COUNTY GOVERNMENT OF KIAMBU

LIMURU MUNICIPALITY

DEPARTMENT OF MUNICIPAL ADMINSTRATION AND URBAN DEVELOPMENT

SOLID WASTE MANAGEMENT PLAN

Prepared By

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MUNICIPAL MANAGER

LIMURU MUNICIPALITY

FOREWARD

Effective management of solid waste is a critical component of urban governance, environmental protection, and public health. As Limuru continues to grow and develop, the volume and complexity of waste generated have increased, creating significant challenges that require a coordinated and sustainable approach. This plan provides a comprehensive framework to guide the municipality in addressing these challenges, while promoting cleaner, safer, and healthier communities.

The development of this plan reflects our commitment to environmental sustainability, community participation, and compliance with national and county legislation. It outlines practical strategies for waste reduction, collection, transportation, recycling, and disposal, as well as mechanisms for stakeholder engagement and private sector collaboration. I am confident that with the cooperation of all residents, institutions, and partners, the implementation of this plan will transform Limuru Municipality into a model of efficient and sustainable waste management, ensuring a better environment for present and future generations.

As Municipal Manager, I reaffirm our commitment to strong leadership, transparency, accountability, and continuous improvement in service delivery. Together, we can build a municipality that is clean, healthy, resilient, and worthy of future generations.

Municipal Manager, Limuru Municipality

ACRONYMS

CBOs	–	Community-Based Organizations
EIA	–	Environmental Impact Assessment
EMCA	–	Environment Management Coordination Act
EPR	–	Extender Producer Responsibility
GIS	–	Geographical Information System
JICA	–	Japan International Cooperation Agency
Km	–	Kilometres
KPI	–	Key Performing Indicators
KUSP 2	–	Kenya Urban Support Program 2
M&E	–	Monitoring & Evaluation
MRF	–	Material Recovery Facility
NEMA	–	National Environment Management Authority
NGOs	–	Non Governmental Organizations
PPPP	–	Public-Private-People Partnership
SWM	–	Solid Waste Management
UNEP	–	United Nations Environment Programme

Executive Summary

Limuru Municipality is experiencing rapid urban growth, increased economic activity, and population expansion, all of which have significantly raised the volume of solid waste generated. Improper waste management has led to environmental degradation, public health risks, and reduced aesthetic and urban livability. To address these challenges, the Limuru Municipality Solid Waste Management Plan provides a structured framework for sustainable, efficient, and environmentally responsible handling of solid waste. The plan aligns with national legislation, including the Environmental Management and Coordination Act (EMCA), relevant county regulations, and local by-laws, ensuring compliance while addressing the municipality's unique urban, peri-urban, and agricultural contexts.

The plan's key objectives are to minimize waste generation through public awareness and adoption of the 3Rs (Reduce, Reuse, Recycle), improve collection, transportation, and disposal of waste, and encourage private sector investment and public-private partnerships in waste management. It emphasizes community participation, stakeholder engagement, and innovative solutions to promote shared responsibility and accountability. Effective implementation of this plan will result in a cleaner, healthier, and more sustainable Limuru Municipality, protecting public health, conserving the environment, and enhancing the overall quality of life for residents.

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1.INTRODUCTION

1.1 Overview of Limuru Municipality.

Limuru is located on the eastern edge of the Great Rift Valley, approximately 30 kilometers (19 miles) northwest of Nairobi. Limuru Municipality covers an area of **105 km²**, with its administrative headquarters in Limuru Town.Limuru Municipality has five administrative wards: Bibirioni, Ngecha Tigoni, Ndeiya, Limuru East, and Limuru Central. It borders Kikuyu, Lari, Githunguri, and karuri. The boundaries cover urban, peri-urban, and agricultural areas, including residential, commercial, tea estates, and industrial zones.

