



County Government of Kisumu

City of Kisumu

Kisumu Integrated Solid Waste Management Plan (KISWaMP) by
horizon 2030

An updated, revised and operational version of the previous plan

December 2017

Vision:

A clean, prosperous and equitable city, empowered to protect and conserve our natural resources, within a sustainable environment that enhances quality of life for the present and future generations.

Mission:

To protect, restore and enhance environmental quality towards good public health, environmental integrity and economic viability.

Core Values:

- Excellence and professionalism
- Results oriented
- Efficiency and effectiveness
- Integrity
- Proactiveness
- Sensitivity and responsiveness
- Teamwork and partnership
- Creativity and innovation
- Accountability and transparency

Strategy Guiding Principles:

The Integrated Solid Waste Management (ISWM) strategy guiding principles are:

- Community Participation: Participatory ISWM planning, development and governance
- Equity: Access to resources and opportunities among the city residents;
- Quality of service: Efficiency and effectiveness in resource use and service provision
- Sustainability: Social, economic and environmental sustainability;
- Inclusivity: The city will cater for all segments of urban residents including marginalized and vulnerable groups engaged in formal and informal waste management and recovery activities;
- Good governance: Transparency and accountability to the people of Kisumu city
- Connectivity: The city management shall be connected with ward and village units
- Green Technologies: The city to have good quality Solid Waste Management (SWM) infrastructure and services that are based on green and cleaner production technologies.

ACKNOWLEDGEMENTS

In reviewing the 10 year Kisumu City Integrated Solid Waste Management Strategy, the consultant benefited from inputs from a team of specialists drawn from different organizations. The task of preparing this strategy plan was led the consulting AWEMAC team (Prof. Jacob K. Kibwage - Team Leader, Dr. Benson M. O. Agaya- Sociologist), Mr. Joshua Onami Obiri - Hydro-Geologist, Dr. Romulus Abila Ecologist, Ms. Grace Moraa Momanyi-Institutional / Community Development Expert and Mr. Peter O. Magati - Finance and Economic Analysis expert)-. Our deep appreciation also goes to our field support staff for their contributions in data collection and processing.

Special acknowledgement goes to the following for their key role and contributions towards development of this strategy:-

- The Governor of Kisumu County
- Kisumu County Assembly Members
- National Ministry of Lands, Housing and Urban Development
- County Executive Member in charge of environment matters at the Kisumu County Government
- The Kisumu County Secretary
- The City Manager, City of Kisumu
- Director of Environment, City of Kisumu
- Director of Planning Department, City of Kisumu
- The Kisumu Urban Project (KUP) Technical Staff

Our sincere gratitude also goes to project partners and stakeholders not mentioned here by name particularly all the participants of the community forums and stakeholder validation workshop. Special mention goes to the AFD and the National Government (Ministry of Lands, Housing and Urban Development) for their financial support to the City of Kisumu that facilitated preparation of this document.

It is our hope that this strategy will provide practical actions for the ISWM sector through support of various stakeholders. The strategy will also form basis for the formulation of relevant county regulations to facilitate the enforcement of standards and procedures stipulated for the appropriate management of solid waste. We are convinced that our concerted efforts will collectively enhance the quality of the environment in the City of Kisumu.

FOREWORD

The Kenya Constitution under Article 42 states that every person is entitled to a clean and healthy environment, while requiring each person to safeguard and enhance the environment. This is given further impetus by Article 69 & 70 of the Kenyan Constitution, on Environment and Natural Resources, which emphasizes on the obligations in respect of the environment and enforcement of the rights respectively.

The solid waste management problem in the City of Kisumu is a big challenge to City managers and the County in general. In summary, community sensitization and public awareness is low among the City residents. A system of segregation of organic, inorganic and recyclable wastes at source is lacking. Subsequent waste collection rates by the Kisumu city management are low while the current County Laws governing the sector don't have adequate provisions to deal effectively with the ever-growing problem of solid waste management.

The Ten Year Integrated Solid Waste Management (ISWM) Strategy presented here is as a result of several participatory processes which began with extensive research that led to some cumulative understanding of the status of solid waste management in the city. The research reviewed that, the roles of all stakeholders including waste generators, micro and small enterprises, the informal waste pickers, recyclers, private collectors and community-based organizations have had an important role in the overall waste management system of the city. The strategy also borrows from local and regional interventions that showcase potential for replicating the knowledge on sustainable waste management.

I would like to thank all the key stakeholders, partners and local communities for their support in developing this comprehensive strategic plan to deal with waste problem in the city. We are all now heading in the same direction. Through a community-based and Public-Private Partnership (PPP) approach, the strategy provides a road map for what the Kisumu city management ought to focus on for the next 10 years (2015/16-2025/26). More specifically, it proposes strategic objectives and key actions to improve the existing waste storage, collection, transportation, recovery and sustainable disposal systems in the city. My government will soon start the implementation of sustainable financing mechanisms, integrated SWM programs, and enactment of required basic legislation, undertake adequate environmental awareness, purchase of required vehicles and equipment and build necessary capacity of our staff involved in waste management. We will be monitoring and doing necessary adjustments over time in order to achieve the overall goal of making Kisumu a clean city and improve on the incomes from the sector to various participants.

I am now happy that we now have the vision in pursuit of an effective and efficient Integrated Solid Waste Management system for the city. We must work hard towards making it a reality with zeal and determination. I call upon all the city residents to share the responsibility for reducing the environmental and health challenges facing the city. I therefore appeal for the support of every stakeholder in the implementation of this strategy to improve the health and livelihoods of the city residents.

H.E. Prof. Peter Anyang' Nyong'o,
Governor, Kisumu County Government

LIST OF ACRONYMS

AFD: French Agency for Development

AIDS: Acquired Immunodeficiency Syndrome

AMREF: Africa Medical Research Foundation

AWEMAC: Africa Waste and Environment Management Centre

CBD: Central Business District

CBOs: Community Based Organizations

CDF: Constituency Development Fund

CTS: Central Transfer Station

CQRP: City's Quarry Rehabilitation Programme

EAC: East African Community

EACR: East Africa Compliant Recycling

EALA: East African Legislative Assembly

EMCA: Environment Management and Coordination Act

EHS: Environment Health and Safety

ESIA: Environment and Social Impact Assessment

ESMF: Environmental & Social Management Framework

E-Waste: Electronic Waste

GPS: Geographical Positioning System

HCW: Health Care Waste

HIV: Human Immunodeficiency Virus

HP: Horse Power

ICT: Information Communication Technology

IRR: Internal Rate of Return

IT: Information Technology

ISUD: Integrated Strategic Urban Development

ISWM: Integrated Solid Waste Management

KAA: Kenya Airports Authority

KCAA: Kenya Civil Aviation Authority

KEBS: Kenya Bureau of Standards

KICOMI: Kisumu Cotton Manufacturing Industry

KIMCOG: Kisumu County Monthly Clean-Up Group

KISOWAMA: Kisumu Solid Waste Management Company

KIWASCO: Kisumu Water and Sewerage Company

KIWARE: Kisumu Waste Recyclers Cooperative Society

KLIP: Kisumu Local Interaction Platform

KMP: Kenya Municipal Programme

KP: Kenya Power

KUP: Kisumu Urban Project

KWRCS: Kisumu Waste Recyclers Corporative Society

LVBC: Lake Victoria Basin Commission

LVEMP: Lake Victoria Environment Management Project

MOU: Memorandum of Understanding

MCAs: Members of County Assemblies

MCIs: Millennium Cities Initiative

MMS: Multimedia Message Service

MRFs: Material Recovery Facilities

NGOs: Non Governmental Organizations

PCs: Private Collectors

PPE: Personal Protective Equipment

PPP: Public Private Partnership

RAP: Resettlement Action Plan

RETRAK: Retail Trade Association of Kenya

SDA: Seventh Day Adventist Church

SMEs: Small and Medium Enterprises

SMS: Short Message Service

SW: Solid Waste

SWM: Solid Waste Management

UNEP: United Nations Environment Programme

WARMA: Water Resources management Authority

WEC: Ward environment Committees

WEE: Waste Electrical Equipment

WUCS: Ward Unit Environment Committees

WED: World Environment Day

WEX: Waste Exchange Platform

WECs: Waste Exchange Centres

WtE: Waste to Energy

DEFINITION OF TERMS

Biomedical waste: Any waste which is generated during the diagnosis, treatment or immunization of human beings or animals or in research activities pertaining thereto or in the production or testing of biologicals and including categories.

Composting: This is the controlled biological decomposition of organic solid waste under aerobic conditions. Decomposition refers to the breaking down into component parts or basic elements. The material form from the composting process is called compost or humus.

Disposal site: Any area of land on which waste disposal facilities are physically located or final discharge point without the intention of retrieval but does not mean a re-use or re-cycling plant or site.

Domestic Waste/ Household Waste: Waste generated from residences.

E-waste: A term encompassing various forms of electrical and electronic equipment that are old, end-of-life electronic appliances that have ceased to be of any value to their owners.

Hazardous waste: Waste with properties that make it dangerous, or capable of having a harmful effect on human health and the environment. These wastes require special measures in handling and disposal due to their hazardous properties (e.g. toxicity, ecotoxicity, carcinogenicity, infectiousness, flammability, chemical reactivity) and are generally not suitable for direct disposal into a landfill.

Medical/Healthcare Waste: Any cultures or stocks of infectious agents, human pathological wastes, human blood and blood products, used and unused sharps, certain animal wastes, certain isolation wastes and solid waste contaminated by any of the above biological wastes.

Incineration: A waste treatment process that involves the combustion of organic substances contained in waste materials. Incineration and other high-temperature waste treatment systems are described as "thermal treatment". Incineration of waste materials converts the waste into ash, flue gas, and heat.

Industrial Waste: Waste arising from processing and manufacturing industries or trade undertakings and can take the form of liquid, non-liquid, solid and gaseous substances.

Integrated Solid Waste Management: A practice of using several hierarchy of options (source reduction, recycling, combustion and landfill) of waste management techniques to manage and dispose of specific components of municipal solid waste materials.

Privatization: A form of partnership between public, private, community-based and non-governmental organizations, so as to mobilize all available experiences, talent and resources to solve the household waste management problem.

Public–Private Partnership (PPP): is a government service or private business venture which is funded and operated through a partnership of government and one or more private sector companies.

Ramp platform : Is a facility allowing the waste to be gathered from Collection Points by small vehicles and to transfer them to transportation trucks, a bit working like a Transfer Station.

Recycling of waste: Refers to the processing of waste material into a new product of similar chemical composition.

Reuse: Means waste reused with or without cleaning and/or repairing.

Sanitary Landfill: A method of disposing of refuse on land without creating nuisance or hazards to public health or safety, by utilizing the principles of engineering to confine the refuse to the smallest practical area, to reduce it to the smallest practical volume, and to cover it with a layer of earth or soil at the conclusion of each days operation or at such more frequent intervals as may be necessary.

Solid waste: Any solid or semi-solid garbage, refuse, or rubbish, sludge (from any facility involved in the treatment of air, wastewater, or water supply), and other discarded material, including any contained liquid or gaseous material, remaining from industrial, commercial, institutional activities and residential or community activities.

Solid Waste Management: Refers to the activities, administrative and operational, that are used in storage, collection, transportation, recovery, treatment and disposal of solid wastes.

Source Reduction/ Minimization: The reduction, to the extent feasible, in the amount of solid waste generated prior to any treatment, storage, or disposal of the waste.

Source Separation: Refers to any activity that separates waste materials at the point of generation for processing.

Storage: The temporary placement of waste in a suitable location or facility where isolation, environmental and health protection and human control are provided in order to ensure that waste is subsequently retrieved for treatment and conditioning and/or disposal.

SWM infrastructure: All facilities (e.g. landfills, transfer stations, workshops), equipment (e.g. vehicles, rubbish bins, crushers), and public infrastructure (e.g. roads, electrical substations, SWM education programs) necessary for SWM.

Treatment: Any method, technique or process for altering the biological, chemical or physical characteristics of wastes to reduce the hazards it presents.

Waste exchange: This is where the waste product of one process becomes the raw material for a second process.

Waste Generator: Any person whose activities or activities under his or her direction produces waste or if that person is not known, the person who is in possession or control of that waste.

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EXECUTIVE SUMMARY

General Background

Solid Waste Management (SWM) is one of the key devolved functions that is handled within the docket of the Ministry of Environmental Management in the County Government of Kisumu. It is no doubt one of the major development challenges confronting the County Government. A detailed contextual assessment was conducted in Kisumu City to determine the status of the problem, its root causes, major stakeholders and what has already been done in response to the issue.

The results indicate that the problem is a consequence of multiple factors which include: rapid urbanization; limited human and financial resources; weak organizational structures; ineffective laws on waste management; failure of garbage storage, collection, transportation, recovery and disposal systems; low public awareness; lack of a framework for Public Private Partnerships (PPP) for the sector; and emergence of new streams of waste (e.g. e-waste, End-of-Life-Vehicles, sanitary waste) which pose new environmental management challenges.

Due to these factors, a large part (about 75%) of the solid wastes in the city remain uncollected. Resultant effects include spread of infectious diseases, blocked sewers, litter in the streets and pollution of Lake Victoria through crude dumping. With both direct and indirect linkages to economic development, waste materials represent wasted money, in terms of the original cost of the materials, the disposal and in its potential value as a recyclable and reusable resource.

Strategic Objectives

The overall objective of this strategy is to provide a framework for the development of the sustainable management of solid waste in Kisumu city. A key means shall be source separation and reduction which will eliminate the need to manage waste. Other means include law enforcement, protection of the environment, promotion of local waste businesses, creation of job opportunities and saving resources.

Therefore, the specific objectives of this strategy are:

- To establish a basis for a policy and regulatory frameworks on integrated solid waste management.
- To enhance environmental protection from solid waste pollution.
- To establish a sustainable integrated solid waste management system based on community support and PPP approaches.
- To provide sustainable and green jobs for the urban poor (especially youths and women)
- To raise public awareness on sustainable management of solid waste in Kisumu.

Proposed Strategies

Utilizing the information from baseline surveys and public consultation, the ISWM strategy proposed will address all issues of municipal waste in a holistic and integrated manner. The strategic document presents an integrated ten (10) year (2015-2025) strategy that aims to

provide the city with practical ways, detailed intervention plans and financial requirement guidelines on key areas for addressing SWM in the city. The Strategy has also taken the city development plans into account and suggested options are aligned with these long term city development efforts.

The strategy is formulated around the following eight (8) key proposed strategies:-

1. Waste Reduction at Source
2. Waste Recycling and Composting
3. Incineration and Waste To Energy Recovery
4. Planning for a Sustainable Solid Waste Management System
5. Institutional and Organizational Reforms
6. Capacity Building, Environmental Planning, Education and Awareness
7. Management of Hazardous and Special Wastes: E-Waste, Medical Waste, Waste Tyres and ELVs
8. Resource Mobilization through Public Private Partnerships (PPPs) and Financing Reforms

The preparation of this strategic plan and areas addressed above all within the framework developed and provided by the National Government in Kenya. It also adopts partnership and community approaches to ensure participation of service users, providers (which in some cases are the same people), the CBO, NGOs, Research Institutions, donor communities as well as political authorities are viewed as key to the successful operation of the proposed strategies and systems. This is specifically, in the process of choosing, planning, designing, implementing and management of the city's solid waste management infrastructure.

At stakeholder level, the ISWM Strategy proposes a supportive institutional framework. The framework develops linkages with key stakeholders representing all community groups who contribute to the problem and are affected by the solutions. The institutional framework also ensures long-term sustainability of the ISWM plan. At operational level, the ISWM strategy addresses the environmental education, awareness and training needs of the various stakeholders involved in waste management, including City of Kisumu (CoK) personnel, industries, civil society, and service providers in the field of waste management. It also includes basic equipment specifications for different aspects of the waste management chain.

From the technical point of view, the strategy proposes a solid waste collection pattern in three steps that are adapted on the type of area:

1. Pre-collection and sorting of recyclable waste through local CBOs using small vehicles and bins, both straight from the households and Collection Points ;
2. Gathering of solid waste into trolleys at the designated Ramp Platforms covering specific areas and allowing the sales of the recyclable waste ;
3. Collection from the Ramp Platforms to the dumpsite through trucks managed by CoK.

The Kachok dumpsite operation will be upgraded at various levels before being replaced by a sanitary landfill with still the same collection pattern and facilities.

The implementation of this strategic plan will be spearheaded by the Kisumu city management in close collaboration with various stakeholders. The key stakeholders to work with include the Kisumu residents / community members, CBOs, NEMA, National Treasury, National Government Ministries in charge of Devolution, Planning, Lands, and Urban Development; County Public Health Department, informal recycling groups and Private Sector/ Companies.

The indicators for monitoring and evaluation at all levels will be generated annually and evaluated continuously on an annual basis to ensure the direction of the strategy plan is focused all the time.

CHAPTER ONE: INTRODUCTION

Background of the ISWM Strategy

This is a review of the 2010-2020 Kisumu Integrated Solid Waste Management Strategy was supported by the National Government of Kenya through a credit obtained from the Agence Française de Développement (Agency for French Development) (AFD) for implementing the Kisumu Urban Project (KUP). The Kisumu City Management applied part of the proceeds to develop this important strategic document through technical support from a local environmental consultancy firm, Africa Waste and Environment Management Centre (AWEMAC).

Strategy Methodology and Approach

This section outlines the methodology, approach and procedures used in drafting this strategy. The process started in July 2014 and part of 2015 through baseline surveys, stakeholder consultations and participatory approach. The review covered KISWAMP, SWM Strategy and other associated documents and records. The review also included updating the situation analysis of solid waste management in the CoK, so as to come up with updated data and statistics on waste generated, waste collected, characteristics of waste, equipment owned by the CoK for Solid Waste Management etc. The entire solid waste management system was reviewed (i.e collection, recycling, transportation, final disposal). A total of ten (10) public/community meetings were held at the ward levels to collect the views on the current situation and way forward. A total of 915 (57.2% men and 42.8% female) people participated in the meetings (KISWM Baseline Survey, 2015). The Kisumu City ISWM Strategy (2015-25) Validation Workshop was held on 4th March 2015 involving the participation of all stakeholders. A total of 96 participants attended the workshop.

A critical review of relevant literature to the objectives of this study was undertaken in libraries. The following 14 key documents were reviewed to advice on this strategy:

- KISWAMP Baseline Report, 2009
- End of Programme Evaluation - Lake Victoria CDS
- Kisumu County ISUD
- Kisumu Investment Profile
- Ten Year Integrated Solid Waste Management Strategy for Kisumu City, Kenya, 2010-2020
- ILO Guidelines for Successful Implementation of PPP In Municipal Service Delivery of Solid Waste Management
- Report of Planning Workshop on Participatory Monitoring and Evaluation
- Technical Report on Training of Kisumu Municipal Technical Staff and Policy Makers on Integrated Solid Waste Management
- KUP Project Prefeasibility Study
- MCK Conservancy by-Laws 2008
- The County Government Of Kisumu Conservancy Act 2014
- A Summary Report for the Sensitization workshop on Promotion of Public Private Partnership (PPP) for Employment Creation and Municipal Service Delivery Improvement

- Siting Study to Identify Sites for Development of Sanitary Landfill in Kisumu
- County Government of Kisumu, Solid Waste Management Bill, 2014
- Decommissioning Audit Report of Kachok Dumpsite- Kisumu City, 2015 by E-Cue Consultants

For waste disposal, an Integrated Solid Waste Management approach guided the review process. An ISWM approach was used in undertaking the review work. According to EPA, (1989) and Kibwage, (2002) integrated systems involve the use of a *combination* of techniques and programmes to manage the municipal waste stream. Within the range of management options, a hierarchy for SWM to be considered when planning and implementing integrated waste management programmes will be as outlined in the figure below.

Briefly, the first level of the management hierarchy will be Source Reduction, which is the reducing of the amount and/ or the toxicity of waste generated at source. The second level will be *Recycling*, which is the collecting, reprocessing, marketing and using materials that were once considered waste. This is commonly being referred as 3 Rs approach, i.e. Reduce, Recycle and Re-Use. Waste *Combustion or Waste to Energy (WTE)* shall be considered next because this method will reduce the bulk of municipal waste and will provide the added benefit of energy production. A final level will be *Landfilling*, which is at the bottom of the hierarchy which will be necessary to manage non-recyclable and non-combustible wastes (refer to the figure below). The strategies proposed herein follow this internationally accepted sustainable solid waste management approach.

Background on Kisumu County

Kisumu County is one of the newly devolved counties of Kenya. Its borders follow those of the original Kisumu District, one of the former administrative districts of the former Nyanza Province in western Kenya. Its headquarter is Kisumu city. Currently, the County is estimated to have a population of 1,098,561 (projected based on the 2009 National Census). The Kisumu city population which is about 45.5% of the County population is approximately 500,000 people (see table 1 below). The land area of Kisumu County totals to 2,085.9 km².

Kisumu County's neighbours are Siaya County to the West, Vihiga County to the North, Nandi County to the North East and Kericho County to the East. Homa Bay County is its neighbour to the South West. The County has a shoreline on Lake Victoria, occupying northern, western and a part of the southern shores of the Winam Gulf.

County Poverty Level and Developmental Challenges

The Kisumu County Fiscal Strategic Paper of 2014-2015 indicates that high poverty level is one of the major developmental challenges in Kisumu County. Estimates show that over 60 per cent of the population are poor compared with the national average of 46 per cent as at 2006. Poverty levels are higher in the urban areas (70 per cent) compared with rural (63 per cent). The main causes of poverty include HIV and AIDS pandemic, collapse of local agro-based industries, unemployment, low agricultural and fish production from Lake Victoria. Food insecurity, inaccessibility to affordable healthcare, lack of proper storage facilities, erratic and unreliable rainfall, poor and inaccessible road network, frequent floods, problems with the sugar, rice, cotton and fish industries, lack of title deeds, poor water and sanitation systems, malaria, and water borne diseases worsens poverty situation in the county (Kisumu County Government, 2014).

Table 1: Kisumu City Population

WARD_NAME	POP2009	EST2015
CENTRAL KISUMU	38,128	44476
KAJULU	40,876	47682
KISUMU NORTH	24,890	29034
KOLWA CENTRAL	31,739	37023
KOLWA EAST	21,288	24832
KONDELE	48,004	55997
MANYATTA 'B'	27,952	32606
MARKET MILIMANI	18,902	22049
MIGOSI	19,826	23127
NYALENDA 'A'	28,269	32976
NYALENDA 'B'	32,430	37830
RAILWAYS	34,924	40739
SHAURI MOYO KALOLENI	14,806	17271
SOUTH WEST KISUMU	22,126	25810
Total	404,160	471452

County Organizational Structure

The organizational structure of the county is as outlined in Figure 2 below. This project falls under the Ministry of Environmental Management but being directly administered through Kisumu City management establishment.

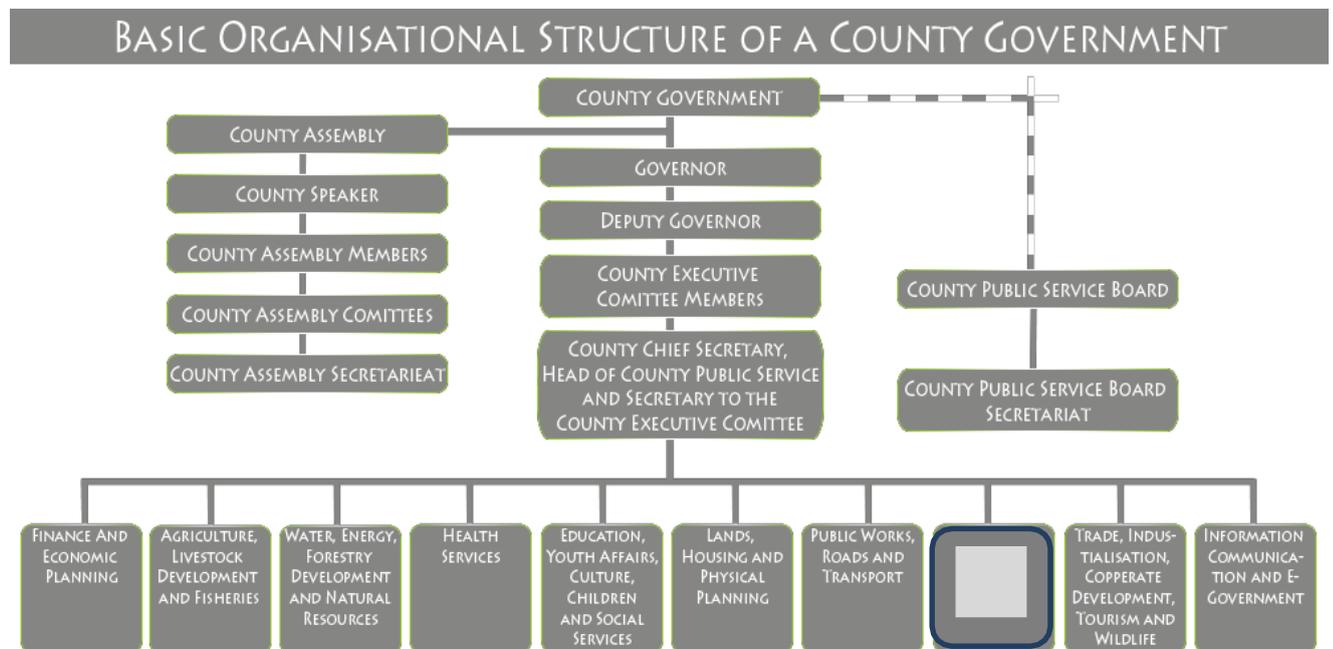


Figure 1: Organizational Structure of Kisumu County Government

The City of Kisumu in Context

Devolution has presented a unique opportunity for Kisumu to re-engineer her city development approaches to create a highly competitive city with the ability to stimulate vibrant County development. The County inherited a city with some burden of unfulfilled urban promises with ever-growing demands on basic needs such as appropriate housing, waste disposal, water and sanitation services to more complex systemic issues such as transportation, trade and commerce. The city land area is also dominated by freehold ownership predisposing it to an aggressive private sector development influence.

