COUNTY GOVERNMENT OF KITUI

MINISTRY OF LANDS, HOUSING AND URBAN DEVELOPMEN
KITUI MUNICIPALITY

WASTE MANAGEMENT PLAN.

SEPTEMBER 2023

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ACRONYMS

EMCA: Environmental Management and Coordination Act CAP 387

EIA: Environmental Impact Assessment

CBD: Central Business District

CBO: Community Based Organization

CSR: Corporate Social Responsibility

GIS: Geographic Information System

3Rs: Reduce, Recycle, Reuse

ISWM :Integrated Solid Waste Management

ISWMP: Integrated Solid Waste Management Plan

NEMA: National Environmental Management Authority

NGOs: Non-Governmental Organizations

UNEP: United Nation Environmental Programme

UN: United Nation

PPP: Public Private Partnership

SWMS: Solid Waste Management System

EXECUTIVE SUMMARY

Solid waste management remains as one of the major development challenges globally, Nationally and at the County level. In the year 2010, the new constitution rationalized the portfolio responsibilities and functions of all the county government ministries. In 2018 the Kitui Municipality got Municipal Charter which delegated the Solid Waste Management Function to Kitui Municipality.

The purpose of the Solid Waste Management Plan is to guide Kitui Municipality on sustainable solid waste management by ensuring a healthy, safe and secure environment for all. The Plan is a deliberate and visionary framework for the municipal board in the managementof solid waste. It is proposed that this plan will cover a period of five (5) years with a midterm review. With the full implementation of the plan, it is expected that the municipality will have embraced environmentally sound waste management technologies and best practices.

The Solid waste management plan consists of five chapters as follows;

Chapter one highlights the background information on solid waste management, challenges and what the plan aims to achieve. It also gives the legal framework guiding the formulation of the plan.

Chapter two demonstrates the current situation of solid waste management and projection in Kitui municipality. This entails; waste generation, collection and transportation, human resource management. It also illustrates solid waste spatial plan.

Chapter three gives road map of integrated solid waste management of Kitui Municipality. It details the whole process of integrated solid waste management from generation, sorting, collection, transportation and disposal.

Chapter four explains action plan which is divided into three stages; short term, midterm and long term. The projected cost for implementing integrated development plan.

Chapter five illustrates the roles of Municipality and other stakeholders in integrated Solid waste Management.

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 biological 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 hierarchies of options (source reduction, recycling, combustion and landfill) of waste management techniques to manage and dispose of specific components of municipal solid waste materials.

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.

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 day's 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.

CHAPTER ONE: INTRODUCTION

Generation of wastes continues to confront man in his living environment. This is as a result of human caused activities which generate waste, especially under conditions of rapid urbanization. The common waste being solid waste, which poses severe impacts on the environment, thus threatening quality of life. Unfortunately, the rise in solid wastes generation has overwhelmed the capacity to effectively manage the emerging challenges.

Given that Kitui Municipality has a rapidly growing population; the problem of generation of huge quantities of solid wastes is likely to become a serious challenge. Currently, about a quarter of the solid waste generated within the Municipality has a high likelihood of not being collected or even professionally handled.

In waste management, the principles of inter- and intra-generational equity, the polluter-pays principle and the precautionary principle prevail. By this plan, it would be possible to address waste management issues in the context of the Environment Management and Co-ordination Act 1999, Amended 2015. The latter provides for a comprehensive framework for the development of an Action Plan at any level.

1.1 Legal Framework Relevant To Solid Waste Management In Kenya

In the Constitution of Kenya, Article 42 on the Environment providesthat- ―Every person has the right to a clean and healthy environment, which includes the right

(a) to have the environment protected for the benefit of present and future generations through legislative and other measures, particularly those contemplated in Article 69; and

(b) to have obligations relating to the environment fulfilled under Article 70.

Part 2 of the fourth Schedule in the Constitution of Kenya explicitly provides that the County Governments shall be responsible for; refuse removal, refuse dumps and solid waste disposal.

The Environmental Management and Coordination Act (EMCA), 1999 (Revised 2015) Section 3of EMCA, stipulates that, “Every person in Kenya is entitled to a clean and healthyenvironment and has a duty to safeguard and enhance the environment”.

The act in Section 9, Section 86 and Section 87also provides for-

a) The standards of waste including such as handling, storage transportation, segregationand destruction of any waste.
b) Prohibition of handling dangerous waste
c) Classification and management of hazardous and toxic waste
d) Transportation, licensing of waste transporters and waste disposal sites

Environmental Management and Coordination (Waste Management) Regulations of 2006

In the Responsibility of the Generator, Regulation 2 states that, "Any person whose activities generate waste shall collect, segregate and dispose or cause to be disposed of such waste in the manner provided for under these Regulations".

Regulation 5 on the Segregation of waste by a generator state that, "(1) Any person whose activities generate waste, shall segregate such waste by separating hazardous waste from nonhazardous waste and shall dispose of such wastes in such facility as is provided for by therelevant Local Authority".

The Occupational Safety and Health Act, 2007

The Occupational Safety and Health Act, 2007 Part IX, Chemical Safety, Section 83 Subsection IV states that at every workplace where chemicals or other toxic substances are manipulated, the employer shall develop a suitable system for the safe collection, recycling anddisposal of chemical wastes, obsolete chemicals and empty containers of chemicals to avoid the risks to safety, health of employees and to the environment.

The Public Health Act, 2012

The Public Health Act Revised Edition 2012, Part 126. Rules under Part, The Minister, on theadvice of the board, may make rules and may confer powers and impose duties in connation with the carrying out and enforcement thereof on local authorities, magistrates, owners and others as to—(d) the drainage of land, streets or premises, the disposal of offensive liquids andthe removal and disposal of rubbish, refuse, manure and waste matters.

Section 118 - What constitutes nuisance-1. The following shall be deemed to be nuisances liable to be dealt with in the manner provided in this;

Part—(c) any street, road or any part thereof, any stream, pool, ditch, gutter, watercourse, sink, water-tank, cistern, water-closet, earth-closet, privy, urinal, cesspool, soak-away pit, septic tank, cesspit, soil-pipe, waste-pipe, drain, sewer, garbage receptacle, dust-bin, dung pit, refuse-pit, slop-tank, ash-pit or manure heap so foul or in such a state or so situated or constructed asin the opinion of the medical officer of health to be offensive or to be injurious or dangerous to health.