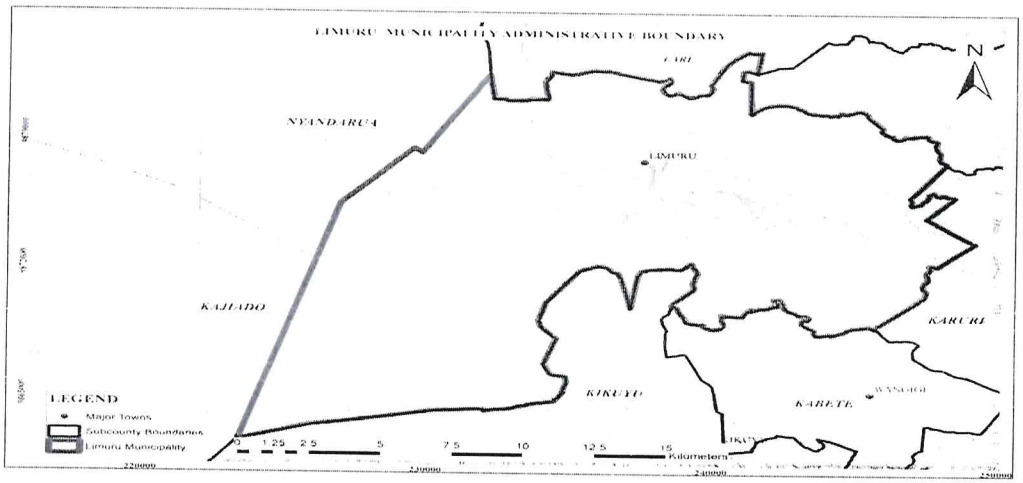

Figure 1: Map for Limuru Municipalityy

The main economic activities within Limuru Municipality include large-scale tea farming, horticultural farming, small-scale mixed farming, and livestock rearing. The area has a strong agricultural base, particularly in tea production, with several tea estates and factories operating within the municipality. The municipality also hosts manufacturing and processing industries such as Bata Shoe Company, Limuru Polypipes Products, Limuru Milk Processors, and various tea processing factories. Limuru Town functions as a commercial hub characterized by open-air markets, Jua Kali artisan activities, retail shops, wholesale businesses, and service enterprises. Residential developments account for approximately 35% of land use within the town and its surrounding areas.

1.2 Population Data

According to data from the Kenya National Bureau of Statistics (KNBS) 2019 National Population and Housing Census, Limuru Municipality had a population of 159,314 in 2019. The population is projected to grow to approximately 197,550 by the year 2030.

Population distribution by ward (2019 Census and 2030 projections) is as follows:

Table 1: Population Projections for Limuru Municipality

Municipality	2019 Census	2030 projection
Bibirioni	25,269	31,333
Ngecha Tigoni	62,735	77,791
Ndeiya	30,819	38,215
Limuru East	12,057	14,950
Limuru Central	28,437	35,261
Total	**159,314**	**197,550**

Source: Kenya National Bureau of Statistics

The projected population growth, coupled with expanding economic activities and residential development, is expected to significantly increase demand for infrastructure, services, and solid waste management within the municipality.

1.3 Purpose of the SWM Plan:

The purpose of the Limuru Municipality Solid Waste Management Plan is to develop and implement sustainable, inclusive waste management practices that meet the municipality's needs while aligning with KUSP2 objectives, as well as county and national policies and environmental standards.

1.4 Key Objectives:

- Ensure timely and efficient collection, transportation, and disposal of solid waste.

- Improve public-private-people partnerships in collection, waste segregation and recycling practices/activities.
- Promote education, public participation and awareness.
- Reduce environmental impact by improving on waste disposal sites and pollution control.
- Ensure financial sustainability of the SWM system.

2. Waste Generation and Composition Assessment

2.1 Current Waste Generation:

Municipal solid waste generation is continuously increasing due to rapid population growth in urban areas. This can be linked with increased economic activity and rural urban migration which further leads to continued rise in number of waste generators. Data on the amount of waste generated and solid waste composition is important to ensure that waste is managed effectively. Most municipalities rely on the amount of waste collected to estimate the waste generated in a municipality, which may underestimate the actual information.

There are various sources of waste generated in a municipality which include hotels, industries, markets, retail and wholesale outlets, supermarkets, institutions, petrol stations, households and medical facilities.

Using the 2019 Census and 2030 projected population figures for Limuru Municipality, and applying an average urban waste generation rate of 0.5 kg per person per day, the estimated ward-level waste generation is presented below.

Estimated Waste Generation by Ward (0.5 kg/person/day)

Ward	2019 Population	2019 Waste Generation (kg/day)	2030 Projected Population	2030 Waste Generation (kg/day)
Bibirioni	25,269	12,635	31,333	15,667
Ngecha Tigoni	62,735	31,368	77,791	38,896
Ndeiya	30,819	15,410	38,215	19,108
Limuru East	12,057	6,029	14,950	7,475
Limuru Central	28,437	14,219	35,261	17,631
Total	159,314	79,661	197,550	98,777

Table 4: Population growth and projected of solid waste generation

Overall, Limuru Municipality generated approximately 79.7 tonnes of solid waste per day in 2019, equivalent to about 28,800 tonnes annually. By 2030, daily waste generation is projected to increase to approximately 98.8 tonnes per day, or about 36,045 tonnes annually, reflecting significant growth in waste management demand across all five wards, particularly in Ngecha Tigoni and Bibirioni, which record the highest population figures.

2.2 Waste Composition in Limuru Municipality

The dominance of organic waste (65%) indicates strong potential for composting and organic waste diversion initiatives, while plastics (12%) and other recyclables present opportunities for material recovery and circular economy interventions. With projected population growth, all waste categories are expected to increase proportionally by 2030 unless effective waste minimization and segregation measures are implemented.

Waste Composition:

1. Household waste

This consists of wastes that are generated by household from activities like sweeping, food preparation, clearing of unwanted clothing, shoes, utensils, furniture or other household material.

Other activities also include from gardening, animal rearing and disposal of packaging and reading materials.

2. Commercial waste

This is waste generated by all commercial premises that is shops, retail stores, banks, service stations, entertainment centers, offices, restaurants and hotels. The waste comprises of packaging materials, office supplies, food waste, glass, plastics, metal, rubber, used oil, e-waste among others.

3. Municipal waste

This category includes waste from open public spaces and mainly is collected from street sweeping such as ash, dirt and leaves. Street waste may also comprise both commercial and domestic waste, especially where waste collection from these two sources is poor.

4. Institutional waste

This category covers wastes from schools, churches, government offices, hospitals and police station. Waste composition is mostly paper, plastics and when the institutions involve residents, most of the wastes are similar to those of households. The waste from hospital constitutes of infectious and hazardous materials and is managed within the medical facility by incineration.

