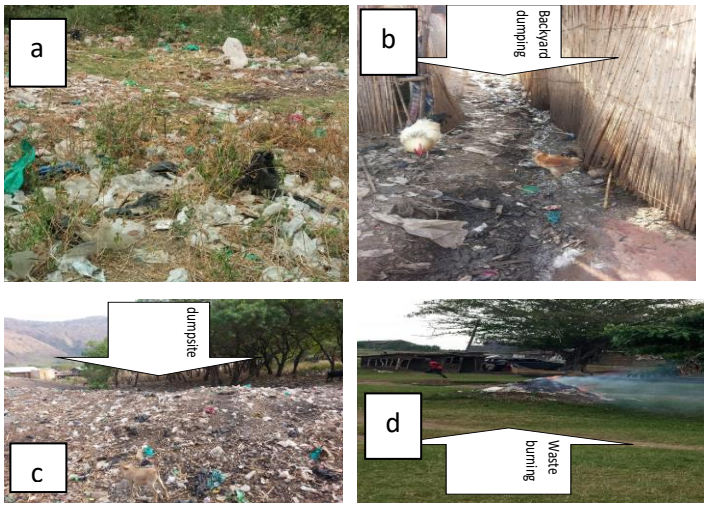


Plate 9: Observable waste management practices in the study area

Plate 9 (a) shows indiscriminate dumping within the community, (b) shows dumping in the backyards as a dispose method in the area, (c) shows dumping of wastes in a gazzeted dump site however only those within a 5m radius dump at the site and the majority practice discriminate dumping and plate (d) shows burning of waste as a management practice. Majority of the community prefer burning as a management practice because it's cheap and does not require any manpower.

During the field visit, a number of poor waste disposal practices were observed along the shores. Urinals draining directly into the lake were observed; pit latrines dug up to the water tables were observed and recorded.

Twelve (12) urinals were observed to be draining urine into the lake. They are located 10m from the lake. Similarly, five shallow pit latrines were also observed with fecal matter leaching directly into the lake. Note that the study area only has less than 20 toilets and most of the fecal wastes were observed in open field areas, dumpsites and in the lake.

Table 4-6: Shows the location of urinals and toilets draining directly to the lake

Urinal/toilets	GPS coordinates	Distance to the lake	Pictorials

Urinal 1	E 023706 N 0120645	10m	
Urinal 2	E 0237072 N 0120675	6m	
Pit latrine 3	E 0237099 N 0120733	7m (1m deep)	

Urinal 5	E 0237102 N 0120758	5m	
Open defecation field	E 0237123 N 0120789	1. acre	

4.1.2 Drivers of poor WM practices

Participants were asked to state drivers or reasons for poor waste management practices and the following results were gathered;

According to the participants, 67% said nothing is wrong with waste management practices, 23% said it is band wagon. From the results below, one can conclude that the residents in the study area are totally ignorant about proper waste management practices.

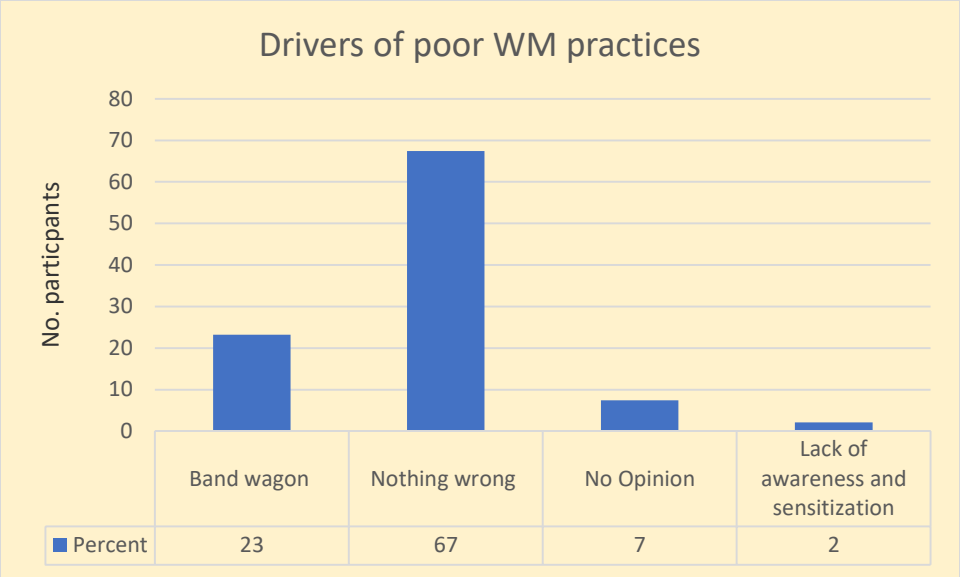


Figure 4-4: Drivers/reasons for poor waste management practices

Source: Author, 2019

4.3 The third objective was set to investigate the effects of poor waste management on the quality of water in the lake.

4.3.1 Effects of poor waste management on water quality

During sample collection, five main effluent sources were considered for sampling. The following sites with GPS coordinates were considered.

Table 4-7. Shows coordinates of wastewater sample sites

Code	Sample site	**GPS coordinates**		**Description**
NOM	Near old market	0237054	0120480	Drainage ponded with waste water drained from the old market
CK	Central Kitebere	0237118	0120609	Most of the urinal and household drainage draining into the lake
AS	Adege's shop	0237129	0120692	Ponded water from the shops, restaurants, clinics
VH	Video hall	0237100	0120528	A drainage through the video hall from homesteads
DS	Drainage	0237074	0120380	Drainage the acts a border of Kitebere village and

	at the shores			Sangoharo village, drains wastewater from the two villages into the lake

Source: field data 2019

4.3.1.1 Physical parameters

The physical parameters sampled included; EC, pH, Turb, and TSS.

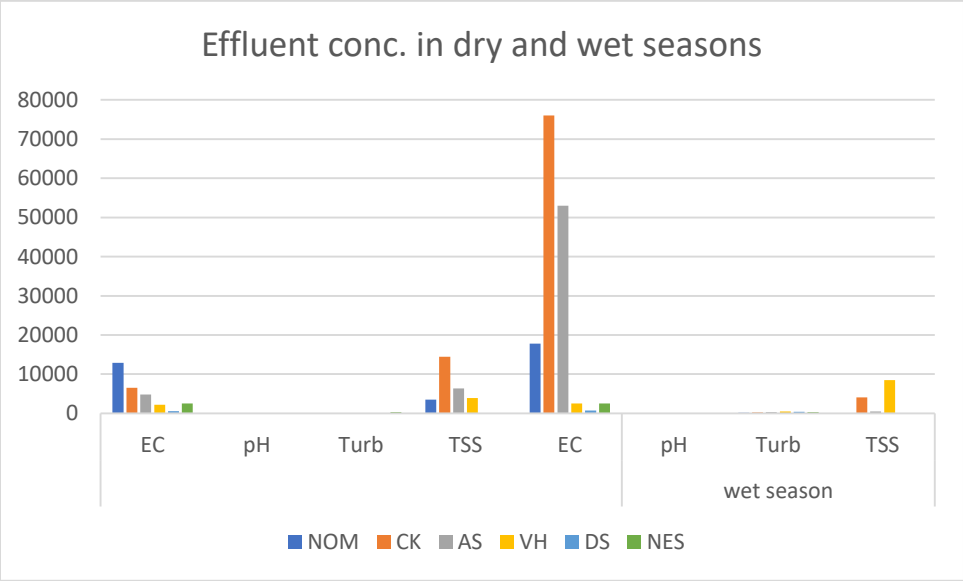


Figure 5. Effluent concentrations both in the dry and wet seasons

Source: Author, 2019

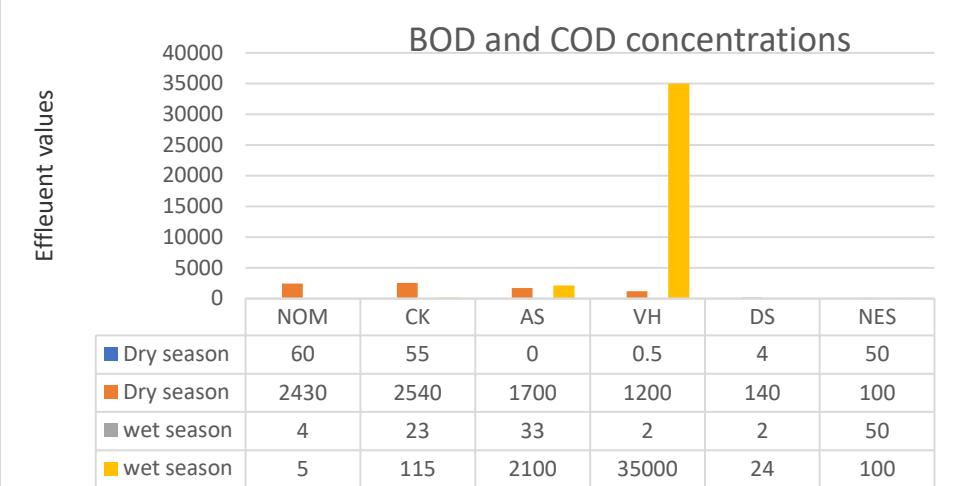
According the results, EC in the wet season had more values as compared to EC in the dry season, TSS in the dry season had more values as compared to that in the wet season. While all the other parameters were within permissible levels.

Key

Code	
NOM	Near old market
CK	Central Kitebere
AS	Adege's shop
VH	Video hall
DS	Drainage at the shores
NES	National Effluent standards

4.3.1.2 Bio-physicochemical parameters

The physicochemical parameters tested were BOD and COD and were tested against the National Effluent Standards (NFS).



	NOM	CK	AS	VH	DS	NES
Dry season	60	55	0	0.5	4	50
Dry season	2430	2540	1700	1200	140	100
wet season	4	23	33	2	2	50
wet season	5	115	2100	35000	24	100

Figure 6 BOD and COD values in the drainage channels collected both in dry and wet season

Source: Author, 2019

BOD in the dry season were within the permissible standards except sample NOM the had slightly higher values while all BOD in the wet season were within permissible standards. COD both in the dry and wet season were high compared to the standard values of 100mg/l.