Part (e) states that any noxious matter, or waste water, flowing or discharged from any premises, wherever situated, into any public street, or into the gutter or side channel of any street, or into any or watercourse, irrigation channel or bed thereof not approved for the reception of such discharge constitutes to be a nuisance.

Section 126 - Rules under Part, The Minister, on the advice of the board, may make rules andmay confer powers and impose duties in connection with the carrying out and enforcement thereof on local authorities, magistrates, owners and others as to—

part (d) the drainage of land, streets or premises, the disposal of offensive liquids and the removal and disposal of rubbish, refuse, manure and waste matters.

The County Governments Act, 2012

Section 120, Tariffs and pricing of public services, subsection (3) A tariff policy adopted undersubsection (1) shall reflect following guidelines — part (h) promotion of the economic, efficient, effective and sustainable use of resources, the recycling of waste, and other appropriate environmental objectives.

The Environmental (Impact Assessment and Audit) Regulations, 2003

This regulation defines "waste" includes any matter prescribed to waste and any matter whetherliquid, solid, gaseous or radioactive, which is discharged, emitted or deposited in the environment in such volume composition or manner likely to cause an alteration of the environment.

Part IV - The Environmental Impact Assessment Study Report, 18. (1)A proponent shall submit to the Authority, an environmental contents of impact assessment study

report incorporating but not limited to the environmental following information - (f) the products, byproducts and waste generated project;

Part V - Environmental Audit and Monitoring 36, (2) an environmental audit report compiledunder these Regulations shall contain - (b) an indication of the various materials, including non-manufactured materials, the final products, and by products, and waste generated.

CHAPTER TWO: SITUATIONAL ANALYSIS

Kitui Municipality being the county headquarter is experiencing population growth which has resulted to increase in waste generation and complexity of the waste streams. Three quarters of the waste generated at the municipality is collected and disposed though not in a safe and environmentally friendly way. Waste segregation at the Municipality and across the county has not been adopted. Consequently, poor waste disposal and generally the whole process of solid waste management at the Municipality poses a myriad of health risks to the residents and to the environment.

The Municipality covers an area of about 580 km^2 and is going through rapid urbanization, resulting in a population growth rate of 3.5% per annum as of 2019, a rate higher than the rest of the county (1.2%) and Kenya as a whole (2.4%).[4] It is estimated that there are around 26,355[5] households in the urban and peri-urban areas of the municipality generating approximately 57.1 tons of solid waste per day (20,842 tons per year).[6] and is expected to increase with the growing population to reach 125,000 tons per year by 2035.[7]

Waste collection in Kitui Municipality is currently a free service offered by the Municipality team. The waste management team comprises of three permanent employees and 147 casual workers engaged by the municipality who include waste pickers, loaders, cleaners, watchmen, and supervisors. The team has five operational trucks with carrying capacities ranging from 5 to10 tones that they use for waste collection. In addition to having few trucks for their operations, some of the estates they are mandated to collect waste from have poor and narrow roads through which the trucks cannot pass. The Municipality is mandated to collect from Kitui Town, which includes the Central Business District (CBD), 9 estates, and 6 wards. The team, however, only manages to collect daily from the CBD and 9 estates in township ward and on scheduled days from the two markets outside the municipality borders (in Kwa Vonza and Kabati). The municipality has allocated casual workers to serve the satellite market centers within municipality.

In addition to challenges faced in the waste collection process, the municipality's current disposal location is a hazard to the environment and poses various threats to the health of the residents. The municipality's current dumpsite is located along the Kalundu River riparian reserve, within Kitui Town neighboring residential zones and stock yard. The site, which has not been licensed by NEMA, is not formally designed or constructed and therefore does not meet any of the appropriate health and safety regulations. The municipality's trucks offload waste collected from different parts in the open area and some of it slips into the river. As a result of leachate (contaminated liquid that is generated

when water passes through waste in a dumpsite, absorbing solid waste particles and percolating through the ground) from the dumpsite, the groundwater and the river nearby are both polluted. With residents living nearby, the dumpsite is unaesthetic, and more importantly serves as a public health hazard to residents who use water from the river for, among other things, house chores such as washing clothes.

An analysis of existing practices provides information that forms the basis for administrative and technical considerations leading to the development of this plan.

Solid waste Generation Projection

Table 1 Solid waste generation(kg)-Domestic

Town	2015	2020	2025	2030	2035	2040	2045	2050
Kericho	16268359	23025351	32588831	46124460	65282053	92396670	130773225	185089315
Litein	1296086	1666234	2142093	2753851	3540320	4551396	5851225	7522270
Mumias	15977373	22613506	32005927	45299449	64114379	90744007	128434135	181778694
Kakamega	14664022	20754660	29375018	41575803	58844133	83284787	117876761	166836361
Naivasha	27027962	38253909	54142503	76630356	108458442	153506184	217264309	307504095
Gilgil	5025022	6460113	8305050	10676881	13726080	17646098	22685629	29164395
Kitui	17508364	24780387	35072813	49640154	70257976	99439320	140741010	199197176
Mwingi	2273811	2923186	3758016	4831264	6211019	7984818	10265194	13196820