5. Industrial waste

They come from processing and non-processing industries. Industrial waste constitutes of by-products of manufacturing wastes, construction and demolition wastes. The composition of industrial wastes is site specific and depends on the raw resources and product which provide the base for a given industrial activity.

6. Agricultural waste

This is waste from animal and crop husbandry such as manure and crop remains. This waste is mostly generated in the market, from traders selling farm products.

The table 3 below summarizes the various waste categories, source and type of solid waste.

Table 3: Category, Source and Type of solid waste

NO	CATEGORY OF WASTE	SOURCE	TYPE OF WASTE
1.	Organic	Market, hotel industry	Food remains, rotten vegetables and fruits
2.	Recyclables	Institutions, Households, Retail and wholesale outlets,	glass, plastics, metal, rubber, wood
3.	Non-Recyclables	Petrol Stations, Construction sites, Commercial premises	Rubber, E – waste
4.	Hazardous waste	Medical facilities, Industries	paints, used batteries, used oil, solvents, cleaning agents, pesticides, medical waste

2.3 Waste Generation Trends:

Waste generation in Limuru Municipality is projected to increase steadily over the medium to long term, driven primarily by rapid urbanization, population growth, and rising household incomes. Continued expansion of residential developments, commercial activities, and small-scale industries is expected to result in higher per capita waste generation and more complex waste streams, including increased plastic, packaging, and organic waste. Without corresponding investments in waste reduction, segregation, and recycling systems, the total volume of municipal solid waste is likely to place growing pressure on existing collection, transportation, and disposal infrastructure.

3. Existing Solid Waste Management System

3.1 Collection Systems:

Collection of solid waste is a very crucial part in the solid waste streams especially in municipality to avoid littered streets, piled up waste in markets which lead to unsanitary conditions and a breeding ground for vector-borne diseases (UNEP 2015). For effective collection of solid waste, it is determined by an inclusive waste collection schedule and the availability and capacity of garbage trucks. For effective collection, more attention is accorded to areas characterized with a large human population and rate of waste generation considered high. An example of a waste collection schedule is given in table 5 below, which helps ensure that there is less pile up of waste and all areas within the municipality get access to waste collection services.

Table 5: An example of Truck Collection Schedule

Day of the Week	Area
Monday	Limuru CBD, Kwambira
Tuesday	Limuru CBD, Ngarariga, Murengeti
Wednesday	Limuru CBD, Kironi, Red Hill
Thursday	Limuru CBD, Bibirioni
Friday	Limuru CBD, Ndeiya
Saturday	Limuru CBD, Ngecha Tigoni

With only a collection of 75% of the total solid waste generated in the municipality, there is need for an efficient and consistent collection system to allow for 100% collection rate and further avoid overwhelming storage facilities.

For this to be achieved, it is necessary to classify various areas in the municipality into red zones; those with high generation rate of waste, orange zones; average rate of generation and waste generators and green zones with lesser amounts of waste generated.

3.2 Waste Treatment and Disposal:

The last stage of solid waste management is the final disposal of waste in an environmentally sound and sustainable manner. There are three options: landfill, recycling and incineration. Kiambu County has one operational dumpsite, Kangoki dumpsite in Thika Municipality which is almost full as disposal method practiced is open dumping.

3.3 Recycling and Resource Recovery:

Recycling efforts of waste materials are done mostly by the private sector, where materials such as cartons, metal, glass, plastics among other materials are recovered and sold to recycling companies. There are about ten companies involved in recovery and recycling of waste materials in Limuru Municipality. Additionally factories within the municipality are engaged in recycling efforts that involve the youth and local community.

3.4 Institutional Framework:

a) **Municipalities**

This is the government body responsible for monitoring the waste generated through the waste stream (from point of generation to safe disposal). The Municipality charges the commercial waste generators a solid waste management fee which is included in the business permits issued annually. Municipalities are also tasked to render municipal services of street sweeping and collecting waste. For household waste, municipalities have licensed private garbage collectors (organized groups or private companies) to properly handle and manage.

b) **National Government**

This includes government ministries and agencies that have a mandate to enhance environmental protection. This includes the Ministry of Environment and National Environment Management Authority (NEMA). They promote effective solid waste management through formulation and implementation of environmental laws and policies, for example the ban of single use plastic bags in Kenya (Gazette Notice published on 28th February 2017), has tremendously improved the state of the environment and overall reduction of waste collected within the municipality.

c) Waste Generators

This includes anyone who generates waste from commercial, industrial, institutional or domestic activities. The number of waste generators is continually increasing in the municipalities due to rural-urban migration. Almost all socio-economic activities result in generation of waste as the products made available in the market have a life span after which waste is generated.

d) Private Service Providers

They are major stakeholders in solid waste management as they manage a larger amount of the waste generated (household waste), roughly estimated to be about 70 percent of the total waste generated. Table 6 below entails a list of licensed private garbage collectors in Limuru Municipality with their area of operation and tonnage of waste transported to the disposal site on a weekly basis.

Table 6: Private garbage collectors in Juja Municipality.