Lake water quality analysis in dry and rainy season

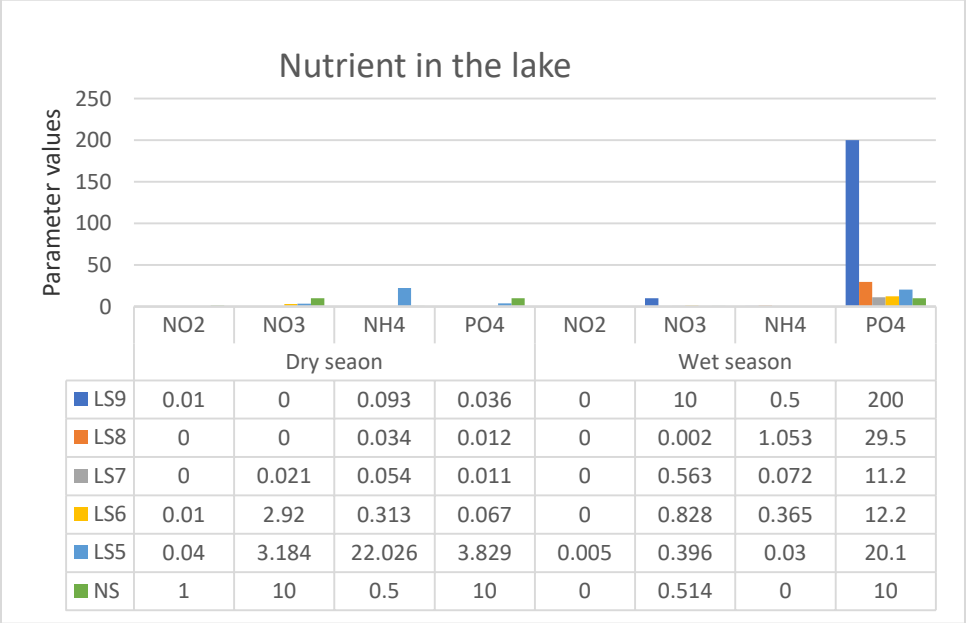
The water quality analysis was undertaken both in dry and rainy seasons, (month of February and May respectively) to analyze the concentration of pollutants in the lake as a result of poor waste management. This comparative analysis was used inform the research team on how much pollutants are in the lake during the dry season and in the rainy season. The participants said the prevalence of waterborne diseases are mainly in the rainy season therefore this analysis helped to inform the study of how much pollutants are in these seasons and explain the reason of high waterborne prevalence.

Each of the parameters was analyzed against the National Effluents' Standards (NFS). The main aim of these analyses was to determine the amount of E. coli and total coliform concentrations since these two parameters are the main causes of waterborne diseases.

Table 4-8. Coordinates of lake water sample points

Codes	Name	Description	GPS Coordinates		Depth(m)
LS9	Lake sample 9	Samples taken at the shores at a distance of 20m	0236907	0120373	0.8
LS8	Lake sample 8	Samples taken from 54.8m in the lake	0236835	0120498	6.32
LS7	Lake sample 7	Samples taken from 92.4m in the lake	0236893	0120426	6.32
LS6	Lake sample 6	Samples taken from 179.5m in the lake	0236701	0120597	6.32
LS5	Lake sample 5	Samples taken from 222.7m in the lake	0236545	0120756	6.32

4.3.1.3 Nutrient parameters sample results



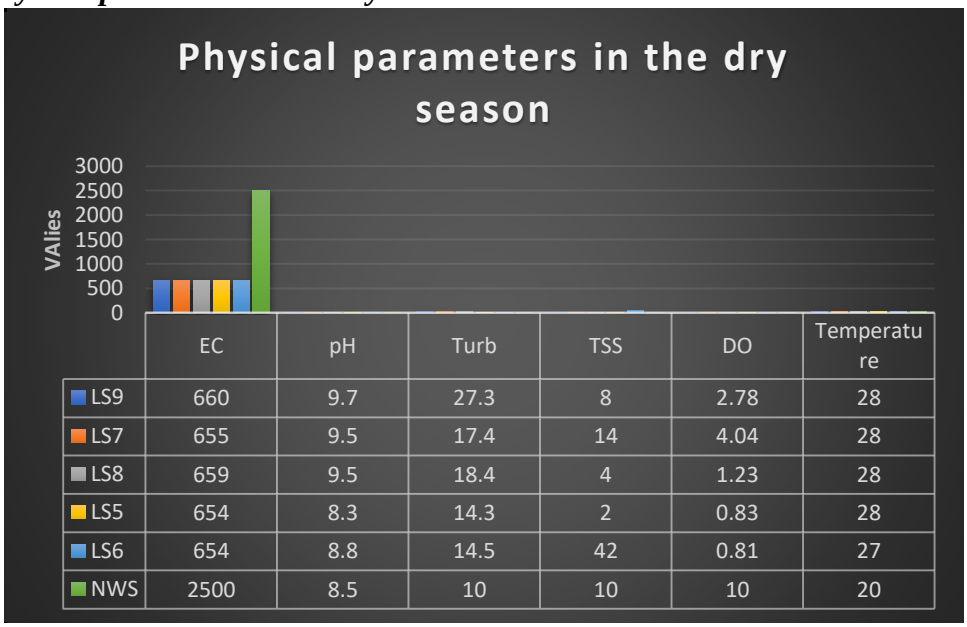
	NO2	NO3	NH4	PO4	NO2	NO3	NH4	PO4
	Dry seaon				Wet season			
LS9	0.01	0	0.093	0.036	0	10	0.5	200
LS8	0	0	0.034	0.012	0	0.002	1.053	29.5
LS7	0	0.021	0.054	0.011	0	0.563	0.072	11.2
LS6	0.01	2.92	0.313	0.067	0	0.828	0.365	12.2
LS5	0.04	3.184	22.026	3.829	0.005	0.396	0.03	20.1
NS	1	10	0.5	10	0	0.514	0	10

Figure 7. Nutrients results from both dry and wet season

Source: Author, 2019

All the nutrient parameters were within permissible levels however in the wet season, PO_4 were tested to have high values in the lake.

4.3.1.4 Physical parameters in the dry season



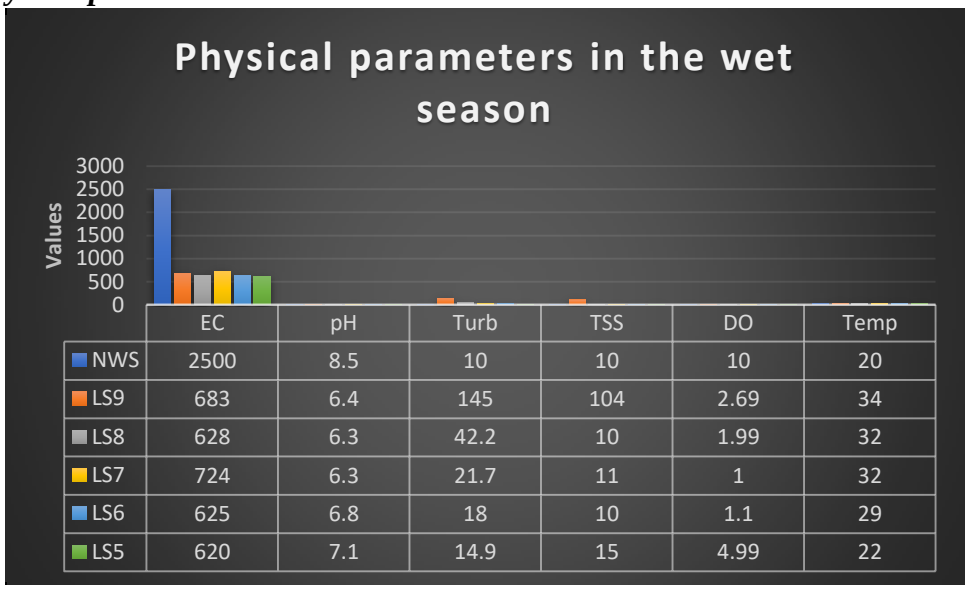
	EC	pH	Turb	TSS	DO	Temperature
LS9	660	9.7	27.3	8	2.78	28
LS7	655	9.5	17.4	14	4.04	28
LS8	659	9.5	18.4	4	1.23	28
LS5	654	8.3	14.3	2	0.83	28
LS6	654	8.8	14.5	42	0.81	27
NWS	2500	8.5	10	10	10	20

Figure 8. Physical parameters in the dry season

Source: Author, 2019

In the dry season, EC levels were within the set national standards, pH was skewed towards the alkaline values between 8.5 to 9.7, and DO was varying at different levels but within the standards.

4.3.1.5 Physical parameters in the wet season



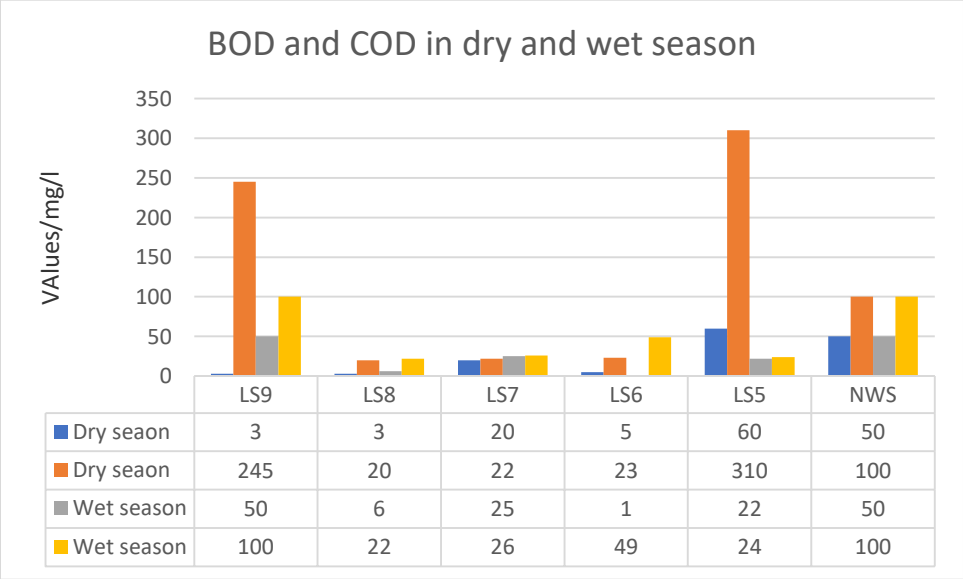
	EC	pH	Turb	TSS	DO	Temp
NWS	2500	8.5	10	10	10	20
LS9	683	6.4	145	104	2.69	34
LS8	628	6.3	42.2	10	1.99	32
LS7	724	6.3	21.7	11	1	32
LS6	625	6.8	18	10	1.1	29
LS5	620	7.1	14.9	15	4.99	22

Figure 9. Physical parameters in the wet season

Source: Author, 2019

EC and PH were within the standards, Turbidity in LS9 was high and the temperatures at all sampling points were high except for point LS5 that had a value of 22^{o}c.