Unlike Nairobi and Mombasa where the cities and Counties share physical boundaries, Kisumu County expands beyond the city boundaries and hence has the benefit of additional specialized production nodes with the city poised as the central node and pulse of the economy. These productive nodes define the economic features of the County, predicated mainly on the present form and profile of predominant economic activities.

Within this development prospect, investing in strengthening productivity of these predominant activities provides the trigger required to germinate a vibrant and balanced County economy that increases the competitiveness of the County as a whole. The city economy remains the anchor of the County carrying mixed specializations, connecting the County to national and regional commerce and trade. Kisumu city serves as the administrative, business, commercial and industrial confluence as well as the main international gateway through air, rail and water transport to the entire western region of Kenya. The global status of Kisumu as a Millennium city¹ has further brought with it international attention that if well harnessed bear the potential of elevating the city to global competitiveness with the attendant benefits.

¹Kisumu was declared a Millennium city in 2006 granting it a comparable portfolio to 11 other millennium cities in the world.

In addition, Kisumu city hosts a few of regional bodies including the Lake Victoria Development Authority (LBDA), and Lake Victoria Basin Commission (LVBC), an organ of the East African Community (EAC) tasked with the mandate of overseeing development of the Lake Region. The Lake Victoria region has been declared by the EAC as an economic growth zone.

The Kenya Vision 2030 and Sustainable Development Goals

The Kenya Vision 2030 is the national long term development blue print that aims at transforming Kenya into a newly industrialising, middle income County providing a high quality of life to its entire citizens by 2030 in a clean and secure environment. The vision comprise of three key pillars; Economic, Social and political. The economic pillar aims to achieve an average economic growth rate of 10% per annum and sustaining the same until 2030. The social pillar seeks to engender a just, cohesive and equitable social development in a clean and secure environment, while the political pillar aims to realize result – oriented and accountable democratic system. The three pillars are anchored on the foundation of macro – economic stability, infrastructural development, science, technology and innovation, land reforms, human resource development, security and public sector reforms. The County Government is keen on the progress of the vision implementation plans with a view of integrating the medium term plans (2012 – 2017) into its planning framework.

After the Millennium Development Goals targets expired by on September 2015, United Nations member countries adopted a set of Sustainable Development Goals (SDGs) to end poverty, protect the planet, and ensure prosperity for all as part of a new sustainable development agenda. Each goal has specific targets to be achieved over the next 15 years. Following the adoption of the new Goals by all the 189 United Nation members states, Kenya included, committed to help achieve the sustainable development goals by 2030. The county government is, therefore, working towards achieving all the SDGs for improved quality of life among its residents and this strategy on waste management will directly contribute towards meeting most of them by ensuring environmental sustainability in its operations.

The Kisumu Urban Project

The Kisumu Urban Project (KUP) is a pilot project, considered to be innovative for both Kenya and French Agency for Development (AFD). It is an urban development project funded by the French Agency for Development (AFD), for a total amount of 40 million Euros (with possibilities of extension of the project period). The project encompasses a global vision for the city's development and the municipal management system, through a multi-sectoral approach to the city's development and a cross-cutting approach to the municipal functions and activities. KUP was conceived as a pilot project to inform broader multi-donor supported programs, such as Kenya Municipal Program (KMP).

KUP key activities include strengthening local capacity (financial, technical and political) and supporting investments (solid waste management, slum upgrading, commercial facilities and other public infrastructure and facilities). The overall objective of the KUP is to improve the living conditions of Kisumu's population by reinforcing the municipal capacities and accountability in the context of ongoing decentralization. Thus, specific goals of the KUP are modernization of public policies through enhancement of the municipal management systems in order to improve public service delivery (improve the municipal management systems by developing effective public policy), improve land management systems through spatial planning and slum upgrading as well as rehabilitation and creation of public facilities, urban infrastructure (improvement of urban infrastructure and services). KUP components include:

- Capacity building, financial management and spatial planning,
- Solid waste management targeting improved waste collection initiatives, economic values (recycling and re-use initiatives), storage and transfer mechanisms as well as ultimate waste disposal destination(s),
- Comprehensive slum upgrading projects (with interventions targeted to Nyalenda, Kaloleni, Bandani and Obunga informal settlements areas)
- Commercial equipment and markets that will involve interventions for markets in locations such as Kiboswa, Nyamasaria, Otonglo, Mamboleo, the Central Business District, Kibuye and Jua Kali
- Public facilities and infrastructural rehabilitation involving improvement of roads, cycle tracks, social facilities (health centres, bus and truck parks and selected schools).

The programme is also focusing on the following cross-cutting issues: environmental preservation and conservation, capacity building and employment issues, *stakeholders' coordination, communication and participation, financial management and planning and HIV and AIDS sensitization.*

The Integrated Strategic Urban Development Plan

The basic necessities and the importance of the city as an engine of growth for the region informed CoK investment in a planning process for the Kisumu City development is outlined in the Integrated Strategic Urban Development (ISUD) plan. ISUD is a holistic and practical document including essential baseline data; the plan itself; a capital investment strategy and; implementation guidelines and recommendations.

While ISUD was crafted as a long term development plan for the city, the KUP components were designed as a quick win, a four years pilot urban development project to enhance living conditions of Kisumu's population by strengthening the local capacity (financial, technical and political) and supporting investments (solid waste management, slum upgrading, commercial facilities and other public infrastructure and facilities).

Urbanization in Kisumu

Kisumu is the third largest city in Kenya and one of the fastest growing cities in the Country. It stands on the shores of Lake Victoria, the second largest fresh water lake in the world and covers an area of approximately 417 Km², 35.5% of which is Lake Victoria. It is located in Kisumu Sub-County in Kisumu County and serves as both as the County headquarters and the principal city in Western Kenya. Having developed progressively from a railway terminus and internal port in 1901, the city has become one of the leading communication and trading confluence for the Great Lakes region (Tanzania, Uganda, Rwanda and Burundi).

Surrounded by an agriculturally rich hinterland mainly supporting large-scale sugar industry and rice irrigation, Kisumu's contribution to the National economy is significant. Its rich endowments, such as the lake itself and fertile agricultural land, should give rise to a thriving economy that provide employment opportunities in the fisheries industry and from large-scale production of molasses, cotton, rice and sugar. Nonetheless, the population of the city has rapidly been increasing, at a growth rate of 1.86%. Its current population is estimated at 500,000 people. Having the highest population density (10,000 people per km²), the peri-urban area houses 50% of the total population, followed by the urban areas at 1,500 to 3,000 people per km² and the rural areas at 170 to 680 people per km² (*Kisumu City Development Strategy*, MCK, 2014).

As a result of the rapid population growth and uncontrolled industrial development the urban environment in Kisumu is seriously being degraded. The city generates an average of 385 tons of waste per day and only 25% is effectively collected. The rest end in the backstreets, markets, road sides and open spaces more so in the informal settlement. The city lacks a comprehensive and strategic response to solid waste management. Coupled with this, there is a poor attitude towards waste management and low capacity to offer waste services by Kisumu city management. Waste is still not viewed as a resource by many city residents. While there are some viable waste business enterprises within the city, they lack technical, financial and policy support to achieve their goals.

The City's Solid Waste Management Crisis

Kisumu city is faced with problems of lack of solid waste collection facilities and low efficiencies in operation of existing facilities as well as the design, capacity and location of final disposal sites. The poor management of solid waste has resulted into generation of leachate which pollutes the ground water and soil, the spread of infectious diseases, blockage of sewers and drainage systems, spread of foul smoke from private burning of waste as well as

pollution of Lake Victoria through run-off. Plastic waste used in most packaging is the most conspicuous nuisance, littering many parts of the city's commercial, industrial and residential neighbourhoods. Furthermore, scavengers and others are exposed to health risks as no separation of hazardous waste fractions is practiced.

As stated above, most of the solid waste generated in the city remains uncollected with a collection efficiency estimated at 25%. The collection that takes place is shared between the city authority and a few private collectors mainly concentrated in the high income areas, leaving the poor peri-urban neighbourhoods largely unattended. Waste transported to the dumpsite for disposal is not properly managed, often applying open burning to reduce the waste volume. Many households, particularly in the peri-urban and extended areas do not have the privilege of any mode of collection, and have resorted to private burning of waste or digging their own pits to bury the waste on site.

It is also notable that of the total amount of waste generated in Kisumu City, approximately 60-65% is organic in character presenting enormous potential for recycling for farm use. Most clinical waste from the hospitals is incinerated, reducing the health related risks from exposure. Some very positive reuse and recycling initiatives exist in the city albeit at micro level. These small-scale initiatives include reuse and recycling of paper, plastic, organic waste and scarp metals, all providing micro-enterprise engagement for a significant number of the city inhabitants.

CoK interventions in response to the above situation includes investment in the following: design and building of the sanitary land fill; review of the Kisumu Integrated Solid Waste Management Plan (KISWAMP); decommissioning and rehabilitation of the current dumpsite at Kachok; and development of Environmental and Social Management Framework (ESMF).

KISWaMP and 2010-2020 ISWM Strategy Shortfalls

Whilst the Kisumu Integrated Waste Management Project (KISWAMP) strategy, initially developed in 2010 and now under review through KUP support outlined incoherent environmental strategies for solid waste management, leading to limited implementation of the strategy, especially at community level. The strategy realized only limited success due to several factors, including:

- Misrepresentation of the KISWAMP to community members
- External political interference by then former councillors who captured the neighborhood processes to reward supporters
- Weak institutional structures at the City of Kisumu (CoK) and community level
- Lack of a comprehensive investment strategy
- Inadequate material, human and financial resources to facilitate implementation of KISWAMP.

Existing SWM institutional, policy and legal frameworks

Stakeholders Involved in Solid Waste Management in Kisumu

In Kisumu city, there exists a wide range of individuals, groups and organizations currently involved in Solid Waste Management. These stakeholders include the following:-

- National Government
- National Treasury
- Ministry of Lands, Housing and Urban Development
- Ministry of Environment, Natural Resources and Regional Authorities
- National Environment Management Authority (NEMA)
- Ministry of Devolution and Planning
- County Government of Kisumu
- City of Kisumu Management- Ministry of Environmental Management
- Kisumu Water and Sewerage Company Limited
- Donors/ Development Partners, e.g. AFD
- Private Companies/ Waste Collectors (PCs)
- Informal Street and Dumpsite Waste Pickers
- Non-Governmental Organisations (NGOs)
- Community Based Organisations (CBOs): These include youth and women groups.
- Waste Generators
- Waste Dealers/ Wholesalers/ Brokers
- Traders (importers and exporters)
- Waste Recycling Industries (WRIs)
- Residents/ business/ neighbourhood/ community associations/ groups

The roles of a few of the critical key stakeholders at the City level as outlined below.

County Government of Kisumu-and Ministry of Environmental Management:

The Ministry of Environmental Management at is one of the 10 Ministries established by the County Executive in the County Government of Kisumu. The ministry has as its core business the formulation, integration, co-ordination, supervision and implementation of policies, plans and programmes, projects and activities relative to protection and conservation as well as the management and enhancement of the environment within Kisumu County. This County Ministry has the legal role of developing environmental and waste management laws policies at the County level. It also prepares, facilitates and supervises annual budgets for SWM activities at the County level. It also acts as a link between the City of Kisumu and the County Assembly. The County Ministry of Environmental Management have the following specific functions: solid waste management , control of air pollution, control of noise pollution , management and maintenance of county parks, environmental conservation, including restoration of degraded sites and rivers, and county afforestation and tree planting.

City of Kisumu Department of Environment: City of Kisumu’s Department of Environment has three key Divisions namely: 1) Environmental Planning and Management, 2) Environmental Regulation, and 3) Urban Aesthetics. The operations of these three sections are limited due to the existing financial and human resources. The functions of the department broadly encompass street sweeping and collection, garbage collection and transportation, waste disposal site operation and management, waste treatment and recycling and other complimentary activities relating to solid waste management within the city’s jurisdiction.

The Directorate of Environment within the City of Kisumu is generally the legal owner of waste once it is collected or put out for collection. The department has serious limitations on human and financial resources to measure up adequately to the responsibilities expected. The department’s major challenges are: Low priority of the Department, shortage of staff, shortage of vehicles, low motivation, poor remuneration, lack of personal protective equipment and inaccessibility to slum areas

The present situation indicates that only 15% of technical staff are available to serve the Department. The department's establishment is also 28% filled with technical staff. With a city of 500,000 people, it means that 1 support staff serves over 10,000 residents compared to a UN recommended standard ratio of 1 to 500 (Kisumu City, 2014).

Subsequently, the present organizational structure of the Kisumu city gives it little leverage to undertake effective solid waste management in the city boundaries. This is especially in view of weak planning and development control frameworks and inadequate capacity to enforce environmental regulations. Institutional norms are weak and unsupportive of environmental planning and sanitation. Moreover, the procurement, maintenance and management of garbage trucks is ineffective and inefficient because all waste collection and transportation equipment is under the City Engineer's Department.

Solid Waste Collection Private Companies: Kisumu has about 16-20 waste collection private companies (registered and non-registered) (see details on the KISWM baseline report, 2015). As potential service suppliers, private sector enterprises are primarily interested in earning a return on their investment by selling waste collection, transfer, treatment, recycling and/ or disposal services. However, they use low capacity pickups of 0.5 to 1 tonne and old trucks of 3-6tons of poor mechanical status. Private sector collectors are mainly contracted directly by individual households, industries, CoK, institutions and restaurants. Constraints to private sector activity are: limited assistance from CoK apart from the provision of a disposal licence at a fee; legally not protected; lack of properly laid- down institutional procedures that are followed by each of the companies interested in provision of SWM services and difficulty in locating suitable sites for the secondary containers i.e. skip since each large skip requires large space. There is also lack of legal framework on Public Private Partnerships (PPP).

The Informal Sector: Enormous opportunities exist for informal waste picking in Kisumu city due to the high percentage of recyclable and reusable items in the waste stream (Refer to the Box 1 below and current KISWM baseline survey report on role and characteristics of the informal sector). The informal private sector on the other hand is unregistered and carries out unregulated activities. They include CBOs, NGO, *Jua Kali* Artisans, waste pickers, waste dealers, informal waste processors, youth and women groups, small-scale entrepreneurs and waste salvagers. The groups undertake waste collection, small-scale recycling and composting programmes as a source of income and a strategy to improve their surrounding environmental health situation. They also help in raising people's awareness of waste management problems, opening channels of communication between CBOs and government authorities, raising CBO's voice in municipal planning and implementation processes, play a significant role in resource recovery and provide services to informal settlements at affordable costs.

However, the base of the recycling sector in Kisumu is from salvagers, municipal waste collectors, and the itinerant waste buyers. The street waste salvagers operate in the commercial, residential and industrial zones. They obtain all kinds of waste materials from open spaces (roadsides, riverbanks), communal dumps, dustbins and other waste receptacles. The waste dealers in Kisumu then act as brokers i.e. a linkage between the waste pickers and the WRIs and the SMEs workshops in the Kisumu and beyond. They buy their items from the waste pickers and sometimes from the itinerant waste buyers. Consequently, waste is a source of livelihoods to a large number of people. They face problems like: Lack of operation land, poor access roads, harassment, lack of policy and punitive regulation, competition is high and there is lack of economical recyclables/equipment.

Box 1: Facts on informal waste pickers in Kisumu city

96% of informal waste pickers in the city are males with only 4% being female.

Majority (80%), of the informal waste pickers are single while 17% are married and 13% widowed.

82% of the informal waste pickers do not engage their family members in informal waste collection

90% of informal waste pickers in Kisumu City are involved in the business as their major source of income.

36% of the informal waste pickers have lived in Kisumu for between 6-10Yrs, with 35% having lived in the city for more than 11yrs and 22% for 1-5Yrs and the remaining 7% have lived in the city for less than 1 year.

The informal waste pickers hail from Kisumu County and other Western Kenya Counties

Individual Households/ Waste Generators: The individual households are mainly interested in receiving effective and dependable waste collection service at a reasonably low price. In low- income residential areas, where services are unsatisfactory, residents normally give priority to water supply, sanitation facilities and drainage. Solid waste is commonly dumped onto nearby open sites, along main roads or railroad tracks or into drains and waterways.

Kisumu Solid Waste Management and Market Value Chain

The Kisumu Solid Waste Management and Market Value Chain is in the Figure 3 below.

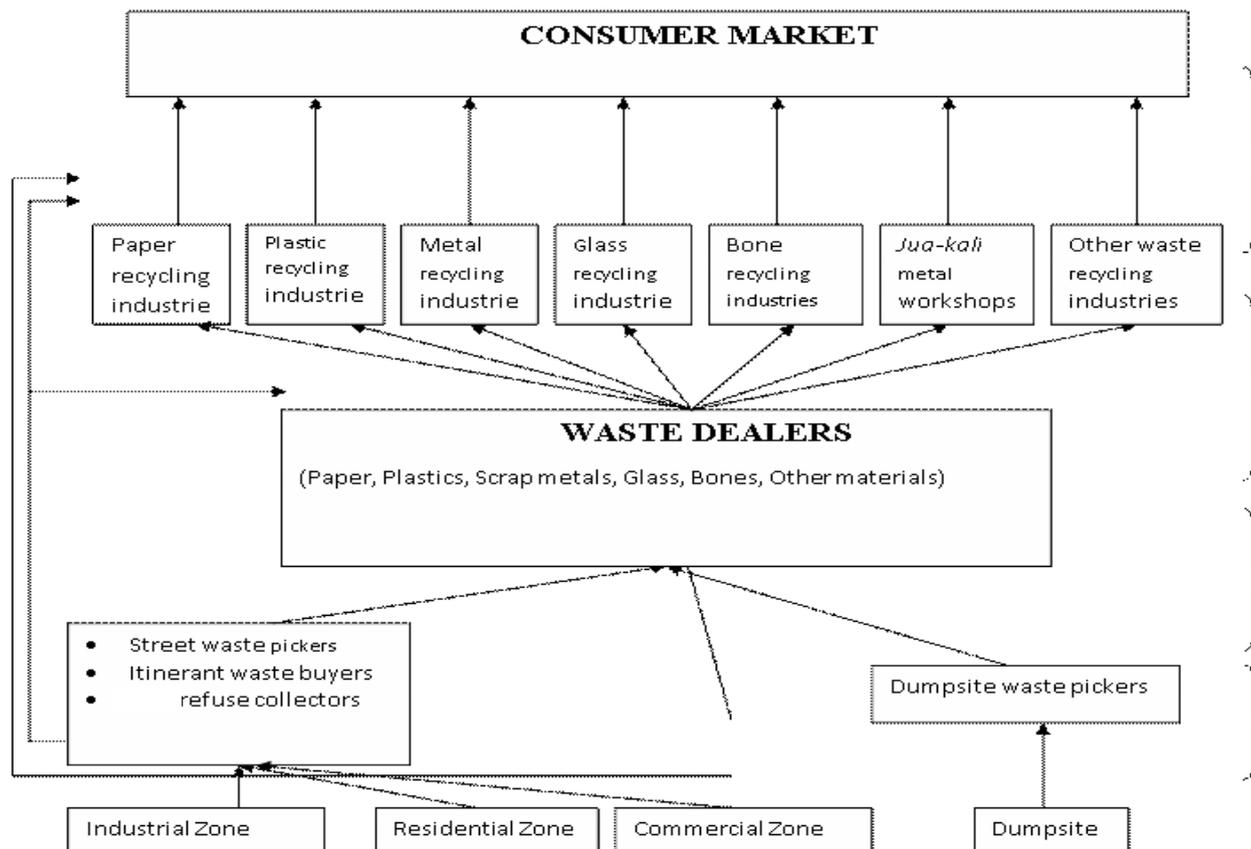


Figure 2: The Kisumu Solid Waste Management and Market Value Chain

Regulatory and Policy Environment

Solid waste management problems in Kisumu city are largely a result of lack of a waste management policy and efficient legal framework that would improve the standards, efficiency and management of the waste sector. The roles of the County Government overlap with those of NEMA especially in enforcement and licensing.

The Kisumu County Fiscal Strategic Paper 2014-2015 indicates that the County Government is in the process of developing a regulatory framework to control and manage waste. Such regulation includes but not limited to landfills, incineration, recycling, sustainability, biological reprocessing, energy/ resource recovery, and waste reduction requirements. Currently, the City Environment Department relies on the city By-Laws on solid waste management, but enforcement of the By-laws is weak as the responsible department does not have adequate resources and human capital. While the city By-laws are comprehensive enough for traditional waste management, it however, lacks provisions for dealing with emerging waste streams like e-waste and does not provide for innovative ideas like waste recycling and the incorporation of stakeholder participation in waste management.

The County Government's draft Waste Management Policy document which is awaiting debate by the County Assembly before it becomes Law, envisages a new structure under a "Solid Waste Management Authority" which will address the current shortcomings and emerging issues in the County with no clear role in the city. This Solid Waste Management Bill 2014 is basically the former by-laws with a few amendments like the proposal to establish the Kisumu Waste Management Authority. The Bill has many gaps that will require to be aligned with this strategy.

The community and CBOs play only a small role in SWM because they are not integrated into the formal system. Policies on community-based SWM service, in addition, have been lacking although the situation is changing. Current national policy emphasizes development of environmental partnerships with stakeholders, including promotion of environmental NGOs and CBOs (Republic of Kenya, 2000). At the national level, considerable progress has been made with respect to the policy and legal/regulatory framework for SWM over the last few years, however. Thus, EMCA (1999) and the national solid waste management regulations of 2006 should guide the County legislation effort.

The most important of these is the right to clean environment allocated to the citizens by the Kenyan constitution of 2010. The citizens can compel polluters, including indiscriminate solid waste dumpers, to pay for the damage or nuisance caused. In reality, however, the cost of litigation (both in term of finances and time) makes it difficult for most of the citizens to exercise this right. Other important rights are those allocated to NEMA by EMCA 1999, for example, with respect to licensing of waste disposal facilities. Institutional weaknesses in NEMA and the lead agencies also affect the effectiveness with which this right has been exercised.

Status of the Existing Solid Waste Management System

This section outlines the existing waste characteristics, storage, collection, transportation and disposal systems. Detailed information can be referred to the KISWM baseline survey of 2015.

Kisumu City Solid Waste characteristics

The Kisumu solid waste stream consists of wastes from various sectors as summarized in the table below in terms of waste types/categories and quantities/generation rates as summarized in the tables 2 and 3 below.

Table 2: Generation rates for various sectors

Sector	Daily Tons	Weekly Tons
Industries	6.5	45.5
Markets, Commercial Zone and Institutions	145	1,015
Hospital/ Clinical Waste	12.5	87.5
Others (Construction waste, agricultural, dead animals, etc)	11.25	78.75

Waste Composition: Composition of waste obtained from source is detailed in the Table below.

Table 3: Kisumu City Waste Composition Characteristics

Item	*Generated Tons of Municipal Waste/ Day	Materials Composition%	Annual (Tons)
Organic Waste	235	63.1	85,850
Waste Paper	46	12.3	16,735
Plastics	38	10.2	13,877
Glass	12	3.2	4,354
Scrap Metals	5	1.3	1,769
Others	37	9.9	13,469
Total	373	100	136,054

* Includes industrial waste dumped at the City Dumping Site but excludes hospital waste

Waste Generation:

The total domestic waste generation rate for Kisumu city is 210 tons/day (1470 tons/Week) with an average city generation rate of 0.42Kgs/Person/Day. With an average overall household size in Kisumu of five (5), high income areas (e.g. Milimani) generate- 18.75 Kgs/HH/Week- 0.54Kgs/ person/ day, middle Income Areas (e.g. Kenya Re) - 12.5 Kgs/HH/Week - 0.45 Kgs/ person/ day and low Income Areas (e.g. Nyalenda and Manyatta) - 9.34 Kgs/HH/Week- 0.27Kgs/ person/ day with each household generating an average of 10.4Kgs per week.

Waste Amounts :

According to a household generation rate of 0.5 kgs/person/day, the generated amount of waste for 2017 of 79 000 tons per year (or 1 529 tons per week) : these results have to be compared to the amount of waste which is actually collected to calculate the collection rate, currently being of around one quarter. Through population growth of 3% until 2020 and 2% until 2030, this amount should grow up to 87 000 tons per year (or 1 671 tons per week) by 2020 and 94 000 tons per year (or 1 809 tons per week) by 2030.

Waste Storage:

96.6% of households have waste storage containers (metallic dustbins, plastic dustbins or paper bags) with majority of the waste storage containers across board having an average waste storage capacity of 6.5 Kgs. Households in Kisumu city have waste storage containers with lower storage capacity than the waste generation rates; with containers in high income areas holding 9.4kgs averagely against 16 Kgs produced by families in a week, containers in middle income the containers holding an average of 7.4 Kgs, containers in low income areas holding 4.5 Kgs against 7 Kgs weekly generation and peri urban areas 7.2 Kgs averagely against 15.7 Kgs weekly generation thus increasing the frequency of waste collection. Conclusively, the amount of waste generated by households is greater than waste containers storage capacity thus increasing the frequency at which waste is collected from the households.