No	Name of Company	Tonnage per week	Area of Operation
1.	Spetika garbage collectors	4 tons	Limuru
2.	Transkraft Energy Ltd	4 tons	Limuru Towm
3.	Zero ten investment	4tons	Limuru Town
4.	Zero ten investment	7tons	Tilisi
5.	Drift conquer	4tons	Bibirioni
6	Friends of creation	5 tons	Ndeiya

Financial Management

Kiambu County receives funding for its solid waste management and environmental services from a mix of local revenue streams and intergovernmental transfers. Below is a refined and expanded overview of the key funding sources:

- **Solid Waste Management (SWM) Fees**

Business Permit Waste Fees – The primary revenue source, where waste management charges are embedded in Single Business Permits issued to commercial entities.

- **Private Garbage Collectors**

a) Licensing & Registration Fees – Annual fees paid by private waste collection companies to operate within the county.
b) Tipping Fees (Gate Fees) – Charges paid by private waste trucks when disposing of waste at designated county dumpsites or transfer stations.

- **Environmental & Regulatory Charges**

Environmental Impact Assessment (EIA) Related Fees – in coordination with National Environment Management Authority (NEMA), where applicable.

- **Development Partner and Donor Financing**

Municipal solid waste management is a priority area for many development partners due to its strong links to public health, climate change mitigation, and urban resilience. Funding may be provided through grants, concessional loans, or blended finance arrangements by institutions such as the World Bank, African Development Bank, UNDP, GIZ, USAID, and JICA. Such funding often supports infrastructure development, institutional strengthening, pilot projects, and capacity building

4.Waste Management Goals and Objectives

4.1 Short-Term Goals (1–3 Years)

1. **Improve waste collection coverage and efficiency**
   Expand service coverage to underserved areas, optimize collection routes, and strengthen supervision to ensure timely and reliable waste collection across all wards.
2. **Increase awareness on waste segregation at source**
   Promote segregation of waste at households, institutions, markets, and business premises

through structured public education programs, stakeholder forums, and enforcement of source separation guidelines.

3. **Develop Waste Transfer and Resource Recovery Infrastructure**
   Establish a Material Recovery Facility (MRF) to enhance sorting and recovery of recyclable materials, and develop a composting facility for green and organic waste, particularly from markets and residential estates.

4.2 Long-Term Goals (5 –10 Years)

1. **Reduce waste sent to disposal sites**
   Achieve significant diversion of waste through recycling, composting, and recovery initiatives, targeting a measurable reduction in landfill-bound waste.
2. **Improve waste disposal facilities**
   Upgrade existing disposal sites to meet sanitary landfill standards, incorporating engineered systems for environmental protection.
3. **Implement a Zero-Waste Circular Economy Approach**
   Promote sustainable production and consumption patterns by encouraging reuse, recycling, and recovery of materials within the local economy.
4. **Increase diversion of recyclable and compostable materials**
   Enhance systems that maximize recovery of plastics, paper, metals, glass, and organic waste for value addition and reuse.

5. Waste Management Strategies

5.1 Waste Minimization

Education and Public Awareness Campaigns
Conduct continuous sensitization targeting households, schools, institutions, and businesses on waste reduction practices such as minimizing plastic use, composting organic waste, and promoting reuse.

Partnerships with Businesses

Encourage adoption of sustainable packaging, extended producer responsibility (EPR) compliance, and waste reduction practices among manufacturers, supermarkets, and service providers.

5.2 Waste Segregation

Segregation at Source

Institutionalize mandatory segregation at household, institutional, and commercial levels into categories such as organic waste, recyclables, and hazardous waste

Segregated Collection Systems

Introduce and enforce color-coded bin systems in accordance with national standards and county waste management regulations to support separate waste streams.

5.3 Collection Systems

Door-to-Door Collection

Expand and strengthen door-to-door waste collection services, prioritizing high-density residential areas, informal settlements, markets, and commercial zones.

Public Waste Bins

Install additional public waste bins in markets, bus stops, recreational parks, and high-traffic areas, ensuring segregation options are available.

Optimized Collection Frequency

Establish appropriate collection schedules to prevent overflow, reduce illegal dumping, and maintain cleanliness.

Collection Zoning

Designate collection zones and prioritize high-waste-generation areas for more frequent service.

5.4 Transportation Infrastructure

5.4.1 Assessment of Transportation Needs

Conduct a comprehensive survey of the service area to identify waste generation hotspots, population density, commercial activity zones, and seasonal variations in waste volumes.

Determine the types and volumes of waste generated (organic, recyclable, hazardous, bulky waste) to guide vehicle selection.

Analyze current fleet capacity, utilization rates, and operational efficiency to identify gaps in service coverage and areas requiring additional resources.

Establish key performance indicators (KPIs) such as collection frequency, turnaround time, fuel efficiency, and service reliability to monitor fleet performance.

5.4.2 Procurement of Vehicles and Equipment

To strengthen the effectiveness and efficiency of solid waste collection, transportation, and disposal, the Municipality will undertake a targeted procurement of modern vehicles and equipment tailored to the needs of both urban and peri-urban areas in Iimuru . These vehicles and equipment will enhance operational efficiency, improve environmental compliance, and reduce reliance on manual labor.

This will include acquisition of:

- **Compactors** for commercial waste to optimize collection frequency and reduce landfill trips.
- **Skip loaders** for areas that have skip bins majorly small shopping centers and markets.
- **Tipper trucks** for kerb side collection within all wards.
- **Tricycles** for low-access settlements and commercial streets
- **Backhoe** to support waste spreading, trenching, site leveling, excavation of cover material, and clearance of illegal dumpsites.