4.3.1.6 Chemical parameters



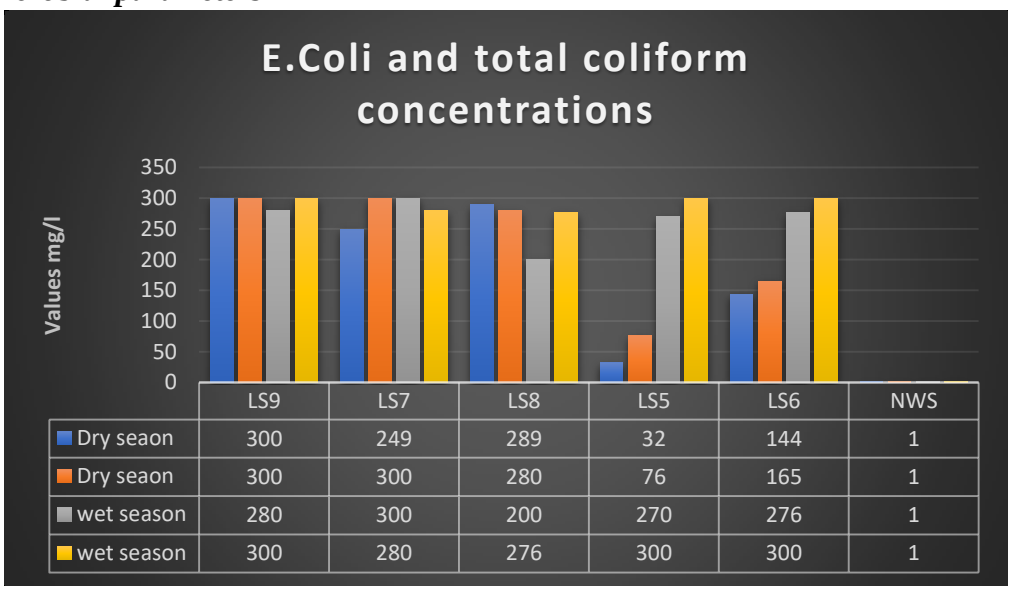
	LS9	LS8	LS7	LS6	LS5	NWS
Dry seaon	3	3	20	5	60	50
Dry seaon	245	20	22	23	310	100
Wet season	50	6	25	1	22	50
Wet season	100	22	26	49	24	100

Figure 10. BOD and COD both in the dry and wet season

Source: Author, 2019

BOD both in the dry and wet season had low values while COD in the dry had exceptional values at sample LS9 and LS5. In the wet season, COD were within range.

4.3.1.7 Microbial parameters



	LS9	LS7	LS8	LS5	LS6	NWS
Dry seaon	300	249	289	32	144	1
Dry seaon	300	300	280	76	165	1
wet season	280	300	200	270	276	1
wet season	300	280	276	300	300	1

Figure 11. E.coli and total coliform concentration in the lake

Key

LS9-Lake sample 9

LS7-Lake sample 7

LS8-Lake sample 8

LS5-Lake sample 5

LS6-Lake sample 6

NWS-National water standards

Source: Author, 2019

All the samples tested positive for both E.coli and total coliform both in the dry and wet season.

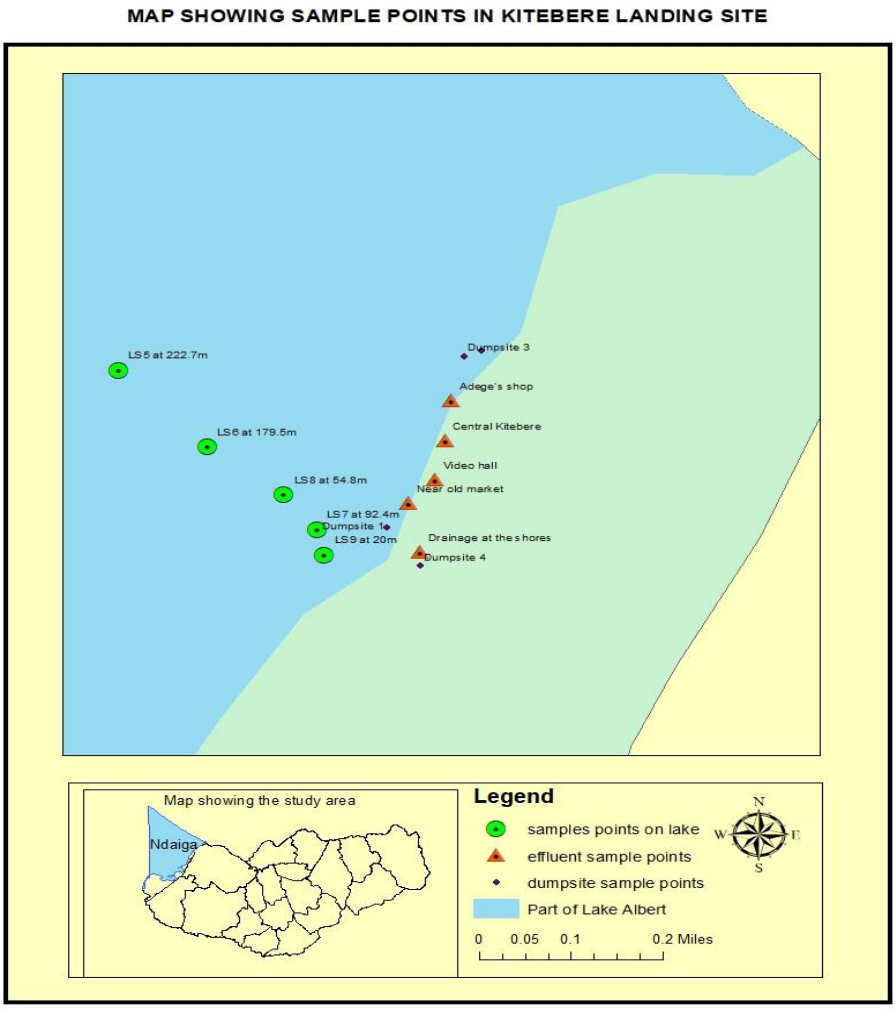


Figure 4-9: Map showing the sampled points (dumpsites, lake and drainage channels)

4.4 Summary of the Findings

Kitebere residents' perceptions and practices towards waste management were negative due to ignorance, lack of political will, lack of awareness and sensitisation. This is also in addition to inadequate land for waste dumping, cultural beliefs towards use of toilets, lack of proper solid waste management services and gazetted areas for waste collection and dumping in the entire village. People did not mind about the final disposal of waste resulting into indiscriminate dumping. The majority of the respondents perceived that it was the council's responsibility to keep public places clean and that residents had no role to play apart from keeping their homes clean. Lack of knowledge by residents on their role in solid waste management was also attributed to lack of awareness and sensitisation and this had a direct bearing on people's perception and practices towards proper waste management.

Environmental awareness (EA) was viewed as being important to bring about changed perceptions towards WM and to make people aware of their roles in solid waste management.

Regarding how EA could be used to try and improve the situation in the study area, the study revealed that continuous engagement with community, leaders and establishment of baseline data was important. Dissemination of information could be done through door to door engagements, radio talk shows, health talks, fliers, mega microphone announcements, community meetings and discussion methods.

The most common type of wastes generated in the study area was plastics in the categories of; polythene (*kavera)*, rubber, bags, fishing nets, bottles among others, followed by decomposable wastes in the categories of feaces, food remains, peelings, fish intestines, vegetables among others. These wastes have led to severe health related problems and the most common was cholera followed by typhoid due to how they handled their wastes. Majority of the community burnt their plastic and polythene wastes however the fecal was disposed in lakes and bushes. These in the long run are eroded into the lake which is their main source of water, leading to severe outbreaks of waterborne diseases especially cholera and typhoid.

In regards to water quality, all the waste water from urinals, feaces in the open fields and bushes are eroded into the lake either through wind erosion or water erosion causing the quality of water to greatly deteriorate. Therefore, the community still faces high risk of contracting waterborne diseases due to poor waste management.

CHAPTER FIVE: DISCUSSION OF THE RESULTS

5.0 Introduction

This chapter presents the discussion of the findings on the respondents' perception and practices towards waste management and its effects on water quality in the study area. The main of objective of the study and specific objectives are discussed in details in this chapter.

5.1 Perceptions

5.1.1 Gender perceptions and cultural beliefs towards waste management

From the findings, the study revealed that females constituted the majority 67.4% (n=64) and males constituted 32.6% (n=31). The selection of more females than males in a study of this nature was influenced by the common knowledge that in the African traditional setting, waste management in a household is the responsibility of the females. This was confirmed during gendered based focus group discussions where majority of the men did not know their roles in waste management. From the results obtained in the discussions, men said it was the responsibility of the women to manage household waste since their work is to look for food for the family. This finding is similar to a study done in India, Indonesia, the Philippines and Vietnam on the Role of Gender in Waste Management Commissioned by Ocean Conservancy, 2019. In this, it was found out that it is women who manage the waste in the households but men participate in the actual handing over to a formal waste collector or the disposal process. In the same source, the study revealed that the women in all the four countries are primarily, if not solely, responsible for managing household wastes whether it's mixed or segregated.

Similar to other studies conducted in urban settings by Trasias Mukama *et al. (2016),* solid waste management was primarily a responsibility of women and girls. This was further echoed in a study conducted by Lake Victoria Environment Management Program (LVEMP) 2005, where it was stated that the role of women in the management of waste at source is being encouraged.

Initiatives targeting improving solid waste management should therefore consider the dominant role played by women and girls in the management of solid wastes.

The study revealed that the public has not taken positive steps in solid waste management practices like source reduction, re-using, recycling or properly disposing of the portion that

cannot be reclaimed. Instead the public has for the most part maintained an "I don't care" attitude of generating as much garbage as possible unconscious of the implications.

The results show that residents had negative perceptions towards waste management due to a number of factors. This included lack of proper solid waste management system, lack of waste receptacles and awareness, lack of political will at village level, inadequate land, and cultural beliefs towards usage of sanitary facilities like toilets among others. This finding is similar to the finding reported by Oruonye *et.al* (2018) in Jalingo Metropolis, Nigeria which revealed that other causes of poor solid waste disposal include lack of good and enough infrastructures, non-implementation of existing environmental sanitation laws and regulations, irregular and unplanned dumping of solid wastes, and insufficient capital to manage solid wastes. There is an increasing trend of indiscriminate dumping of solid waste in Kitebere as in other major landing sites along the shores of Lake Albert. The perception of one's capability can be said to set a limit to what one can do and ultimately what could be achieved.

Majority of the participants as stated above believe that there is nothing wrong with the way they manage their waste, this implies that the community is at peace living with waste as part of them besides the consequences. Information gathered during focus group discussions shows the greatest percentage contributing to negative perceptions towards waste management is inadequate awareness, lack of toilets especially for rented houses.

It was also revealed during the study that cultural beliefs were the main reasons for the negative perceptions towards waste management. The following were some of the beliefs related to waste management;

Pregnant women are not encouraged to use toilets because they believe their unborn babies may fall in the pit, fishermen believe that when you use the toilet, you do not capture fish, children may fall in the toilet therefore they use open fields. This finding is similar to the finding found in an environment scoping report (2018) in Kitebere by Ministry of Water and Environment. In this report it was found out that the residents practice indiscriminate dumping, open defecation simply because of their cultural beliefs. This increasing trend is further made worse by the prevailing incidence of poverty, population explosion, poor governance and low level of environmental awareness. It is therefore argued that negative perceptions towards waste management are directly attributed to their cultural beliefs. Therefore, continuous awareness and

sensitisation of the community must be prioritised to change their mindset, attitudes and perceptions to proper SWM practices and embrace the use of toilets.