Waste Collection:

Waste collection in the city is done by the county government, private collectors or CBOs respectively for waste collection services. Majority of households do not pay for waste collection services. 58.2%, 49.3 %, 20.1%, 18.5% of households in low income, middle income, high income and peri-urban areas respectively do not pay for waste collection. The high number of households that do not pay for waste collection in low income areas can be attributed to low sources of livelihoods. Averagely, Low, Middle and High Income households pay Ksh. 59, Ksh. 84 and Ksh. 176 for waste collection services. Averagely, households in Kisumu pay Ksh. 106 for waste collection services. This survey revealed that the households who do not pay for waste collection (64.1%) were however willing to pay for the collection services. This therefore means that there are opportunities for investment in waste collection hence job creation and a source of livelihood especially in the low income areas and peri urban areas where unemployment is a major concern.

Waste Disposal:

33.6 % of households practice open-dumping, 26.1 % use compost pits, 23.8% use backyard disposal, 7.7% road side disposal and 4.8% trenches. Only 3.1% of the household was collected for final disposal. In low income areas, 41.9% use open dumping. This underscores

the need of having central collection points within the estates to address the challenge of initial waste disposal.

82% of households do not separate wastes at source with majority being at the low income areas. This can be attributed to lack of information, knowledge, skills and benefits of waste separating at source. 45.4% of the households re-use or sell some waste while 54.6% do not. However, 83% of households revealed that they were willing to separate waste if they are taught on the benefits and techniques of waste separation. This provides an opportunity for training on integrated waste management to the city residents. It is also important to note, that majority of the waste is handled by the households this should be the first the level for sensitization and education.

Medical Waste Management:

According to the seventh schedule (regulation 38) of the Environmental Management and Co-ordination (Waste Management) Regulations 2006, there are 11 categories of medical waste; these are infectious, pathological, sharps, pharmaceuticals, genotoxic, pressurized containers, general/non-infectious, radioactive, micro-organisms, wastes with high content of heavy metals and chemical wastes.

According to the MOH (Ministry of Health) classification, Kisumu city has 50 healthcare facilities, 8 hospitals (2 public and 6 private); the rest are classified into health centres and dispensaries. Evidence from the revealed by KISWM baseline survey in 2014/ 2015 shows that the current medical waste management procedures in hospitals in Kisumu city are not satisfactory. Hospitals in Kisumu have adopted and practice poor Medical Waste Management (MWM) procedures. There is poor storage of MWs with only 3 hospitals having well-built, concrete storage rooms; one had a waiting bay and the remaining four had no specific places designated for storage of MWs awaiting final disposal. Incineration, open burning and open dumping are the most common method used for final disposal of MWs in hospitals in the city with no prior treatment of waste. Apart from one public hospital, the other seven hospitals use sub-standard and unlicensed incinerators for MWs incineration. These pose grave health and safety concerns to the city's residents (See Plate Below).



Plate 1: Unhygienic handling of medical wastes in hospitals in Kisumu city

E-waste waste composition and management:

There are no estimates on e-waste generated in Kisumu city. However, according to a recent UNEP study, electronic waste is now Kenya's fastest growing waste component. UNEP

estimates that over 17,350 tonnes of electronic waste is generated in Kenya annually. This comprises approximately 11,400 tonnes from refrigerators, 2,800 tonnes from TVs, 2,500 tonnes from personal computers, 500 tonnes from printers and 150 tonnes from mobile phones (Press Release UNEP, 2010). Using these national figures and urban populations in the country, Kisumu generates approximately 200 tons (over 16 tons per month or 0.5 tons per day) of e-waste per year. These figures are set to increase by the introduction of the Laptop computers to every child entering standard one in all Kenyan primary schools according to the current National Government educational policy.

While electronic waste is a valuable resource, disadvantaged people carry out rudimentary recycling practices such as burning cables to access the copper and discard the less valuable parts which pollute the environment and are harmful to their health. Research has shown that heavy metals such as lead and mercury in the soil contaminates the air and many people working in the informal sector have respiratory problems and body abnormalities due to heavy-metal poisoning Kenya is one of the African countries that have established large scale recycling facilities in Nairobi city to approved international Health, Safety and Environmental (HSE) standards.

E-waste management is carried out by both the formal and informal sectors. E-waste management by the formal sector is being spearheaded by the Computer for Schools Kenya (CFSK) which distributes refurbished computers to schools. Collected computers are refurbished, some to TV monitors. Some monitors and boards are exported for disposal. Mobile phone companies like Nokia and service providers like Safaricom have started national mobile phones/ e-waste collection and recycling schemes which also cover Kisumu city. HP has set up a national e-waste recycling and disposal facility in Nairobi's environs. This also serves Kisumu city.

On the other hand, the informal e waste management sector in Kisumu city is, like the other informal sectors, neither registered nor authorized and is characterized by inadequate skills. This sector's activities revolve around dismantling discarded Waste Electrical and Electronic (WEE) equipment items to recover usable parts, mainly, electronics and scrap metal such as copper. The remainder is disposed with other domestic waste at the Kachok dumpsite or in the open spaces.

The following are some of the main e-waste management challenges experienced in Kisumu city.

- Significant amount of second-hand equipment in the market with short remaining lifespan
- Increasing international dumping of e-waste by developed nations in the scheme of donations to schools and institutions
- Inadequate local County regulatory and policy structures to safeguard health, environment and social consequences of e-waste
- Limited capacity and management facilities to deal with e-waste by Kisumu city management and National agencies like NEMA and KEBS

The city management is working with partners to address the emerging challenges of electronic waste management. To this end, the city in collaboration with Safaricom launched an e-waste management initiative, where e-waste receptacles are placed at Safaricom outlets

and residents can drop all forms of old phones for subsequent transportation to Nairobi for further processing.

Waste Storage Systems

The City Management has managed to install 20 No. 3-in-one litter bins for source-segregation of waste within the Central Business District (CBD) and 70 single unit litterbins, all in an effort to manage litter within the CBD (See plate below).

Waste Collection Systems

Current daily collection of garbage is estimated at 25% of estimated daily generation of 385 tons within the city. Routine surface sweeping continues in the CBD of the city and markets, though hampered by shortage of staff and equipment. Casual labourers are occasionally hired to augment the regular staff.

All the waste spots with high generation areas within the city have been documented by the City Department of Environment in a comprehensive report that was done in collaboration with Millennium Cities Initiative (MCI). These include commercial areas like the CBD, Bus park and its environs (including Jubilee Market), Kibuye market, Kondele, Manyatta, Nyalenda, Migosi and Nyawita. Waste collection route plan to guide daily operations has also been developed to ensure that all the spots are effectively covered and appropriate interventions put in place.

Community groups have been mobilized within Nyalenda and Manyatta neighbourhoods to participate in the SWM collection and disposal. The output of the process has culminated in establishment of a central structure for coordinating the neighbourhood campaigns called Kisumu County Monthly clean-up Group (KICOMOG). The participation levels in such clean-ups still remain very low due to limited environmental education and poor attitude/perception that County Government is responsible for SWM services rather than the waste generators themselves.

Field investigation and city records showed that refuse collection vehicle types under City of Kisumu and County Government include the following:-

Equipment operational include:

2 No. farm tractors (with trailers – 1No. in Muhoroni and Nyando sub- counties respectively)

1 No. tractor skip loader tractor in the city: mainly used for collection and transportation of garbage from Jubilee market, Kibuye Market, other Food Markets and the bus stage.

- 1 15-ton tipper truck
- 1 4-ton refuse truck (Canter): It is usually loaded manually making the exercise extremely labour intensive.

The truck is more often diverted for use in other activities hence minimizing its economic use in SWM.

City Equipment with mechanical breakdown (62.5%):

- 1 wheel loader (shovel)
 - 1 4-ton refuse truck (requires “diff” replacement)
-

- 1 5-ton skip loader (requires gear box and crank shaft replacement)
- 1 7-ton refuse compactor truck (old and dilapidated, operation and maintenance costs are huge, spares not available)
- 1 40-ton landfill Compactor (requires specialized assessment to diagnose problem)

The equipment in the City under operation was about 37.5%. The refuse collection vehicles in operation makes on average 1-2 trips per day while the tractor makes at least 2-4 trips per day. There has been a steady decline in the volume of waste collected by the city management over the years relative to the growth of the urban population due to various challenges outlined in this strategic document.



Plate 2: One of the existing waste collection vehicles at the City Workshop Yard



***Plate 3: One of the Existing Skips being Off-loaded at Kachok Dumping Site
(Photo credit: AWEMAC, 2014)***

Status of Kachok Dumpsite

Around 1975, the dumping commenced at the present day Kachok at a disused borrow pit for the construction of part of the main Kisumu – Nairobi highway. Although illegal, dumping continued and in the 1990s the site was eventually „recognized' by the former City Council as the official dumping site. Hence, Kachok dumpsite, which is about 2.73 hectares, is the only designated site for waste disposal in Kisumu city (see plate 5 below). The dumpsite is unplanned, particularly with respect to siting considerations since it is located in an area not feasible for such a facility. Furthermore, operations at the site are haphazard without specific operational guidelines and there is lack of appropriate equipment as well as the necessary expertise. Often, burning of waste is done to reduce the volume of waste and preserve disposal space at the site. The poor aesthetics, noise, odour from decaying organic matter, dust, smoke, and gases generated from the site, insecurity concerns, public health implications do directly and indirectly affect the neighbourhood of Kachok and residents of Kisumu city in general.

The facility has been undergoing rehabilitation by constructing a temporary perimeter fence using corrugated iron sheets erected to restrict access and contain the waste within the confined areas demarcated as the disposal site. The landfill compactor for management of Kachok is broken down thus adding to the management challenges of the facility as this has had crippled efforts to compact the waste to manage volumes and odour (see plate 6 below). The facility, therefore, poses significant access challenges for trucks transporting waste for disposal, more so during the rainy seasons. There is need to open up proper access roads to facilitate movement of trucks and waste vehicles to ensure the dumping is carried out in a structured and controlled manner. The drainages also need to be opened up to ease flow of storm water and special drains opened for leachate control within the facility as decommissioning is planned.



Plate 4: Status of Kachok Dumpsite (photo credit: AWEMAC, 2014)



Plate 5: Broken down landfill compactor abandoned at the entrance to Moi Sports Stadium, Kisumu. (Photo credit: AWEMAC, 2014)

Status of the Proposed Sanitary Landfill

The siting study for a Modern Sanitary Landfill for the County has been ongoing in a bid to relocate the current Kachok dumpsite and during the year 2014 the Consultant (Log Associates Ltd) identified two potential sites as suitable, located at Kabonyo Settlements (North of Kibos Sugar Factory) and Majiwa (Past KSR) after rigorous fieldwork exercises. However, formal opinions from the key lead agencies, namely NEMA, WARMA, KCAA and KAA were not positive due to their proximity to the Kisumu International Airport and existence of several natural streams flowing from the neighbouring Nandi Hills. Their surrounding neighbours were also not re-locating the site into their vicinity. This has greatly hampered the city management from moving to the next step of design and construction of a sanitary landfill. The process of identifying a landfill site within a radius of 45Km from the city centre is ongoing to pave way for decommissioning and subsequent rehabilitation of the Kachok site. Areas in the Muhoroni direction are currently prioritized by the City management due to the topographical nature in Kisumu.

Waste Recovery and Recycling Activities

There are some informal recycling initiatives within the city, mainly for plastics and paper as an integrated component of solid waste management system. Most commonly recovered items are waste paper, plastics, glass/ bottles, scrap metals and some organic wastes (see details in KISWM baseline surveys of 2014-2015 on waste pickers and households respectively). The plates below also demonstrate ongoing intensive waste recovery activities in the city.



Plate 6: A Plastics Recycling Centre, off-Ondiek Highway



Plate 7: Recycling of scrap metals in Kibuye Market by the informal sector

Environmental Awareness Activities

The Department of Environment, Kisumu County has made attempts in environmental awareness through various initiatives and partnerships. These include: *Environmental Awareness Initiatives and City Monthly Clean-up Programme*.

Environmental Awareness Initiatives: Increased awareness creation and community participation in SWM, manifested in groups coming up to take responsibility over waste management within their jurisdiction, e.g. Kibuye Traders Clean-up initiative. Presently the initiative is being extended to Manyatta estate, with the support of Kisumu Local Interaction Platform (KLIP). KLIP, which is an international NGO initiative, provides a public interactive platform on environmental awareness through annual events that offer the participants the opportunity to partake in bicycle races, exhibitions, traditional dances and songs as well as a youth football tournament.

City Monthly Clean-up Programme: This programme was launched on 6th July 2013, during a huge function held at the Jomo Kenyatta Sports Grounds, pursuant to a declaration

by H.E the Governor during Madaraka Day Celebrations on 1st June 2013 that the County government would set aside every 1st Saturday of the month as a clean-up day. The Ministry of Environmental Management took up the challenge and mobilized stakeholders for a very successful launch which saw the participation from several stakeholders who, not only donated several tools and equipment for clean-up purposes but also been turning up to participate in the clean-ups that are held consistently at various focal points within the County (see plate below). Subsequent clean-ups have been done every first Saturday (and first Sundays of every month for the Seventh Day Adventists -SDA faithful who are many in the city). For Kibuye market, there is also an effort to encourage all the market users to participate in clean-ups every Monday morning since Sundays are the main market days.

The Kisumu City management is planning to procure the services of a community organizing or private firm/ NGO to mobilise and organize community members into grassroots structures for improving the existing community level solid waste collection, transportation and disposal systems through monthly neighbourhood environmental clean-up and awareness creation campaign, with emphasis on the 3 Rs (Reuse, Reduce and Recycle) principles. Community Organizing for Monthly Neighbourhood Environmental Clean-Up Campaign will set in place process of community ownership of the implementation of ISUD and all related city environmental projects. This will act as a linkage with the Kisumu ISUD.



Plate 9: Kisumu City Monthly Clean-ups (Photo Credits: Kisumu County Government)

Revenue from waste management and other environmental services

The Department of Environment is primarily structured as a service delivery entity and thus does not focus much on revenue collection. In the period 2013/2014 (July 1st 2013 – June 30th 2014) alone, the department collected total a revenue of Ksh. 2,257,700 as shown below, indicating major gaps in revenue collection policies. It also shows that the county government is not collecting any fee from waste generators in the city leaving a major financial gap. There

exists great potential for sustainability of the SWM services if reforms proposed in this strategy are fully implemented.

Table 4: Revenue collection by the Department of Environment, Kisumu County in the period 2013/2014

SOURCE	AMOUNT (Ksh)
Noise regulation license & permit	622,800
Tipping fee	120,000
Cess (murram, sand, etc)	1,439,900
Tree felling	75,000
TOTAL	2,257,700

Source: Kisumu County Government, 2014

The County Ministry of Environmental Management through the City Directorate of Environment is in the process of establishing a section dealing with revenue collection by deploying specific officers to handle the task as one of its key output areas. Other revenue streams like solid waste permits, private tree nursery permits are planned to be implemented as from the financial year 2015/16, as a move to streamline and strengthen the section, without compromising the objectives of other programmes. The Ministry has also put in place appropriate structures for collection of EIA review fees from developers to facilitate site visits of emerging projects, but this lacks national legal support through EMCA, 1999.

Views of the community on the current SWM problems

Consultation of the community members through public forums at the Ward levels, City Managers and key stakeholders, the extent and nature of the solid waste management problem in the city can be summarized below (see details in the 2015 KISWM community consultation report):

- Rapid urbanization within the County, significantly impacting on the levels of waste generation
- Shortage of trained staff, both technical and labourer category for waste management both in the public and private sectors.
- Dilapidated infrastructure, including storage facilities, skips for collection and trucks for waste transportation. The security of the skips is not guaranteed due to their poor locations and lack of community ownership of the facilities. Delays in repairs of waste transportation trucks and other refuel collection equipment is also common.
- Lack of designated well-designed transfer stations
- Poor attitude, limited sensitisation and lack of awareness among the city residents on waste management. Mixed waste due to lack of source separation programmes is critical to the failure of the whole system

- Lack of effective and efficient organizational structures at the city.
 - Lack of designated disposal site outside the CBD. The waste collection and tipping charges are unstandardized
 - Community participation and ownership is very low
 - Weak structures for enforcement (shortage of trained enforcement staff). This is also due to limited community participation in the existing organizational structure.
 - Low level financial investment in solid waste management infrastructure for efficient and effective collection, transportation, treatment and safe disposal
 - Poor systems and infrastructure for management of hazardous waste, including clinical waste, asbestos (as residents replace old dilapidated roofing materials in old estates like Ondiek, Arina, etc)
 - Low levels of waste reduction and recycling technology, including lack of adequate infrastructure and policy framework for the same. There is increased use of plastics for packaging, especially low density plastics
 - Inadequate training of youths and other community members on recycling of waste, bones, plastics, scarp metals, glass, charcoal, tissue papers, organic waste, etc.
 - Delays in procurement of requisite tools and equipment (including trucks)
 - Lack of an effective framework for PPP in SWM at the county level, hence lack of motivation to the private sector actors. For example, there is too much bureaucracy on the tracking documents for the private collectors at CoK offices.
 - Emerging new streams of waste, e.g. e-waste, End-of-Life-Vehicles (ELVs), condoms, and sanitary waste (pads and pampers) posing new environmental management challenges
 - Inadequate county laws and policies to deal with solid waste management in the city
 - Lack of public toilets in all the wards and the CBD compared to the existing population leading to disposal of human waste in open spaces or communal waste dumps leading to contamination of waste at source. Street children also dispose human waste in the streets at night due to inadequate sanitary facilities in the CBD.
 - Failure of most real estate property owners to provide space for garbage disposal especially in Obunga, Manyatta and Kondele estates.
 - Inability of the urban poor to afford the services of the existing high charges of private waste collectors. However, they are willing to pay form if the sector is reformed.
 - Poor planning during the construction of houses by the landlords because they are either built close to roads, near trenches or without toilets which leads to lack of space for storage facilities. It also hampers waste collection equipment.
 - Haphazard disposal of hazardous waste, plastic/polythene papers, condoms, and sanitary waste (pampers and sanitary towels). The number of standard incinerators in hospitals for hazardous waste management if the city are inadequate
 - The policies of integrating the informal sector actors into the mainstream activities of the County government are limited
 - Political interference in matters of waste management in the city.
 - There is no designated yard established by the County government for disposal of the End of Live Vehicles (ELVs)
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CHAPTER TWO: STRATEGIC AREAS, OBJECTIVES AND PROPOSED ACTIONS

Based on the baseline surveys; existing literature on the County, community and stakeholder consultations, and existing city development plans, policies and laws, the existing ISWM strategy was reviewed through a rigorous process and eight (8) prioritised strategic areas were identified. The integrated SWM and PPP approaches have been applied in this process to ensure sustainability in the proposed strategies.

The eight (8) strategic areas are to be implemented in the next 10 years of this strategic plan include:-

1. Waste Reduction at Source
2. Waste Recycling and Composting
3. Incineration and Waste To Energy Recovery
4. Planning for a Sustainable Solid Waste Management System
5. Institutional and Organizational Reforms
6. Capacity Building, Environmental Planning, Education and Awareness
7. Management of Hazardous and Special Wastes: E-Waste, Medical Waste, Waste Tyres and ELVs
8. Resource Mobilization through Public Private Partnerships (PPPs) and Financing Reforms

Details of each of these strategies are outline below.

STRATEGY 1: WASTE REDUCTION AT SOURCE

Waste reduction at source is the first priority in the ISWM hierarchy. In this strategic plan, source reduction implies reducing the volume of waste at the source/ point of generation by changing the material-generating process. It includes incorporating reduction in the design, manufacture, sale, purchase, and use of products and packaging. Other terms that may be used to mean source reduction, include waste prevention and waste minimization.

Source reduction strategy objective is to reduce the amount of materials the City will produce and the harmful environmental effects associated with their production and disposal. It includes: reduced material use in product manufacture, increased useful life of a product through durability and ease-to-repair, material reuse, reduced/ more efficient consumer use of materials, and increased production efficiency resulting in less production of waste. Source reduction will offer several opportunities for cost savings for the City management which include direct savings on waste collection, transportation, and disposal costs. Specific actions proposed are outlined below.

Waste Reduction Strategies and actions

Source reduction legislation: Source reduction legislation should be reviewed in order to provide guidelines on the following:

- County Government procurement and purchasing requirements
- Packaging requirements and guidelines
- Labeling guidelines
- Business licensing and reporting requirements on waste management
- Banning garden and farm waste from disposal in the City landfill to encourage composting at the source
- Banning specific types of packaging (especially unstandardized plastic bags) for items bought from the supermarkets, shops, kiosks, markets, hardware shops, etc.

Economic incentives: Introduce both economic incentives and disincentives to encourage source reduction.

Proposed possible economic incentives include the following:

- Fund research and development of source reduction and education programs in collaboration with public Universities in the region (like Maseno and Jaramogi Oginga Odinga University of Science and Technology Universities) by postgraduate students or postdoctoral works. For example, there is need for life cycle analysis of all products in the market. The results should be formulated into waste management policy briefs for easy utilization by the County Government
 - Supporting short term waste management and recycling technology training programs at technical colleges targeting youths, disabled and marginalized individuals.
 - Establish waste business centers to act as waste exchange points. Waste exchange is where the waste product of one process becomes the raw material for a second process. This is similar to using pre-consumer recycled material in a product. This represents a way of reducing waste disposal through reuse for that which cannot be eliminated.
 - The County Government should sponsor programs or create opportunities for volunteer programs such as neighbourhood recycling workshops within the proposed *Taka-n-Pesa (Waste-is-Money)* Centres.
-

- Developing source reduction measurement standards and improved product designs to ensure value addition to final products.
- Funding other materials reuse programs and businesses
- Provide grants and annual prizes to recycling businesses, e.g. for motor vehicles, electronics, scrap metals, etc.
- Provide prize recognition for businesses that embrace waste reduction at source, especially plastic waste
- Providing grants, prizes and incentives to schools and other learning institutions who have put in place measures to reduce waste paper generation at source

Proposed economic disincentives include the following:-

- Creating local taxes/ charges that reflect disposal costs of packaging
- Increase charges for disposal of product that can be recovered at source and reused
- Instituting volume-based rates for all waste collection programs. All large waste generators to pay more.

Annual waste audits: Waste audits or assessments are the keys to successful source reduction programs in Kisumu City. They will involve assessing the material flow through an institution or businesses and preparing accounting for the amount of materials purchased, used, recycled and disposed off. This should be integrated to the National Environment Management Authority (NEMA) annual Environmental Audit of businesses by making it mandatory for the City Management receiving copies of such audit reports as a feedback mechanism. The City Directorate of Environment should develop work sheets and guidelines that will help in guiding waste audits by various institutions and businesses in the city.

Selective purchasing: City management offices, organizations, institutions, and individuals should be educated and required to preferentially purchase products that are durable, reusable, and repairable; buy in bulk; and avoid purchasing single-use products. It is important for solid waste, environmental, and purchasing officials at all levels of city management to work together in planning, implementing, and monitoring source reduction programs.

Reduction strategies for local industries: Kisumu city has some light industries. These include textile, molasses, waste recycling plants and agricultural produce processors. Also present in the main industrial area are large scale factories for maize milling, soft drinks, and fish processing plants. Other small industries are active in tailoring, making of handicrafts, housing and construction materials and boat-building. Proposed source reduction strategies for local formal and informal industries include the following:

- Designing products and packaging with durability, reuse, and ease of repair in mind
- Initiating "in-house" source reduction programs at company facilities

Reduction strategies for offices, institutions and businesses: Proposed source reduction strategies for private and public offices, institutions and organisation, and local businesses within the city include the following:

- All businesses, offices and institutions in the City to develop and integrate source reduction internal policies
 - Promoting of copy double sided (*back-to-back*) printing in all offices, cyber cafes, printing and photocopying bureaus.
-

- Use of electronic mail among all staff of institutions/ organizations. Ensure all staff have access to email address.
- Install online systems that use bulk Short Message Service (SMS) among staff of the County and other institutions will help local institutions and businesses to increase overall efficiency, reduction of waste paper generation, office space for storage of documents and overall operation costs. The system will further reduce advertising, environmental education/ awareness and billing costs, and also improve on emergency notifications. Bulk messaging will let the County Government deliver SMS messages on waste management, reduction, recycling, etc. to all residents almost anywhere in the County.
- Circulate only one copy of printed material (memos, documents); use routing slips indicating who should read it and who has already seen it.
- Establish central physical and on-line document and file storage areas and systems.
- Reuse paper that has been printed on only one side for different purposes.
- Promote eco- shopping, i.e. the reuse and return of packaging materials
- Establish waste exchanges through the proposed waste business centres.
- Encourage businesses to sell items in reusable containers.
- Shops and supermarkets to provide items in bulk (with discounts) and encourage shoppers to buy in bulk to reduce packaging waste.
- Supermarkets and businesses to provide shoppers with incentives to reuse packaging materials like bags, cartons, boxes, etc.
- City Environment Directorate to appoint waste reduction programs coordinator
- Promote donation of household items like old clothes, utensils for re-use rather than disposal to dumpsite. This can be done through material exchange/ reuse information programs. Material exchange is where the City managers bring together residents who would like to discard any unnecessary or unwanted items with residents who are looking for used items in good condition. This could be done monthly or quarterly at city-wide level.

Source reduction campaigns: Source reduction programs aimed at consumers and residents can achieve significant benefits. An aggressive source reduction campaign for the residential/consumer sector involves using a variety of approaches, in addition to regulatory tools. Decision makers can consider using the following:

- Economic incentives, such as weight-based garbage fees for all generators.
- Environmental Education programmes in all Schools, Churches, Mosques, and Institutions.
- Provision of technical assistance and promotions aimed at increasing participation in source reduction activities like plastic paper bags reduction programs. This should mainly foster reducing the number of plastic bags emerging from major supermarkets (e.g. Nakumatt, Uchumi, Tuskys, Tumaini, Naivas, Ukwala, Yatin, etc.) in the City in agreement with the recent law.
- Promotion of backyard composting practices especially in Schools, high income areas, Hotels, Hospitals (kitchen waste only), and other Institutions that produce large amounts of organic waste.
- Educate the public on waste reduction legislations and best practices.