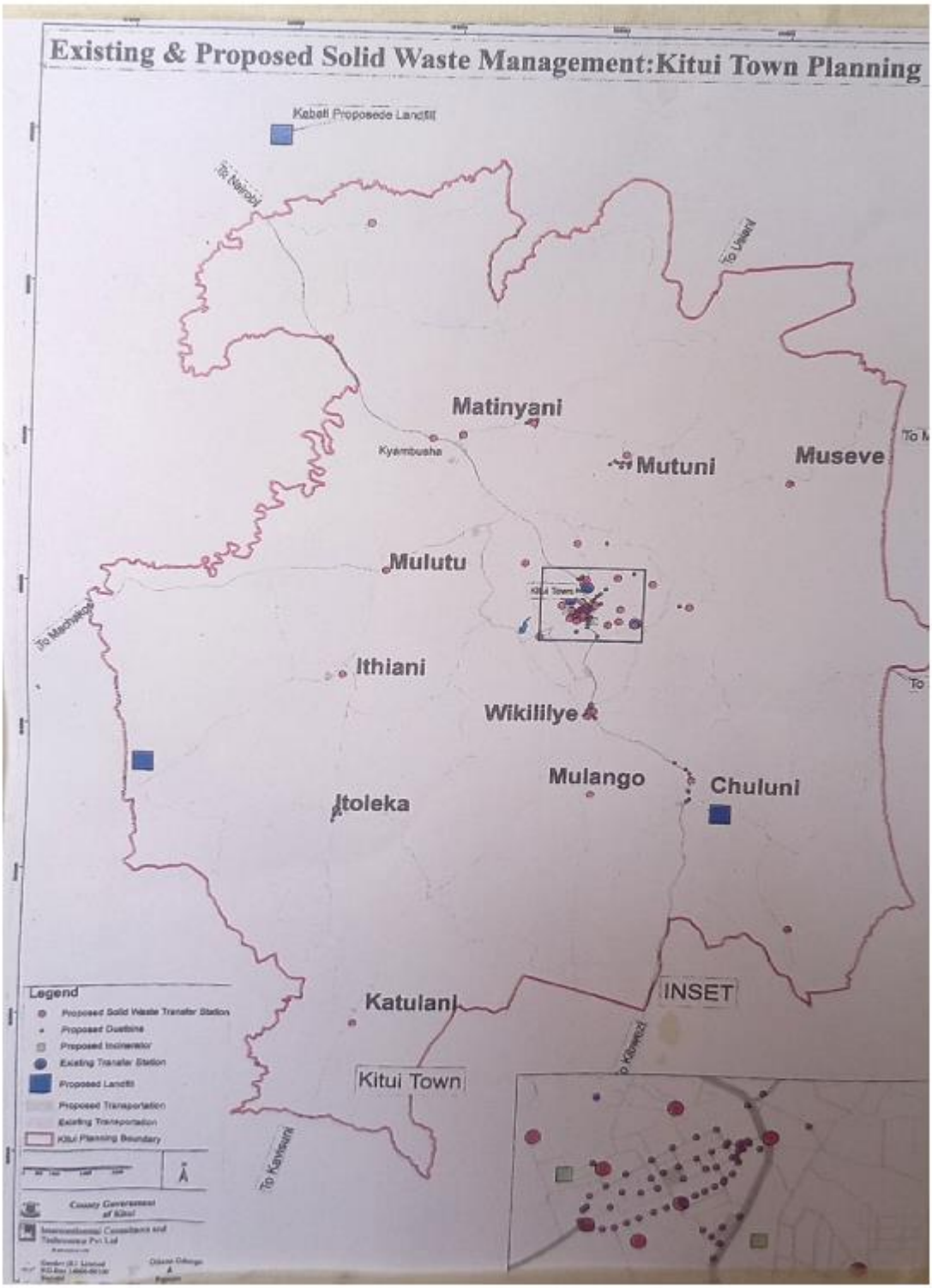
source: Consultant Team,2016

Table 2 solid waste generation (Kg): Commercial

County	Town	Total Domestic Waste (MT)			Total Non-Domestic Waste (MT)			Total Waste Generated in 30 Years (MT)
		2020 - 2029	2030-2039	2040-2050	2020 - 2029	2030-2039	2040-2050	
Kericho	Kericho Town	367191	689433	1381075	157367	295471	591889	3482426
	Litein	23862	36683	60628	10226	15721	25983	173103
Kakamega	Mumias	360623	677101	1356372	154553	290186	581302	3420138
	Kakamega Town	330979	621443	1244877	141848	266333	533519	3139000
Nakuru	Naivasha	610044	1145412	2294493	261447	490891	983354	5785641
	Gilgil	92513	142223	235057	39648	60953	100739	671133
Kitui	Kitui Town	395179	741983	1486343	169362	317993	637004	3747864
	Mwingi	41862	64356	106363	17941	27581	45584	303686

Source: Consultancy team 2016

Solid Waste Management Spatial Plan



2.1 Waste Streams

Most of the waste generated in Kitui Municipality is recyclable and comes from households, creating an opportunity for household level segregation. Households account for 88% of the waste generated with business centers contributing 8% and hotels 4%. The municipality can recycle an estimated 85% of the total waste collected from different sources. This comprises of bio waste which makes up the majority at 63.3% and other recyclable waste includes paper, plastics, textiles, and glass. The large volume of recyclable waste presents an opportunity for greater reuse than is currently happening in the municipality but will require strong and well-organized aggregation services for households.

Type of waste	**Percentage**
Bio waste	63.30%
Non-Recyclables (metals)	15.50%
Textiles and clothing	7.40%
Plastics	6.80%
Paper and cardboard	6.60%
Glass	0.4%

2.2 Impacts of poor waste management

The poor state of solid waste management has caused the following environmental problems:

2.2.1 Surface water contamination: Waste from commercial and residential areas end up in water bodies negatively changing the chemical composition of the water. Technically, this is called water pollution, and it affects wetlands and other riparian ecosystems. It also causes harm to animals that drink from such polluted water sources.

2.2.2 Soil contamination: Hazardous chemicals that get into the soil (contaminants) can harm plants when they are taken-up through their roots. If humans eat affected plants and animals that have consumed such plants as pasture, then there is a high possibility of occurrence of negative impacts on human health.

2.2.3 Pollution Poor waste management practices in the county have resulted in land

and air pollution which can cause respiratory problems and other adverse health effects to humans as contaminants, are inhaled and absorbed into the lungs proceeding to other parts of body.

2.2.4 Leachate The liquid that forms water trickles through contaminated areas is called leachate. It forms a harmful mixture of chemicals that may result in hazardous substances entering surface water, groundwater or soil.

2.2.5 Municipal wellbeing- Most trading centers in the county have poor sanitation, smelly and with waste matter all over the place, an indication of poor living standards in urbanized areas of the county.

CHAPTER THREE: KITUI MUNICIPALITY INTEGRADED SOLID WASTE MANAGEMENT PLAN

3.1 Introduction

Kitui Municipality has the potential to improve its waste management system within the municipality and integrate the private sector into its waste collection and management system**.** This plan will focus on three main components:

i) Increased service delivery within the municipality

ii) Waste segregation for recycling and sale

iii) Development of a new landfill.