5.4.3 Strategic Fleet Deployment

This will involve:

- **GIS - Based Service Area Mapping:**

The Municipality will apply Geographic Information Systems (GIS) to map all collection service areas within its jurisdiction, including informal settlements, commercial centers, markets, and institutions. GIS analysis will help identify high-priority zones based on population density, waste generation intensity, illegal dumping hotspots, and accessibility challenges. The system will also support route optimization by analyzing road networks, traffic flow, and proximity to transfer

points or disposal facilities, thereby improving efficiency, reducing operational costs, and enhancing service reliability.

- **Zonal Deployment Strategy:**

The Municipality will implement a zonal deployment model in which collection vehicles and staff are assigned to specific wards. Allocation will be guided by waste generation volumes, settlement patterns, road conditions, and infrastructure accessibility. This structured approach will promote accountability, improve supervision, ensure equitable coverage, and enable quicker response to service gaps within each zone.

- **Peak-Time and Density-Based Scheduling:**

Collection schedules will be structured to reflect the varying waste generation patterns across various areas within the municipality. Central business districts, markets, and transport corridors will receive more frequent and strategically timed collections to prevent overflow and safeguard public health.

- **Data-Driven Operational Planning:**

Utilize historical collection data, GPS vehicle tracking, and waste volume records to forecast demand and optimize fleet deployment. Continuous monitoring of key performance indicators—such as collection frequency, turnaround time, fuel consumption, and service complaints—will inform dynamic adjustments to routes, staffing, and resource allocation. This data-driven approach will enhance efficiency, transparency, and cost-effectiveness in solid waste management operations.

5.4.4. Maintenance and Operational Efficiency

- Establish a preventive maintenance schedule to minimize breakdowns,prolong vehicle lifespan, and reduce operational costs.
- Train drivers and operators on fuel-efficient driving practices, safety protocols, and waste segregation procedures.
- Implement a reporting system for operational issues, route deviations, and equipment malfunction to allow rapid response.

5.5.5 Integration with Waste Management Strategy

The Municipality will strategically coordinate fleet deployment with waste reduction, segregation at source, composting, and recycling programs to enhance overall system efficiency and sustainability. Collection vehicles will be scheduled and configured to support separate waste streams where applicable, ensuring that recyclables and organic waste are efficiently transported to recovery facilities while minimizing contamination and landfill disposal. Routing plans will be aligned with recycling collection days and community initiatives to avoid duplication of services, reduce fuel use, and maximize material recovery.

There will be continuous monitoring of the environmental impact of fleet operations by tracking fuel consumption, greenhouse gas emissions, air pollutants, and operational noise levels, particularly in densely populated or sensitive areas. Performance data will inform measures to improve fuel efficiency, optimize routing, and reduce idling time. Where financially and technically feasible, the Municipality will progressively adopt greener alternatives such as low-emission vehicles, alongside operator training programs that promote eco-driving practices and preventive maintenance to lower environmental footprints.

5.5 Recycling and Resource Recovery

- Establish community-based and market composting initiatives to manage organic waste and promote production of compost for agricultural and landscaping use.
- Implement Extended Producer Responsibility (EPR) programs to involve manufacturers in the recycling process.
- Conduct public awareness campaigns to encourage proper waste segregation at the source.
- Invest in Material Recovery Facilities (MRFs) and advanced recycling technologies to enhance recovery rates.
- Introduce market incentives for secondary materials to stimulate private sector participation.
- Integrate circular economy principles to ensure waste is recognized as a resource, supporting sustainable and efficient solid waste management.

5.6 Waste Disposal

- **Disposal Site Management**

  Develop sanitary landfills that comply with environmental and regulatory standards.

- **Leachate and Gas Management**

  Install systems for leachate collection and treatment, and methane gas management to reduce environmental pollution and greenhouse gas emissions.

- **Advanced Waste Treatment Technologies**

  Explore environmentally sound technologies such as waste-to-energy facilities for residual waste and anaerobic digestion/biogas systems for organic waste, subject to feasibility studies and environmental safeguards.

6. Institutional Capacity and Regulatory Framework

Effective solid waste management requires a combination of strong institutional structures, clearly defined governance roles, robust regulatory oversight, strategic partnerships, and active community participation. These elements provide the foundation for a comprehensive solid waste management plan that is operationally efficient, environmentally sustainable, and socially inclusive.

a) Urban Governance and Institutional Roles

The Municipal Board is responsible for providing overall policy direction and governance for solid waste management within the municipality. Its role includes developing and adopting policies, plans, strategies, and bylaws; setting targets; entering into contracts and partnerships; and mobilizing resources and investments. The Board also prepares and submits annual budget estimates for approval, monitors budget implementation, collects revenue through taxes and fees, evaluates the effectiveness of waste management policies, promotes public–private sector engagement, and ensures environmentally sound practices. Additionally, it may establish sub-committees and maintain a comprehensive waste management database and information system.

The Municipal Manager is responsible for the implementation and day-to-day administration of the solid waste management function. This includes executing the approved policy, supervising the relevant municipal section, preparing and presenting annual revenue and expenditure estimates to the Board, and making reports and recommendations on waste management within the municipality.