Reduction of Plastic Waste

Plastic bags have a number of advantages over their substitutes. As a result, they have, through the years, replaced traditional and paper (khaki) bags and secured a firm place in the consumer economy of today including within emerging urban centres and hence the fastest growing component of the waste stream. They have also a number of good environmental qualities. In this regard, some studies have documented reduced generation of solid waste, reduced emissions to water and reduced energy consumption in the production of plastic bags as compared to paper bags. However, an assessment of their environmental impacts cannot be complete without consideration of their total lifecycle repercussions, especially end-of life impacts.

It is estimated that over 200,000 plastics bags (2 bags per family) are generated daily (73million/ per year) from Supermarkets and informal Shops in the City. The vast majority destined to end up in the environment, clogging sewers and drains, act as mosquito breeding grounds, blight of landscapes and trees, polluting soil and water, posing a danger to aquatic life and causing death to livestock when inadvertently consumed. Plastic bags take a long time to degrade. Community consultations indicated that flimsy plastic bags are also associated with *„flying toilets‘*, another growing concern in slum settlements like Nyalenda, Manyatta, Obunga and others. As a result, concern has been expressed from the public at large.

According to the banning law published in March 2017, city management should work with all major supermarkets and shops in the City and reduce the number of plastic bags used to package items for shoppers. Members of the public recommended the following measures for implementation by the City management:

- The use of bags made from cotton, sisal, corn, banana leaves, paper and cloth should be encouraged. This includes the use of traditional baskets (*„kiondos“*).
- Use of green bags/ bio-degradable/ photo-degradable plastic bags or brown bags. A small fee to cover the bag costs can be added into products indirectly.
- Use of milk dispensers in milk supermarkets and all shopping centres, etc. to reduce the number of plastic milk packets.
- Reusing of shopping sturdy bags
- Households, hotels and food stores to refrigerate food in containers rather than plastic bags.
- Promote public awareness campaigns on reduction of plastic bag usage.

All Supermarkets operating in Kisumu to adopt the proposed 3-colour coding system proposed in this strategic document. This is in line with the 3R principle of plastic waste management: re-use, reduce, and recycle. Heavier/ standard bags will also be easier to collect and recycle. This will increase jobs in the recycling (*jua kali*) sector for City residents.



Plate 9: Plastic bags versus green bags in Nakumatt Supermarkets in the East Africa Region (Photo Credits: AWEMAC, 2014)

Successful Initiatives on Waste Reduction for Replication

From mid-2013, Nakumatt Holdings Ltd which has 2 major supermarket outlets in Kisumu (Mega City and Nakumatt Nyanza (Mega Plaza branches) unveiled an internal initiative to reduce the use of plastic paper bags across its branches in East Africa through an elaborate behavioural change campaign. The Nakumatt campaign is geared at imploring shoppers to consider allowing their shopping to be packed in reusable bags, used cartons and bales instead of plastic or paper bags. The Project has already started bearing fruit with Nakumatt management reporting a 15% reduction of its plastic and paper bag usage. To encourage the uptake of the project, Nakumatt Smart shoppers also earn two extra Nakumatt smart points every time they come shopping with their reusable bags at Nakumatt.

In addition, a donation is made by Nakumatt Holdings to Africa Medical Research Foundation (AMREF) for every purchase of a Nakumatt re-usable bag. All these are efforts geared at reducing the consumption of plastic bags by 85% in the long run. Nakumatt management believes that the plastics war can only be won through an aggressive, ambitious, integrated, focused and sustainable approach geared at sensitising end users and shoppers to adopt a more responsible attitude by refraining from the use of plastic bags and opting to use reusable bags. Besides shoppers, the company is also engaged in a consultative process with key suppliers to reduce unnecessary use of plastics in product packaging.

Nakumatt, Naivas, Tuskys, Text Book Centre, Ukwala, and PC World have formed a national forum hosted by the Retail Trade Association of Kenya (RETRAK) to push for Kenyan shoppers to pay for the plastic bags used to pack groceries from supermarkets. This is aimed at tackling the environmental menace posed by polythene bags and reduce operational costs.

On the other hand, over the past five years, campaigns to reduce the use of plastic bags in the East African region have been gathering pace. Last year, the East African Legislative Assembly (EALA) passed the Polythene Materials Act, which is supposed to impose levies on producers and consumers of plastic bags. The levy was a compromise on the part of the East African Community (EAC) member states after Kenya argued that a blanket ban on polythene bags would harm the local economy. It is estimated that manufacturers of plastic bags in Kenya currently employ thousands of people directly since there are many people engaged in the distribution network, performing different jobs ranging from transportation to sales in the streets near markets. However, the EAC Polythene Materials Control law is yet to be implemented. The some of the above successful initiatives could be replicated by the City management to reduce waste generation.

Monitoring and Evaluation of Source Reduction

Monitoring by the City Directorate of Environment should be an integral part of source reduction programs. Although standardized methods to measure source reduction have yet to be developed, tracking the costs associated with source reduction and integrating them into the decision-making process is essential to developing accountability. Monitoring will also facilitate evaluation of programs for efficiency and identifying other possible source reduction measures and program revisions. For example, close monitoring programs with major

Supermarkets management will provide information on the number of plastic bags that have reduced over time.

STRATEGY 2: WASTE RECYCLING AND COMPOSTING

Recycling is the process by which materials otherwise destined for disposal are separated at source, collected, processed, and remanufactured or reused. This is increasingly being adopted by urban communities as a method of managing municipal waste and source of income for the urban poor. Whether publicly or privately operated, a well-run recycling program can divert a significant percentage of municipal, institutional, and business waste from disposal and can help to control waste management costs by generating revenue through the sale of recyclable materials. Public support for establishing recycling programs continues to increase in Kenyan towns.

As discussed earlier, there is a potential of recycling about 27% (waste paper, plastics, glass and scrap metals) and composting up to 63% (organic waste) of the total solid waste produced in Kisumu city (refer to KISWM baseline survey, 2015). For the recycling and composting programs to succeed, the city management must aim at continually providing consistent stream of high-quality (free of contaminants) recovered waste materials that meet the standards of the marketplace and limit health risks to workers involved in the sector and therefore consider an upstream sorting of the recyclable waste.

The strategies proposed are categorised into two: 1) recycling, and 2) composting.

Recycling Strategies

Establishing an effective recycling program presents major administrative and political challenges to the city. For a successful program, strategies proposed and procedures should be continually reviewed and adjusted according to evolving conditions and changing community needs and waste characteristics. The recycling program proposed uses systems approach - where all program components are interrelated, with public participation, public convenience and support in mind as it emerged from the community forums conducted. Proposed strategies are:

Promote Reducing, Reusing and Recycling of waste (3Rs) approach: It is expected that this will lead to the development of appropriate infrastructure to facilitate waste separation and recovery at source, promotion of incentives as well as formalizing informal waste entrepreneurs in the city.

Taka-n-Pesa Centres: Establishment of at least 4 to 5 well-designed and branded *Taka-n-Pesa* (local language meaning *Waste-is-Money*) Centres (waste recycling / waste business centres) in various parts of the city to filter off the recyclables within the waste pathway and ensure economic benefits are extracted along the value chain. The proposed sites for *Taka-n-Pesa* Centres are: Kasagam, Car Wash/ Manyatta, Migosi, Mamboleo and Kisat/ Airport, in addition to smaller centres which will be located at the collection platforms used for household waste. This idea should start with piloting around two (2) centres to assess their impact in waste management and jobs creation. Mamboleo and Kasagam sites are the most recommended for piloting in the first two years of this strategy because land acquisition and availability might not be a major challenge at these sites. They also have sufficient space for future expansion for other commercial activities.

To facilitate the waste exchange between industries and to market reusable materials at the waste Centres, a computer-based Waste Exchange Platform (WEX) should be established. The WEX shall provide a database on the wastes available at the centres (industry waste as

well as post-consumer wastes) and operate on current marketing practices. Once the Centres are in operation, individuals as well as businesses and industries can sell recyclable/reusable waste to the Centres. The Centres should initially accept only inorganic recyclables that have already been separated at the source from municipal solid waste generated by residential, commercial, institutional or industrial sources.

The city management should in the short-term acquire the lands proposed and design the Taka-n-Pesa Centres. Three crucial considerations in designing Taka-n-Pesa Centres (Material Recovery Facilities- MRFs or Waste Exchange Centres- WECs) should be taken into account by whoever will be undertaking detailed designs:

- The points selected will accommodate required buildings, traffic and space for storage and operations.
- Layout and equipment must facilitate efficient and safe materials processing, movement, and storage in compliance with local building codes.
- Design must allow efficient and safe external access and internal traffic flow.
- Support facilities like offices, sanitary block, electricity, ICT infrastructure, showroom of final products, cooperative office, etc. should be included in the design.

The County Government shall initially support the *Taka-n-Pesa* Centres by budgeting for personnel, equipment, building, and other expenses;

City Waste Recycling Park: An investment proposal to develop a Waste Recycling Park for identified wastes in the city area is proposed at the existing Jomo Kenyatta Sports Ground waste composting area based at the CBD or the Kachok Dumpsite after successful Decommissioning. In this park, the city shall encourage setting up of small-scale waste recycling technologies that serve as a model for local businesses. The city should act as a facilitator of the park while private investors/industrialists may own the individual recycling machines in small spaces of about 15m²-25m². The support infrastructure facilities shall be provided by the city at a reasonable cost to ensure long-term sustainability.

The park will provide incubation and capacity building infrastructure to young investors from the County to set up recycling industries in other major towns in Kenya, East Africa and Africa in general. The park will also serve as a demonstration site for civil society, especially for students and others interested to learn about waste recycling and resource recovery. The park design should accommodate an environmental education training section with a library for research and public information. The park should be designed in such a way that it does not create any new environmental burdens for the city or the neighbouring businesses, thus emulating the model of eco-industrial parks. It should be modelled to generate some basic income at a no-profit basis to support its activities. The centre should target visitors from other Counties and integrate itself to the existing western Kenya tourist circuit. The centre may incorporate some services like mobile money transfer services (Mpesa, Airtel money etc), food canteens, Eco-toilets, etc. for sustainability purposes.

Pilot Biogas Plant & Composting Station: Parallel to the development of the Waste Recycling Park, an organic waste-based biogas generation unit and a composting station can be developed to help convert organic waste into useful materials/energy and thus promote resource efficiency. The Directorate of Environment will prepare an investment proposal to secure private sector participation. The station shall be designed to use waste segregated at source to ensure availability of clean biodegradable materials for the bio- generating unit and composting station. The organic materials can be made available to the other industries in the

Waste Recycling Park. To ensure the quality of the final product and guarantee that the compost produced is suitable as organic manure for urban and rural agriculture, expert advice will be solicited. The composting station should also be designed based on modern scientific standards and shall serve as a model training center for other counties.

Market development for waste materials and recycled products: City management should pursue several options for market development for waste materials and recycled products. This can be done through legislative options, economic incentives, recycling technology developments and improvements, development of transportation networks and systems, business development, education strategies, and cooperative marketing.

City recycling program organization: To be successful, the recycling program must be run like a business, rely on trained personnel, and use the proposed institutionalized structures (Ward/ Unit/Village system) within the community. Recycling programs may be designed to be purely public (run by city management as a demonstration and source of income), public and private (run through shareholding in a public company), or purely private (non-profit or for profit).

A 12-component specific and step-by-step plan is proposed to provide an outline for a successful city recycling program design:

Recycling goal: It is proposed that the City Management shall target to recycle about 15 % of the inorganic solid waste collected in the City and 50% of organic waste.

Characterization of recyclables in terms of volumes and accessibility: Should be undertaken by the City Environment Directorate once every year to obtain planning statistics and changing trends in waste characteristics.

Assess and generate sustainable political support: City Environment Directorate should engage community and elected leaders at the Ward and Unit levels to get their support in source separation, willingness to pay for the waste management services, management of community facilities like transfer stations/ skips/ waste collection containers.

Cooperative marketing: Joint/ cooperative marketing of recyclable material can enhance marketability by increasing the volume of material available to buyers and consumers. Organize waste materials sellers, pickers and small recyclers/ artisans into cooperatives. The purpose of the cooperative movement will be to help waste sellers, pickers and small scale/ informal recyclers in the City to make savings and also market their waste materials and recycled products at better and negotiated prices. It was clear from baseline surveys that waste pickers and small –scale recyclers lose a significant amount of profits to middlemen who sell the recyclables to industries. Establishing cooperatives, waste pickers, sellers and recyclers can circumvent the middlemen majorly from Nairobi and increase their profits. The cooperative should also provide welfare services for its members and help to dignify informal waste recycling activities.

Cooperatives involved should have clear organizational structures and annual plans should be developed by registered members. These cooperative(s) should be benchmarked with successful similar cooperatives in Colombia, Brazil, Argentina, Mexico, Philippines, India, and Indonesia, where the members of the cooperatives have benefitted from increased incomes and profits.

The PPP approach proposed herein shall provide opportunities for cooperatives in the sector to render services for a fee, such as the collection of wastes and / or recyclables, street sweeping, composting operations, and materials recovery facilities. The incorporation of small-scale waste actors into formal ISWM programs and the awarding of contracts to waste management cooperatives can save the City money while providing a steady income to waste pickers and small recyclers.

Assessment of markets, market structure and market development strategies for recyclables:

The above proposed cooperative through the technical support of the City Management to undertake annual assessment of markets and market development strategies for recyclables. The county government shall endeavour to secure stable, reliable markets by basing marketing decisions on a clear understanding of the recyclables market system, and sharing decision making among waste sellers, county government officials, the public, and other relevant private sector actors. Assessing markets should involve identifying, profiling, selecting and contracting buyers.

Appropriate waste management technology for collection and processing: Target to undertake recycling at small and medium scale using appropriate technologies.

Annual budget for city recycling programs: Provide an annual budget of about Ksh. 5-10 million for supporting recycling activities by enterprising community groups and private sector every year.

Design of storage containers/ facilities: A three colour (**Green, Red and Yellow**) waste separation system at the point of generation or source is recommended where it will be possible:-



Plate 10: Proposed colour-coding options for waste segregation/separation in the County of Kisumu

GREEN: Organic / Wet/ bio-degradable and compostable waste (mainly food wastes)

YELLOW: Inorganic Materials/ Dry waste (waste paper, glass, scrap metals, plastics)

RED: Hazardous/ dangerous materials/ Others (Clinical waste generated at the homes,

batteries, pampers, expired chemicals and drugs, etc.)

The design, size and type of storage facilities must clearly distinguish the 3 colours and this must be legalised by county laws. Various designs, sizes and types of containers are recommended as outlined elsewhere in this strategy.

When small amounts of waste generated, a single container with three colours or plastic bags of different colours should be designed and legalised by the county government for households. For institutions, different containers with different colour codes are recommended as the most appropriate facilities. These colour system/codes should be implemented through a city-wide campaign and environmental education awareness system, piloting, exhibitions and demonstrations using all forms of media by targeting all city residents, students, etc. Mandatory waste separation at source and recycling regulations with option and flexibility are recommended for this strategy to work in the short and long run.

Siting of collection points and options for preparing recyclables for collection: Eight hundred and fifty (850) potential waste collection points were identified and geo-referenced (*see KISWM Baseline Survey Report, 2015*) for long term planning on the siting of collections points. The GPS points shall be used as a general guide to locations. However, the most convenient, acceptable and cost-effective collection points shall be selected by the community using the Ward Units / Village system and officials. Collection from the communal/ village points is recommended to be contracted locally to a community group of youths or women or a cooperative of waste management actors like waste pickers.

Recommended options for preparing recyclables for collection will depend on individual community/ estate needs and circumstances that are appropriate. The options recommended include the following:

- Source separation using the 3-colour system (Green, Red and Yellow)
- Curbside collection for multiple-family dwellings/ Apartments or gated estates
- House-to-house/ door-to-door collection
- Establishment of Taka-n-Pesa centres as drop-off centers for recyclables to support the youths and women in the sector without pay or for cash from high and medium income residents
- Mixed waste collection for a higher fee (of upto three times is recommended)

Recommended options for collecting recyclables from collection points to the *Taka-n-Pesa centres* may include the following:

- Using existing city workers for waste and recyclables
- Using private companies for recyclables only
- Using private haulers for waste and recyclables.

A combination of the above three options for the city is recommended depending on the estate and waste characteristics.

The proposed Ramp Platform to gather waste should integrate the recovery of materials from the separation at source. They should be carefully management such a way by the city.

Start-up plan and commencement of recycling programme: The City management in partnership with various stakeholders should start with a *voluntary* or *pilot* recycling program, and use information and experience gained from it to plan for a large-scale recycling

program. The first step will be to select one Unit in High, Medium and Low estates to pilot the waste segregation and recycling programs proposed in a period of about 6-12 months. Piloting can also be done in one Unit per Ward depending on availability of funds. Then, the city management shall use lessons learned and roll out a mandatory recycling program throughout the 14 Wards and all approved Ward management Units.

Implement education and publicity program: The whole range of the system proposed should be implemented through a city-wide campaign and environmental education awareness system, piloting, exhibitions and demonstrations using all forms of media by targeting all city residents, students, etc. The proposed section of *Environmental Planning, Education and Awareness (EPEA)* within the Directorate of City Environment should take a leading role in the implementation of education and publicity program. Program publicity, promotion, and education must be a continuous process.

Monitoring and Evaluation (M&E): The whole program components shall be continuously monitored and evaluated at the end of every financial year to undertake necessary review and adjustments to achieve success. The City Directorate of Environment will design monitoring system using indicators given in this strategy.

Composting Strategies

The composting programs should target compostable portion (60%) of mixed solid waste, including food wastes, waste paper products, and other decomposable organics. Composting organic materials can significantly reduce waste generated and offers economic advantages for the city and county government since the costs of other options are high. Composting as part of recycling is the second component in the hierarchy of ISWM as source reduction. When developing and promoting a composting program and when marketing the resulting compost, Kisumu city planners and managers should stress that the composting process is an environmentally sound and beneficial means of recycling organic materials, not a means of waste disposal. Developing and operating successful composting programs in Kisumu City presents several challenges. The challenges that need to be solved during the strategic period include the following:

- Lack of waste separation as source and collection systems
- Developing markets and end uses
- Inadequate or non-existing national standards for finished compost
- Lack of knowledge and experienced technical staff on composting
- Potential problems with odours
- Controlling of contaminants from composting sites
- Usually low price of sales

For this strategy to succeed, the composting procedures recommended at the ***community/household level, Taka-n-Pesa Centres*** and at a large scale at the approved ***county sanitary landfill*** are:

- Collection of organic materials from the source and starting by markets where the organic part is high
 - Making of compost piles at the household, institutional centres
 - Turning, monitoring and screening of final product
 - Packaging and marketing of the compost
-

- Utilization of compost in agricultural farms, urban forestry, urban agriculture, and landscaping

Political support: Get political support for changing the community's waste management approach by the residents, MCAs and other leaders, CBOs, NGOs, etc. Most city composting projects, whether county or privately operated, will require some county governmental political and financial support or approval.

Composting sites: composting is recommended at the community/ household level (Backyard Composting), institutions, hotel backyards, *Taka-n-Pesa centres* in small-scales and on a large scale at the approved county sanitary landfill. All actors must avoid using mixed waste for composting purposes due to contamination. Construction of a composting facility at an approved sanitary landfill is recommended because it will have its benefits. One of the major advantages is the savings in transportation costs for the compost which should be close to the markets and also for the non-compostable and non-recyclable wastes. A second advantage is that the difficulty of acquiring a site is significantly reduced.

Potential compost uses and marketing: Marketing compost products is crucial to the success of any program. Market outlets to be targeted to expand the market for compost include crop farming applications (urban, peri-urban and rural areas), horticulture, tree nurseries and greenhouses, parks, golf courses, soil remediation, cemeteries, landscaping of the towns/ urban centres, surface quarry reclamation material, roadside landscaping management, forestry applications as a top soil, office parks, new housing estates and playgrounds. The compost can also be used as alternative cover on waste at the sanitary landfill. All forms of marketing strategies should be used to create market for the compost product.

Environmental education, awareness and capacity building programs:

- Establishing an effective two-way communication process between county government, developers and the public is crucial, and public involvement in the must begin during the planning stages.
- Concerns voiced by public representatives should be addressed as early in the project's development as possible through video shows in various forums that include churches, schools, radio talks, newspapers and magazines articles/ adverts, T.V. programmes and public gatherings.
- Communication with community leaders and neighbours of composting sites should be continuous.
- To ensure good relations, the public should be informed of the types of materials accepted and prohibited and the collection schedules. A complaint response procedure will also be important to document and respond to complaints promptly.
- City residents active in composting, planners and managers should visit successful compost programs in Kenya and other African countries like South Africa to benchmark and learn appropriate technologies.

Participation of the County Ministry of Agriculture: County Ministry in charge of Agriculture will be required to take a leading role in market research, developing compost quality standards, and running demonstration projects, involving of the local farmers and give practical assistance to farmers and other users on the distribution and sale of the compost product. Opportunity exists to enhance synergies between urban and peri-urban agriculture

and other urban sectors through multi-stakeholder consultations on rural and urban agriculture policy, planning and management.

Inventory of materials available for composting: This should be done on a 5 year-cycle basis for planning purposes. The planning process should include an accurate assessment of the quantities of materials available for processing and their composition and sources. This will also help in designing waste collection and other disposal programs.

Composting techniques, needs and compatibility: Composting at a household or community-level and other centres (like markets) at a small-medium scale is recommended. *Pile, window and in-vessel composting systems* are the most recommended in the city. A successful composting program will require space, trained manpower, the correct tools, good supply of quality and non-contaminated organic materials, enough water supply and ready market for the compost. Whichever approach is chosen, it should be compatible with existing collection, processing, and disposal systems. All composting facilities require some degree of material separation, which can take place at the source (as with source-separated programs) or at the processing facility. Labour intensive technologies should be given priority due to availability of cheap labour in the county.

Organic materials collection: Recommended options for collecting organic materials for composting purposes from collection points to the ramp platform sites may include the following:

- Using existing City workers for waste and recyclables
- Using private companies for recyclables (including organic waste) only
- Using private haulers for all waste and recyclables.

County Government composting policy: Composting standards and guidelines should be regulated by amending the existing laws. The county government should explore the possibility of setting prices for compost and provide guaranteed supply and flexible price system. The County Government should also facilitate the process by providing permits, zoning variances/ change of user, or special land use permits for all composting and recycling facilities where need arises.

Budget and financing: The County government to budget for about Ksh. 50 million every financial year (with an annual increment as per the inflation rates) to support composting programs at various levels. This can be used in constructing composting facilities at the municipal sanitary landfill and purchase marketing and supply equipment, if needed.

Monitoring and Evaluation: Routine testing and monitoring is an essential part of any composting operation. At a minimum the following should be monitored: compost mass temperatures, oxygen concentrations in the compost mass, moisture content, particle size, maturity of the compost, pH, soluble salts, ammonia, organic and volatile materials content. Overall, city management must also monitor the percentage of organic materials being composted, employment opportunities generated, health and safety conditions in composting sites, compost prices and general market conditions. Periodically, evaluation records will help to identify where improvements will be needed and provide information necessary for making the operations more efficient.

Investment in a Small-Scale Commercial Compost Composting Plant

Investment costs for the construction of the plant amount to approximately Ksh. 186,865,000 and include the cost of site, land, procurement of materials for the construction of necessary facilities, procurement of equipment and machinery as well as the cost of management, planning, design, and construction.

We assume that the organic waste is already in a landfill area hence avoiding additional transportation costs. The other assumption is that the organic waste is already sorted out and all hazardous and inorganic materials have been eliminated at the Central Transfer Station (CTS).

The total finished product (Compost) is 40% of the total tons processed (400 tons) amounting to 160 tons/day which translates to 58,400 tons/year. Sale of produced compost (58,400 tons/year), at a cost of 1,700 Ksh. /ton, achieves an annual (average) income of Ksh. 99,280,000. Annual expenses (average) amounting to Ksh. 37,986,543 include operating costs, Human resource costs taxes and Marketing costs of Ksh. 1,440,000.

Assuming that the funds are provided from borrowed sources in the form of credit from a bank (Ksh. 186,865,000), in the form of loans to 4 years and the interest rate of 12%, a complete return on investment is made in 4 years, provided that annually 58,400 tons are produced and sold. This translates to a positive Net Present value of Ksh. 34,881,451. The summary is shown in table below (refer also to the photo below).

Table 3: Medium-Scale Compost Plant Financial Analysis Summary

Item	Amount (Ksh)
Total set up cost (capital, machinery & other start-up costs)	186,865,000
Average Revenue/year/ contract price awarded	99,280,000
Average Operating Expenses including taxes/year	37,986,543
Average Net Income/year	61,293,457
Payback period	4 years
NPV @ 12% p.a after 5 years	34,881,451

In summary, for the CoK to venture into this option, the following conditions must be met before a final policy and executive decisions are made:

- Undertake a market feasibility study for organic compost in the county and western region
- Ensure all organic waste is separated at the source in all the county's urban centres so us to get the required minimum uncontaminated organic waste material
- Ensure that all organic waste is transported to the composting site at no extra cost to the composting plant investor
- Draft county policies and laws that promote organic farming by using organic compost products produced by the county government. The county government can also guarantee to purchase a given percentage of compost for farmers. The county government may also opt to provide an initial short term subsidy to farmers that buy the compost.
- Establish quality control standards and procedures for organic approved by Kenya Bureau of standards

STRATEGY 3: INCINERATION AND WASTE TO ENERGY RECOVERY

Prioritization of Incineration for the City

Incineration is a waste treatment process that involves the combustion of organic substances contained in waste materials. Incineration and other high-temperature waste treatment systems are described as "thermal treatment". Incineration of waste materials converts the waste into ash, flue gas, and heat. In some cases, the heat generated by incineration can be used to generate electric power as will be explained briefly below.