Perception on environment awareness and sensitization

Environmental awareness facilitates the acquisition of knowledge and skills and enables people to change their perceptions towards SWM. It helps people understand the harmful effects of their behaviours and highlight their roles and responsibilities in SWM. EA among the people would generate environmental concerns which could lead to the formation of groups concerned with how to protect the potentials of the environment and avoid or minimise the hazards of environmental pollution and degradation. Unfortunately, local government has not done well in educating the people of the study area on environmental sanitation hazards of indiscriminate solid waste dumping and management. Knowledge of waste minimisation, sorting and recycling can also be gained through EE. When people have the knowledge on waste handling and minimisation, become willing to solve environmental problems in their locality, then solid waste accumulation in undesignated areas would reduce. Kamara (2006), states that EE plays a critical role in enhancing movement upward along the waste management hierarchy from mere disposal through recycling and reuse to prevention. Kamara (2006) argues that if understanding of the connection between environmental awareness and education and people's health are well internalized, people's perception and attitude towards environmental protection are likely to improve. It is for this reason that Larijani (2010), states that it cannot be thought of achieving a sustainable way of life without an appropriate educational system designated to internalise the principles of sustainability in the life and work of the people.

Methods of sensitisation

During the survey, it was revealed that majority 85.1% of the participants reported that community meetings were the most common method used to raise awareness on waste and environmental management at the landing site. This followed by 10.6% of the respondents who received waste management awareness information through door to door. The other means of reaching out to the people on waste management awareness are radio talk shows and poems and debates.

Community meetings were mainly done by government entities were the local leaders mobilize the community in a single place and people are sensitised on environment issues, the door to

door and radio talk shows were mainly done by NGOs especially during cholera outbreaks. The participants stated that these methods have not caused any significant impact on the way residents manage their wastes. They said the campaigns are theoretical yet people want the practicality and demonstrations. This finding did not support the finding by Akpoghiran & Okoro (2014) that broad cast media can help to influence people's attitudes. Heavy dependency and exposure to the media tend to shape people's beliefs, attitudes and perceptions about waste management. Micro phone announcements and fliers were cited to be some of the methods to be used in disseminating environmental awareness. It is therefore argued that more frequent awareness campaigns must be undertaken in order to change community perceptions towards waste management.

Effectiveness of the awareness campaigns

According to the participants, 54% said the campaigns have not caused any improvement on the way residents manage their wastes, while 32% said there was improvement.

They said majority of the people in the community have not been trained on how to handle their household wastes. All they do is to tell them that littering the surrounding is bad, use toilets and boil your drinking water. No initiative has been taken to train people on how to sort wastes and recycle or reuse, no clean source of water had been constructed either by government or NGOs, no waste collection bin, transportation or constructed designated dump sites have been provided, the local council has never been funded to prepare by-laws to govern waste disposal in the area. For these reasons, "we say there has been no significant impact of environmental awareness". The findings are similar to Sichaaza's (2009) findings in Lusaka. Sichaaza revealed that the majority of the residents in Ng'ombe lacked knowledge on waste minimisation, sorting, recycling and composting due to lack of educational programmes and subject matter. Lack of educational programmes and subject matter on waste management was found to be the reason why respondents dumped waste anyhow without sorting, recycling and minimising even though they were aware of the dangers of ill-disposed waste. It is for this reason that Palczynski (2002) contends that most African countries do not have educational programmes on waste management. This was affirmed by a study conducted by ministry of water and environment in Mbegu landing along Lake Albert. The study revealed that lack of practical trainings,

demonstrations and providing waste management kits has escalated indiscriminate dumping at the landing site.

The socio-ecological theory identifies opportunities to promote participation of individuals in SWM by recognising the multiple factors that influence individual's behaviour. This theory explains that efforts to change people's behaviour are more likely to be successful when the multiple levels of influence are addressed at the same time. Educating people to make environmentally healthy choices when environments are not supportive would not be effective in making behaviour change. The theory is of the view that strategies focusing on the physical environment for example waste bins are put in place before education or community awareness initiatives are attempted. For instance, campaigns which encourage people to exhibit proper waste disposal behaviour will not be effective in communities where there are no waste receptacles or bins. The council was also not able to enforce the policy on the people that had not received any education about solid waste management behaviours. With highly supportive structural conditions, even individuals with negative attitudes tended to behave in an environmentally sound way. This theory puts it clear that it takes a combination of both individual level and environmental/policy level intervention to achieve proper waste disposal behaviour. The findings in Kitebere are in line with the explanation given by the socio-ecological model hence the need to address all levels of the socio-ecological theory if improvements in SWM are to be achieved.

Some of the respondents who had been attending the awareness campaigns (32%) said there has been change in ways in which people manage their waste as compared to earlier days when no sensitisation had been undertaken. For example, in the market area, the chairman market vendors ensures that after every market day the market is cleaned; wastes collected, sorted and are either burnt or taken to the dumpsites which weren't the case a past few years ago. Even with the community, there are people who have started cleaning their homesteads and burning the wastes.

The little health education, awareness and sensitisation offered in the study area has however resulted into the following; made some people especially marketers to dispose their waste at a temporal illegal dumpsite, reduced littering of the market premises, shop owners' attitudes towards payments for solid waste has been changed positively and some shop owners have purchased temporal waste bins to be used at their premises.

It is therefore urged that despite being aware of the effects of improper waste dumping, it was not consistent with their disposal behaviour. It is for this reason that Al-Najede (1990) argues that in order to transfer the knowledge into practice or good environmental behaviour, the residents' perceptions and attitude have to be changed and that this can only be achieved through Environmental Education (EE). The objective of EE includes awareness, knowledge, attitudes, skills and participation of people in protecting the environment (Engleson, 1985). The Present situation in the study area demands the development of attitudes that would help residents to acquire a set of values and feelings of concern for the environment, and motivation and commitment to participate in environmental maintenance and improvements.

Hinderances for effective awareness campaigns

Forty seven percent (47%) of the participants interviewed said the greatest challenge they encounter is lack of government support, followed by ignorance of the residents towards waste management at 34%.

The sub county health assistant in Ndaiga health center II stated that, periodic sensitisation and health education was offered to the communities only when and wherever there was an outbreak of cholera. He stated that apart from health education offered to these people once in a while, there no proper EE, awareness and sensitisation offered to the residents. The type of education offered to the community was perceived by both the council and the residents to have had little impact on the landing site's aesthetics in general.

When asked why EE was not offered frequently, the district representative gave low staffing levels and inadequate funding as the major reasons. This study supports a finding by Mugweri Fredrick and Joseph Oonyu (2019) in their study where they revealed that the main challenge was inadequate levels of public education on the management of wastes which is impacting adversely on levels of awareness, knowledge and waste management practices. Other challenges included lack of receptacles, the poor roads network, population influx in the study area, and the weak regulatory framework on solid waste management, poor urinal and toilet systems, and inadequate awareness and sensitisation among others.

Lack of EE offered to residents had resulted into indiscriminate dumping of waste in residential areas and the council's failure to pass a by-law on proper waste disposal.

5.1.2 Community contributions towards waste management

The knowledge of the households' demand for solid waste management services is important in developing sustainable waste management strategy. This study revealed that most households in the study area acknowledge the fact they need improved solid waste management services however they were not willing to contribute towards proper waste management services.

Due to the prevalent negative impacts of poor municipal solid waste management, when asked about their willingness towards paying for improved solid waste management services, a significant majority 70.4% of the participants reported that they would not be willing to pay for the services. Only 29.6% of the participants reported that they would be willing to pay.

Several studies that have been carried out in developing countries have shown that willingness to pay for SWM services depended on age, income, household size, occupation and educational level (Rahji & Oloruntoba, 2009; Chuen-Khee & Othman, 2010; Niringiye & O-mortor, 2010; Yusuf *et al.*, 2007). In the study area, the most influencing factors towards willingness to pay for WM services were recorded as follows; Out of the 70.4% of the respondents who were not willing to pay for improved waste management services, 42.1% said they would not pay for the services because they are poor. This is in line with the study conducted by (Rahji & Oloruntoba, 2009; Chuen-Khee & Othman, 2010; Niringiye & O-mortor, 2010), who found out that poverty was the biggest problem towards attaining proper waste management services. 28.3% said they cannot pay for the services because these are government services and they should be undertaken by the government free of charge; after all the government collects tax from them to improve on community services. They said it is the local council that represents the government therefore the local council of Kitebere must ensure that the village is free from wastes. This finding is similar to a study conducted by Roberts (1996) which revealed that in most developing countries solid waste management is still a problem. The problems are more to do with collection. Solid waste management is a municipality's responsibility in nearly all developing countries. A lot of solid waste is however, uncollected due to municipalities' financial and administrative capacity constraints. In the context of this study, waste collection is nearly the responsibility of the local council according to the respondents in the study area. It is for this reason that Heeramum (1993) argues that waste collection and disposal in developing countries has been left to individuals or communities. This has led to garbage pilling up almost everywhere in townships, urban centers and along the roadsides. Heeramum (1993) further observed that less than 50% of solid waste is

collected and the common waste disposal method is the open dumping. In developing countries where there are a lot of capacities constraints, costs of collecting waste tend to be high compared to income, in comparison to collection costs in developed countries. In a study conducted by Nasir Kofi Essuman (2017) in Ghana in the coastal communities of Mamprobi, Glefe and Gbegbeyise, he found out that the communities had a notion that the government is responsible for anything regarding waste. In the same context, the study area is characterised by open dumping in backyards, public places, lake among others, and solid waste management is further crippled by inadequate funding and appropriate technology and awareness.

In addition, people who are more enlightened are likely to get access to information regarding the costs and benefits of improved residential waste management. Thus, such people are more likely to pay for improved residential solid waste management. In Kitebere, the study revealed that 90.5% of the respondents had at least gone to school with majority stopping at primary level; however 7.4% had spent longer time in school up to tertiary level. This implies that majority of the residents are illiterate however, if continually sensitised about proper waste management and willingness to pay services, would effortlessly understand and adopt. This finding is similar to the finding by Oruonye *et al*. (2018) in Jalingo Metropolis where they found out that a community with low education status may not be aware of the effects associated with waste management and therefore may not be willing to pay for waste management services.

It is therefore urged that the willingness to pay is influenced by income and education levels, change of mindset and owing waste management responsibilities by individuals, and not only depending on government.

