

EMBU COUNTY GOVERNMENT



Mobile:+254 771 204 003/+254 703 192 924 ~~Tel:+25430686/30656~~
Address: P.O. Box 36 - 60100 Embu, Location: Embu Town House
Email: info@embu.go.ke Website: www.embu.go.ke

MINISTRY OF LAND, PHYSICAL PLANNING, URBAN DEVELOPMENT, HOUSING, WATER & IRRIGATION,
ENVIRONMENT, & NATURAL RESOURCES

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The National KUSP Coordinator
P.O Box 34477-00100
Nairobi

RE: FOWARDING OF APA-3 SELF ASSESSMENT DOCUMENTS

Reference is made to your letter ref: **MHIHUD/HUD/UD/5/14/1/IV/(75)** dated **20th April 2021** on the 3rd Annual Self Performance Assessment. I therefore hereby forward the Solid Waste Plan.

Yours faithfully


Jayne N. Mugambi
CECM-Urban Development





COUNTY GOVERNMENT OF EMBU

MUNICIPALITY OF EMBU

Waste Management Plan

January, 2020



TABLE OF CONTENTS

Contents

TABLE OF CONTENTS.....	1
1.0 INTRODUCTION.....	2
2.0 PURPOSE	2
3.0 WASTE MANAGEMENT OPTIONS -WASTE HIERARCHY	2
4.0 PREVENTION	2
5.0 RE-USE.....	3
6.0 RECYCLING	3
7.0 RECOVERY	3
8.0 DISPOSAL.....	3
9.0 WASTE CATEGORIES.....	3
10.0 WASTE TREATMENT OPTIONS	7
11.0 WASTE PRODUCTION PROJECTIONS.....	7
12.0 EXISTING AND PROPOSED WASTE MANAGEMENT INFRASTRUCTURE	7
13.0 SOLID WASTE MANAGEMENT.....	8
14.0 PERFORMANCE MONITORING INSPECTIONS.....	10
15.0 DATA COLLECTION	10
16.0 WASTE AUDIT.....	10
17.0 PERFORMANCE INDICATORS	10
18.0 ENVIRONMENTAL AUDIT RESULTS	10
19.0 PERCENTAGE WASTE GENERATED.....	10
20.0 RESPONSIBILITIES.....	10
21.0 RECORD KEEPING	12
22.0 REVIEW PROCESS	12



1.0 INTRODUCTION

The Waste Management Plan (WMP) addresses management of all solid and liquid refuse, including hazardous and non-hazardous waste, produced as a result of waste generating activities within Embu Municipality.

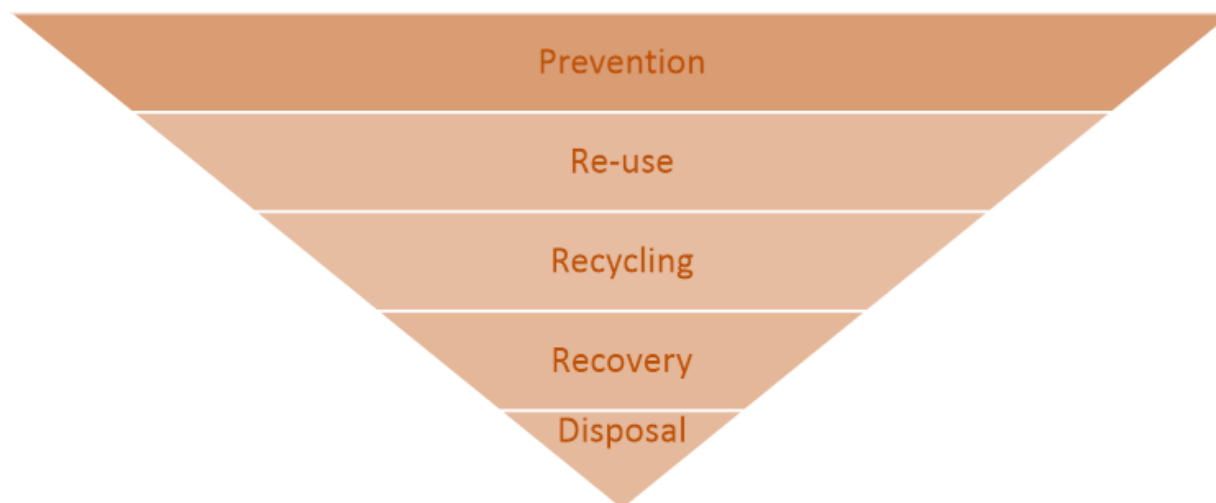
2.0 PURPOSE

The Embu Municipal WMP aims to provide guidelines on waste reduction, segregation, collection and disposal practices in accordance with international best practices, to avoid deterioration of the natural environment and negative impacts on the health and safety of communities in the Project Area. This plan is the primary tool to guide Municipal citizens towards waste management.