Incinerators reduce the solid mass of the original waste by 80–85% and the volume (already compressed somewhat in garbage trucks) by averagely 95%, depending on composition and degree of recovery of materials such as metals from the ash for recycling. This means that while incineration does not completely replace landfilling, it significantly reduces the necessary volume for disposal. Furthermore, incineration has particularly strong benefits for the treatment of certain waste types such as clinical wastes and certain hazardous wastes where pathogens and toxins can be destroyed by high temperatures.

Incinerators may emit fine particulate, heavy metals, trace dioxin and acid gas, even though these emissions are relatively low from modern incinerators. Other concerns include proper management of residues: toxic fly ash, which must be handled in hazardous waste disposal installation as well as incinerator bottom ash, which must be reused properly. Incineration is recommended for Kisumu city since the global warming potential of the landfill gas emitted to atmosphere is approximately 30% higher than the amount of Carbon dioxide (CO₂) that would be emitted by combustion process.

Waste-to-Energy (WtE)

Waste-to-Energy (WtE) or energy-from-waste is the process of generating energy in the form of electricity and/ or heat from the incineration of waste. Most WtE processes produce electricity and/or heat directly through combustion, or produce a combustible fuel commodity, such as methane, methanol, ethanol or synthetic fuels. It is a common modern development strategy of managing waste in Japan, Germany, USA, France, China, Canada and other Countries. One problem associated with incinerating Municipal Solid Waste (MSW) to make electrical energy, is the potential for pollutants to enter the atmosphere with the flue gases from the boiler. These pollutants can be acidic and may cause environmental damage by turning rain into acid rain. However modern industrial technology has solved this problem by the use of lime scrubbers and electro-static precipitators on smokestacks. By- passing the smoke through the basic lime scrubbers, any acids that might be in the smoke are neutralized which prevents the acid from reaching the atmosphere and polluting the environment. Many other devices such as fabric filters, reactors and catalysts also destroy or capture other forms of pollutants.

Investment Analysis of Waste to Energy Plant

Small investment in a waste to energy plant has been estimated to cost Ksh. 2.0 billion. Such resources are currently not within the reach of Kisumu County Government considering the total resources currently earmarked for all her development programmes is less than Ksh. billion as per its annuals financial reports. This means that the county may need to

consider financing for this project from external sources subject to guarantee by the National Government.

Projects of this magnitude require a high tonnage to the sanitary landfill and the county will have to increase the delivery to the landfill to about 400 tonnes up from the current 273 tonnes per day available from the city. Collection will therefore have to be marshalled from all of Kisumu county urban centres and some from neighbouring counties to make this feasible. Further to this, the County would at a minimum have to negotiate with Kenya Power (KP) to sell the 9 MWH produced from this investment at \$ 35 per MWH for it to be feasible. Based on this assumption, the payback period is 10 years with the NPV at the end of 20 years being Ksh. 1,889,720 (see Table below for summary calculations).

It is recommended that further in-depth feasibility studies are carried to establish complete viability of this venture by analysing waste characteristics on other urban centres in the County and other surrounding counties like Vihiga, Kakamega, Homabay, Siaya, Kisii, Nyamira and Nandi. This should explore the economic viability of investments in large-scale WtE plants of over 1,000 tons. Before attempting the WtE initiative, it will also be essential to investigate very carefully the moisture content and composition of the waste (after it has been picked over by informal sector recycling workers) in all seasons because the energy value of some wastes is so low that incineration is not feasible.

Table 10: Investment Analysis for the 400 ton Waste to Energy Plant

Item	Amount (Ksh)
Total set up cost (capital, machinery & other start-up costs)	2,025,825,000
Average Revenue/year	414,151,982
Average Operating Expenses including taxes/year	237,381,184
Average Net Income/year	177,790,797
Payback period	10 years
NPV @ 6% p.a after 5 years	1,889,720

Recovery of energy from waste remaining after organic and recyclable solid waste is removed is not likely to be cost-effective and could therefore even be counterproductive for the material recovery projects. Moreover, the recent ban of plastic bags has even more reduced its interest and benefits.

STRATEGY 4: PLANNING FOR A SUSTAINABLE SOLID WASTE MANAGEMENT SYSTEM

This strategy focuses on the planning of sustainable storage, collection, transportation and disposal systems. Storage, collection, transport and disposal are the four essential elements of any solid waste management system. Compatibility between each of the three stages of storage, collection and transport is essential to ensure economic operation. The objective of this strategy is to partly containerise storage, collection and transport system, which does not allow the waste material to come in contact with the ground at any stage of the collection system. The proposed specific strategies are outlined under the following sub-headings.

Planning for Storage Facilities: Three Coloured Waste Separation System

The city management should apply the following criteria to select and purchase storage facilities: Animal proof; insect proof i.e. be protective against breeding of flies/ should have a lid; weather proof/water proof; washable; robust enough to meet the exigencies of normal use; fire proof where it is applicable; cost effective and affordability by city residents; and must have the three approved three (Green, Red and Yellow) colours to promote waste separation at source wherever it is possible. It is recommendable that all primary and secondary storage facilities should have excess capacity of 50% to avoid spillage at any point.

The design, size and type of storage facilities should clearly distinguish the 3 colours and this must be legalised by county laws. Various designs, sizes and types of containers are recommended as outlined elsewhere in this strategy. These colour system should be implemented through a city-wide campaign and environmental education awareness system, piloting, exhibitions and demonstrations using all forms of media by targeting all city residents, students, institutions, etc. Mandatory waste separation at source and recycling regulations with options and flexibility are urgently recommended for this strategy to work in the short and long run.

It is also recommended that a 3-coloured waste separation bins are placed at public places and various locations including roadsides, parks, schools, sports venues, leisure and cultural facilities and Government office buildings, as well as public and private housing estates. The county of Kisumu (CoK) Directorate of Environment shall consider any required adjustments in the number and locations of the bins based on a number of factors, including requests from the public, pedestrian flow and the actual amount of recyclables deposited in the bins. The CoK should encourage and assist property management companies and resident organizations for provision of waste separation facilities on each building floor to facilitate source separation of waste by waste generators, as well as broaden the types of recyclables collected.

The city environmental laws should be reviewed to ensure that the responsibility of providing standard storage facilities lies with waste generators including all businesses and shops in commercial areas. Each business must provide facilities in strategic points for its customers. The city can only provide storage facilities in public areas not covered by private businesses.

Only standard storage containers approved under the city laws should be used by waste generators. Temporary and unstandardized containers e.g. oil drums, cartons, boxes, assorted plastic bags and household containers should be prohibited.

A variety of facilities may be used for primary storage of solid waste provided they meet the minimum criteria outlined above. Both, (1) **primary** i.e. individual and (2) **secondary or**

communal storage of facilities are recommended for the city. The storage volume/ capacities and type required for solid waste should be a function of the: number of premises/ business size served; rate of waste generation; family size/ household size; frequency of collection; nature e.g. portions of organic/inorganic waste; and abrasiveness of materials e.g. glass, recyclable or not.

Standardization of primary storage facilities is recommended to maximize labour and transport productivity. Standardization should be a city-wide policy. Three types of primary standard containers are recommended:

Standardized plastic bags of three colours (Green, Yellow and Red): Plastic bags are suitable in a number of ways – they contain moisture if they have not been torn and they are relatively clean and easy to handle. However, they will require careful organization to distribute by service providers based on experiences from the private sector. The city must provide general guidelines to avoid alternative use of the plastics bags and limit susceptibility to tear by scavenging animals. Mass usage will reduce the cost of the bags and distribution. Recovery of the bags is recommended so that they may be recycled into new bags, plastic poles and other products.

Plastic or galvanized -iron bins with lids: These should be promoted in middle and high income estates, hotels, offices, commercial areas/ businesses and institutions. Capacities of 10-100 Kgs/ Litres are recommended. They should be used together with standard plastics bags to promote hygiene standards (see Plate 13 below). Wastes from large containers should be collected from source.

Street Containers: These should be in City three colours at every point at strategic points for pedestrians to use. Continuous clarity of the 3 colours and display of environmental awareness information is critical for waste separation in the streets. Trainers, environmental inspectors and law enforcers will be required to monitor the usage of these street containers to ensure their effectiveness.



Plate 13: Street containers with no guiding colours

Planning for Solid Waste Collection

The collection system proposed here below should be operated in an integrated way. This means that all of the links in the management chain should be considered when any part of the system is being designed, so that all system components are compatible.

Such a way, the CoK should be able to reach a higher collection rate than the current quarter (25%) and achieve half of the waste (50%). This objective of collection rate should be achieved by 2020 for the pilot areas and by 2030 for the whole city.

Frequency of collection: The frequency of collection is influenced by public expectations, rate of fly breeding and decomposition. An average and general frequency of once per week is recommended as the minimum standard for solid waste in the City to reduce the cost. However, in high waste generation spots like markets and busy hotels and other eating places, hospitals, etc., daily collection is recommended to avoid excess accumulation and decomposition.

Time of the day and number of collection days: Collection should be done only during the day (7am-7pm) since the City does not experience must traffic jams like large cities such Nairobi and Mombasa. Collection at night may be preferred by collection crews during seasons when daytime temperatures are very high and the sun is very strong. It is recommended that collection vehicles to operate for 6 days of the week (including weekends) but workers should be entitled to off-days and over-time where applicable as per labour and constitutional workers' rights. Workers can work on well-organised shifts like those used in hospitals among medical staff to ensure a continuous public health service to the city residents.

For industrial, demolition and construction wastes – A big percentage of wastes from industries and construction sites are not biodegradable so they can be collected less frequently than household wastes, either on a regular schedule or at the request of the generator. This also applies to day schools and other institutions without kitchen wastes.

Waste collection points: The point of collection is the location at which the waste passes from the control of the generator to the control of the collection stakeholder. It is the interface between the service recipient and the service provider. Despite the time and effort required, the generator should be responsible for the task of taking the waste to the point of collection and must be willing to do this work. Accessibility should be considered by Ward-Unit leaders when planning these points. Communal points should be prioritised by residents to kerbside systems to reduce house-to-house collection costs. Table 11 below gives the existing 310 Ward-Units that must be involved in selecting points of waste collections. The roles of Ward-Unit leadership / environmental committees should be enshrined in the County environmental laws for this proposed strategies to work.

Table 11: Existing Ward-Units in Kisumu City

S / N	Administrative Ward	No. of Units
1	Migosi	06
.		
2	Kondele	06
.		
3	Nyalenda A	05
.		
4	Nyalenda B	05
.		
5	Manyatta B	03
.		
6	Central Kolwa	30
.		
7	Railways	30
.		

8	Milimani/Market	19
9	Central Kisumu	36
1	North Kisumu	26
0		
1	Kajulu	44
1		
2	South West Kisumu	37
3		
1	Kaloleni /Shaurimoyo	22
3		
1	East Kolwa	41
4		
T		310
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Stationary waste collection facilities: Recommended secondary/ communal facilities waste collection facilities may be either stationary or portable units.

The stationary units should be designed as covered containers made of heavy duty plastic or steel material with access/ loading facilities and three (3) proportional compartments (Green, Yellow and Red) to promote waste separation at source and prevention of contamination. They should be placed on concrete platforms on communal points selected by the Ward-Unit leaders/ officials. Container sizes should range between 0.5-5 tons depending on the waste generation rates at a particular point and area. Stationary facilities are the most recommended for all residential areas in the city to enable residents easily drop their wastes for collection.

See Plates below which can be modified with three colours and other basic environmental standards/ criteria to serve the Kisumu residents effectively.

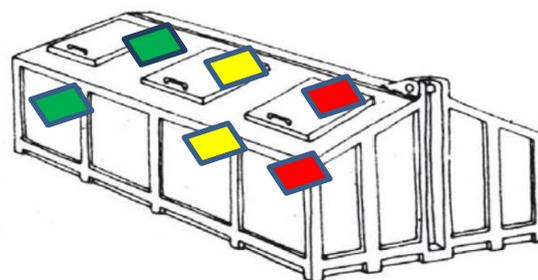
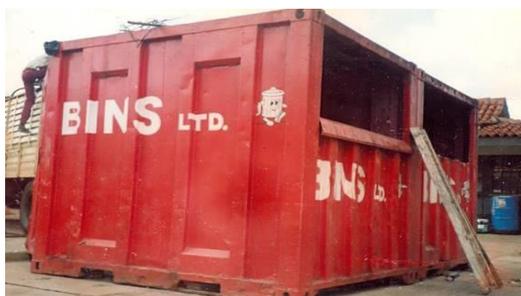


Plate 14: Sample of a communal / secondary stationary facility (must be designed to have 3 colours)



Plate 15: Types of stationary skips / containers (3 Colours) proposed for Communal Collection Points

The numerous collection points will be managed by the City and their location will be confirmed or removed on a regular basis. Their number should remain as low as possible to easier management.

Collection of municipal waste and recyclables: There are various kinds of vehicles that have been designed to collect different types of waste in separate compartments, but such systems are very expensive and not suited to the economic and social conditions in developing countries. For the Kisumu city situation, it is better to encourage the informal or private sectors to collect the recyclable fraction directly from the collection points through agreed terms by the CoK and Ward-Unit administration/ leadership and as per the law.

Street sweeping management: It is recommended that all streets in the Central Business District and major roads (Nairobi, Busia, Kakamega and Kibos Roads) should all be mapped and their manual cleaning and landscaping/ beatification be privatised to local companies through the public procurement procedures but restricted to youths, women, physically challenged groups or small private collection companies in operation in the city. The tender price and area to be cleaned should be based on the distance to be covered and estimated waste generation statistics. The CBD can also be zoned to units and contracts can be awarded to different groups to encourage competition and efficiency. The groups cleaning the streets should be responsible in delivering the waste to CTS. Streets within residential estates and industrial area should be cleaned during the mandatory monthly clean-ups by adjust communities as it will be coordinated by the Ward-Units Environment Committees. Schools and colleges should be integrated into the monthly clean-ups.

Ramp platforms (RP):

Waste transfer stations are facilities where municipal solid waste is unloaded from collection vehicles and briefly held while it is reloaded onto larger long-distance transport vehicles for shipment to landfills or other treatment or disposal facilities. By combining the loads of several individual waste collection trucks into a single large truck, the city can save money on the labour and operating costs of transporting the waste to a distant disposal site. They can also reduce the total number of vehicular trips travelling to and from the disposal site.

Further to collection points, the household waste will then go through a few Ramp Platforms (RP) that will be built and work like transfer station. Since the landfill will be located further

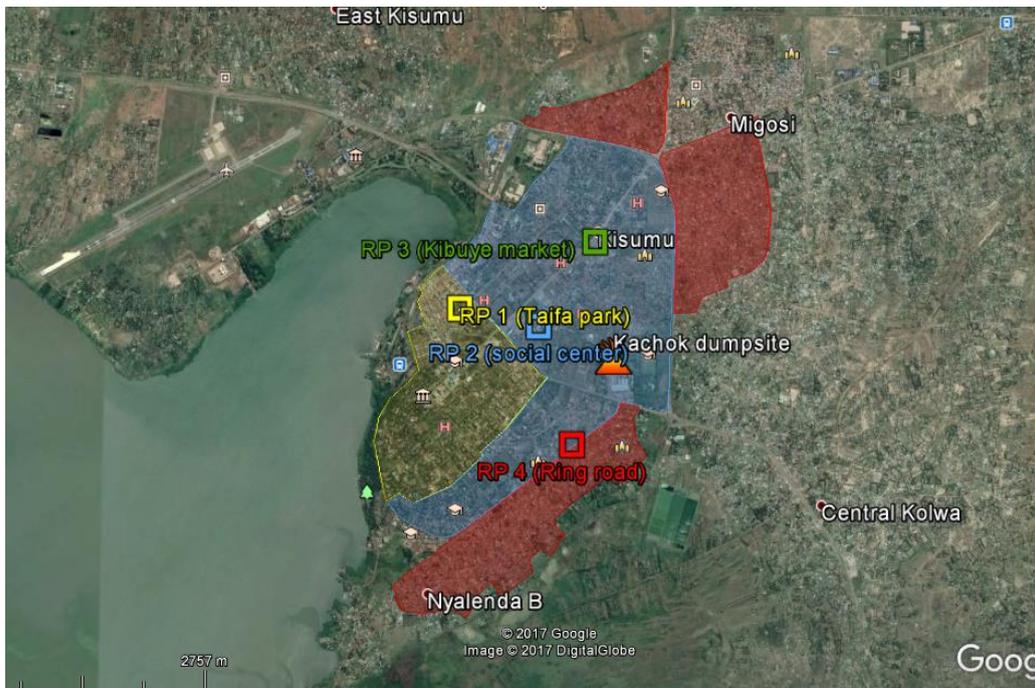
from the city center, this new step will be helpful to reduce transportation of waste which is a costly part of SWM for the community.

A well-designed RP should be averagely 400 square meters should include the following features: Road entrances and exits, traffic flow routes on site, queuing areas, the scale house, primary functions at the transfer station building, buildings, parking areas, public conveniences, buffer areas, holding area, leachate collection and treatment system, Taka-n-Pesa Centre, health and safety facilities, and space for future expansion of the main transfer building.

The sites proposed for these new facilities are already used as collection points and will cover:

1. Extended CBD (Taifa park),
2. Housing estates (social centre),
3. Slum and outskirts (Ring road),
4. Big market (Kibuye market).

The map of covered areas by RP is shown below.



The basic design of the ramp platforms (RP) will be composed of :

- a ramp (less than 12% or 7°) allowing the small collecting vehicle to go up to,
- a platform where to drop waste into skips or trolleys.

With regard to the geometry of the available spaces, the portable secondary units (skips or trolleys) will be located at the top of the platform.

The skips or trolleys will then be loaded into trucks and tipped off at the landfill after transportation. The new equipment should be procured in consequence.

Portable secondary units: The skips will require the use of automatic skip-lifting equipment, fitted on to collection vehicles for speedy waste- loading. This type of containers are physically loaded on to collection vehicles and transported to standby large tonnage vehicles at the RP for direct disposal to the sanitary landfill. In this system, which partially exists in the city, vehicle productivity is maximized, since time taken to set down an empty container and load a full one is very small (usually about 5-10 minutes). Tipping is also done within 3-5 minutes. Such vehicles will be able to make several round trips compared to those collecting from dustbins/primary storage facilities/ stationary facilities. The labour requirement will also be minimal when compared with stationary units.

With a waste collection of about 145 tons/day (1,015tons/week), the city's commercial/ business centres/ nodes, markets and institutions require about **300 skips of averagely 5-6 tons**. This also includes an excess capacity of 50% for planning purposes and achievement of high environmental standards. This excludes the facilities required in industries and hospitals for hazardous waste. Public hospitals should use storage facilities as recommended in the public health act on management of clinical waste. However all kitchen waste should be stored in skips that should be accommodated in the above provision of 300 skips for the city. The city requires **5-7 tractor skip loaders** to serve the whole city effectively. Their role will be limited to collection of waste from high generation points to the CTS proposed at Kasagam area.

Skip loader and skip specifications: Guiding specifications of skip loaders and skips that exist in Kisumu can be referred to the baseline study report for reference purposes. The existing system (see plate 23 below) was found to be effective and needs expansion to cover other high generation points in the city.



Plate 16: Recommended skip system for expansion with some minor modifications

The sections and staff responsible for primary and secondary collections must be different but should be well-coordinated by the City Director of Environment. A community-based scheme operated at the Ward–Unit level should take a leading role in transferring waste from the communal points to the RP. Procurement of an agent to operate at the Ward-Unit level should

be decentralised in terms of bidding and short listing while contracting should be done by the County Government. The transfer from the RP to the final destination should be the responsibility of the CoK management or their appointed/ contracted agents through public procurement procedures.

Wastes already categorised as green waste, recyclables and hazardous waste should all be received at the RP. All recyclables should be sorted out and sold to various *Taka-n-Pesa* Centres. If communities based at Ward-Units offer programs that manage parts of the waste stream separately, it might reduce expenses by locating the material management programs at the RP. Since the RP will be publicly operated, it is more likely to be open to public use as the CoK management may decide.

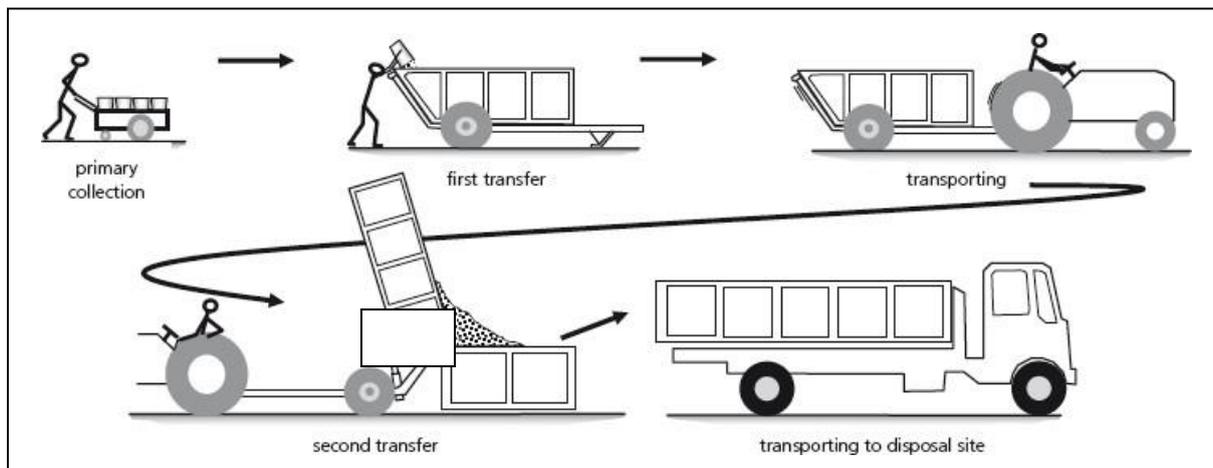


Figure 2 : Proposed Waste Collection System

Taka-n-Pesa Centres and City Zoning : To ensure the acceptance of the idea of the CTS by the local communities and stakeholders, it is recommended that the CoK should integrate *Taka-n-Pesa (Waste-is-Money)* centres to act as central Waste Materials Recovery Centres (WMRCs). This will not only improve the overall goal of the ISWM Strategy but also put the County Government on task to meet the set goals and standards of the proposed centres and also create employment for the youths and women.

The key six (6) areas identified for potential **Taka-n-Pesa** Centres were: **Kasagam** (E 34.77336 N -0.11468 or E 34.774802 N -0.115010), **Mamboleo, Kisat** (E 34.749 N -0.081928 or E 34.750103 N -0.081914 or E 34.753665 N -0.085151), **Migosi** (34.7875 N -0.07034), **Manyatta/ Kibos Road** (E 34.78466 N -0.08095), and **Dunga**. Two **Taka-n-Pesa** Centres have been recommended for Zone B due to its expansiveness and availability of space. The County Government has to approve these centres before final designs and development is undertaken to serve various estates/ zones identified. The zones are a guiding factor to ensure all areas and residents of the City have an accessible **Taka-n-Pesa** Centre. The SWM laws should ensure that zoning should not be used to discriminate who should operate from those centres. The CoK should set criteria of allocation of space in the proposed centres.

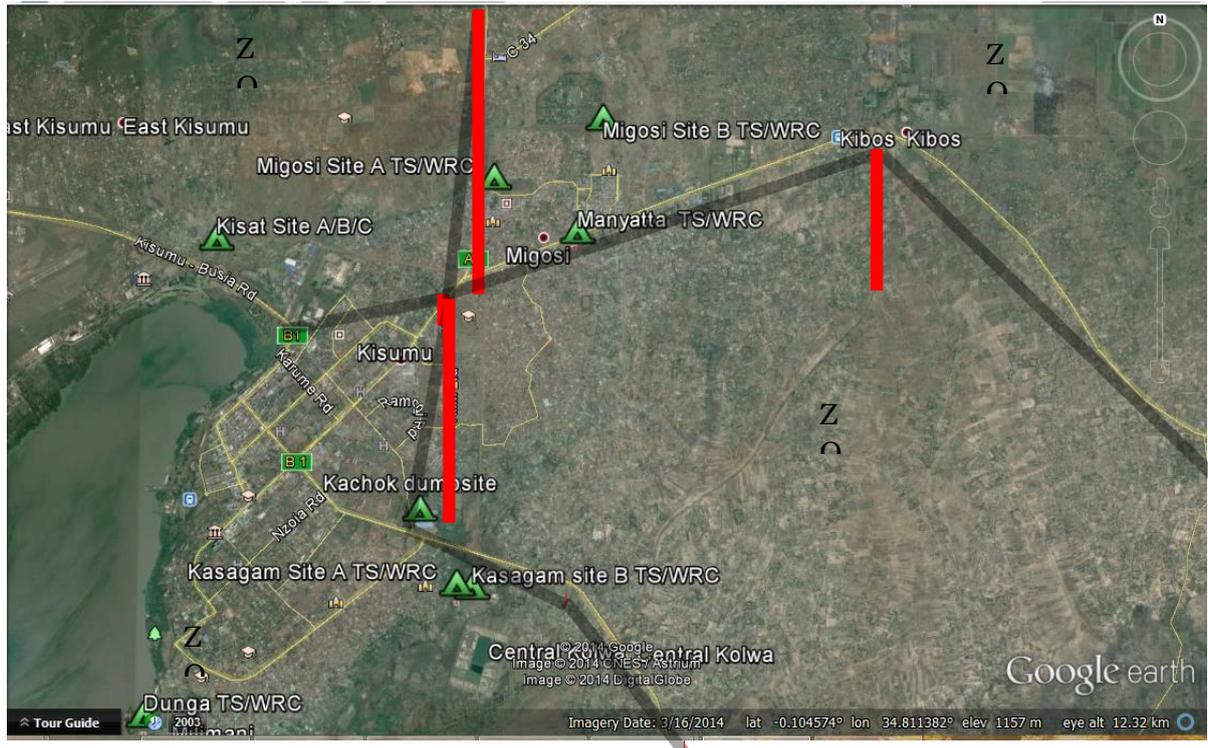


Figure 5: General Guiding Zones for Operating the Taka-n-Pesa Centres

Operation and maintenance of collection vehicles: A preventive maintenance programme is recommended to optimize the waste collection vehicles. A section for minor repairs for garbage vehicles should be created in the main city workshop yard along the Obote road to serve the city Directorate of Environment.