5.1.3 People's perceptions on who is responsible for solid waste management in the community

During the study the researcher was interested in knowing people's perceptions on who is responsible for solid waste management in their community. It was revealed that majority 74.7% (n=71) of the participants reported that it's the responsibility of government to manage waste in the community. This finding implies that majority of the people rely on government to manage wastes in the community. This was followed by 13.7% (n=13) of the participants who reported that they think it is the resident's responsibility to manage wastes in the community. About 10.5% (n=10) of the participants reported that they think that it's the responsibility of Non-

Governmental Organisations (NGOs) to manage wastes in the community. However, 1.1% of the participants reported that they do not know who is responsible for waste management in the community.

From the qualitative analysis, key informants also claimed that it's the responsibility of the government to manage wastes in the community since it even collects revenue from the people. One of the participants said, *"Sub counties are funded and paid by the government to manage wastes in the community, besides they also collect revenue from fishermen that would be used to pay some people to clean."* Another key informant said that "*It is the sole responsibility of government to keep us in a clean and healthy environment because they collect tax from us."*

From the findings, most residents thought that solid waste management is a programme that should be carried out by the authorities in charge; they said they had no role to play apart from cleaning their immediate surroundings and their households. This finding is in line with the findings by WaterAid in a study on solid waste management arrangements and challenges in Kampala. The study revealed that collection, transportation and disposal of solid waste in Kampala are the responsibility of Kampala Capital City Authority (KCCA), Municipalities and its agents or appointed private collectors. It also revealed that it is the sole responsibility of the person at any dwelling unit (home), industrial or institutional establishments of the city where solid waste is generated to collect and manage the wastes until it is collected by the council.

Most of the participants did not know their role in solid waste management. Because of lack of knowledge on their role in solid waste management, residents also had a general lack of concern towards keeping public places clean. People had a sense of responsibility for their immediate environment and not public places as they were considered to be the council's responsibility. When participants were asked questions related to their littering attitudes and practices, the sample statements regarding this variable were as follows; "I don't care if someone throws litter anyhow because it is not my responsibility to tell people to dispose wastes properly but that of the council, some said they do care but it is council's responsibility to tell people and to keep public places clean, others said they care but they don't tell people for fear of being victimised and majority said they do not tell them because they would not listen, they only listen to the local council leaders."

Though some respondents said that they felt bad when they see someone throwing litter anyhow, they have always tried to reach out to them but most of the people do not care, some are rude and ignorant about the impacts of poor waste management. They felt that it was only the council who should do the work.

Residents did not know their role in solid waste management possibly due to lack of environmental awareness (EA). This is similar to the R. Yoada *et al. (*2014) findings in Accra that noncompliance by residents towards solid waste management were because they were of the opinion that waste collection and disposals were a sole responsibility of the government. It is therefore concluded that the community have a perception that it is not their responsibility to manage wastes but rather of local authorities. This has led to indiscriminate dumping of waste in the study area.

5.2 Waste management practices

5.2.1 Types of waste generated and waste management practices

According to the findings, 61% of the participants said plastics were the most common wastes generated followed by decomposable wastes at 37%, while medical waste (2%) was the least generated. This was confirmed through waste segregation from the various dumpsites in the study area. The results showed that non-decomposable wastes constituted the percentages of 61%, plastics and polythene having the highest composition, while decomposable constituted 39%. This finding is in line with the findings reported by Abdulfatah AbdubYusuf *et al*. (2019) in the study of municipality solid waste management system for Mukono district. It revealed that waste generated from the Mukono Municipal Council (MMC) and the immediate catchment constitute of over 33.3% plastics especially at low-density polyethylene, with the rest (glass, clinical debris, waste paper, vegetable food, wood savings, ash, and clothes) comprising about 66.7%. Despite the finding of the study being supported by Abdulfatah AbdubYusuf *et al*. (2019), the study conducted by WaterAid in partnership with the National Water and Sewage Cooperation and Community Integrated Development Initiatives (CIDI) (2016) disagrees. The study revealed that Bwaise II generates an estimated 31,423 tons of garbage daily with a composition as; Biodegradable (76%), Plastics (4%), Metal (3%), Polythene (8%) and others (9%). This was contrary to the findings of the study which showed that non-biodegradable had the greatest percentage composition.

The research through observation of dump sites and littered wastes revealed that most of the waste contained plastics and E-waste (electronic wastes) including (old radios, wires, old television sets, batteries, mobile phone, among others). The study also revealed that most of the respondents did not know how to handle e-waste. In this era of cybernetics, the young generation is being influenced by cyberphilia. As a result, worldwide e-wastes are generated uncontrolled and unchecked. Liu *et al.* (2006) stated that Chinese domestic e-waste stockpiles are approaching a peak. In Kitebere, used old television sets, radios, computer monitors and system units, mobile phones and their batteries as well as other electronic gadgets discarded as waste are on ascendency. Similarly, Liu *et a.l* (2006) indicated that e-waste is the fastest growing segment of the solid wastes in India (0.01-1%). This rate is growing at an alarming pace and a high percentage of electronics are ending up in the waste stream releasing dangerous toxins into the environment. To curb this situation involves the collective effort of government and local waste management authorities, educational institutions and NGOs, to give proper guidance to this neglected area of waste management. The most generated type of plastics was polythene bags locally known as *kaveras*. Polythene bags were commonly used by consumers because they were light (weight) and cheap (Uganda Shillings 100). In most cases the polythene bags were given free of charge for any item bought in retail shops. A case in point is where an individual goes to buy items and gets separate *kavera* for each item and yet he or she would just use one *kavera* for all the items bought. This is then taken to households which are then generated back to the community as wastes. This finding is in line with the findings by WaterAid (2016) in a study on SWM arrangements and challenges in Kampala which showed that most times the actual operation of the business (shops and kiosks) was observed creating unnecessary waste due to the way they conducted their business. A case in point was the generation of plastic water bottles and polythene bags which were among the highest amount of garbage generated in the area and found its way in the drainage channels. The practice was observed that the consumers deposited the *kavera* and the plastic bottles indiscriminately after use which leads to waste generation. In the study area, large volumes of wastes are generated from households. Vivek *et al*. (2013) in their study in Kerala, India asserted that a large amount of solid wastes are generated from homes and that household waste is a major source of solid wastes.

The other composition of solid wastes included wood, charcoal, fishing nets, fish gills, mosquito nets, human breads/ hair, debris, card boxes, ash, household goods and food wastes which

comprised mainly of vegetable peelings and fruit skins. The latter usually arose from everyday household activities like cooking. Intestines of fish were also observed.

The waste composition in Kitebere is similar to that found in Nairobi as revealed by Karanja (2005) who stated that the main fractions in the waste comprise plastic bags of all sizes and colours. He further stated that these were found dotting the landscape in Nairobi. Karanja (2005) observed that fragile and thin plastic bags used lead them to inadvertent littering which had become a serious problem in the urban centres and world over. Increasing food packaging, bottling and the use of tins are common phenomenon today in the cities and beyond (Karanja, 2005). Solid waste is not only increasing in quantity but also changing in composition. Plastics are now the most perceived common solid waste. During the study it was also observed that high population influx accounted for increase in wastes produced. The study area is densely populated with every house having between 6-10 occupants.

According to the findings, 42% of the participants' burn wastes as a management practice while 33% dump in the lake. The remaining 25% practice burying especially fish intestines, dumping in the bush while others dump in the existing dump sites.

The study revealed that participants handled their recyclable wastes by separating them for selling. For example plastic bottles are separated and sold to fuel dealers for packaging fuel, others to hotel owners who use for packaging drinking water and juice.

Despite the different ways of handling recyclable and decomposable wastes, generally the community said the cheapest ways in which they handle their wastes is burning and it is the most common way of getting rid of wastes in the study area. Residents said they do not need money to burn their wastes neither do they need land to burn; all you need to have is a match box to light the wastes.

The lake being a universal sink for all kind of wastes just as the soil, most of the residents practiced lake dumping. This was mainly because the lake transports these wastes into the inner part of the lake and therefore the residents said this does not cause any negative impact to them. Despite having dumpsites in the community, only 10% of the respondents use it. Majority of the retail traders said they dump their wastes in the dumpsite after collecting them in small box or sacs from their businesses. The main type wastes dumped in the bush are feaces tied up in polythene locally known as *kavera*.

This finding is similar to an environmental scoping report conducted in Dei landing, Pakwach district by the ministry of Water and Environment, 2018. The report revealed that the intensity of SWM problem increases with increased population resulting from increased human activities and the volume of solid wastes to be disposed. It further revealed that burning is the commonest form of SWM. Other wastes like feaces are disposed in the lake and in the bushes. The safe alternative to open dumpsites which is sanitary landfill, is a site where wastes are disposed at a carefully selected location constructed and maintained by means of engineering techniques that minimise pollution of air, water and soil, as well as other risks to humans and animals.

The reasons cited by respondents for not participating in waste sorting and serious recycling activities included lack of a ready market for recycled wastes, lack of knowledge on the importance of sorting and lack of time to sort out wastes, cultural or traditional beliefs, and distance of the dumpsite for communities residing far away from dumpsites; they said they cannot move all those distances to just dump rubbish.

Most recent studies however, recommend the reuse and recycling of solid waste (Banga 2013, EU, 2010). They state that for any recycling to take place the waste has to be separated. EU (2010) recommends that successful recycling programmes should be designed in such a way as to increase people's environmental knowledge, their attitudes as well as their behaviour towards recycling. This implies that residents need to be educated on the need for their involvement in solid waste management. Banga (2013), states that awareness of recycling activities is important in household behaviour towards solid waste separation. She further states that, in many countries recycling activities have gained increasing attention as a means of protecting the environment. Banga (2013), reports that in urban Uganda just like most developing countries, recycling activities have not become a major way of managing solid waste. Meanwhile, it should be noted that proper management of solid waste is critical to the health and wellbeing of all peoples.

According to the findings, there were no waste receptacles provided in the study area, therefore wastes are dumped anywhere within the community at leisure without anyone minding about the impacts associated with it. Despite the fact that wastes are littered anywhere in the study area, there some households that managed their wastes in responsible ways for example by recycling, use of toilets, collection and transportation to the dumpsite, re-using of waste, among others. The findings revealed that organic waste like fish intestines, feaces, food remains, vegetables and

fruit remain were dumped in the lake which is the highest mode of decomposable waste management. They said the lake acts as a perfect dumping place because the wastes are taken away from the community and also acts as food for the fish, they do not realise that they are contaminating the very water they use.

5.2.2 Drivers of poor waste management practices

According to the participants, 67% are ignorant about other waste management practices therefore they see nothing wrong with how they manage their wastes, and 23% said its band wagon. Because of ignorance, participants said this is how they have been managing their household wastes for years and there has been no problem with the practice. “As long as my immediate surrounding is clean then there is no problem”, they stated in their response. Likewise, majority (23%) of the participants said they practice backyard littering because everyone else is doing it. They reported that even if you try to clean your area and collect the rubbish, your neighbours will still dump rubbish in your compound therefore doing what they are doing balances the equation. Lack of awareness in solid waste management was also pointed out by the residents as a major driver in poor waste management.