The municipality will expand its network to reach currently unserved areas, utilizing casuals, collection bins and smaller trucks for efficient waste collection. The plan has also accounted for the current and projected land use within the surface area.5.2 Spatial Development Framework

Integrated Spatial Urban Development Plan implementation and enforcement shapes the structure and urban fabric of town's growth based on structuring elements1 such as natural growth constraints and opportunities. It provides long term development framework for Kitui town. It indicates broad land use classifications, transportation corridors in relation to land uses, location of utilities and services. The plan in total shows the form, shape, urban development limits, trends and pattern of developments that Kitui town will take in future.

3.2 The Spatial Plan

Based on spatial development strategy, spatial plan has been classified into following three categories.

Re-densification of core area;- This is currently the developed zone and covers up to the inside and outside proposed ring road. It includes the CBD, Kitui township, Kyanika, Kaveta and civic area. This is the zone for redevelopment and regularization.

New growth towards the west:- This is currently the undeveloped zone lying between proposed ring road and Kitui bypass. This is the zone for redevelopment and new proposals.

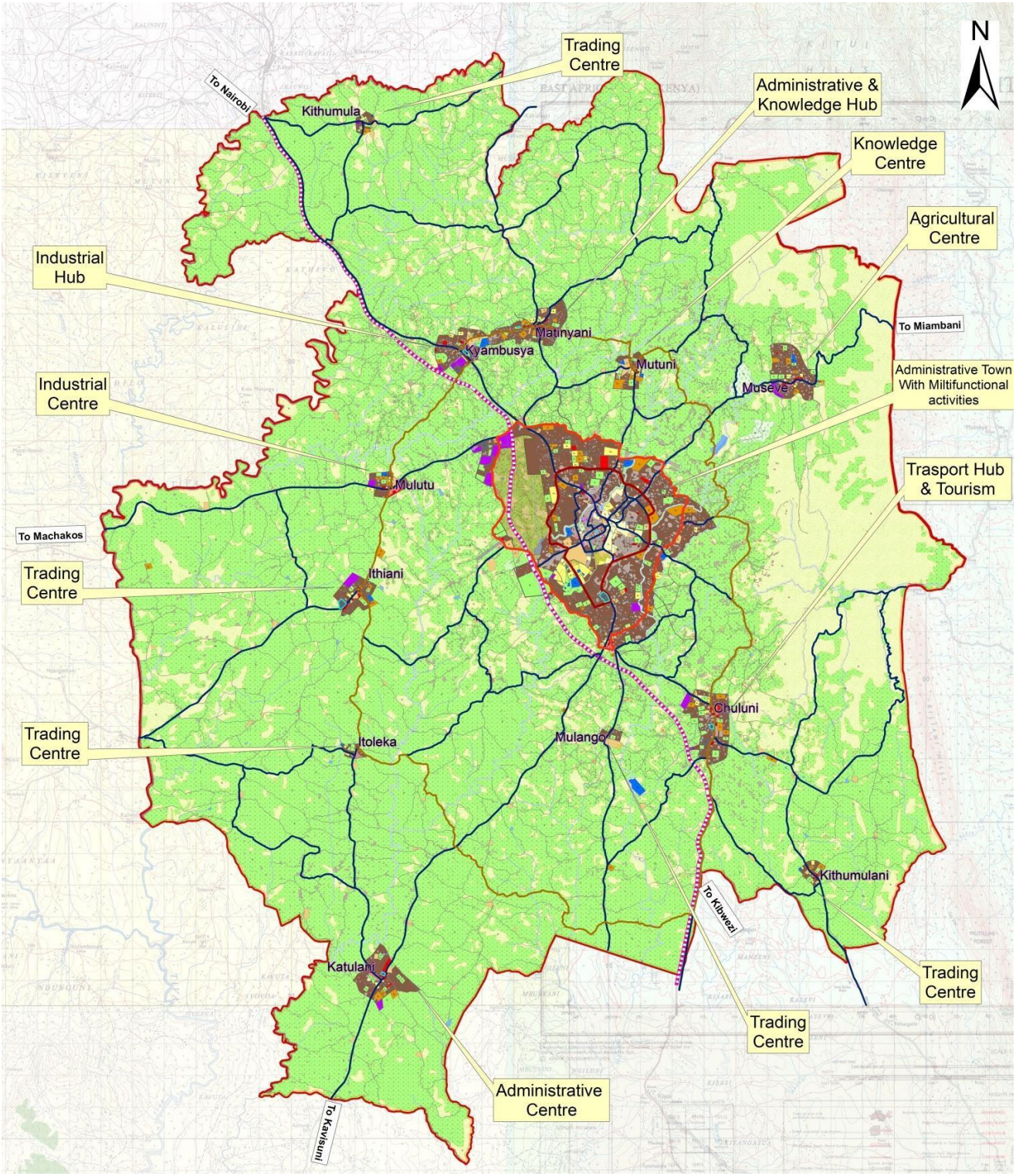
Decentralized development with medium growth in new area: The planning area consists potential growth centers such as Chuluni, Katulani, Ithiyani, Mulutu, Kyambusya, Matinyani, Museve, Mulango, Kithumulani, Kithumula and Itoleka. These growth centres development shall be promoted as self-sustainable nuclei. Based on location, connectivity, present function and growth

potential development theme has been given to each growth centres. These development themes are guiding in preparation of land use map for growth centres. Following table describes development theme of each growth centres.