The Municipal Environment Officer shall promote a safe and healthy environment within the Municipality by planning, coordinating, and overseeing waste management services. Their functions include setting collection schedules, designating disposal sites, allocating resources for fleet and infrastructure, monitoring service delivery, and ensuring compliance with environmental standards.

Specialized waste management agencies, both public and quasi-public, are responsible for implementing operational components of the plan. These include waste collection, transportation, treatment, recycling, and final disposal. A well-structured institutional framework ensures that each entity knows its mandate, reducing duplication of effort and service gaps.

The private sector plays a complementary role, providing waste management services to all residential premises and services such as recycling. Integrating private sector operations into the municipal plan allows for increased efficiency, cost-effectiveness, and scalability of waste management interventions.

b) **Regulatory Compliance and Legal Framework**

Solid waste management operations must adhere to national policies, environmental laws, and regulatory standards. Key frameworks include the Environment Management and Coordination CAP 387 and the Sustainable Waste Management Act, 2022. These laws provide guidelines for waste segregation, collection, transportation, treatment, recycling, and disposal. Compliance mechanisms, such as inspections, audits, reporting, and enforcement of penalties for violations, are critical to ensuring that the solid waste management plan is executed within legal and environmental boundaries. Regulatory alignment ensures that the plan contributes to sustainable environmental outcomes, mitigates pollution risks, and promotes public health through safe handling and disposal of waste.

c) **Public-Private-People Partnerships (PPPPs)**

A Solid waste management plans is most effective when it integrates a Public-Private-People Partnerships (PPPPs). These collaborations combine the resources, technical expertise, and

innovation of private companies with the regulatory oversight and planning authority of public institutions, while engaging communities in participatory roles.

PPPPs can facilitate investments in collection infrastructure, recycling plants, composting units, and waste-to-energy technologies. It also allow for shared responsibilities in service delivery, operational monitoring, and maintenance of facilities.

By integrating PPPPs into the plan, municipalities can leverage efficiency gains, stimulate local economic opportunities, and ensure that innovative solutions are implemented in a cost-effective manner.

d) **Community Engagement and Participation**

In a solid waste management plan, community involvement is essential for success, particularly in informal settlements and high-density urban areas. Residents must be engaged in waste segregation at source, proper disposal practices, recycling initiatives, and neighborhood cleanup campaigns.

Structured engagement includes education programs, awareness campaigns, participatory planning, and feedback mechanisms. Communities can provide insights on collection challenges, preferred schedules, and operational inefficiencies that may not be visible to municipal authorities.

Fostering a culture of shared responsibility between authorities, service providers, and communities ensures sustainability, accountability, and public ownership of solid waste management initiatives.

e) **Integration with Operational Solid Waste Management**

Institutional and regulatory frameworks are directly linked to the operational components of a solid waste management plan. Clear governance structures support strategic fleet deployment, route optimization, collection prioritization, and maintenance schedules.

Regulatory compliance guarantees that waste is handled safely and sustainably, from collection through to the final disposal.

PPPPs and community participation complement operational efficiency by enabling broader coverage, fostering behavioral change, and supporting recycling and resource recovery initiative

7. Public Education, Awareness and Stakeholder Engagement

7.1 Public Education Campaigns

Effective solid waste management includes public education campaigns essentially to mold behavior change, strengthen compliance, reduce operational costs and ensure long-term sustainability of the waste management system.

Conducting education campaigns to inform the public on need to reduce, reuse and recycle while practicing segregation at source to reduce contamination of recyclable material and encourage generators of organic waste to practice composting. This in the long run reduces the volume of waste reaching Kango'ki Dumpsite. Awareness creation complements a functional collection system as it is characterized by proper sorting and zero contamination of recyclables.

Public education strengthens enforcement and community ownership by making environmental protection a shared responsibility rather than only a government obligation. Even if limuru municipality invests in waste infrastructure, its success is achieved by informing people on collection schedules and proper sorting methods.

7.2 Stakeholder Consultation

For Limuru Municipality, stakeholder consultation is essential to ensure the successful implementation of a solid waste management plan because it builds ownership, trust, and shared responsibility among those who generate and manage waste. When residents, businesses, NGOs, CBOs, and the informal sector are actively engaged, the municipality demonstrates transparency and accountability in its decision-making processes. This builds trust, reduces conflict, and increases public acceptance of new policies such as waste segregation requirements, revised collection systems, or the introduction of service fees.

Consultation also enables the municipality to design more practical and cost-effective waste management systems. Stakeholders provide firsthand knowledge of local conditions, service gaps, and operational challenges that may not be fully captured through internal assessments. By incorporating this input, the municipality can improve route planning, infrastructure placement,

recycling initiatives, and communication strategies, leading to better service delivery and more efficient use of resources.

Importantly, stakeholder engagement enhances long-term sustainability and compliance. When communities and businesses understand their roles and feel included in the planning process, they are more likely to cooperate with regulations, participate in recycling programs, and support cost recovery mechanisms. Ongoing consultation further supports monitoring and performance improvement, helping the municipality maintain service standards, address emerging issues promptly, and ensure the continued success of the solid waste management system

7.3 Feedback Mechanisms

Establishing effective complaint and feedback mechanisms is essential to the sustainability of a municipal solid waste management plan. These systems provide residents, businesses, and other stakeholders with structured channels to report missed collections, illegal dumping, damaged bins, irregular service schedules, or environmental and health concerns. By enabling two-way communication, the municipality demonstrates responsiveness and accountability, which strengthens public trust and encourages continued cooperation with waste management policies such as segregation of waste at source and timely payment of service fee.