Supervision of waste collection: Supervision will be needed for increasing safety and efficiency, and for promoting good public relations. There is need of about 5 supervision double cab pick-up vehicles for senior managers and field officers. Supervision will require official documentarian and automation of the transport section by the city Directorate of Environment.

Health and safety: Waste collection is a dangerous occupation. There are many kinds of risks of infection and injury. Prevention of illness and injury shall be prioritised because it is not just a humanitarian duty and an employer's responsibility, but can also improve morale and motivation, reduce costs and improve service reliability.

Transportation Planning

The following factors were considered in undertaking waste transport planning process for the city: Transport distance and road conditions within Kisumu city, to the CTS and to the landfill site; local availability and sustainability; cost of vehicles and durability; vehicle bodies; waste density; waste nature and characteristics; waste generation rates and points; past experience of SWM staff, experts and experience from other towns; and the availability of spare parts and servicing.

While standardisation of vehicles has been taken into account to aid maintenance system, Kisumu city requires more than one kind of vehicle due to its three-stage collection/ transfer proposed system. This is due to the long distance to the proposed landfill site. Based on the above factors, the following combination of refuse collection vehicles will apply for Kisumu city.

Tractors and skip loaders (45-60 hp): Because of the widespread use and relatively low cost of farm tractors in Kenya, the tractor and conventional open trailer is recommended for handling areas with high generation points (hot spots) like markets, institutions, main CBD bus park and commercial points. Tractors have longer economic lives than trucks because of their low engine speeds and simple construction. 45-60 hp tractors with gross vehicle weight of 11 tons and body volume (6m³) are the most recommended for the kind of waste densities existing in the city (see Plates below). This kind of tractor hydraulic system will be used for both picking up the 4-6 ton containers/ skips and for tipping the wastes without the driver having to leave the tractor seat. To handle the proposed initial 300 skips, the city requires 5-7 tractor skip loaders (full sets) to serve the city's hot spots effectively. Their role will be limited to collection of waste from high generation points to the CTS proposed at Kasagam area.



Plate 17: Proposed tractors and trailer system

Side loading roll-top Vehicles: Side loading roll-top vehicles with gross vehicle tare weight of (10-12 tons) with a capacity of carrying loads of averagely 8 tons (pay load) are recommended for waste collection from communal collection points at the ward –units to the Central Transfer Station (CTS). Basic specifications include: 8 tons, overall length 8.7 m with 6-wheels. It is recommended that the county technical officials project engineers to benchmark quickly with garbage trucks in use in Nairobi and other African cities and select the best specifications for Kisumu.

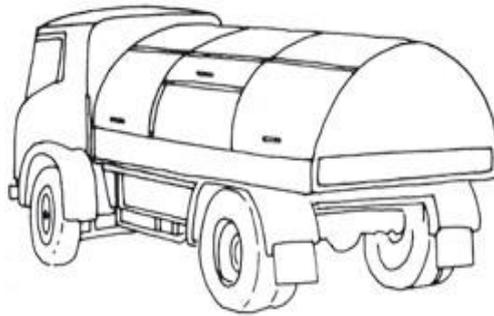


Figure 6: Proposed side loading roll-top vehicles for communal points to the CTS

Heavy Duty and Long Distance Trucks: A set of heavy duty and long distance trucks with gross carrying capacity for loads of averagely 8 tons (pay load) and 20 tons (pay load) are recommended for waste collection from the Central Transfer Station (CTS) to the proposed landfill in (see sample plate 18 below). A total five 8-ton and five 20-ton trucks are required to handle 272 tons per day. An investment of about Ksh. 117,000,000 is needed to invest in such 10 garbage collection trucks.



Plate 18: Sample of a heavy duty 20-ton garbage truck recommended for long distance haulage

Tractor Shovels: The County government should also purchase tractor shovels for the CTS and land fill operations. The same equipment can be used for clearing some hop stops with garbage accumulations and for soils excavations for landfill soil cover. The numbers required are summarised in the Table 12 below.

Table 12: Summary of Proposed Refuse Collection and Transportation Equipment and Vehicles

SN	Item and Number/ Quantity Required	Specifications	Purpose/ Justification	Remarks
1.	450 Stationary skips	Average 10 tons 3 compartments with 3 colours	<ul style="list-style-type: none"> For waste generators to use communally to collect their waste already sorted out in plastics bags For easy collection using side loading roll-top refuse vehicles 	To be managed by the CoK in collaboration by Ward-Unit Environmental Committees
2.	300 Portable Skips	4-6 tons 3 Colours	<ul style="list-style-type: none"> For high generation points/ hot spots like markets, bus park and some institutions 	To be managed by the CoK in collaboration by Ward-Unit Environmental Committees/ Community or Business Groups
3.	5-7 Tractors and skip loaders	45-60 hp	<ul style="list-style-type: none"> For both picking up the 4-6 ton containers/ skips from high waste generation points and for tipping the wastes 	CoK to decide on number as per available funds and urgency
4.	8-10 Side loading roll-top refuse vehicles	8 tons	<ul style="list-style-type: none"> To collect waste from communal collection points/ kerbsides to the Kasagam Central Transfer Station 	CoK to decide on number as per available funds and urgency
5.	5-6 Heavy duty trucks	8 tons	<ul style="list-style-type: none"> To collect special garbage from CTS to landfill To collect soil for waste covering 	CoK to decide on number as per available funds and urgency
6.	5-6 Heavy duty trucks	20 tons	<ul style="list-style-type: none"> To collect garbage (mainly organic) from CTS to landfill 	CoK to decide on number as per available funds and urgency
7.	4 Shovel tractors	Heavy duty	<ul style="list-style-type: none"> 2 for loading trucks at the Central Transfer Station and 2 for Landfill Operations 	CoK to decide on number as per available funds and urgency
8.	2-3 Garbage Compactors/ or bulldozers	Heavy duty	<ul style="list-style-type: none"> One for the CTS, two for the Landfill Operations 	CoK to decide on number as per available funds and urgency
9.	5 Pick-ups	Diesel double CABs, tare weight-minimum of 1,350 and 2,500 cc and 5 passengers	<ul style="list-style-type: none"> For supervision/ inspection and local / emergency deliveries, CTS and monitoring Landfill Operations 	CoK to decide on number as per available funds and urgency
10.	14 Standard motorcycles	250-350 cc	<ul style="list-style-type: none"> One per ward for supervision/ inspection and local / emergency deliveries 	CoK to decide on number as per available funds and urgency e.g. can start with 5-7 (one for every 2-3 wards)
11.	Assorted Street sweeping tools and equipment	Brooms, wheel barrows/ handcarts, hand shovels, forks, hand scoopers, etc.	<ul style="list-style-type: none"> For street sweeping and opening/ cleaning of drainage systems 	Number to be calculated internally by staff in charge of street sweeping operations
12.	Assorted Personal Protective Equipment (PPE)	Sets for each worker for confined spaces, eye protection, fall protection, general safety, hand protection, respiratory tract protection	<ul style="list-style-type: none"> To protect workers from health and safety hazards 	Plan for at least 2 sets per worker in waste collection

Waste transportation, distance to disposal sites and investment venture options

Since the minimum required distance under aviation policies of a landfill from an international airport is 13 km, this analysis is based on 3 scenarios based on the distance to a sanitary landfill site i.e. 45 km, 30 km and 15 km from the CBD and service provider options (private and public options) as summarised below.

Scenario A: Analysis with Distance of 45 km from CBD

Private Investor Contracted: An investment of Ksh. 117,000,000 is needed to invest in 10 garbage collection trucks – 5 trucks carrying 20 tons and 5 carrying 8 tons. This investment will enable the collection of at least 272 tons a day that are produced by Kisumu residents. If we are working with an 8 ton truck costing Ksh. 8,100,000 while the 20 ton truck costs

Ksh.15,000,000; this brings the total cost of vehicles to Ksh. 115,000,000 plus set up costs for this venture including registration and office space of about Ksh. 1,500,000. The number of workers needed for this investment is 52 workers being 12 drivers and 40 waste collectors. The total distance travelled each day by the trucks to meet the current waste tonnage to the sanitary fill will be 90kms representing the distance to and from the landfill meaning each truck makes 2 trips a day. For anyone to invest in this venture for the city, a contract of at least Ksh. 75 million p.a. should be awarded so that positive returns are achieved from such an investment. The summary table showing the viability and return from this contract is shown below

Table 4: The viability and return from private investor contracting for Scenario A

	Amount (Ksh)
Total set up cost (capital, machinery & other start-up costs)	117,000,000
Average Revenue/year/ contract price awarded	75,000,000
Average Operating Expenses including taxes/year	46,935,489
Average Net Income/year	34,731,177
Payback period	4 years
NPV @ 12% p.a after 5 years	8,574,841

County Government Investment: The County government could get involved in the waste collection venture with the revenue stream for this being the collection from households. The investment would remain the same at Ksh.117 million as a result of purchase of trucks and setting up the operations. There are approximately 94,290 households in Kisumu who would be charged for this service. It is expected that the collection from each household would bring in revenues of up to Ksh. 10 million per month assuming each household pays Ksh.100 per month for this service. The expenses for this operations excluding depreciation would however go up by 25% as a result of general inefficiencies associated with public service to Ksh. 53,4 million. The payback period would be 4 years and the NPV in this case Ksh. 3,470,193 million. The summary is presented below.

Table 5: Summary of investments & payback period from investments by County government under Scenario A

	Amount (Ksh)
Total set up cost (capital, machinery & other start-up costs)	117,000,000
Average Revenue/year/ contract price awarded	80,000,000
Average Operating Expenses including taxes /year	53,377,696
Average Net Income/year	33,288,971
Payback period	4 years
NPV @ 12% p.a after 6 years	3,470,193

Scenario B: Analysis with Distance of 30 km from CBD

Private Investor Contracted: A total investment of Ksh. 77,700,000 is needed to invest in 6 garbage collection trucks – 4 trucks carrying 20 tons and 2 carrying 8 tons. The total distance travelled each day by the trucks to the sanitary fill will be 60kms compared to 90kms in the previous scenario. This will reduce the total fuel cost by Ksh. 5,119,200 per year meaning

that the contract price over the 5 year proposed can be reduced to Ksh. 50 million p.a. over the 5 years to attract the same investment. The number of staff needed for this operation is 8 drivers and 26 waste collectors. Because of the cost reduction as a result of the relatively shorter distance, the contract price should be at least 50 million per annum down from 75 million given to a private contractor in the previous scenario. The summary table showing the viability and return from this contract is shown below.

Table 15: Summary of the viability and return from the contract with the private investor under Scenario B

	Amount (Ksh)
Total set up cost (capital, machinery & other start up costs)	77,700,000
Average Revenue/year/ contract price awarded	50,000,000
Average Operating Expenses including taxes /year	30,884,802
Average Net Income/year	23,687,198
Payback period	4 years
NPV @ 12% p.a after 5 years	7,951,988

County government Investment: Here, there would still be no change in investment with the investment of trucks and set up costs remaining at Ksh. 77.7 million. The workers also remain the same as before. The revenue in this case will be collected by the county government from the 94,290 households with collection totalling 67.8million assuming each household contributes Ksh. 100 per month and a collection rate of 60%. The expenses in this case will rise by approximately 25% as a result of inefficiency associated with public service. It therefore means that while the total cost rises in this case to Ksh. 34.9 million up from 30.9 million. The payback period for this investment will be 4 years while the NPV as detailed in the summary below Ksh. 9.2 million.

Table 16: Summary of investments & payback period from investments by County government under Scenario B

	Amount (Ksh)
Total set up cost (capital, machinery & other start up costs)	77,700,000
Average Revenue/year/ contract price awarded	53,000,000
Average Operating Expenses including taxes/year	34,955,902
Average Net Income/year	22,616,098
Payback period	4 years
NPV @ 12% p.a after 5 years	4,157,146

Scenario C: Analysis with Distance of 15kms from CBD

Due to the scarcity of land within 15Kms from the CBD, this option is viable if sanitary landfills are established in the existing quarries under the proposed City Quarries Rehabilitation Programme (CQRP) by using solid waste whose details are given later in this strategic document.

Private Investor Contracted: A total investment of Ksh. 62,700,000 is needed to invest in 5 garbage collection trucks – 3 trucks carrying 20 tons and 2 carrying 8 tons. The total distance travelled each day by the trucks to the sanitary fill will be 30kms compared to 60kms in the previous scenario. This will reduce the total fuel cost by Ksh. 3,434,400 per year meaning that the contract price over the 5 year proposed can be reduced to Ksh. 40 million p.a

over the 5 years to attract the same investment as opposed to Ksh. 50 million for a private investor when the distance is 30kms. The number of staff needed for this operation are 7 drivers and 21 waste collectors. The summary table showing the viability and return from this contract is shown below.

Table 17: The viability and return from this contract under Scenario C

	Amount(Ksh)
Total set up cost (capital, machinery & other startup costs)	62,700,000
Average Revenue/year/ contract price awarded	40,000,000
Average Operating Expenses including taxes /year	30,884,802
Average Net Income/year	23,687,198
Payback period	4 years
NPV @ 12% p.a after 5 years	9,815,786

County Government Investment: Here, there would still be no change in investment with the investment of trucks and set up costs remaining at Ksh. 62.7 million. The workers also remain the same as before. The expenses in this case will rise by approximately 25% as a result of inefficiency associated with public service. It therefore means that while the total cost rises in this case to Ksh. 26.5 million up from 23.6 million. The payback period for this investment will be 4 years while the NPV as detailed in the summary below Ksh. 6.8 million.

Table 18: Summary of investments and payback period under Scenario C

	Amount (Ksh)
Total set up cost (capital, machinery & other start-up costs)	62,700,000
Average Revenue/year/ contract price awarded	42,000,000
Average Operating Expenses including taxes/year	26,481,419
Average Net Income/year	19,190,582
Payback period	4 years
NPV @ 12% p.a after 5 years	6,765,231

Sustainable Waste Disposal Options

Decommissioning and post closure management of Kachok Dumpsite: The decommissioning and post closure management of Kachok Dumpsite is of priority at the moment due to its poor environmental quality status. Two (2) prioritized options are recommended for consideration by CoK management which could be combined.

Option One: Integrating decommissioning with rehabilitation of quarries in the city using solid waste as a landfilling material: Land filling with solid waste is also a means of rehabilitating quarry sites by filling large holes and reinstating the landscape to relatively natural surface levels. For Kisumu city, it is proposed that the solid wastes may be used as a quarry rehabilitation material (50-75% while the rest will be soil layers) for several dangerous open quarries around the City in Migosi , Nyawita, Mamboleo, Riat/ Kanyakwar, Kisiani – Bondo Road and Rabour quarry sites. This will require high environmental standards and community partnership to succeed. This can be duped as the City Quarries Rehabilitation Programme (CQRP).

The waste will have to undergo basic testing and treatment before they are used as a filling material. Most operations are recommended to take place late at night to avoid inconveniencing the members of the public with the smell. The public should be sensitised on the activities to avoid conflicts with local communities who will finally benefit from safe

environmental conditions due to reduced hazards associated with open quarries to children, adults (especially drunkards) and livestock. This will require NEMA approval using procedures outlined in EMCA, 1999 and its subsidiary laws. This should also be done after detailed studies on the hydrogeological features of those quarries to avoid contamination of groundwater.

Areas to be rehabilitated can be under a raised plastic safety net/ wire mesh protection to avoid attraction of birds. The waste must be covered daily without fail. The best approach is to work on a pilot project using the Migosi-Kakamega road quarry (GPS E 34.776874, N - 0.076119) in partnership with other stakeholders like NEMA, Kenya Airports Authority (KAA), KCAA, local communities and donors like AFD. The goal should be that of transforming the existing quarry within a residential area into a community garden/ recreational/ public sports ground for local residents. Ownership of the site should not be an issue because this should be through a partnership approach with whoever might be the owner and local residents.

This proposed pilot site is approximately 0.29Ha and it is estimated to 4.5 Km from the Kachok dumping site. The project will require environmental assessment approval by NEMA and a Resettlement Action Plan (RAP) to reduce environmental and social impacts to local residents near the site.

Option Two: Undertake procurement process for the decommissioning of the Kachok dumpsite based on recommendations from the CoK environmental audit consultancy report: The CoK consultancy report recommended that the Kachok dump site be closed in a phased manner using a Progressive Closure Plan to realize environmental remediation and social benefit by giving sufficient lead time for acquisition of land and operationalization of a new landfill. This option will involve compacting and finally capping all the waste starting from one end and systematically capping until all waste is finally covered to the desired height. This decommissioning process may require an ESIA licence before implementation to ensure the environment and local interested parties are protected and safe. During the decommissioning process and transitional period to implement this strategy, the Kachok dumpsite may act as a Temporary Central Transfer Station. This third option is the least preferred since the site is very near to the CBD and sensitive and valuable developments and institutions around it.

Proposed Protocols of Closing and Rehabilitation of Kachok Dumpsite: The dumpsite has reached the closure stage to avoid the many environmental social impacts associated with it. The CoK will follow the following 10 standard steps used in dumpsite closure and reclamation (or rehabilitation):

- Document the situation in and around the site, including water and air pollution, scattering of waste, other visual aspects, effects surrounding settlements and other land uses, on vegetation/ riverine vegetation/ wetland, on local stream, etc. The decommissioning audit study report may serve this purpose.
 - Make plans for the site including the area to be rehabilitated or closed and areas available (if any) for future use
 - Plan and establish monitoring systems for ground water control in the area surrounding the dumpsite
 - Make engineering designs for site closure and possible rehabilitation or reclamation of the dumpsite for a different public use
 - Undertake ESIA and public consultation of proposed rehabilitation or reclamation plans
-

- Determine the needs for equipment and manpower to carry out immediate works and any future monitoring of the site
- Calculate financial outlays necessary to carry out the works and determine the sources of finances
- Carry out the proposed site closure, rehabilitation and /or reclamation work as per the public procurement laws. One contract of designing rehabilitation or reclamation works, undertaking of ESIA and implementation of the approved plans should be grouped together due to the urgency of the matter in order to avoid wastage of time and continued environmental pollution.
- Undertake environmental audit after completion of the work
- Commissioning of the new land use

Construction, operations and best practices for the new sanitary landfill

Site selection procedures: The site for a new landfill should be selected carefully, taking into account topography, geology and water resources, land use, distance from the centers of waste generation, transport routes linking the site to the city and distance from housing and airports. It cannot be expected that the nearest residents will welcome the site, but it is important to secure their acceptance through consultation, negotiation and compensation. It is also prudent that Kenya government public procurement procedures for land acquisition for public use are followed. It is a good practice and precautionary measure for the CoK to initially sign a Memorandum of Understanding (MoU) with the property owner to facilitate a feasibility study, planning and Environmental and Social Impact Assessment (ESIA) and NEMA approval before purchasing land for a landfill site. This strategy is undertaken on the assumption that the landfill site is currently being considered at a maximum of 45Km as the most possible sanitary landfill site distance.

Preparing the site: There are many factors that shall be considered when designing and constructing a landfill site, but the primary issues are water pollution and operational efficiency. Polluted water from the waste is prevented from reaching water resources by an impermeable layer which may be a natural clay bed below the site, or an artificial barrier constructed using imported clay, plastic sheeting, bitumen, or soil mixed with bentonite. A sanitary landfill should have the following design features:

Leachate controls	Utilities
Gas controls	Recycling drop-off
Surface water controls	Fencing
Access roads	Lighting
Special working areas	Wash racks/ sanitary facilities
Special waste handling	Monitoring wells
Structures	Landscaping

Operations: Continuous compaction of the wastes in the landfill makes the best use of the void space and promotes decomposition. Compaction and daily covering of the wastes controls smells, insects and rats. A high standard of management is required with strict control of the types of wastes reaching the landfill. Large amounts of daily cover material are required, involving the excavation, transport, spreading of this material and compaction using a landfill compactor (see plate 19 below). Gas emissions from the decomposing wastes (mainly methane and carbon dioxide) are collected and can be burnt on-site or sold for electricity generation if

they have a commercial value. The existing landfill compactor (see plate 19 below) can be repaired and used for this purpose or a new one purchased.



Plate 1913: Existing landfill compactor parked next to Moi stadium

Preparing cells: Any landfill site should be divided into cells, one main cell being filled before the next is started. Cells on flat land should be formed by excavating them. Excavators, wheeled loaders or tracked loaders are used to excavate or construct cells and stockpile cover soil, but on a smaller site like the one proposed for the City, they are not needed all the time. The cells of about 1 acre each or slightly less are expected to be 5- 6 metres deep depending of the water levels of the site.

Spreading the waste material: A bulldozer, tracked loader or a landfill compactor will be required. To enable the wastes for easy compaction, they should be placed in layers of less than 50 cm thick.

Compacting and levelling the wastes: The waste are compacted to reduce the amount of space required, and to control insects and rodents. This is normally done with a very costly landfill compactor which is specially designed for this purpose, or a bulldozer pulling a sheepsfoot roller.

Spreading cover material: To prevent litter blowing and to prevent flies and rodents breeding in the wastes. Standard landfilling practice is to cover the compacted wastes every day with a thin layer of soil. This will involve excavating and transporting soil / murrum from a nearby source. Wheeled loaders and tipping trucks are used for this purpose. A bulldozer is used for spreading and levelling the cover soil.

Constructing and maintaining site roads and infrastructure: Is an important function to ensure that trucks can travel on the site without difficulties or damage. A grader is useful for this purpose. The site will also need connection to electricity, water and telephone. Sanitary facilities for landfill workers should also be constructed at the site.

After each cell is filled: it is covered with a temporary or final cap, which is usually made to be impermeable by means of clay or a plastic membrane. Topsoil is spread on the final cap and seeded to promote the growth of vegetation which stabilizes the soil.

Stationary equipment: such as a weighbridge, office facilities, pumps, lighting, gas control equipment and wastewater treatment systems are also required and landfill designing engineer should undertake to do that into detail.

Maintenance of the machinery: The maintenance of the machinery to be used on the landfill site is of crucial importance and should be managed according to the principles of planned preventive maintenance.

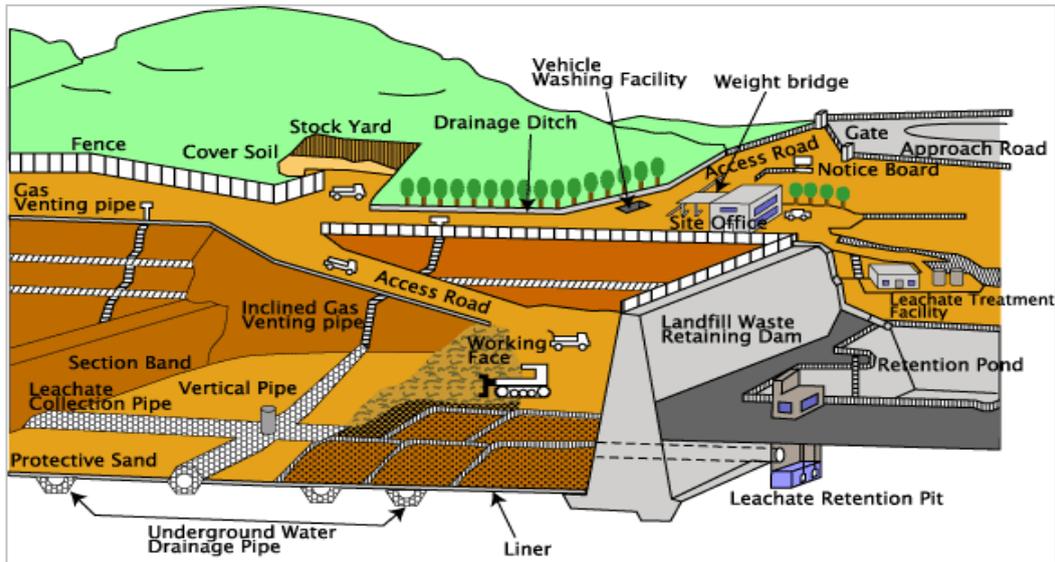


Figure 7: Typical sanitary landfill design

Investment Analysis for a Sanitary Landfill

This is a highly capital intensive project that would require a minimum conservative estimate investment of at least Ksh. 324,404,000 for the first phase of the landfill. This consists of plant and equipment of Ksh.70million and the rest being civil works and setup costs for the landfill as shown below.