Town and Growth Centres and Their Development Theme

Sr	Growth Centres	Development Theme
1	Kitui Town	Administrative town with multifunctional activities
2	Chuluni	Transport and Tourism Center
3	Museve	Agriculture town
4	Matinyani	Administrative and Knowledge Hub
5	Kyambusya	Industrial Centre
6	Mulutu	Industry and Knowledge Centre
7	Ithiani	Trading Center
8	itoleka	Trading Center
9	Katulani	Administrative Center
10	Mulango	Trading Center
11	Kithumulani	Trading Center
12	Kithumula	Trading Center
13	Mutuni	Trading Center

Development Theme of Each Growth Centres



3.3 Land Use Proposal

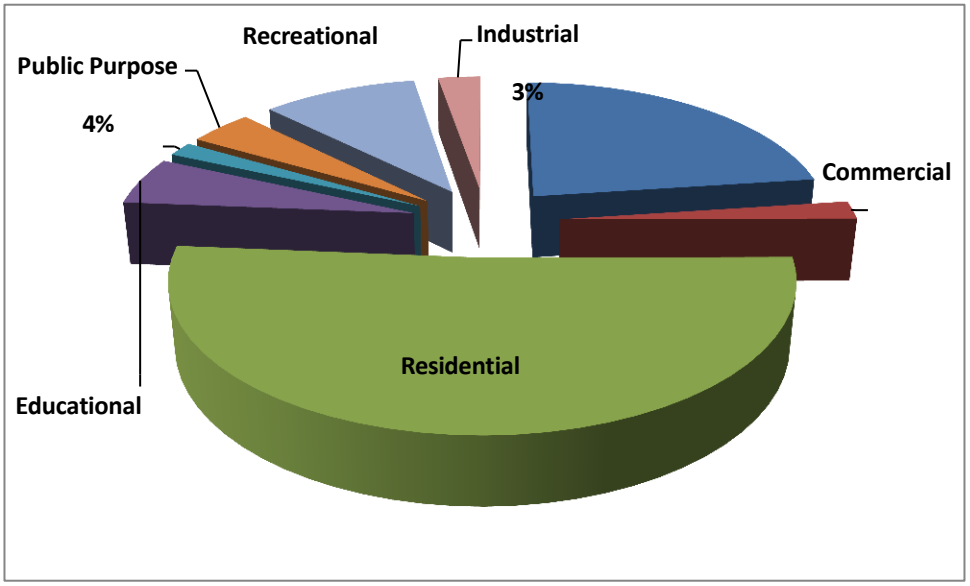
The proposed land use plan for Kitui indicates broad land use zoning and allocation of land under various uses. It has been prepared on the basis of the population projection and demand gap assessment for various sectors such as residential (housing), commercial, education, public purpose, recreation, public utility and transportation. During the process of formulation of development plan, future needs of the town in terms of physical features and constraints for various activities of Kitui town have been taken into account. The plan has been prepared to cater to the requirements of approx. 383216 persons for the horizon year 2035 for the planning area.

Proposed Land use distribution

Kitui Municipality							
S/No	Land Use	Existing Area in km^2	% Area Nat	Proposed Area in km^2	% Area Nat	Total Area km^2	% Area Net
Developed Area							
1	Residential	19.06	47.2	18.45	51.37	37.51	49.17
2	Industrial	0.08	0.2	0.97	2.7	1.05	1.38
3	Educational	3.51	8.69	1.95	5.44	5.46	7.16
4	Recreational	0.06	0.15	3.55	9.87	3.61	4.73
5	Public purpose	1.07	2.65	1.46	4.06	2.53	3.32
6	Commercial	0.97	2.4	0.73	2.03	1.7	2.23
7	Public Utility	0.53	1.31	0.59	1.65	1.12	1.47
8	Transportation n	15.1	37.39	8.22	22.88	23.32	30.57
Sub Total of Developed Area		**40.38**	**100**	35.91	100	76.29	100

Kitui Municipality							
S/No	Land Use	Existing Area in km²	% Area Nat	Proposed Area in km²	% Area Nat	Total Area km²	% Area Net
Undeveloped Area							
1	Conservation	0.97	0.17		-	0.97	
3	Vacant Land	108.94	18.77			83.8	
4	Riparian Reserve	12.78	2.2		-	12.78	
6	Agriculture	417.3	71.9		-	406.52	
Sub Total of Undeveloped Area		**539.99**			**-**	**521.63**	
Total		**580.37**	**100**		**-**	**580**	**100**

Land Use Distribution for Planning Area



3.4 Kitui Planning Area Rationale for land use

The land use proposal has been derived considering strategic location, demographic characteristics, growth potential, main functions, improved connectivity (distance) and the proposed rail link to some of these growth and trade centres. The following table describes rationale of land use for Kitui town and growth centres.

S/No	Town Growth Center	Existing Function / Potential	Proposal	Proposed Town Function
1	**Kitui Town** (Projected Population- 250,000, Area- 2456 Ha)	Strategic location, situated on national highway B7 (Kitui Nairobi road), Administrative Head Quarter	Setting up of Centre of Excellence for Business and Industries	Administrative town with multifunctional activities
		Business Centre /Trade & Commerce Activities	Develop Trade Centres; Organize Exhibition, Trade Fair, Marketing Yard etc.	
		Agriculture / Industrial Development	Setting up Light and Medium Industries and Storage, go-downs etc.	
		Tourism –Natural / Cultural / Built Heritage	Promote Local Artists and Facilitate Marketing, Skill Development	
		Develop as Education Hub	Set up University for higher education and research	
2	**Chuluni** (Projected Population- 8000)	Strategic location situated on national highway B7 (Kitui Nairobi road)	Transport Town- Proposal for railway station, truck terminal for compatible development ,	Transport hub with a Tourism function.
		Transport Corridor (Junction of Mui and Kibwezi road)	Other facilities such as hotels, commercial, education, recreation have also been proposed to serve population	
		Proximity to Kitui (8.5Km) Trading Centre	of 8000.	
3	**Kyambusya** (Projected Population 5,000)	Strategic location situated on national highway B7 (Kitui Nairobi road) , Proximity to Kitui, & connectivity by Road and rail	Industrial -Warehouse and Industrial Park,	Industrial hub