The findings in Kitebere are similar to the finding in Myanmar by Minn *et al.* (2010). Minn *et al* (2010) revealed that many people were aware of solid waste problems that affected them, but the majority did not realise the harmful effects of their disposal behaviour and did not have a sense of responsibility. The people of Myanmar were almost totally unaware that the crisis situation was basically caused by their behaviours; instead they saw themselves as the victims of that crisis (Minn et al., 2010). Environmental education, awareness and sensitisation being holistic in nature and aiming at attitude change can help people understand (rather than merely being aware of the problems) the harmful effects of their behaviours and highlight their roles and responsibilities in relation to the environment. Environmental education is needed in Kitebere because people think that the problems of SW are more to do with the council’s failure to manage it, neglecting their wrong disposal behaviours.

In Kitebere, all residential and business areas were not provided with waste collection services which made it difficult for people to exhibit good environmental practices. This escalated indiscriminate dumping in the study area. This finding is affirmed in a study conducted by Joel R. Kinobe *et al.*, (2015) in their study on mapping out the solid waste generation and collection

models in Kampala. In their study, they revealed that solid waste collection is lacking in slum areas, given the low collection frequency and inadequate services by the Kampala Capital City Authority (KCCA). It revealed that most of the houses in slums are inaccessible by refuse collection vehicles due to poor road networks. This is very similar to the study of Kitebere where the landing site is inaccessible and characterised by slum settlements.

The landing site has less than 20 toilets therefore most of the fishermen who rent in the area prefer defecating directly in the lake and those who don't fish defecate in *kaveras* (polythene) and throw in the lake. This is evident as you travel in the lake using a boat, you see floating feaces in water. This kind of behaviour was noticed among 43% of the residents who do not have permanent houses in the study area. This was mainly attributed to lack of adequate land for construction of toilets as the landlords only mind about constructing more houses on the smallest land available ignoring the need to construct toilets. This calls for intense awareness and sensitisation of the community to change their perceptions and practices towards toilet usage. This situation was mentioned in the situational analysis prepared by NIRA(2018), where the report sighted the absence of sanitary facilities for waste disposal.

Population influx was observed as one of the biggest drivers to waste generation in the study area. As the population increases, more wastes are generated in the area. According to the District Development Plan (2014), the population in the study area was 3,158 people; however at the time of the study, the sub chief of the area reported that the population is 10,000 persons. When this is computed in waste generated per person, the following is the result;

In tropical African countries, the solid waste generated is 0.6-1.0 kg/person/day and the mean European production is 1.2 kg/person/day. Given that the population currently in Kitebere landing site is 10,000 persons, and from the Equatorial African countries waste generation rate of 0.6-1.0 kg/person/day. Uganda being a low-income country, the waste generation rate is estimated at the rate of 0.4-0.6 kg/person/day. Taking the generation rate for Kitebere landing site to be 0.4 kg/person/day, Therefore, the amount of solid waste generated is $0.4 \times 10{,}000 = 4{,}000$ kg/day. Amount generated per year is $(4{,}000 \text{ kg/day}) \times 365 = 1{,}460{,}000$ kg or 1,460 tons per year.

5.3 The effects of poor waste management on water quality

According to Ndaiga Health Centre II, Cholera (31%) was registered as the most prevalent water borne disease as a result of poor waste management in Kitebere landing site followed typhoid (20%) and the least being dysentery at 6%.

At the time of the study, about 30 people had died of cholera in the study area in a period of 6 months. This was then confirmed by the sub county health assistant at Ndiaga health center II when the study team conducted an assessment of the most prevalent water borne diseases in the study area. Cholera was singled out as the most common water borne disease as a result of poor sanitation and waste management. This state was attributed to lack of sanitary facilities like toilets, poor waste disposal practices like throwing feaces in the lake, sharing of water source with animals and poor drainage systems in the community.

According to the statistics above, waste management is still a major problem in the study and if not well handled may affect the human capital and hence escalate poverty. The lack of adequate waste collection and disposal systems in the study area causes health problems resulting into diseases. These aggravate poverty and lead to negative consequences such as loss of income due to illness, increased spending on health care, and the deprivation of the poor's capacity to live in a safer environment. This is in line with the report issued by World Bank (World Bank- WB, 2001). It is important to recognise that, the fulfillment of human needs depends on environmental factors such as availability of pure water, clean air, and adequate living space and in many circumstances people's ability to maintain a spirit in cultural and aesthetic relation with their environment (Panneerselvam & Ramakrishnan, 2005).

Joel R. Kinobe *et al.,* (2015) noted that uncollected waste was illegally and indiscriminately dumped in open spaces along roadsides and streets, water bodies, and drainage channels that are eventually blocked, leading to a filthy environment. The filthy environment is prone to flooding, and diseases like cholera and diarrhea, as well as to mosquito breeding, which exacerbates the malaria situation.

Erosion of fecal matter and leachate find their way into the surface and ground water hence contaminating the water. This was confirmed when a rapid analysis of water samples taken a few points into the lake confirmed that the surface water was actually contaminated with *E.coli* bacteria. This study agrees with the findings of Tsiboe & Marbell (2004). In their study, they

concluded that in Accra, disposal sites are located near the sea and are polluting the Korle Lagoon creating an unhealthy environment. This was affirmed in an environmental scope study on the proposed construction of landing site in Kitebere conducted by ministry of water and environment (2018), where the water quality of the lake indicated numerous amounts of *E.coli* found at the lake shores.

Residents of Kitebere were more concerned with the effects of poor SWM than the causes. Residents, for example, showed more concern for high vector populations and high burden of diseases related to poor SWM than the presence of wastes in their neighbourhood. This could be an indication that community members lack sufficient knowledge on the casual relationships between poor SWM and its related consequences. Thus there is need to create awareness among the Kitebere residents on the importance of proper SWM, while putting emphasis on aspects with most significant impacts on public health.

5.3.1 Quality of wastewater draining into the lake from the community

Samples of wastewater from drainage channels that drain direct into the lake were collected in calibrated and sterilized containers and taken to the laboratory for analysis. Following the analysis of physical and chemical characteristics, the following results are discussed as indicated below;

Electric conductivity

The (natural) conductivity is normally under 2,500 µS/cm, but in the sample taken during the two seasons, the EC rises rapidly in the sample Near the market and reduces as you head towards the shores of the lake. The EC values ranged from 12,880 µS/cm to 601 µS/cm in the dry season and in the rainy season the EC ranged from 17,820 µS/cm to 698 µS/cm. The results show that EC increased both in the dry and rainy seasons.

High values of EC show that inorganic ions such as H^+, Na^+, K^+, Mg^{2+}, Ca^{2+}, Cl^-, SO_4^{2-}, HCO_3^- among others are present in reasonable concentrations in the wastewater; Such ions have major influence on the conductivity of water according to Mosley *et al.,* (2004). During the wet season, organic substances present in the stagnant channels are broken down and dissolved in the water. Substances dissolved in the water often include carbohydrates, proteins, esters, mineral salts among others. High values of EC indicate high total dissolved solids concentration. Discharge of

wastewater with a high TDS level would have adverse impact on aquatic life and exacerbate corrosion in water networks (LVEMP, 2002).

pH

The pH values of the wastewater samples tested where slightly alkaline in both seasons however as you go closer to the shores, the alkalinity increases to 9-9.9 at the sample at the shores.

pH is a key variable because it influences other Characteristics like the capacity to dissolve oxygen, electric conductivity, and many chemical processes. It also affects mucous membrane aquatic life.

Turbidity

The turbidity of effluent samples in the dry season where all within the recommended values of 300NTU ie 125NTU and ranged from 22NTU to the highest which was 47NTU compared to the high values in the rainy season that ranged from 127NTU to 500NTU.

The turbidity values were high in the rainy mainly because of erosion, soil particles that have been washed settle in drainage channels while in the dry season, there is minimal soil erosion by storm water. This finding is in line with Smith and Davies-Calley (2001).

Total suspended solids

All the results in the dry season had very high values for Total suspended solids apart from DS sample that registered a TSS value of 4mg/l. The samples in the rainy season also had very high values of TSS except samples from NOM and DS that had values of 22mg/l and 15mg/l respectively. These have a significant effect on aquatic community dynamics when they interfere with light penetration thus reducing primary production in the lake ecosystem.

Chemical parameters from the drainage channels

Biochemical Oxygen Demand (BOD)

All the samples of the effluents were within the recommended standards of waste water effluent of <50 mg/l in the dry season while all samples of the wet season also had recommended concentrations of BOD at <50 mg/l. The standards were within the National Environment (Standards for Discharge of Effluent into Water or on Land) Regulations (1999). If BOD is high

(much oxygen consumed), this is indicative for organic pollution that can lower the oxygen content within the water body.

Chemical Oxygen Demand

Chemical oxygen demand (COD) is the amount of oxygen that is chemically needed to break down all organic compounds in a water sample (Meertens *et al.,* 1995. Waste water draining into the lake had the following variance in COD values; NOM 5mg/l, which is low and within the standards, CK 115mg/l above the standards, AS had very high values of COD up 2100mg/l while VH had the highest values of COD 35000mg/l (the National Environment (Standards for Discharge of Effluent into Water or on Land) Regulations) (1999).. This indicates that the samples of CK, AS and VH are heavily polluted by waste from the households in the study area, At DS, the COD values were low and still within the recommended values ie DS 24mg/l.

The lake samples all had low COD values ranging from 22mg/l-60mg/l, which are all within the recommended values (the National Environment (Standards for Discharge of Effluent into Water or on Land) Regulations) (1999).

5.3.2 Quality of lake water in regards to the poor waste management in the study area

Electrical Conductivity (EC)

Electrical Conductivity is a measure of how much total salt is present in the water. The more the ions, the higher the conductivity (Mosley *et al.,* 2004).The electric conductivity in the of lake water sample analyzed in the rainy and dry seasons where both within the recommended range of <2500µS/cm at 25°C (EC25) US 201 Drinking (potable) water (2008). The analysis ranged between 625-724µS/cm in both seasons. The (natural) conductivity is normally under 2500 µS/cm, but in the sample taken during the two seasons, the EC do not rise beyond the recommended values meaning that inorganic ions such as H+, Na+, K+, Mg2+, Ca2+, Cl-, SO42-, HCO3- among others are present in small quantities in the lake. This implies that the ability of an electric current to pass through the lake water is proportional to the concentration of ionic solutes dissolved in the water. Therefore, it is concluded that the lake water both in the rainy and dry season were not polluted by inorganic ions.

pH

The PH values were higher than the recommended range of 6.5-8.5 according to the National Environment (Standards for Discharge of Effluent into Water or on Land) Regulations (1999) for lake water samples analyzed during the dry season except LS 5 that had pH values of 8.3. This implies that water in the dry season is more alkaline/ basic. The high pH is mainly attributed to bases added into the lake through washing of domestic chores in the lake and the bases are concentrated along the shores. Samples taken during the wet season shows that the lake water is a little bit more acidic compared to the dry season, samples ranged from 6.3- 6.4 for samples at the shores and as you move dipper in to the lake. The increase in acidity of the lake at shores in the rainy was because storm water was eroding away urine from the near urinals to the shores hences the acidic increase. This finding is similar to finding by Kayima and Kyakula (2008) that Urine contains uric acid that can increase the acidity of water. Samples at 92.4m and 179.5m were more less neutral ie 7.1 and 6.8 respectively. This shows that the water entering the lake from the community through the drainages is more acidic according to the results because the pH is low at the shores and increases as you move into the lake.