Table 19: Estimated investment costs in a sanitary landfill project

Capital Costs Estimates	KES
Particulars	
Landfill Facility Equipment	
2 Backhoe Loader	8,000,000.00
Bull Dozer	19,800,000.00
Sub-Total A	27,800,000.00
Civil Works	
Landfill Cell Development	178,704,000.00
Other infrastructure (Roads, Drains, Fencing, Building etc)	16,000,000.00
Land Costs	30,000,000.00
Sub-Total	224,704,000.00
Total - Landfill Facility B	252,504,000.00
Compost Plant Equipment	
2 Backhoe Loader	8,000,000.00
Tipper Tractor	5,100,000.00
Water Tanker	2,000,000.00
Weigh Bridge	10,000,000.00
Landfill Compactors (2)	11,000,000.00
Plant and Machinery (other)	6,500,000.00
Sub-Total C	42,600,000.00
Total Compost Plant	42,600,000.00
TOTAL CAPITAL COSTS A+B+C	295,104,000.00

A total of 30 staff are required for this venture being; 2 weigh bridge inspectors, 4 drivers, 2 machine operators, 2 sanitary inspectors and 20 waste collectors/ manual workers. We are also assuming that the waste quantities increase by 2.5% per annum from the current 272

tonnes which impacts on the costs. The suggested estimated contract award for this phase is Ksh. 1.2 billion over 10 years with the payback period for this venture being 8 years. The summary of this investment is shown below.

Table 20: Summary of the investment and payback period

ITEM	AMOUNT (Ksh)
Total set up cost (capital, machinery & other startup costs)	324,404,000
Average Revenue/year/ contract price awarded	120,000,000
Average Operating Expenses including taxes/year	65,624,212
Average Net Income/year	54,375,788
Payback period	8 years
NPV @ 12% p.a after 5 years	29,367,412

Establishment of a Controlled landfill Option

The CoK may consider to adapt a controlled landfill strategy rather than a sanitary landfill. This is because of the city's financial status and if a new landfill will 30-45 Kilometres far-off from the city in a remote area. A controlled dump is a planned landfill that incorporates to some extent some of the features of a sanitary landfill described above: siting with respect to hydrogeological suitability, grading, compaction in some cases, leachate control, partial gas management, regular (not usually daily) soil cover, access control, basic record-keeping, fencing and controlled waste picking. This may save up to an average of 50% of the operational cost of sanitary landfilling operational expenses. This option should be considered as an alternative option to save county resources by the landfill planners, engineering designers and ESIA experts without compromising environmental and social impacts to the neighbourhood.

Proposed Implementation Approach for a Sanitary / Controlled Landfill:

Assuming that the land for a sanitary landfill is available and preliminary studies have been undertaken the county should re-package the following as LOT 1 of the ISWM strategy for implementation purposes under support by existing AFD funded Kisumu Urban Project. The city management should release an Expression of Interest and Request for Proposal for: "*Plan, Design and Built a Landfill, Central Transfer Station, Supply of Equipment and other Support Facilities and Services*". It will be prudent to use the design and build approach to save time and resources. The Design and Build Contract is designed for construction projects where the contractor carries out both the design and the construction work under one agreement.

Regulatory requirements for landfills in relation to airport operations:

Kisumu International Airport is the busiest airport in Western Kenya and the third busiest airport in the country in terms of passenger movement. The airport handles over 17 flights daily including scheduled, chartered and non-scheduled. Following completion and commissioning of the new terminal building and other associated infrastructure, the airport has shown rapid increase in passenger movement. The airport is designed to accommodate large aircrafts (Code „D“) which operate within very stringent conditions.

There is therefore need to ensure that the airport is well protected in terms of safety and security. Anything that can compromise safety in the vicinity of the airport needs to be controlled as much as possible if not eliminated altogether in order for the airport to achieve its dream of being the Hub of East Africa. The Kenya Civil Aviation Aerodromes Regulations 2013 require that aerodrome operators monitor the vicinity of the Aerodrome to ensure that

land use activities do not negatively impact aircraft operations in and out of the Airport. This is part of the Safety Management Systems that need to be approved by the Civil Aviation Authority. Regulation 65 is clear on dumpsites, waste management sites and any refuse collection sites. The following is an extract from the Regulations.

An operator shall consult with the relevant authorities to take action to eliminate or to prevent the establishment of refuse collection sites, garbage disposal dumps, landfill sites, or any other source which may attract wildlife (includes birds) to the aerodrome, or its vicinity, unless an appropriate wildlife (includes birds) assessment indicates that they are unlikely to create conditions conducive to a wildlife hazard problem.

Refuse collection sites, garbage disposal dumps and landfill sites shall be located no closer than a 13km circle centred on the aerodrome reference point and shall be located further, if located in the vicinity of an approach and take-off path of an aerodrome, where studies of flight lines of birds attracted to these sites prove that they may be problematic for the aerodrome.

Where the elimination of existing sites is not possible, the operator and the relevant authorities shall ensure that any risk to aircraft posed by these sites is assessed and reduced to as low as reasonably practicable.

It is therefore recommended that the proposed a new landfill should meet the above aviation requirements. The proposed strategies on waste disposal and decommissioning of Kachok dumpsite are within these guidelines.

Mainstreaming Gender Aspects ISWM

The roles that are available to men and women must clearly be defined at all the stages of the solid waste management system to ensure gender aspects are integrated / mainstreamed into the whole system. This should also be done at the proposed waste management committees and institutions at the County, Ward and Ward-Unit levels.

STRATEGY 5: INSTITUTIONAL, ORGANIZATIONAL, POLICY AND LEGAL REFORMS

After reviewing the strengths and weaknesses (status) in the existing organizational set-ups to manage solid waste in the city, reforms are proposed in the following four (4) areas.

- Institutional reorganization of the City Directorate of Environment
- Establishment of the Ward-Unit/ Community-Based / Nyumba Kumi/ Residents Association System
- Establishment of the Kisumu County Solid Waste Management Company Ltd
- ISWM Policy and Legal Reforms

Institutional Reorganization of the City Directorate of Environment

The City Directorate of Environment requires re-organisation and major reforms by establishing three Deputy Director Positions for an easy implementation of this strategy. The existing sections should be reviewed and upgraded as per the proposed new organogram below. Staff with technical skills in relevant areas should be recruited to start-of the divisions.

The Executive Committee Member (ECM)/ County Minister for Environmental Management / waste disposal will be in charge of policy and law reforms and resource mobilization for CoK's Directorate of Environment.

The CoK Manager: should be responsible in facilitating the department in terms of human, financial and technical resources.

The Director of Environment (DoE), Kisumu city: To be the focal point responsible this strategy implementation and expected to exercise overall managerial responsibility for the administration, coordination and implementation of this strategy. This office should be responsible for human resource (HR), revenue collection and approval of all departmental expenditures. CoK should target somebody with at least postgraduate training in environmental studies or environmental engineering with specific experience in ISWM. All issues on refuse collection equipment and vehicles, transportation and maintenance should be handled by this Directorate instead of the City Engineer' Department. Any refuse collection vehicles and relevant staff like drivers and supervisors should be transferred to this Directorate for day-to-day operations. Usually, most of the vehicles in the municipal garage were waste collection vehicles, so there is some justification for putting the workshop directly under the person in charge of solid waste management operations.

Deputy Director of Environment (Technical Operations - TO): To be responsible for the implementation of technical and operational matters on a day-to- day basis. CoK should target somebody with at least graduate level training in environmental studies or environmental engineering.

Deputy Director of Environment (Environmental Planning, Education and Awareness- EPEA): To be responsible for the research, data collection, planning, public education and awareness creation, partnerships, public relations/ communication, fund raising and partly monthly community clean-ups. CoK should target somebody with at least graduate level training in environmental studies or education.

Deputy Director of Environment (Inspection and Legal Affairs- I&L): To be responsible for the implementation of environmental monitoring, inspection of facilities,

enforcement and compliance matters. This section should also handle all environmental cases and prosecution issues at the City Magistrate Court. CoK should target somebody with at least graduate level training in environmental Studies or environmental law and with basic training in prosecution.

Establishment of the Ward-Unit/ Community-Based / Nyumba Kumi/ Residents Association System

First is important to note that, waste management systems must meet local community needs and priorities if they are to be effective. Accordingly, solid waste management decisions must be informed by community perspectives as well as by technical analysis. This approach encourages participation and enhances the efforts of waste managers as they seek new innovative ways to provide effective and efficient services to the community.

In Kigali City, Republic of Rwanda, this is commonly referred to as “*Umuganda*” - Time to Clean Up! “*Umuganda*” also means a mandatory community service day that happens on the last Saturday of every month. This mandatory service day exists to help clean up the streets in Rwanda. Each “*Umuganda*”, the leader of the “*Umudugudu*” (neighbourhood) decides where the village or estate-unit residents should focus and everyone will meet there to clean up the area. This system was reviewed and recommendations are outlined below on how this would be applied in Kisumu through the concept of the existing Residents Associations and Ward-Units organisational set-ups.

This community-based approach recommended took environmental, social and cultural sustainability into account. The views of the Kisumu residents also shaped the drafting of this section of the strategy. The system from the source to collection points should be managed and owned by the community groups/ associations. This will also help to increase environmental awareness at grassroots and also distribute benefits fairly among community members.

One of the objectives and principles of this strategy is to improve the existing community level solid waste source separation, collection, transportation and disposal systems through well-structured and organized neighbourhood environmental management and awareness, with emphasis on the 3 Rs (*Reduce, Reuse and Recycle*) principles. The participation of the community at the grassroots levels especially in solid waste separation, collection, transportation and disposal systems - through monthly neighbourhood environmental clean-up and awareness creation campaigns, will, therefore, not only fulfil the requirements of the law on citizens’ participation, but will also build a grassroots owned, efficient and sustainable solid waste management system for the City.

Apart from the need for an organized and informed community environmental structure as a platform for realization of the end results of the city management interventions in SWM, it is important that the community fully appreciates the mega interventions which currently appear quite remote and abstract because of lack of precedence and the time it takes to realize the same. This can only happen through innovative and action oriented awareness creation that allows the community to own the micro level components of the interventions. It is therefore important that as the bigger interventions are being implemented, micro level interventions that encourage the 3Rs principles are initiated and support technically, legally and financially.

We recommend strengthening and re-organisation of neighbourhood / Ward-Unit-level clean-up campaigns and efforts in the city. The process of mobilizing, organizing and undertaking

community neighbourhood clean-up campaigns is a very effective platform for disseminating information on solid waste management and even changing attitude of the citizens towards management of the environment around them. There are many other good reasons to conduct community clean-up efforts. Well implemented community clean-up campaign will not only reduce unmanaged solid waste, but will improve physical community, as well as create opportunities for social networks and improved security in the community. Cleaning up the environment will also create more pleasant places to live within the neighbourhoods and a good impression on prospective investors, tourists, and others who visit the city. In doing this, the community clean-up campaign will provide a great opportunity to introduce community members to each other, have fun, and build sustainable social connections.

Additionally, clean-up efforts will provide community health benefits such as the elimination of mosquito breeding sites to reduce the malaria. Cleaning up a community (and keeping it clean) may also have positive results corresponding to the reduction of crime, fear, and feelings of helplessness in urban settings. Research also indicates there are many positive links between the environment and how citizens feel about themselves. In comparing neighbourhoods with varying levels of vegetation, researchers have found positive associations with green neighbourhoods. Community neighbourhood clean-up campaigns will therefore provide many opportunities for citizens to get involved in not only their immediate community improvement, but also in achievement of the broader City SWM initiatives. The value of these opportunities cannot be underestimated.

Establishment of County Environment Committee: Establish the “County Environment Committee-CEC” as per EMCA, 1999 and county environmental laws to provide leadership for strategic, policy and broader planning efforts on all the ten (10) strategic areas in this document. It should allocate resources to the 14 wards within the city boundaries to implement various activities proposed and actively promoting environmental awareness.

Establishment of Ward Environment Committees: Establish “Ward Environment Committees-(WECs) within the county environment laws with representation from every unit within a given ward. This WECs comprising of not more than seven (7) people with adequate representation of stakeholders and gender, should be entrenched into the programmes of the City Department of Environment. Its role will to coordinate and facilitate all activities planned by each unit within the ward units and be responsible in monitoring performance in common areas and streets.

Establishment of Ward-Unit Environment Committees: Establish “Ward-Unit Environment Committees- WUECs” through the county environment laws at each of the city wards and units comprising of not more than seven (7) people with adequate representation of stakeholders and gender. Occasional attendance of key officers within CoK Directorate of Environment, officials of relevant government agencies (e.g. NEMA, KIWASCO) to provide technical advice and dissemination of county government and national government policies will be important. Representatives of the civil society working on environment and representatives of the private sector should be incorporated in the WUECs. The city management should legally and politically mandate and support each Ward-Unit Environment Committees to plan and rollout their neighbourhood specific community sensitization, mobilization and organization processes. This structure should be entrenched into the programmes of the City Department of Environment.

The functions of WUECs should include but not limited to:

- Providing guidance and direction on all issues relating to environmental services, community sustainability, storm water management, solid waste management, utilities /water and wastewater, water pollution control, urban forestry, and management/ protection of open spaces.
- Recruitment of Ward-Unit residents, businesses and stakeholders and regular revision and maintenance of a manual and digital register of members.
- Planning, organizing, supervising and executing monthly community clean-ups on behalf of the city management
- To plan and rollout a community sensitization, mobilization and environmental awareness programmes.
- Storage and general management of equipment and tools used for provision of the environmental services
- Mobilization of participants, equipment and supplies, and facilitation of the monthly clean-ups. The Ward-Unit Environment Committee will identify and strategize how to bring on board those in the community who have an interest or investment in a clean community. These will include neighbourhood groups, traders' associations in markets, youth groups and women groups.
- Enforcement of County Environmental Laws and orders
- Facilitate and support the County government in revenue collection from all households and other waste generators within the Ward-Units for sustainability of the ISWM system.
- Local coordination and implementation of the annual city environment day events
- Each Ward-Unit Environment Committee should meet monthly or regularly to develop a comprehensive programme with clear roles, dates, venues and time schedule for various solid waste management activities including monthly clean- ups.

Utilization of the Nyumba Kumi, customary leadership systems and Residents Associations Structures: The proposed system should also endeavour to utilize and be integrated in the newly established Nyumba Kumi structures without creating parallel structures that may cause confusion. Officials of the Nyumba Kumi initiative should be the same for SWM system if possible. The Nyumba Kumi initiative is anchored on the principle that one must know at least 10 of his/ her neighbours for security purposes. The resident associations' / customary systems boundaries also need to be harmonised to the Ward-Unit boundaries. This proposal brings to the door step of the city residents the mandate to ensure neighbourhood environmental cleanliness is a collective responsibility and not for the county government alone. This will mean that the county government appreciates that it cannot handle the huge task of garbage disposal on its own. One can argue that the taxpayer pays the national and county governments, so it should provide better environmental services by employing both human and technology. This argument fails to consider the reality that resources are always scarce and everyone has the primary concern of their environment and should collaborate with government to make public health both a personal and institutional endeavour.

ISWM Policy and Legal Reforms

ISWM Policy Guidelines: This strategy should be adopted as the main policy document for the City of Kisumu on ISWM issues. The strategy sets a clear direction for the city for the next 10 years (2015/16-2025/26). It integrates views from various local and national stakeholders, professional views and international best practices. It sets directions in a number of key areas adopting strategies in key areas that include: 3Rs; planning of sustainable solid waste

management systems (storage, collection, transportation and disposal systems); institutional reforms; introduction of PPPs; management of special wastes (e-waste, hospital, ELVs, etc.); capacity building, environmental planning and environmental awareness; fundraising and financing reforms required.

The City Directorate of Environment is expected to make annual action plans using this strategic plan as the main policy guideline on solid waste management. The technical staff must internalise most the guidelines on ISWM principles, vision, goals, objectives and specific actions/ activities proposed. The policy should be reviewed at mid-term in 2020 or at any other time as need may arise from the CoK management to address emerging concerns, new policy dimensions and changes in internal and external factors. This strategy informs county solid waste legislative initiatives required in order to implement this proposals fully.

Legal Frameworks for ISWM: The county government should adopt a legal framework appropriate for achieving the objectives and implementation of the actions identified in this strategy. Framework legislation will therefore be adopted that establishes:

- The overall role of City Directorate of Environment and its three (3) proposed Divisions proposed to revitalize the the solid waste management sector.
 - Revision of the existing county waste management laws and regulations by outlining the roles, activities and operations of all stakeholders. They need re- drafting and passed as a matter of urgency by the Kisumu County Assembly. The law must recognize key stakeholders in the sector reforms which include NEMA, Ministries in- charge of Environment and Urban Development, private collectors/ transporters, informal street and dumpsite waste pickers, NGOs/CBOs, waste generators, dealers, traders (importers and exporters), PPP system, residents/ business/ neighbourhood associations/ Nyumba Kumi system; recycling industries, and county and ward level environmental committees.
 - The long term focus on minimizing and reducing waste generation together with achievable targets.
 - Procedures for establishment of new sites and systems, and the upgrade or closure of existing site in consultation with key stakeholders.
 - Scheduled submission of monthly and annual plans within the context of the city ISWM Strategy approved by the CoK. These plans will respond to the objectives of the policy, identify implementable mechanisms while addressing the financing, cost recovery, institutional and other frameworks necessary to implement the strategy. It will also address the waste management facilities and systems to be developed, and the role, if any of private sector waste management service providers. Also to be included will be the scheduling of waste characterization studies, with the resulting strategies to manage the collection, treatment and disposal of special wastes.
 - The establishment of a new public entity (Kisumu County Solid Waste Management Company) that will take over the SWM matters in the whole county (including the CoK) in the long term.
 - The responsibility of the CoK to issue licenses and permits for waste management facilities and major equipment, to be operated in accordance with requirements set out in licenses and permits requirement of the Kenya Constitution and NEMA waste management regulations.
 - Economic incentives and measures that will stimulate a search for or the development of pollution control technologies by the business sectors in support of desired waste management outcomes.
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- The “polluter pay and –user pay” principles with respect to solid waste management;
- Penalty and liability provisions in instances where individuals or organizations contravene SWM legal requirements.
- The basis for local entities to undertake cost recovery and to retain private sector waste management services.
- The institutional structures through which to deliver waste management services.
- The laws and regulations being drafted should use an integrated SWM approach by providing legal guidelines on waste reduction programs, storage, transfer stations, collection, disposal, treatment and recovery/ recycling systems and waste trade.

Legislation shall also be developed by the county government that will identify waste management standards and the schedule of financial contributions / payments of residents (high, medium and low incomes), businesses (large, medium and small), industrial entities and manufacturers of products (large, medium and small) that become waste together with the institutional framework through which they will participate in the management of those contributions.

This approach will provide focus and coordination to the upgrading of solid waste management systems, while at the same time provide flexibility in how this strategy will be implemented. This will also lead to efficiency, effectiveness, improved environmental quality and human life through improved incomes in Kisumu city and the county in general. The proposed reforms will generate many green jobs in the short term and act as part of the city climate adaptation and mitigation strategy.

The City management must resolve legal and land issues during the planning and implementation process as crucial matters. The following legal and land issues shall be streamlined by the City Management by reviewing the existing waste management County Assembly Bill and align it to this strategy so that it can be used as a legal tool for implementation of 3Rs and PPP programs. The CoK management shall pursue as a priority the processing of land acquisition process that should include compulsory acquisition and compensation as per the Constitution and Land Act 2012 in order to provide land required for the CTS, waste collection points, landfill, proposed sites for materials recovery and other facilities. All these should be achieved in the short term first by appointing a legal consultant to update the existing laws and re-align them to this strategy.

STRATEGY 6: CAPACITY BUILDING, ENVIRONMENTAL PLANNING, EDUCATION AND AWARENESS

Capacity Building in ISWM

Approach to capacity building: Developing integrated solutions for waste management problems in Kisumu city requires capacity building, environmental planning, education and awareness. To economically and efficiently operate a waste management programme requires significant cooperation from generators, regardless of the strategies chosen- separating recyclables from non-recyclables, community-based composting or using colour designed waste storage and collection containers. To maintain long-term programme support, the public needs to know clearly what behaviours are desired from them and why, in order to avoid legal and social conflicts. Public education will stimulate interest in how waste management decisions are made. And, when citizens become interested in their community's waste management programs, they frequently demand to be involved in the decision-making process.

This city management should support awareness creation and information dissemination campaigns on the provisions of laws, policies and best practices in waste reduction, sorting, re-use and recycling to all stakeholders. There is need for early education through the formal and informal school education system on SWM. To achieve this, the strategy implementation unit should target school going children and other institutions of higher learning, church-based programmes to implement this strategy. The key strategies proposed are discussed below.

Capacity building needs: Implementation of this strategy will require broad-based capacity building at the level of county, city, ward and ward-unit levels, private sector and non-governmental organizations. This section excludes capacity development in terms of waste collection equipment which has been outlined elsewhere. The CoK should provide capacity development opportunities at all levels through which all stakeholders can acquire the knowledge and skills necessary for the effective implementation of this strategy. Partnerships should also be established with tertiary institutions or any other professional firms/ institutions in Kenya and internationally to structure appropriate short term courses to meet the local needs in the city's solid waste management sector. Key capacity development needs will include the following strategic areas: the 3 Rs and PPP approaches, waste to energy/ combustion/ incineration technologies, sustainable storage, collection, transportation and disposal systems; policy, institutional, and legal reforms; and management of special wastes (E-Waste, Hospital, ELVs, hazardous wastes). Capacity building of policy makers in ISWM is required at county, ward and ward-unit levels for all residents, technical, administrative and policy stakeholders. Capacity building on ISWM and the development of ISWM plans using the PPP approach will have great multiplier effects.

Capacity Building through Demonstration Projects on ISWM: Demonstration / pilot projects especially through the on-going CoK and other future SWM projects should form the core of ISWM activities as these will be instrumental in developing in-depth capacity of local partners on ISWM while at the same time leading to designing comprehensive ISWM plans for the respective wards within the city. Demonstration projects with budgets of about Ksh. 2.5 to 5 Million per ward should be supported in the short term. The existing waste recycling / composting point at the Jomo Kenyatta Sports Ground should be the first to be rehabilitated to cover the CBD and for wider publicity and awareness. Training of personnel

from partner institutions and organisations, policy makers and other stakeholders should also be an integral part of the pilot / demonstrations projects on the ISWM and management of specific waste streams in the city.

County, Ward and Ward-Unit Technical Training of Workers on ISWM

Training of workers at all levels is an essential part of a successful solid waste collection system.

Training SWM manual workers: Manual workers need training in: Working policies and safe working practices; personal hygiene and basic first aid; and customer relations/ for example on how to explain angry citizens their basic rights.

Training for Waste Collection Drivers: Drivers should participate in the same training courses as manual workers, but they also need additional information, including: performing daily vehicle checks and what to do if any deficiencies are detected; driving in ways that do not cause unusual wear and tear; safe reversing procedures; driving on soft ground (if delivering waste to a disposal site); what to do in the event of a breakdown, accident or puncture; use of modern communication equipment, and first aid.

Training for mechanics, electricians and skilled tradesman: The training for these trades in vocational technical schools/ colleges/ polytechnics can be of variable quality so it will be necessary to rely on “on-the-job training”. Training provided by manufacturers and equipment suppliers when new types of equipment are acquired should be given to the right employees in the SWM sector.

Training for SWM managers, engineers and technicians: Because of the emerging concerns in solid waste management, it is important that professional training is appropriate to the conditions that the trainees are working in. It should cover all stages and components of an ISWM, Environment, health and safety concerns.

Organisation of ISWM Training: Training of workers on ISWM is critical to raise awareness of high level policymakers and to get political support for ISWM. ISWM training should be organised to all members of CEC, WECs and WUECs. The goal of these programmes will be to train practitioners as trainers to undertake the demonstration projects and spearhead long term strategies. These trainings should be planned for short periods for every target group to cover the basics of various components of ISWM strategies and technologies. Such training should cover all the ten (10) strategic areas proposed. A budget of about 2.5 million for every ward will be sufficient to create positive impacts. Such training should be undertaken by a solid waste management / environmental expert who clearly understands the local city conditions.

Environmental Planning: Waste Inventory and Periodical Assessment

Inventory and periodical assessment of all waste categories in the city and the county in general should be undertaken every five (5) years using monthly and annual analysed statistics and primary data. This includes source identification, quantification of wastes, including household, commercial, industrial wastes, and hazardous wastes (including medical wastes), e-waste, etc. New findings can be used during the mid-term and final review on this strategy in the years 2020 and 2025.

Capacity should be built to enable the County technical staff to conduct a comprehensive assessment of the extent and effectiveness of the existing waste management practices from

collection to final disposal. In addition to the collection and analysis of secondary data, this assessment requires a series of meetings to be held as well as several interviews to be conducted with different stakeholder groups. The assessment shall analyse the extent and effectiveness of the existing waste management system and the level of compliance with the national and county solid waste management strategies, policies and regulations. It will also identify constraints and areas for improvement to meet the desired level of performance.

Environmental Education Plan

The six steps of a successful city environmental education plan or program recommended include the following:-

Awareness: At this stage, people will be learning about something new. The goal is to let people know that a different way of handling waste is being proposed by the CoK management. In the first instance, pre-primary schools that are within the city, through curriculum structuring will be targeted as the key change agents that will influence the habits of the older generation. Young people will be nurtured to develop habits that support best practices in the waste diversion initiatives where appropriate responsibility and behavior will precede misguided disregard for the environment. The private sector through the various commercial and manufacturing associations will also be encouraged to participate as partners in bringing about change in the workforce that they engage. Corporate mandates and directives could begin to inculcate a new culture towards waste diversion, where labour will appreciate and embrace this county initiative in defense of the environment.

Interest: After people have been made aware of waste management issues, they are likely to seek more information. Program planners must use a variety of methods to inform people. Voluntary programs require strong emphasis on promotion; mandatory programs should make clear what is required. The CoK will therefore work with all key stakeholders, non-governmental organizations, community organizations and other grass root stakeholders in order to understand and respond to community priorities in solid waste management.

Evaluation: At this stage, individuals will decide whether to participate or not. Initial participation should target at least 25-50% in the first 2 years. The city management should make program requirements clear and easy to comply and increase participation over time to over 75% in the next 10 years of this strategy.