A well-designed feedback system should be accessible, inclusive, and easy to use. This may include a dedicated telephone hotline, online reporting platform, mobile application, suggestion box at municipal office, and community liaison officers and/or at ward level. Clear procedures must be established for logging, categorizing, and responding to complaints within defined timeframes. Tracking data on the number, type, and frequency of complaints allows the municipality to identify recurring operational issues, service gaps, or contractor performance problems and address them systematically.

Beyond resolving individual complaints, feedback mechanisms serve as valuable monitoring and evaluation tools. Regular analysis of community satisfaction levels helps the municipality measure service quality, assess the effectiveness of collection systems, and inform adjustments to routes, infrastructure placement, or public awareness campaigns. Publishing periodic performance reports and sharing improvements made in response to feedback further enhances transparency. Ultimately, a structured and responsive feedback system supports continuous improvement,

strengthens community engagement, and contributes significantly to the long-term sustainability and success of the solid waste management plan

7.4 Social Inclusion and Gender Integration

Social inclusion and gender integration are critical components of a sustainable solid waste management plan. A municipality must intentionally identify and engage vulnerable and marginalized groups to ensure that waste services are equitable, accessible, and responsive to different social and economic realities. Failure to consider these groups can result in unequal service delivery, health risks, and exclusion from economic opportunities within the waste value chain.

Key vulnerable groups often include low-income households, particularly those living in informal settlements where access to regular waste collection may be limited. These communities may face higher exposure to illegal dumping, unmanaged waste, and associated health hazards. Women, especially female-headed households, are also an important group to consider, as they are frequently responsible for household waste management and may be disproportionately affected by poor services. Ensuring their participation in consultations and decision-making processes helps design systems that reflect household realities and time burdens.

The informal sector, including waste pickers and recyclers, represents another critical group. Many depend on waste recovery activities for their livelihoods but often operate without formal recognition, social protection, or safe working conditions. Integrating them into the formal waste management system through cooperatives, contracts, or material recovery facilities can improve both social protection and recycling outcomes. Youth and unemployed individuals are also important stakeholders, as waste management initiatives can provide green job opportunities and entrepreneurship pathways.

Persons with disabilities and elderly residents must also be considered in service design. Collection systems, skip bin placement, and communication materials should be accessible and inclusive to ensure that all residents can participate in waste segregation and disposal programs. Language barriers and literacy levels should be addressed through clear, culturally appropriate communication strategies.

By identifying and integrating vulnerable groups into planning, implementation, and monitoring processes, the municipality promotes equity, enhances social acceptance of the waste management system, and strengthens overall sustainability. Social inclusion and gender integration not only reduce environmental health risks but also create inclusive economic opportunities and foster shared responsibility for maintaining a clean and healthy municipality.

8. Financial Strategy

A strong financial strategy is essential to ensure that the solid waste management (SWM) system in Limuru Municipality is efficient, reliable, and sustainable over the short, medium, and long term. The strategy should focus on diversified revenue sources, improved cost recovery, strategic partnerships, and realistic financial projections to support infrastructure expansion and service delivery improvements.

8.1 Revenue Sources

Limuru Municipality should adopt a diversified funding model to reduce reliance on a single income stream. Core funding should come from county government budget allocations to cover essential public services such as street sweeping and municipal waste collection. In addition, user fees charged to commercial establishments, markets, industries, and institutions should form a significant and predictable revenue base. Fee structures may be differentiated according to waste generation levels and property categories.

Private sector investment can be mobilized through service contracts, franchising, and investment in recycling and composting infrastructure. Donor support and climate-related funding mechanisms can also be explored, particularly for projects that promote circular economy principles and environmental protection. Grants or concessional loans from development partners may help finance initial capital-intensive investments.

8.2 Cost Recovery Strategy

To enhance financial sustainability, Limuru Municipality should implement a structured cost recovery framework. This includes reviewing and rationalizing existing user fees to reflect the actual cost of service delivery while ensuring affordability for vulnerable groups. A tiered tariff

system—where large waste generators such as supermarkets, industries, and institutions pay higher fees—can improve equity and revenue adequacy.

Strengthening billing and collection systems is equally important. Integrating waste fees into property rates or utility bills can increase payment compliance. The municipality should also reduce revenue leakages through digital payment platforms, transparent accounting systems, and strict enforcement measures against non-payment. Public awareness campaigns can help residents understand how their contributions improve service quality.

8.3 Public-Private-People Partnerships (PPPPs)

Limuru Municipality can leverage Public-Private-People Partnerships to mobilize capital, expertise, and community participation. Under PPPP arrangements, the municipality provides regulatory oversight and enabling infrastructure, private investors finance and operate facilities, and community groups participate in segregation and recycling initiatives.

Potential PPPP projects include the development of material recovery facilities (MRFs), composting plants for organic waste, recycling plants, and waste-to-energy initiatives. Engaging organized waste picker groups and youth enterprises within these partnerships promotes social inclusion while strengthening recycling rates. Clear contractual frameworks, risk-sharing arrangements, and performance-based payment systems are essential for successful partnerships.