S/No	Town Growth Center	Existing Function / Potential	Proposal	Proposed Town Function
		Transport Corridor	Transport center - Railway station and Truck Terminus,	
		Agriculture Produce & Marketing	Recreation- Stadium,	
		Development of Service & Cottage Industries, Development of Trade Centre	Education, Entrepreneurial Institute College	
4	**Matinyani (Projected Population 3,000)**	Strategic location situated on Kitui Matinyani road , Proximity to Kitui, & connectivity by Road and rail	Administrative -Office Complex, Police Station	Administrative cum Knowledge hub
		Administrative- Matinyani District Headquarter,	Education-Youth Polytechnic, Training Institute, College	
		Education- DEB and other schools	Recreation-Zonal Park and Playground	
		Recreation- Kalia Primary Playfield Commercial-Trading Centre	Commercial-Informal Market, Expansion of commercial areas;	
5	**Mulutu** (Projected Population 3,000	Strategic location situated on Kitui Machakos road , Proximity to Kitui, & connectivity by Road,	Industrial-Industrial Park (Setting up of Light Industries, Fruit processing)	Industrial center
		Potential for Industrial Development	Education-Entrepreneurial Institute	
		Commercial-Trading Centre	College, Hotel & Tourism Management Institute Commercial-Expansion of commercial areas;	
6	**Mutuni** (Projected Population 4,000)	Existing technical institute, Several schools	Medical College	Knowledge center
7	**Museve** (Projected Population 8,000)	Strategic location situated on Kitui Miambani road , Proximity to Kitui,	Residential	Agricultural town
		Trading Centre	Agri-based industries	

S/No	Town Growth Center	Existing Function / Potential	Proposal	Proposed Town Function
		Growth Potential of economic activities	Commercial-Expansion of commercial areas;	
8	**Katulani** (Projected Population 5,500)	Strategic location situated on Kitui Kavisuni road and proposed rail , Proximity to Kitui,	Residential	Administrative center
		Trading Activities	Commercial-Expansion of commercial areas;	
9	**Ithiani**	Strategic location situated on Kitui Tiva road , Proximity to Kitui,	Recreational-Zonal Playground	General purpose trading center
	(Projected Population 5,000)	Education, Other schools Other schools	Education -Youth Polytechnic, Special school	
10	Itoleka (Projected	Proximity to Kitui,	Education--Youth Polytechnic	General purpose trading center
	Population 5,000)	Education-Other schools Administration-A.P Line	Administration-Administration Land use	
11	**Kithimula** Projected Population 4,000)	General function trading center	Promote Innovation in Agriculture and awareness programme for Farmers Setting up Marketing Facilities and Transport Services, Storages	General purpose trading center
		Marketing of Goods	Develop Market Yard and Processing of Agro Products	
			Setting up small scale Industrial Estate	
12	**Mulango** (Projected Population 3,500)	General function trading center	Promote Innovation in Agriculture and awareness programme for Farmers Setting up Marketing Facilities and Transport Services, Storages	General purpose trading center

S/No	Town Growth Center	Existing Function / Potential	Proposal	Proposed Town Function
		Marketing of Goods	Setting up of Vocational Training for skill development	
13	**Kithumulani** (Projected Population 4,500)	General function trading center	Promote Innovation in Agriculture and awareness programme for Farmers Setting up Marketing Facilities and Transport Services, Storages	General purpose trading center
		Marketing of Goods	Develop Market Yard and Processing of Agro Products , Setting up small scale Industrial Estate	

The plan also looks at the introduction of a waste sorting and composting site to be run either fully by the municipality or in partnership with a private operator.

This plan not only provides an opportunity to generate a positive economic and environmental impact in Kitui but also contributes towards the creation of a circular economy in various value chains**.** The implementation of this plan will generate economic impact by creating job opportunities as the municipality employs more casuals for waste collection and team members across the various new operations. The plan will help mitigate climate change through reduced environmental pollution and burning of waste. This will in turn increase business activity in Kitui Municipality because of improved aesthetics. That, in addition to increased productivity by farmers because of increased access to high-quality inputs from compost-based fertilizer will support the municipality in achieving economic growth. Establishing a composting facility therefore allows the municipality to increase access to high quality and affordable fertilizers for farmers. Separately, through recycling of waste such as plastic and glass, the project will also contribute towards the circular economies of these value chains by reducing the amount of virgin material produced.

This section outlines the formalized SWM plan operational aspects with a focus on the operational process, team structure, and the potential ownership structure

3.5 Operational Process

The plan is designed around three components of the solid waste management process – waste collection, waste segregation / recovery and the establishment of a new landfill**.** The first component will focus on improving and commercializing waste collection services, the second will focus on revenue generation from segregation and recycling, while the final component will focus on the proper disposal of unrecyclable waste to reduce environmental pollution and emission of greenhouse gases that contribute to climate change.