Trial: Individuals will try the program at this stage. If they encounter difficulty, they may opt not to continue participating. This must be avoided by all means by the CoK management. Well-publicized hot lines and committees at the ward unit, ward and county/ city levels of governance will provide additional instruction and information to ensure success of the program. By this stage in the educational program, everyone should have the information describing exactly what they are expected to do.

Adoption: If the education program has been well-planned and implemented, public support and participation should grow. Participation should continue to grow after the 3rd year if the first 2 years are successful. CoK management should initiate continuous education programs to solicit for constructive feedback and provide new program information when and where necessary.

Maintenance: At the sixth stage, the program is expected to be up and running. Using a variety of intrinsic and extrinsic incentives will maintain and increase participation. CoK

management is expected at this stage to provide continuous incentives and education to keep participation rates high at the Ward - units.

Public/ Community involvement plan

Effective waste management shall be a continuous process of public education, discussion, implementation and evaluation. All options should be continually investigated and actively debated, moving the community towards a consensus on the proper mix of source reduction and waste management programs. Public involvement should be undertaken using the following eight (8) stages.

Concern: Waste management concerns shall be put on the public agenda at the county, ward and ward-unit levels. For example, new strategies, new sanitary landfill, decommissioning plans of existing dumpsite, introduction of skips, etc. will require continuous discussions to improve the performance in future.

Involvement: Representatives of various interest groups (regulatory officials, individuals from communities, local waste management experts, representatives from environmental and business groups), CEC, WECs and WUECs should be encouraged to participate.

Issue Resolution: Interest groups make their points of agreement and disagreement clear to each other and to city waste managers.

Alternatives: Groups should make a list of available alternatives on levels of participation, management and location of skips, siting of collection points.

Consequences: Economic and environmental consequences of each alternative should be discussed.

Choice: Alternatives are decided upon by stakeholders.

Implementation: The steps necessary to carry out the program are described and potential adverse impacts are mitigated, if possible.

Evaluation: The community should continually evaluate the program and solicit input. Avoid politics in the whole process.

Environmental Awareness

The goal of the environmental awareness is to let Kisumu residents know that a different way of handling waste being implemented is preferable to the historical way and that good reasons for considering a change in their waste management practices do exist. A variety of publicity methods suggested by the city residents during public consultations can increase community awareness (see Table below 21). Low-cost methods include news articles and public service announcements or shows on local radio and television. High cost efforts include television commercials or billboards. City-wide events such as City Environment Day will also help in stimulating public awareness.

It is recommended that the city should start with low cost methods of publicity in 0-2.5 years (First Quarter) of the strategy and 2.5-5.0years (second quarter) before moving to high cost options which are recommended in year 5.0-10 (last half) of the strategy (Refer to the Table 21 below).



Table 21: Proposed Methods of Publicity

Over the long term, education in city schools will be the best way of raising awareness as implied above. School curricula introducing school children from nursery, pre-unit, and primary on the concepts of source reduction, recycling, composting, and other waste management techniques. The city education and social officers should use sports, cultural days/ events, symbols/ cartoons, etc. that are popular with children, to promote and explain its 3Rs programs. Besides educating the next generation of citizens, school programs will indirectly help make parents aware of waste issues, because children frequently take home information they have learnt and discuss it with their parents.

Education and awareness should also form the foundation of this strategy where all the stakeholders understand the need for retirement of existing habits so as to embrace new and innovative approaches offered by the strategy. A series of direct and sustained county education and community participation programmes should be developed to engage all target groups and to reinforce the importance of solid waste minimization and diversion through reduction, reuse and recycling.

City Environment Day and City Environment Week

The City management shall organize and hold an annual City Environment Day/ forum on every 5th June of every year. This will act as the local domestication of the World Environment Day (WED) which is also globally celebrated every year on the same date to raise global awareness to take positive environmental action to protect nature and the planet Earth. The city management must work closely with NEMA which hosts the WED on an annual basis. Stakeholders clean -ups, sports, public talks, fashion shows on County Miss Mazingira competitions are some of the activities that must be integrated to the City Environment Day events. A half-day stakeholder's annual forum in the afternoon of the city environment day should be organized to discuss the progress of the implementation of the city ISWM Strategy, ward-units neighborhood monthly clean-ups and environmental concerns in general. Such annual forums should be used to review and synchronise roles to be played by each stakeholder and agency in the implementation of the ISWM system.

The City Environment Day should be followed by the *City Environment Week* where the city management should hire several youths for 7 days every year to do cleaning of public places and opening of drains. Extra private vehicles should be hired to transport the high amounts of wastes collected during the week. The city management should also consider using National Youth Service vehicles and manpower/ trained youths during the week so that local youths can learn some community work skills.

Monthly Neighbourhood Clean-Ups

These should be planned, organized and undertaken through the 3 levels of leadership by county, ward and Ward-Unit Environment Committees.

In establishing these County, Ward and Ward-Unit environmental management structures, it must be remembered that the clean-up effort will require the involvement of all the community members. When planning clean-up activities, efforts will therefore be made to reach out to everyone to actively participate.

Shared leadership and involvement is vital for successful clean-up campaigns. Consideration shall be made on how every community member subscribing into the campaign will share responsibilities. Local leaders will be needed that are skilled in organization, publicity, equipment distribution, transportation, communications and volunteer coordination. Various levels of the structure will invite leaders from community organizations to participate.

Most community clean-up activities will involve public properties and utilities like major roads and streets, hospitals, markets and institutions. Private property owners should involve all relevant residents.

Every WUEC will, as part of its mobilization process, establish a working relationship with local primary and secondary schools. In these relations, through environmental clubs, capacity of the pupils will be built on solid waste management. Teachers will also be encouraged to incorporate local content on solid waste management into their curriculum and extra-curriculum activities.

The CEC, WECs and WUECs shall ensure that opinion shapers and key stakeholders representatives within the neighborhoods are sufficiently briefed and made aware of the objectives of planned clean-ups, the dates and expectations.

Select and concretize key and catchy messages using local language or national languages (in English or Kiswahili, e.g. Our Environment/ Mazingira Yetu, Our Lives/ Maisha Yetu, Our Health/ Afya Yetu, Our Future, One City, Taka n Pesa, etc.).

Allocate and synchronize roles to be played by all the key stakeholders and partners including the residents, CoK staff, county government staff and partner agencies in government, private collectors, CBOs/ civil society and business community including the informal sector.

Political goodwill and support

The city management must seek and obtain political goodwill and support of key political stakeholders through various channels that include structured and regular environmental meetings/ forums. Political goodwill and support of the Governor, the Senator, Members of Parliament, Members of the County Assembly, National Government representatives at the County and other influential opinion leaders is critical for success of this strategy. They should be mobilized, even if not to sit in all planning sessions (monthly/ quarterly or annual), but to at least show their commitment to the wider city environmental cleanness programmes by participating in monthly community clean-up campaigns at the ward-unit level, City Environment Day, media events and actual launch and implementation of various initiatives and projects proposed in this strategy.

Media campaign on the Community-Based ISWM

The city management should carry out a comprehensive media campaign on the proposed community-based / Nyumba Kumi / Residents Association system through: _____

- Regular media briefing sessions and media releases;
 - Invitation of the media to cover planning sessions and waste management events, including post clean up state of the neighbourhood environments.
 - Regular radio and TV talk shows and advertising
 - Newspaper advertising at county and national levels
 - Bulk SMS/MMS releases to city residents
 - Social media campaigns (including Facebook, Twitter, Instagram, Foursquare, YouTube and Vimeo accounts among others)
 - Production and dissemination of video documentary
 - Production and dissemination of environmental education and awareness materials including T-shirts, caps, bandanas, banners, brochures and posters.
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STRATEGY 7: MANAGEMENT OF HAZARDOUS AND SPECIAL WASTES: E-WASTE, MEDICAL WASTE, WASTE TYRES AND ELVs

Hazardous Waste Management

The proposed strategy is to separate waste at source using the 3-colour system in order to maximise the collection of hazardous materials with a view to reducing the environmental and health impacts of any unregulated waste. All hazardous waste should be handled using NEMA national standards, Waste Regulations of 2006 and guidelines during the strategic period.

For batteries, although some alkaline batteries can be disposed of as domestic waste, rechargeable batteries and silver oxide batteries can contain heavy metals such as mercury and cadmium which are classified as hazardous substances and may present an environmental threat when disposed of to the landfill. There is no recycling or disposal facilities for alkaline, rechargeable and silver oxide batteries and hence, they are disposed in landfills as per NEMA guidelines. Lead-acid batteries that have been used are considered a hazardous waste. There is an established recycling factory for these kind of batteries in Nairobi that already has trade networks in Kisumu.

Health Care Waste/ Medical Waste Management

Health Care Waste (HCW) is generated in varying quantities at healthcare facilities and because of its pathogenic characteristics, there is need to treat it before disposal. Systems to support the proper segregation of HCW are not always in place in hospital wards and clinics in the City. The wastes are disposed through incineration and some find their way to the Kachok dumpsite. The National Ministry of Health has developed guidelines on the management of health care waste which the County Government must embrace in all its health facilities. Incineration facilities can also be developed through the PPP approach for this category of the sector. Heavy penalties should be considered and enforced for violation of these regulations.

E-Waste Recycling

Due to the many hazardous components and materials used in the manufacture of electronic goods, including mercury, brominated flame retardants, and cadmium, e-waste is considered a hazardous waste stream. NEMA has developed e-waste regulations which have taken into consideration extended producer responsibility, recycling, reuse and exportation of the problematic fractions. The CoK should take advantage by adopting the same instead of developing its own regulations.

The NEMA e-waste guidelines provide a framework for identification, collection, sorting, recycling and disposing of electrical and electronic waste (e-waste). The guidelines also provide the basis for developing legal instruments to enhance enforcement. The purpose of guidelines is to assist the national and county governments, private sector, learning institutions among others to manage e-waste in a manner that enhances environmental conservation.

Some of the strategic activities / opportunities recommended to strengthen E-waste management include:

- Develop relevant e-waste guidelines for the county Government using the National Guidelines published by NEMA in May 2011 to target local importers, assemblers, consumers (government organisations, learning institutions and others), informal sector e-waste collectors/ pickers, recyclers, refurbishers, standards for recycling facilities.
- Development / adoption and gazettment of e-waste regulations by the county government
- Partner with potential e-waste stakeholders like Hewlett-Packard (HP), Dell, Philips, Nokia and Reclaimed Appliances (UK) Ltd, Safaricom among other companies to establish organised collection, semi-processing and processing systems and facilities in the proposed *Taka-n-Pesa* Centres/ Waste Business Centres in the city for income generation purposes.
- Up scaling current and starting new take back schemes in the city by manufacturers, suppliers and service providers
- Create employment opportunities for local youths by sponsoring them to capacity building programs, especially through certificate practicum courses on e-waste recycling
- Assist existing informal businesses in e-waste recycling to become sustainable by capacity building and provide easy access to devolved funding from both County and national governments through youth and women empowerment schemes like Constituency Development Fund (CDF), Youth Enterprise Fund (YEF), UWEZO Fund, etc.
- To encourage and sensitize the final consumers to play an active role in environmental management since consumers have long been ignored in a product cycle that is highly dependent on them. This will expand the number of places where people can conveniently dispose e-waste products for recycling purposes.

Waste Tyres Management

There are no established formal systems for collection and recycling of tyres with the exception of retrading. The bulk of the tyres are informally collected and often illegally burnt on open land to recover steel for recycling, presenting a health hazard and leaving environmentally damaging residues in soil. It is recommended that the city applies the NEMA Waste Tyre Management Regulations of 2013 regulations and any national guidelines on management of this type of special waste.

Management of End of Life Vehicles (ELVs)

It is primarily the owner's will which designates a given vehicle an End-of-Life Vehicle (ELV). However, in certain cases, a vehicle is considered ELV simply due to the condition it is in. According to the Kenya Traffic laws, such vehicle may not be roadworthy. Today, however with material prices on the rise, end-of-life vehicles are considered a valuable resource for many different materials rather than waste. A vehicle irrespective of its age and its weight, is made out of approximately 75% of metals both ferrous and non-ferrous with the non-ferrous steadily increasing. The remaining 25% of the vehicle weight result from tires, fluids and other compound materials. Most of these can be recovered. The large space recommended for *Taka-n-Pesa* in Mamboleo is recommended for a large scale ELVs recovery centre. The Kisumu County Assembly ought to make regulations on ELVs to reduce their numbers in the city (see Photo below) by defining clear procedures of disposal and responsibilities of the vehicle owner, recyclers, manufacturers, and other stakeholders.



Plate 20: End of Life Vehicles (ELVs) in a Jua-Kali area

STRATEGY 8: RESOURCE MOBILIZATION THROUGH PUBLIC PRIVATE PARTNERSHIPS AND FINANCING REFORMS

This strategy outlines recommendations of resource mobilization through the application of the Public Private Partnerships (PPP) approach and undertaking various financing reforms at the CoK and county levels.

Public Private Partnerships in ISWM Projects

"Public Private Partnership- PPP" in ISWM projects in CoK will entail an arrangement between a county government of Kisumu and a private party under which a private party undertakes to perform a public function or provide a service on behalf of the contracting authority.

Based on the views of the community members and stakeholder consulted, the following PPP activities to actualise the process are recommended for the CoK.

The CoK management should organize a technical consultation meeting with the Chief Executive Officer (CEO) and senior staff of the Public Private Partnerships Unit (PPP Unit) at the National Treasury and explore opportunities on ISWM through the PPP approach that can be supported by the national government. If possible, the delegation should be led by the Governor. Alternatively, CoK may invite the National Public Private Partnership Committee to CoK for a meeting to discuss or how they can partner on ISWM and other projects through the PPP framework:

- Establish a Public Private Partnership Node within the CoK (if it does not exist).
- Train CoK staff especially those in the PPP Node on ISWM through national PPP framework for Counties
- Develop proposals on ISWM through PPP and submit to the National PPP Unit using the procedures in the PPP Act, regulations and any other existing guidelines and applicable laws
- CoK SWM staff to visit and benchmark on PPP in other Countries in Africa and elsewhere.

The CoK management should support the participation of the private sector in waste management in the following areas using the PPP options as outlined in the PPP Act (2013) for various specific projects/ activities.

Main Streets/ Roads and CBD Sweeping: It is recommended that all streets in the CBD and major roads (Nairobi, Busia, Kakamega and Kibos Roads) should all be mapped and their manual cleaning and landscaping/ beautification be privatized to local companies through the public procurement procedures but restricted to youths, women or small private collection companies in operation in the city. The tender price, period and area to be cleaned should be based on the size/ status of road and distance to be covered in Kilometers. The groups cleaning the streets should be responsible in delivering the waste to the CTS.

Primary collection from communal/ collection points at the Ward- Units to the RP: To support many companies, at the beginning, a company should be restricted to one ward or ward-unit because of their small scale nature. As the companies grow in capacity, they can be given more wards/ zones to handle. The CBD can also be zoned to units and contracts

can be awarded to different groups to encourage competition and efficiency. Small private companies that have existing contracts with the following facilities should be allowed in the transitional period (maximum of 5 years) to continue with their normal services encourage competition.

- | | |
|-------------------|--|
| ▪ Public markets | ▪ Public facilities (Schools, Parks, Social halls, etc.) |
| ▪ Households | ▪ Road sweeping |
| ▪ Restaurants | ▪ Carcass of animal on the streets |
| ▪ Hotels | ▪ Supermarkets |
| ▪ Shops | ▪ Petrol stations |
| ▪ Offices | ▪ Motor garages |
| ▪ Private schools | |

Operation of the Central Transfer Station: This can be tendered and firms with capability in terms of machinery and equipment to handle the unloading and loading operations at the transfer station.

Secondary Transfer of Waste from the CTS to the Landfill: This can be tendered openly with no restrictions and firms with capability in terms of machinery and equipment may be awarded the contract to transfer waste from Kisumu to the landfill.

Operation of “Taka n Pesa Centres”: They should have various sizes of spaces for county residents to bid for. The spaces should be privatized to local companies through the public procurement procedures but restricted to youths, women or small private waste recycling companies in operating in the city. Transparency in soace allocations will be key in this strategy.

PPP methods proposed: During the public consultations, the Kisumu people proposed the following PPP methods for implementation:

- Open competition for special, commercial, industrial and institutional waste
- Contracting of ISWM services to small/ local companies and community-groups in the services listed above
- Franchising of ISWM services- for projects that require high and long-term investment - e.g. Waste-to-Energy facilities. The waste collection fee charged by the Franchisee to the city shall be decided according to the tender result. The Franchisee shall collect and transport the waste from the RP.

In particular, the CoK should work with other public and private stakeholders to ensure that the participation of private sector organizations in the waste management sector is undertaken in the context of:

- Private sector service providers being considered as an implementation tool through which the objectives of this strategy may be met;
- Legal, institutional and financial frameworks supportive of private sector service organization participation in the waste management sector;
- Open competition, transparency and accountability;
- Equitable application of contractual obligations;
- Consideration of the social impacts associated with the participation of private sector service organizations

Public Private Partnership Arrangements for ISWM Projects: The Public Private Partnership arrangements should be adapted from the PPP Act 2013, Second Schedule and

applied on ISWM projects listed in the above section. These includes on procedures on: *management of PPP contracts, output performance based contracts, leasing, concession administration, Build-Own-Operate-Transfer schemes, Build-Own Operate schemes, Build-Operate-and-Transfer schemes, Build-Lease-and-Transfer, Build-Transfer-and-Operate, Develop-Operate-and-Transfer, Rehabilitate-Operate-and-Transfer, Rehabilitate-Own-and-Operate and Land Swap possibilities.*

Resource Mobilization and Financing Reforms

From the field surveys, six (6) major sources of finance were identified : 1) Households, 2) Commercial waste producers, 3) Advertisements (on Vehicles, Containers etc.- see table 22 below), 4) Licencing (Collectors), 5) Fines and Penalties, 6) Grants and Donations that can generate up to Ksh.165.0 million/ year (65%) of an estimated operational expenditure requirement of 252 Million/ year indicating an annual deficit of about Ksh. 87 million (35%). All incomes were worked out at 70% collection efficiency that has to be supported by environmental education and awareness programmes and enforcement of legal instruments. It is recommended that the city management should diversity its financial sources for sustainability of the sector.

Table 6: Potential Annual Incomes vs Operational Expenditures

Estimated Incomes

Estimated Annual Income Sources	Amount (Ksh)
1 Households/ Domestic Waste Generators	95,044,320.00
2 Commercial and Industrial waste producers	50,400,000.00
3 Advertisements (Vehicles, Containers etc.)	5,000,000.00
4 Licencing (Collectors)	400,000.00
5 Fines and Penalties	6,000,000.00
6 Grants and Donations	8,130,180.00
Total Annual Incomes	164,974,500.00

Estimated Expenditures

Annual Expenditures	Amount (Ksh)
1 Source to Central transfer station costs	61,850,000.00
Annual Operational Costs (Waste Collection From	
2 CTS to Landfill)	37,635,513.00
3 Annual Operational Costs (Landfill Operation)	82,030,264.00
4 General Administrative costs	58,054,733.10
5 Education and awareness Costs	12,000,000.00
Total Annual Expenditures	251,570,510.10
Annual Deficit	(86,596,010.10)

Note: Kisumu Residents proposed a Penalty for offenders/ violators who illegally dumps waste ranging from Ksh. 500-50,000 depending on the type of waste that one disposes illegally with hazardous waste attracting the highest.

CoK shall ensure sustainable financing of solid waste management programmes by filling up the 35% financial gap through:

- Develop systems of collecting rental income from releasing of spaces at the proposed Taka-n-Pesa Centres especially at the RP level.
- Create a well-equipped and IT-based section for collection of revenue from the sector waste generators and other sources listed above.

- The county government should implement a web based e-revenue collection system to ensure maximized collection so as to seal loop holes through which leakages have been experienced over the years in other sectors. It is recommended that the system shall include SWM charges and fees approved by the county government. The full implementation of this system for all sectors shall ensure financial sustainability in the SWM sector.
 - Timely allocations of budgeted financing for capital, operations and research and development expenditures to the CoK, Wards and Ward-Units
 - Application of appropriate fees, payments for services, county taxes, penalties and charges for offences.
 - Creation of *Taka-n-Pesa* fund to support operations and management financing relating to recovery and recycling services, incentives, deposit-refund schemes, waste recycling cooperatives, etc.
 - Establishment of the Kisumu waste recyclers savings and credit cooperative society and other small cooperatives that might emerge in future to be responsible for solid waste management.
 - Providing incentives to private Small and Medium Enterprises (SMEs), NGOs and CBOs for recycling initiatives that coincides with other fiscal incentives.
 - Maximizing global benefits relevant to Kisumu city from carbon trade initiatives in the SWM sector.
 - Enabling public - private partnerships in areas identified in this strategy,.
 - Mobilization of the residents and corporate institutions to support important environmental days.
 - Extending access to direct national funds for solid waste management and environmental projects in the Country especially on urban reforms, climate change, etc..
 - Establish the position of Deputy Director of Environment - Environmental Planning, Education and Awareness (EPEA) who will be in-charge of fundraising to support ISWM programmes of the City.
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CHAPTER THREE: INTEGRATED WASTE MANAGEMENT INVESTMENT BUDGET

The investment matrix below shows the estimated and projected budget that needs to be mobilised and invested in the implementation of this 10 year strategy. The matrix is based on an initial figure of Ksh. 251 million in the base year (2015/16 Financial Year) that grows at a rate of 10per cent per annum. This figure has been derived in the report and consists of operational expenses while the base year has also an annual income stream of Ksh. 164 million from major sources of finance (households, commercial waste producers, advertisements, licensing, fines and penalties, grants and donations). The incomes are expected to increase at a rate of 10% p.a. Capital costs are accrued over the 10 year period. For instance, investment in a landfill and accompanying investments like trucks are done in year 2015/16 while an investment in an energy plant is done later on. These investment costs are as per investment costs estimated in the report. For the next 10 years, the County Government will invest approximately Ksh. 3,547,127,624 for operations and Kshs.2,682,003,326 for capital costs. This implies that the city requires approximately Ksh. 6,229,130,950.00 to meet its overall goal. This excludes investments envisaged from the private sector.

CHAPTER FOUR: IMPLEMENTATION, MONITORING AND EVALUATION

Implementation Schedule

This strategy will be implemented in phases and the strategies will be categorized into immediate, short-term, mid-term and long-term strategies as indicated in Table 23 below.

Table 23: Implementation Schedule

Strategic Action	1-2.5 Years	2.5-5Years	5-7.5Years	7.5-10Years
Waste Reduction	✓	✓	✓	✓
Waste Recycling and Composting	✓	✓	✓	✓
Waste to Energy/ Combustion				✓
Incineration	✓	✓	✓	✓
Planning of Sustainable Solid Waste Management Systems (Sustainable storage, collection, transportation and disposal systems)	✓	✓	✓	✓
Institutional Reforms: Ward-Unit/ Community-based / Nyumba Kumi/ Residents Association System	✓	✓		
Public Private Partnerships	✓	✓	✓	✓
Management of Special Wastes (E-Waste, Hospital, ELVs, etc.)	✓	✓	✓	✓
Capacity Building, Environmental Planning and Environmental Awareness	✓	✓	✓	✓
Fundraising and Financing Reforms	✓	✓	✓	✓
ISWM, Policy and Legal Reforms	✓	✓		

Monitoring and Evaluation

Monitoring and evaluation is an important aspect of strategy implementation that ensures that actions and projects are implemented in a cost effective and efficient manner according to what is proposed in this policy document. The following are recommended as part of M&E.

Monthly Progress Report: CoK staff will conduct periodic visits to project sites in the city based on a schedule that will be agreed with the Ward, Ward-Unit, and project coordinators/officials. These periods will be factored in the annual work plans of the proposed actions. The purpose of site visits will be to assess the progress in the implementation of specific actions/project activities in the field. Monthly report based on annual set indicators and

performance will be prepared and submitted to the County Executive Member (Minister) in charge of solid waste matters.

Annual Strategy Report: This report will be prepared by the CoK staff in the Directorate of Environment and will be submitted to the County Government for discussion at the County Executives meeting. The report will enable the ISWM stakeholders to obtain information on the performance of the strategy with regard to the implementation of agreed annual actions/ activities/ projects. The ASR will also provide details on the strategy achievements, initial evidence of success, including constraints in the implementation of agreed activities and how those constraints/shortcomings will be addressed in subsequent years. The report will also include a compilation of lessons learnt and financial expenditure statement. The review of ASR should be based on agreed performance indicators at the commencement of each financial year.

Mid-Term Evaluation Report: The proposed strategies should undergo an independent Mid-Term Evaluation at the mid-point of strategy implementation. The mid-term evaluation of this strategic document will focus on relevance, performance (effectiveness, efficiency and timeliness), and issues requiring decisions and actions and initial lessons learned on the ISWM projects design, implementation and management. The evaluation will be carried out using a participatory approach - parties that benefit or are affected by the strategy will be consulted. The Project Coordinators will prepare a management response to the mid-term evaluation recommendations along with a plan for effecting the required changes in strategy implementation. Mid-term revision may be undertaken if the main direction of dealing with SWM requires to be changed due to some major changes in internal and external factors.

Terminal Evaluation Report: An independent final evaluation will take place at least three (3) months prior to the final date of implementation of the this strategy. This terminal evaluation will focus on the same issues as the mid-term evaluation but in addition it will also examine the early evidence of strategy projects/ activities impact and sustainability of results, including the contribution to capacity building and the achievement of environmental benefits to the people of Kisumu and the City in general. The Terms of Reference for this evaluation will be prepared by the CoK technical staff and evaluation will be done by an independent consultant. The Terminal Evaluation will also provide recommendations for follow-up activities and overall review of this strategy.

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