The pH is a measure for the acidity of the water. It is a key variable because it influences other Characteristics like the capacity to dissolve oxygen, electric conductivity, and many chemical processes.

Turbidity

In the dry season, the turbidity of the lake water samples at the shores appeared to be more turbid with values of 27.3 NTU compared to other samples within the lake. Compared to the dry season, samples in the rainy season were considered to be highly turbid with values of 145NTU at the shores and 42.2NTU at 92.4m from the shores. In the rainy season, the high turbidity was strongly attributed to erosion of top soil from upstream, fecal wastes and solid wastes from the community settlements.

Turbidity is an indirect measure for the content of suspended solids and light permeability of water.

Despite the high variability, the Lake shore Sample carries the most turbid water at 145NTU (> 10 NTU) US 201 Drinking (potable) water (2008), while from there on, turbidity decreases as

you move further into the lake, as a rule of thumb, turbidity values can be interpreted as proposed by Weiner (2012):

Turbidity < 0.1 NTU is required for effective disinfection.

Turbidity ≈ 5 NTU in drinking water is visible, but generally acceptable to consumers.

Turbidity < 10 NTU is generally regarded as low turbidity.

Turbidity > 10 NTU is generally regarded as turbid.

Turbidity > 50 NTU is generally regarded as high turbidity.

All the lake samples had high turbidity values.

Turbidity is an expression of the optical property that causes light to be scattered and absorbed rather than transmitted in straight lines through a water sample (Smith and Davies-Calley, 2001). Turbidity in water is caused by the presence of suspended matter such as clay, silt, finely divided organic and inorganic matter, plankton, and other microscopic organisms.

Waters with turbidity in excess of 50 NTU are quite cloudy, and waters with turbidities exceeding 500 NTU are downright muddy. Suspended sediment is a ubiquitous water pollutant, with a multitude of environmental impacts on water bodies, including transport of other pollutants such as adsorbed nutrients and toxic materials.

Effects turbidity on aquatic life

Effects on aquatic organisms include benthic smothering once sediment settles out of the water column (Smith and Davies-Calley, 2001). However, the most visually and ecologically significant, impact of suspended sediment is optical/increased light attenuation through water, decreasing algal growth, and low algal productivity can reduce the productivity of aquatic invertebrates, a food source of many fish. High turbidity levels affect fish feeding and growth. Light attenuation by suspended particles in water has two main types of environmental impact: reduced penetration into water of light for photosynthesis and reduced visual range of sighted animals and people. This finding is in agreement with a finding by Muwanga and Barifaijo (2006)

High turbidity also due to total suspended solids supports high numbers of foreign microbiota in the water body, accelerating microbial pollution.

Total suspended solids (TSS)

The flow rate of the water body is a primary factor in TSS concentrations. Fast running water can carry more particles and larger-sized sediment. Heavy rains can pick up sand, silt, clay, and organic particles (such as leaves and soil particles) from the land and carry it to surface water. A change in flow rate can also affect TSS; if the speed or direction of the water current increases, particulate matter from bottom sediments may be re-suspended.

The eroded soil particles can be carried by storm water to surface water. This will increase the TSS of the water body. All the factors that lead to increase of TSS in the study has been mentioned above considering the fact that the area is a watershed and water way for storm water from the upstream hills. This explains the reason why the shores of the lake have high values of TSS up to 104mg/l. TSS are eroded by running water during the rainy season and settle in the shallow areas of the lake before they are deconcentrated into the other sections of the lake by wave action of the water and this explains the low values of TSS as you go deeper into the lake. In the dry season, the TSS is within from the recommended 100mg/l3, The National Environment (Standards for Discharge of Effluent into Water or on Land) Regulations (1999). At the shores as compared to the rainy season, the TSS is 8mg/l meaning that were no impacts of erosion therefore no suspended particulate was being eroded in the lake. However, TSS can naturally exist in water as a result of the following;

Decaying Plants and Animals. As plants and animals' decay, suspended organic particles are released and can contribute to the TSS concentrations;

Bacteria and algae can also contribute to the total solids' concentration.

Total Suspended Solids (TSS) are solids in water that can be trapped by a filter. TSS can include a wide variety of material, such as silt, decaying plant and animal matter, industrial wastes, and sewage. High concentrations of suspended solids can cause many problems for surface water health and aquatic life and these include;

Blockage of light from reaching submerged vegetation. As the amount of light passing through the water is reduced, photosynthesis slows down. Reduced rates of photosynthesis cause less dissolved oxygen to be released into the water by plants. If light is completely blocked from bottom dwelling plants, the plants will stop producing oxygen and will die. As the plants are decomposed, bacteria will use up even more oxygen from the water. Low dissolved oxygen can lead to fish kills. This is in line with a finding by Muwanga and Barifaijo (2006), an increase in surface water temperature, because the suspended particles absorb heat from sunlight. This can cause dissolved oxygen levels to fall even further (because warmer waters can hold less DO), and can harm aquatic life in many other ways. (Mitchell and Stapp, 1992), the decrease in water clarity caused by TSS can affect the ability of fish to see and catch food, clog fish gills, reduce growth rates, decrease resistance to disease, and prevent egg and larval development, smother the eggs of fish and aquatic insects, as well as suffocate newly hatched insect larvae.

Biochemical Oxygen Demand (BOD)

Biochemical oxygen demand (BOD) is the amount of dissolved oxygen needed by aerobic biological organisms in a body of water to break down organic material present in a given water sample at certain temperature over a specific time period.

When a biodegradable organic waste is discharged into an aquatic ecosystem such as a stream, estuary or lake, oxygen dissolved in the water is consumed due to the respiration of microorganisms that oxidize the organic matter (Davies and Walker, 1986). The more biodegradable a waste is, the more rapid is the rate of its oxidation and the corresponding consumption of oxygen. Because of this relationship and its significance to water quality (dissolved oxygen levels in the water), the organic content of waste waters is usually measured in terms of the amount of oxygen consumed during its oxidation, termed the Biochemical Oxygen Demand (BOD).

In an aquatic ecosystem, a greater number of species of organisms are supported when the dissolved oxygen (DO) concentration is high. Oxygen depletion due to waste discharge has the effect of increasing the numbers of decomposer organisms at the expense of others. When oxygen demand of a waste is so high as to eliminate all or most of the dissolved oxygen from a stretch of a water body, organic matter degradation occurs through the activities of anaerobic organisms, which do not require oxygen (Meertens *et al.*, 1995).

Not only does the water then become devoid of aerobic organisms, but anaerobic decomposition also results in the formation of a variety of foul smelling volatile organic acids and gases such as hydrogen sulphide, methane and mercaptans (certain organic sulphur compounds). The stench from these can be quite unpleasant and is frequently the main cause of complaints from residents in the vicinity.

In the study area, most samples of the lake in the dry season ie from the shores to 122m in the lake had BOD values within the recommended concentrations of <50 mg /l The National Environment (Standards for Discharge of Effluent into Water or on Land) Regulations (1999) except LS 6 at 222m that registered slightly high values up to 60mg/l. This means that at this point more oxygen is being consumed, this is indicative for organic pollution that can lower the oxygen content within the water body. All the BOD values recorded in the rainy season were within the recommended values of 50mg/l with the highest values registered at LS 6 at 32mg/l as compared to that in the dry season.

Chemical Oxygen Demand

Chemical oxygen demand (COD) is the amount of oxygen that is chemically needed to break down all organic compounds in a water sample.

The COD in the dry season was very high in Lake Sample 6 which is 222m away from the shores as compared to the COD sample 6 in the rainy season. This means more oxygen is being used to break down organic compounds in the lake during the dry season as compared to the rainy season. Similarly, the samples at the shores in the dry season had high COD values as compared to the rainy season. All the samples taken in the rainy season had COD values lower than the recommended 100mg/l.

Nitrite NO_2

Nitrite is naturally only present in very low concentrations, as it is quickly oxidized to nitrate from ammonium in presence of sufficient oxygen. Its presence indicates recent pollution. In Lake Albert at Kitebere landing site it was detected to exist naturally with very low quantities.

Nitrate NO_3

Nitrate (NO3) is the oxidized form of nitrogen that can be taken up as nutrient by microorganisms and plants. Natural nitrate concentrations in aquatic systems are usually very low, with elevated values mostly being the consequence of waste discharge or agricultural runoff from fertilizers and manure. The study detected that there was no pollution through agricultural inputs and therefore NO_3 were all existing naturally.

Ammonium (NH_4)

Ammonium (NH_4) is the ionized form of ammonia (NH_3), which is an extremely toxic compound to aquatic life. Low concentrations are present by nature, while elevated levels generally indicate pollution from sewage or manure. Therefore, Lake sample LS6 had high Ammonium values which indicates pollution from the poor waste disposal which finally gets leached into the lake.

Phosphates (PO_4)

Phosphates (PO_4) are important phosphorous-compounds that are used by microorganisms and algae and can, together with nitrates, lead to eutrophication and excessive growth of algae if present in high concentrations Perry *et al*, (2007). Like nitrate, its concentrations are usually limited in natural systems. Phosphates are commonly found in fertilizers and domestic detergents, and thus elevated concentrations usually point to agricultural runoff or (domestic) waste water discharge.

Phosphates concentrations in the lake drying season found to be in a natural state however, in the wet seasons, levels were high at shores with values of 29.5mg/l. This indicates that a lot of domestic detergent is washed from homes in the lake during the rainy season as compared to the dry season.

Total Coliform

Coliform bacteria are a large assemblage of various species of bacteria that are linked together because of the ease of culturing as a single group. They include both fecal and non-fecal coliform bacterial sources according to EAI analytical laboratory.

The Lake Albert water at study area tested positive for Total coliform from all the sampled points in the lake. In all the samples, total coliform was too numerous to count at 1mg/l as

compared to samples analyzed during the dry season where samples LS5 and LS6 had a count of 76 and 126 per ml of the sample respectively.