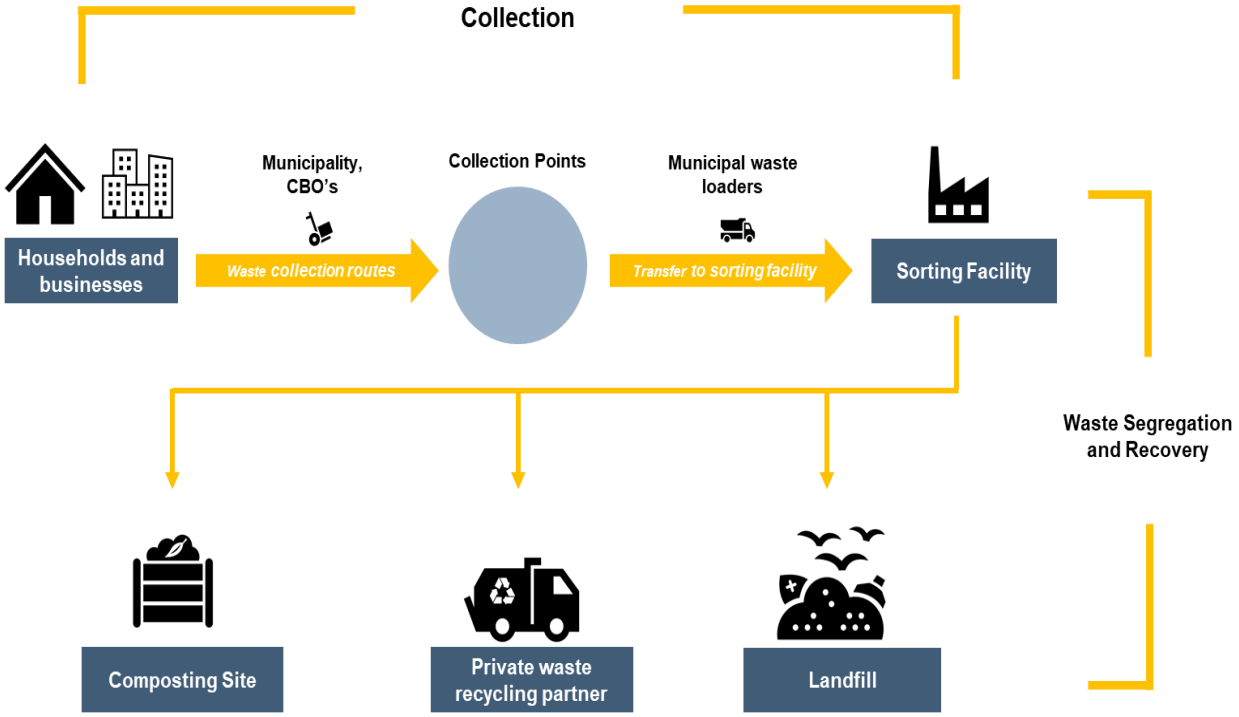


Fig. 1 Summary of the operational process of the solid waste management plan

To increase service delivery and reach previously unserved estates and wards, the municipality will need to invest in additional resources and navigate current infrastructure**.** The municipality will work with CBOs/Private Investors to collect waste from households and businesses currently unserved, resulting in an additional waste collected daily. The municipality will also work with private sector to educate and train households and businesses on how to correctly identify different types of waste to be segregated at the household and business level. The municipality will also provide households and businesses with labeled solid waste segregation bins/liners required to segregate the different waste types.

The municipality will partner with several private-sector players for efficient sorting and segregation of the waste collected as well as off takers of recyclable waste.

3.5.1 Household and Business-level Segregation

Household segregation will start with an education and sensitization component**.** For households to understand how to segregate waste correctly, they will need to be educated about the types of waste they have and how to dispose them. As households become educated, the municipality will provide color coded waste segregation bins one for recyclable waste and the other for non-recyclable waste. Integrating waste segregation at the household level makes the eventual process of recycling easier, reduces the volume of waste that goes to landfill and improves public health protection. This will be managed by the municipality but run by private actors and CBOs/ Private Investors. The waste sorting facility will serve a dual role, as a backstop to ensure that unsegregated household waste is sorted into recyclable and non-recyclable waste and to further segregate recyclable waste into separate piles such as plastics, glass, textiles, and paper. This will also serve as a check for household segregation as the waste will still need to go through the sorters.

3.5.2 Collection and Transportation

The municipality will continue collecting waste from households and businesses it currently serves, and leverage CBOs/ Private Investors for inaccessible areas. Currently, municipality workers pick waste from residential areas/estates and businesses on prescheduled days and load it to the collection trucks. This collection method will remain with the new plan and the collected waste will then be transported to the sorting facility for segregation. The road infrastructure in most of the estates in the municipality is impassable for collection trucks, necessitating the presence of large collection bins and partnership with CBOs/ Private Investors in some estates. The CBO/ Private Investors and municipality waste pickers pick waste door-to-door from households and deposit it in strategically located collection points from which the collection trucks can pick it up. While residents in some estates drop their waste to collection points themselves, the municipality casuals could visit all households to ensure that all waste is collected. Skips or large storage containers will be used at the collection points and the type of collection truck used will determine which waste storage option is most appropriate.

3.5.3 Waste Sorting

The current waste sorting process involves an unsystematic and unreliable sorting method by waste pickers who scavenge for recyclable materials in the heavily contaminated dumpsite, giving room for exposure to diseases.[10]

Waste sorting and material recovery provide an opportunity for a new income stream through the sale of high-quality organic and recyclable waste to interested parties**.** This process can either be manual or done through a waste sorting facility with an integrated waste sorter.

For this plan, a waste sorting facility will be constructed on new land that the municipality will purchase**.** Initial sorting will be done manually, after which an integrated waste sorter will be incorporated to provide the opportunity to recover higher-quality materials and improve sorting efficiency.

Below is a detailed overview of the waste sorting process with the integrated waste sorter:

I. **Reception and feedstock preparation:** The waste collected from the collection points is received at the waste reception area of the sorting facility and fed into the waste sorting machine. The waste is transported through a plastic waste feeder where large plastic pieces are sorted out. After this stage, the waste passes through the conveyor belt to the manual sorting platform.

II. **Classification and sorting**: At the manual sorting platform, the waste is first sorted by generic properties like size, shape, and density then by quality of materials as defined. The rest of the waste will then be transported to a magnetic separation machine. At the magnetic separation machine, the iron materials will be sorted out from the waste. The rest of the waste will then be transported to the final sorting platform for quality control.

III. **Quality control:** In this final round, trained sorting workers will perform quality checks and sort waste into three main piles - non-organic waste to be taken to the landfill for disposal (which include soiled plastics, cartons, paper and cardboard), organic recyclables (which consists of food scraps and other waste to be used to create compost) and quality plastics and other recyclables to be sold to off-takers.

3.5.4 Disposal

The sorters will separate the waste into different piles for collection by different partners. The municipality loaders will pick the unrecyclable waste for transportation to the landfill and the biowaste for transportation to the compost site.

CHAPTER FOUR: ACTION PLAN

4.1 Planning Direction and Goals of the Final Disposal Plan

The action plan concerning final disposal is divided into three stages, i.e., short-term (2023-2024), mid-term (2024-2025) and long-term (2025-2027). The objective, planning policy, strategy and goal of the final disposal component of the Master Plan are elaborated, as follows:

4.2 Objective

To ensure Health Secure and Sustainable solid waste management system fit for Municipality, in a time of increasing resource scarcity; that seeks to minimize waste generation and promote reuse, recovery and recycling of waste materials and sustainable waste disposal

4.3 Planning Policy

The sanitary landfill is evaluated to be the most appropriate landfill method from both economic and environmental viewpoints. Therefore, the final landfill plan shall be formulated for the construction and operation of a sanitary landfill. Altogether, a plan of urgent improvement and closure of Kalundu dumpsite and the existing illegal dump sites is considered sanitarily as possible where the present reclamation is performed.

4.4 Strategy

The scale of SWMS, facilities and their operation shall take financial availability into consideration. Due to financial constraints concerning SWM financing, a phased construction of the landfill site shall also be considered. Urgent improvement plan and closure plan of the Kalundu dumpsite and existing illegal dumpsites shall take economic efficiency into consideration to reduce the negative impacts on the surrounding environment.