8.4 Financial Projections

Short-term (1–3 years) financial planning should focus on priority investments such as waste collection vehicles, bins, transfer stations, route optimization systems, public awareness campaigns, and staff recruitment and training. These investments are critical to improving immediate service coverage and efficiency.

Medium- to long-term projections (5–10 years) should account for infrastructure expansion, including landfill upgrading or rehabilitation, establishment of recycling and composting facilities, fleet replacement programs, and digital monitoring systems. Population growth, urban expansion, inflation, and regulatory requirements must be factored into cost forecasts.

The municipality should prepare detailed capital expenditure (CAPEX) and operational expenditure (OPEX) estimates, alongside projected revenues under different tariff and growth scenarios. Scenario analysis can help decision-makers understand funding gaps and identify financing strategies early.

Overall, a well-structured financial strategy for Limuru Municipality will ensure that solid waste management services are adequately funded, progressively expanded, socially inclusive, and environmentally sustainable over the next decade.

9. Monitoring and Evaluation

A robust monitoring and evaluation (M&E) framework is essential to ensure that the municipality's solid waste management (SWM) plan remains effective, accountable, and responsive to changing conditions. Monitoring enables the municipality to measure operational efficiency, environmental performance, financial sustainability, and service coverage, while evaluation helps determine whether strategic objectives are being achieved. Together, these processes support evidence-based decision-making and continuous improvement.

9.1 Key Performance Indicators (KPIs)

Clearly defined and measurable Key Performance Indicators (KPIs) should be established to assess progress and performance.

a) Operational indicators may include the total amount of waste collected per day, collection coverage rates across all wards, and frequency of collection services.

b) Environmental performance indicators should measure the percentage of waste diverted from landfills, the total volume of waste recycled or composted, and reductions in illegal dumping incidents.

c) Service reliability indicators such as equipment availability, fleet downtime, and response time to complaints are equally important in evaluating operational efficiency.

d) Financial indicators such as cost recovery rates and revenue collection efficiency can also be incorporated to assess sustainability.

All KPIs should have defined baselines, annual targets, and responsible departments to ensure accountability.

9.2 Monitoring Mechanisms

To effectively track performance, Limuru municipality should establish structured monitoring mechanisms. These may include daily operational logs, weighbridge data at disposal sites, route tracking systems, contractor performance reports, and periodic field inspections. Digital data management systems can enhance accuracy and timeliness of reporting.

Regular reporting frameworks—monthly operational reports, quarterly performance reviews, and annual public reports—should be institutionalized. Community feedback systems and satisfaction surveys can complement technical monitoring by capturing service user experiences. Internal audits and supervisory reviews further ensure data integrity and compliance with established standards.

10. Periodic Reviews and Updates

The SWM Plan should not remain static. Periodic reviews—ideally every 3–5 years—are necessary to respond to population growth, urban expansion, evolving waste composition, policy changes, and technological advancements. These reviews should assess whether targets are being met, identify emerging challenges, and recommend adjustments to infrastructure, service models, or financial strategies.

Stakeholder consultations should form part of the review process to ensure the plan remains inclusive and aligned with community needs. Updating the SWM Plan based on monitoring results and new developments ensures long-term relevance, resilience, and sustainability of the municipality's waste management system.

11. Implementation Timeline

Key Area	Key Activities / Indicators	Target / Benchmark	Data Source / Method	Timeframe	Responsible Entity
Improve Collection Systems	- % of households and businesses covered by collection services - Efficiency of waste collection (kg/household/day)	95% coverage of municipality; reduced missed collections	Collection logs, GPS tracking of trucks, field inspections	0-3 years	Private waste collectors / Municipal Environment Dept
Awareness Campaigns	- Number of campaigns conducted - % increase in community participation in segregation and recycling	4 campaigns per year; 20% increase in participation	Attendance records, surveys, school & market reports	0-3 years	Municipal Manager, Municipal Environment Dept
Initial Infrastructure Upgrades	- Number of transfer stations established - Number of skip bins distributed and functional	1 transfer stations; 15+ skip bins strategically placed	Field inspections, distribution logs	0-3 years	Municipal Manager, Municipal Environment Dept
Expand Treatment Capacity	- Tons of organic waste composted / digested - Tons of dry recyclables processed at MRFs - Functionality of recycling facilities	Composting: 30% of organic waste; MRF: 40% of dry recyclables recovered; 1 operational recycling facility	Facility reports, MRF intake records, audits	3-5 years	Compost Facility Operators / MRF Operators / County SWM Dept
Full Recycling Implementation & Waste Diversion	- % of total waste diverted from landfill through recycling or composting - Types and volume of materials recovered (plastics, metals, paper, glass)	50–60% diversion from landfill	MRF reports, recycling facility records, audits	5 years +	Private collectors / Municipal Environment Dept

Key Area	Key Activities / Indicators	Target / Benchmark	Data Source / Method	Timeframe	Responsible Entity
Advanced Treatment Technologies	- Adoption of anaerobic digestion, pyrolysis, or waste-to-energy for non-recyclable waste - Efficiency and output of recovered energy	Pilot projects operational; energy recovery >10% of non-recyclable waste	Facility reports, energy output logs, technical audits	5 years +	Municipal Environment Dept

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