Total coliform is mainly generated by the contamination of human animal wastes from leaching animal manure, improperly treated septic and sewage discharge, storm water runoff or from domestic animals and open defecation fields including shallow pit latrines within the landing site. During and after precipitation, bacteria and harmful microorganisms from the sources may be drained in to the lake. Unavailability of land for proper disposal of human excreta accelerates direct drain of fecal matter into the lake. In water coli form bacteria have no taste, smell or colour therefore identification of the presence of bacteria is very difficult. The effects of the numerous total coliforms may manifest in terms gastrointestinal illness, fevers, diarrhoea and dehydration to the community people that feed on the water.

E. coli

Escherichia coli, commonly called *E. coli*, is one of the most common species of fecal coliform bacteria. It is a normal component of the large intestines in humans and other warm-blooded animals, and it's found in human sewage in high numbers Environmental fact sheet (2019). *E. coli* is used as an indicator organism for fecal contamination because it is easily cultured. If sewage is present in water, pathogenic or disease-causing organisms may also be present therefore samples taken from the study area tested positive for the presence of E. coli both in the rainy and dry season. All the samples from the lake during the rainy had values which were too numerous to count as compared to the dry season where samples from LS6, LS7 had counts of 144 and 249 per l00ml respectively.

Although most strains are harmless and live in the intestines of healthy humans and animals, this strain produces a powerful toxin and can cause severe illness. Infection often causes severe bloody diarrhea and abdominal cramps. It should be noted that these symptoms are common to a variety of diseases, and may be caused by sources other than contaminated drinking water.

CHAPTER SIX: CONCLUSIONS AND RECOMMENDATIONS

6 Introduction

This chapter provides the summary of the analysis discussed in chapter five and the recommendations in relation to the findings. Future research study to be conducted is also presented.

6.1 Conclusions

The purpose of the study was to find out the perceptions and practices of Kitebere residents towards SWM. The study revealed that, participants had a negative attitude towards solid waste management in the study area. The negative attitude was as attributed to lack of education, awareness and sensitization and lack of waste management services. The council did not collect waste from all residential areas of Kitebere. The only waste collected once in a while was from the markets and dumped in a nearby ungazetted dumpsite.

Participants' perception regarding the roles they were supposed to play was low. People perceived that it was the council's responsibility to keep public places clean. The majority of the respondents showed a sense of responsibility for their immediate environment and not public places; this resulted into a general lack of concern towards keeping public places clean.

In regards to waste management practices, the study revealed that the effluents from households' drainage systems, urinals, shallow pit latrines and open defection yards were poor managed and had a big impact on the quality of water in the receiving lake. However for solid wastes, the study revealed that majority of the participants burnt their wastes for examples paper, card boxes, polythene bags, fishing nets among others while other participants recycled plastics wastes as containers and storage materials.

Despite the positive and recommendable practices revealed in the study, it also revealed negatives practices like open defecation, dumping of wastes in the lake, and random littering of the surrounding areas with all sorts of wastes. These negative practices were attributed to perceptions and beliefs of the residents at the landing site.

Lack of knowledge on the residents' roles in SWM and lack of concern for the environment was attributed to lack of awareness. The low level of public awareness on their role in SWM was perceived to have a direct bearing on people's participation in waste management. The study

revealed that environmental education was not offered due to a shortage of human resources in the public health unit of the council to ensure a clean and healthy environment in Kitebere. In addition to shortage of human resource, the study area is isolated and very hard to reach with no access by road, long distance from the sub-county and the mountainous terrain to the landing site. As a result of this, it remains the sole responsibility for each household in the study area to manage its own waste in a manner that is convenient for them.

In regards to water quality, the study revealed that the effluents from households, urinals, toilets and open defection yards have a big impact on the water quality of the receiving system. This is depicted by the fact that there is a general increase in concentration of the parameters analyzed both in the dry season and rainy season. Although the values in some cases were lower than the maximum allowable National water standards, the continued poor waste management may result in severe accumulation of the contaminants in the receiving lake.

6.2 Recommendations

Based on the findings, it is therefore recommended that;

1. The council should engage community members to increase on awareness and sensitisation of SWM and to practice compulsory community general cleaning twice a week;
2. A by-law must be passed in the study area that every landlord must construct a toilet for his/her tenants in order to reduce on open defecation. Landlords must also provide home waste pits for waste collection and management;
3. The community must embrace boiling of drinking water, and treating using water guard given the fact that the water is highly contaminated with fecal E. coli;
4. The community in Kitebere should practice waste avoidance to help in the reduction of solid wastes generated in the area;
5. Waste management dumpsites, landfills, incinerators be constructed by the government for the people of Kitebere out the community to improve on waste management;
6. The government must support the people of Kitebere by providing waste bins, transportation of collected wastes to gazetted dumpsites and continually sensitize the community on the impacts of poor WM.

6.3 Future research

In line with the findings, the study suggests further research on the how environmental education can transform the perception and practices of the residents in Kitebere towards waste management.

More detailed research on the impacts of waste management practices on different receiving ecosystems of water and soil in Kitebere landing site.

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7. APPENDIX I: QUESTIONNAIRES

KYAMBOGO UNIVERSITY

FACULTY OF SCIENCES

DEPARTMENT OF BIOLOGICAL SCIENCES

MSC. CONSERVATION AND NATURAL RESOURCES MANAGEMENT

TITLE: COMMUNITY PERCEPTIONS AND PRACTICES TOWARDS SOLID WASTE MANAGEMENT AND ITS INTERACTIVE EFFECTS ON WATER QUALITYIN LANDING SITES ALONG LAKE ALBERT: A CASE OF KITEBERE LANDING SITE, KAGADI DISTRICT

Respondent #: _____

Section A: Background Information

1. Gender of the respondent?

a. male ☐

b. female ☐

2. Are you a permanent resident of Kitebere?

a. yes ☐

b. no ☐

Section B. Household assessment

3. How many persons live in your household, i.e. how many persons eat, drink and sleep in your house on a regular basis?

a. _____ adults (15 years and older)

b. _____ children (under 15 years)

4. What is the level of education of the most educated member of your household in number of years?

a. _____ years in primary school

b. _____ years in high school

c. _____ years in university

d. _____ years in professional courses

e ----------None

5. What does the principal income earner do?

a. fisherman ☐

b. boat owner ☐

c. fish monger ☐

d. owner of business, retail shop, hotel, video hall etc (tick one)

e. bodaboda rider ☐

f. Others(specify)

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6. What is your household monthly income?

a. Less than 100,000 ☐

b.100,000-400,000 ☐

c. More than 400,000 ☐

12. Do you own your house?

a. yes ☐

b. no, I am a tenant ☐

Section C: Perceptions of Respondents towards Solid Waste Management (SWM)

7. In your own opinion what do you think is the most common type of waste generated in Kitebere landing site?

a. decomposable wastes (vegetable peeling/remains, food remains, fecal matter etc) ☐

b. non decomposable (plastics, bottles, polythene, nets, rubber) etc ☐

c. Medical waste (flesh, cotton wood, plasters, drip bottles, needles tabulates) etc ☐

8. What is your take on the methods of waste disposal you are practicing?

a. I'm doing it because everyone else is doing it ☐

b. nothing is wrong with the way I dispose my waste ☐

9. would you be willing to pay for waste management services?

a. yes ☐

(to go 10)

b. no ☐

(go to 11)

If yes

10. how much are you willing to pay/collect per month?

a.Ugx 200 ☐

b Ugx 500 ☐

c. Ugx 1000 ☐

d. nothing ☐

if no

11. Why?

In your own opinion whose responsibility is it to keep the communities, market places and town centers clean?

a. Government ☐

b. NGOs ☐

c. Myself ☐

d. I don't know ☐

Section D: Types of waste generated in Kitebere landing site

12. What are common types of waste generated in Kitebere landing site?

a. decomposable wastes (vegetable peeling/remains, food remains, fish guts, fecal matter etc) ☐

b. non decomposable (plastics, bottles, polythene, nets, rubber, gills) etc ☐

c. Medical waste (flesh, cotton wood, plasters, drip bottles, needles tabulates) etc ☐

Section E: Waste management practices

13. How do you handle or dispose off waste generated at household level?

a. burn it ☐

b. throw it in the lake ☐

c. bury it in the backyard ☐

d. dump in the bush ☐

e. take it to the dump site ☐

f. in the dustbin ☐

14. What are the main drivers of poor waste management practices?

a. band wagon ☐

b. Nothing wrong with waste management practices ☐

c. lack of awareness ☐

d. no opinion ☐

15. What would be the most preferred sustainable solutions to poor waste management in Kitebere?

a. awareness and sensitization ☐

b. byelaws ☐

c. construction of waste collection points and transportation ☐

d. construction of toilets for tenants ☐

e. regular community cleanups ☐

f. provision of clean water ☐

16. Who does the waste collection and transportation in Kitebere landing site?

a. district ☐

b. Sub county ☐

c. local council I ☐

d. NGOs ☐

e. None ☐

17. What is your opinion about the present site where you dispose your waste?

a. anyone can throw his waste there ☐

b. anything can be thrown there ☐

c. the site produces foul odours ☐

d. nothing is wrong with the site ☐

e. no opinion/don't know ☐

18. What do you think is your role as a household in solid waste management?

_____

19. In your own opinion what should your community do to reduce waste accumulation in the area?

_____

Effects of poor solid waste management

20. What some of the most common problems or issues associated with poor waste management in Kitebere landing site?

a. health related issues ☐

b. pollution ☐

c. littering ☐

d. reduced water quality ☐

e. nothing wrong ☐

21.Were any members of your family ill in the past 6 months? ____

a. yes ☐

b.no ☐

22. If yes, what type of illness(es)?

a. Cholera ☐

b. Typhoid ☐

c. Bilharzia ☐

d. Dysentery ☐

e.malaria ☐

23. Do you associate any of these illnesses with poorly managed solid waste?

a. yes ☐

b. no ☐

Thank you very much for your cooperation

End!!!

8. APPENDIX 2: KEY INFORMANTS GUIDE

KYAMBOGO UNIVERSITY

FACULTY OF SCIENCES

DEPARTMENT OF BIOLOGICAL SCIENCES

MSC. CONSERVATION AND NATURAL RESOURCES MANAGEMENT

1. Official position of respondent: _____

2. Which department is responsible for waste collection and management?

_____

3. What activities does the department responsible for waste collection carry out to meet their objectives? _____

4. When the officers responsible for waste management go out into communities, what do they sensitize? _____

12. Do you have any projects that have dealt with solid waste? Explain

_____

13 Do you have any collection bins, dump site, landfills/service and collection points?

_____

14. What do you think is the solution to the littering problem in Kitebere landing site?

_____

16. Do the residents know the risks of improper waste management? Explain

_____

17. do ever target vendor in the market area in relation to effective waste management in the own working area?

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18. Any other suggestion you would like to make in relation of waste management in Kitebere landing site.