4.5 Goal

Short-Term Plan

- Reduction of secondary pollution from Kalundu Dumpsite by urgent improvement works at the site.
- Feasibility studies; designs, Risk assessment, Environmental and Social Impact Assessment for the proposed new landfill.
- Enactment of Bylaws on the Integrated Solid waste management for the strategy
- Public education
- Elimination of illegal waste collection points within Kitui Municipality.

- Establishment of segregated labelled garbage skips at mapped points within the Kitui Municipality and other urban areas within Kitui County.
- Provision of litter Bins within the markets for different category of wastes.

Mid-Term Plan

- Designation of solid waste transfer points within Kitui town and other Market centers within Kitui Municipality.
- Minimization of secondary pollution from Kalundu Dumpsite by closure of the unsustainable operation at the site
- Preparation of a post closure land use plan at Kalundu dumpsite e.g., transfer station
- Establishment of Waste plastic recycling plant
- Preparation and commencement of construction of new sanitary landfill Site.

Long-Term Plan

- Acquisition of land for a Landfill
- Construction of a new landfill complete with ash pit
- Minimization of adverse effects from the new landfill site by proper operation and management

Table 0-1: Indicative capital expenditure requirement for implementation of the ISWMP

		Time Framework of the Master Plan																				
	Year	2023				2024				2025				2026				2027				Indicative cost (Ksh)
	Quarter	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	
Masterplan																						
1	Enactment of Bylaws on the Integrated Solid waste management for the strategy																					4,000,000
2	Formulation of Kalundu Dumpsite Closure Plan																					1,000,000
3	Implementation of Environmental Audit for Kalundu Dumpsite																					2,000,000
4	Public education																					4,000,000
5	Establishment of 300 segregated litter Bins at mapped points within the Kitui Municipality and other urban areas within Kitui County.																					15,000,000
6	Provision of 50 labelled garbage skips within the markets for different category of wastes.																					25,000,000
7	Acquisition of 3 garbage collection trucks																					50,000,000
8	Implementation of Kalundu Dumpsite Urgent Improvement Plan																					43,000,000
9	Designation of 20 solid waste transfer points within Kitui and other urban centres within the County.																					6,000,000

10	Establishment of Waste plastic recycling plant																					20,000,000
11	Operation & maintenance of Kalundu Dumpsite																					5,000,000
12	Formulation of New Landfill Site Construction Plan																					2,000,000
13	Implementation of Environmental and social Impact Assessment for the Landfill																					2,000,000
14	Survey/risk Assessment for Construction of new Landfill Site Construction Plan																					2,000,000
15	Construction of New Landfill Site																					132,000,000
16	Waste sorting facility construction																					25,000,000
17	Waste sorting machine																					70,061,950
18	Wheel loader																					9,000,000
19	Weighing equipment																					1,200,000
20	Compactor																					4,000,000
21	Bulldozer																					11,000,000
22	Cleanup of unauthorized transfer points																					2,000,000
23	Human Resource																					150,000,000
Total																						**585,261,950**

This provides quantitative analysis of the cost of implementing the proposed ISWMP in short-, medium- and long-term including equipment acquisition and maintenance, staff remuneration and facilitation.

CHAPTER FIVE : ROLES AND PARTNERSHIP FOR ISWMP

The ISWMP for Kitui Municipality is prepared taking into consideration different scenarios, their financial implications, the current status of SWM and the budgetary allocations for SWM taking into account possible and continuous upgrade of the system with time to acquire internationally accepted standards of solid waste management. Solid waste management is a shared responsibility between municipality management, waste generators (public) and other private organizations. Each organ of the system must therefore play their key role effectively if the implementation of solid waste management plan is to be efficient. Currently, there exists no proper framework of engagement between the municipality management and the public or even regulations governing solid waste storage and disposal within Kitui Municipality. In the midterm plan, this ISWMP recommends formulation of regulations and rules of engagement guided by the roles of each stakeholder as described in the subsequent sections:

5.1 Roles of Municipality in Solid Waste Management

- Formulation of bylaws and guidelines for solid waste management
- Enforcement of rules and regulations guiding SWM
- Provision of equipment and vehicles for both primary and secondary collection and transportation of municipal solid waste
- Provide personnel for solid waste collection and transportation
- Provide land for final disposal of municipal waste
- Facilitate and carryout public awareness on solid waste management
- Provide framework for collaboration between municipality management and public in SWM

5.2 Community-based Organizations for solid waste management

Currently there is no a community-based organization (CBO) involved in Solid waste management within kitui Municipality. The CBOs play a vital role in waste management such as designing and implementing, education campaigns, even though not directly involved in waste collection or treatment. Thus, it can support collection services and change the behavior of households. CBOs also act as a watchdog to control behavior of households and ensure they conforms to the agreed rules and schedules.

5.3 The role of community members in community-based solid waste management

Community members can participate in solid waste management by adopting the best solid waste management practices.

5.4 Roles of Waste Generators

The waste generators are categorized into households, Commercial and Industrial. Their role include:

- Temporary storage of waste at source
- Deposition of waste at transfer stations. Construction waste generation

5.5 Funding Mechanism

The sources of funding for the implementation of the plan will be from Kitui Municipality, Public Private Partnerships, waste generators and the development partners. The funding must be self-sustaining in the long run and strategically integrated in all phases of the waste management system. These phases include initiatives to minimize generation of waste at source, waste segregation, improve collection and transportation systems as well as managing the disposal of waste that cannot be recycled or reused**.**

Monitoring And Evaluation

Poor solid waste management has direct and indirect effects to the public health and the environment and therefore monitoring and evaluation is an integral component. The Monitoring and Evaluation system adopted for this plan will be designed to provide feedback to stakeholders to ensure accountability, transparency, facilitate appropriate decisions on future implementation and review of the plan to ensure that the input delivery, work schedules and target outputs are progressing according to the plan.

CONCLUSION

There is need to introduce service charge to the residents for solid waste collection in order to offer commensurate service provision. It is proposed that a well-designed charging system can have a positive effect in reducing waste generation by producers through offering incentives for those who minimize waste by lowering their chargeable tariff. This initiative requires intensive social marketing and public goodwill. Other premises e.g., supermarkets would be encouraged to buy back valuable used items such as bottles hence enabling greater recovery