3.0 WASTE MANAGEMENT OPTIONS -WASTE HIERARCHY

The waste hierarchy presents waste management stages commencing with the most preferable option to the least preferable option. Waste prevention is the most preferred option, followed by reuse, recycling, recovery including energy recovery and as the last option is safe disposal. See Figure 1.

Figure 1: Stages of Waste Management Hierarchy



4.0 PREVENTION

Enterprises and households should be required to strictly manage purchasing of raw materials and finished products in order to ensure there is minimal wastage. The focus is to prevent raw materials, ingredients and products from becoming waste in the first place. Any surplus raw materials or produce not meeting recyclable standards should be reduced.



Enterprises and households should be committed to avoiding the generation of waste and not using hazardous materials. Where the use of hazardous materials is unavoidable, efforts should be made to identify replacement materials that are non-hazardous through continued research and development.

5.0 RE-USE

Enterprises and households should be required to prepare a maintenance management plan which seeks to ensure that all equipment is regularly checked and maintained and refurbished or repaired. In addition, Enterprises and households should seek to sell and buy used items, donating them for free or exchanging them.

6.0 RECYCLING

Enterprises and households should seek to turn waste into a new substance or product, such as composting of organic wastes to a standard that meets quality controls. This compost could be sold or given to farmers outside the municipality to facilitate improvements in soil conditions and hence their production levels.

7.0 RECOVERY

Recovery of waste is usually most successful when done in bulk. Therefore, a centralized recovery facility is preferable. Forms of recovery include anaerobic digestion, incineration with energy recovery, gasification and pyrolysis which produce energy (fuels, heat and power) and materials from waste. It is recommended that the solid waste management system be modified and improved to make it compatible with the requirements of the proposed bio-methanation technology.

8.0 DISPOSAL

Disposal is deemed the last resort and must occur in an environmentally responsible manner. Disposal results in waste going to landfill or to incineration without energy recovery and is the least preferred environmental option. However, when wastes must go for disposal, this must occur at a suitably designed sanitary waste disposal site.

9.0 WASTE CATEGORIES

Solid waste generation generally includes domestic waste, commercial waste, construction and demolition debris, sanitation residue and waste from streets. These wastes are in solid or semi-solid form and potentially include low quantities of industrial hazardous wastes and bio-medical waste. The main waste categories of waste are:

- a) Biodegradable waste (food and kitchen waste, green waste (vegetables, flowers, leaves, fruits) etc.;
- b) Recyclable material (paper, glass, bottles, cans, metals, certain plastics, etc.); and
- c) Inert waste (construction and demolition waste, dirt, rocks, street sweeping, drain silt, debris, etc.)

Table 1 shows the sources of waste, waste generators and content:



Table 1: Sources of Waste, Waste Generators and Content

Source	Typical waste generators	Solid waste content
Industrial	Process by industries and employees	Food wastes, paper, cardboard, plastics, ashes, special wastes (e.g. bulky items, consumer electronics, batteries, oil, tyres) and limited industrial hazardous wastes.
Residential	Dwelling units	Food wastes, paper, cardboard, plastics, textiles, leather, yard wastes, wood, glass, metals, ashes, special wastes (e.g. consumer electronics, batteries, oil, tyres) and limited household hazardous wastes, Sewage waste.
Commercial	Stores, hotels, restaurants, markets, office buildings	Paper, cardboard, plastics, wood, food wastes, glass, metals, special wastes, hazardous wastes
Institutional	Schools, hospitals, government centres	Paper, cardboard, plastics, wood, food wastes, glass, metals, special wastes, hazardous wastes
Construction and demolition	New construction sites, road repair, renovation sites, demolition of buildings	Wood, steel, concrete, rubble, dirt etc.
Municipal services	Street cleaning, landscaping parks and other recreational areas, water and waste water treatment plants	Street sweepings, drain silt, landscape and tree trimmings, general wastes from parks and other recreational areas, sludge.

Table 2 shows a summary of emerging issues in SWM in Embu municipality:

Table 2: Emerging Issues in SWM

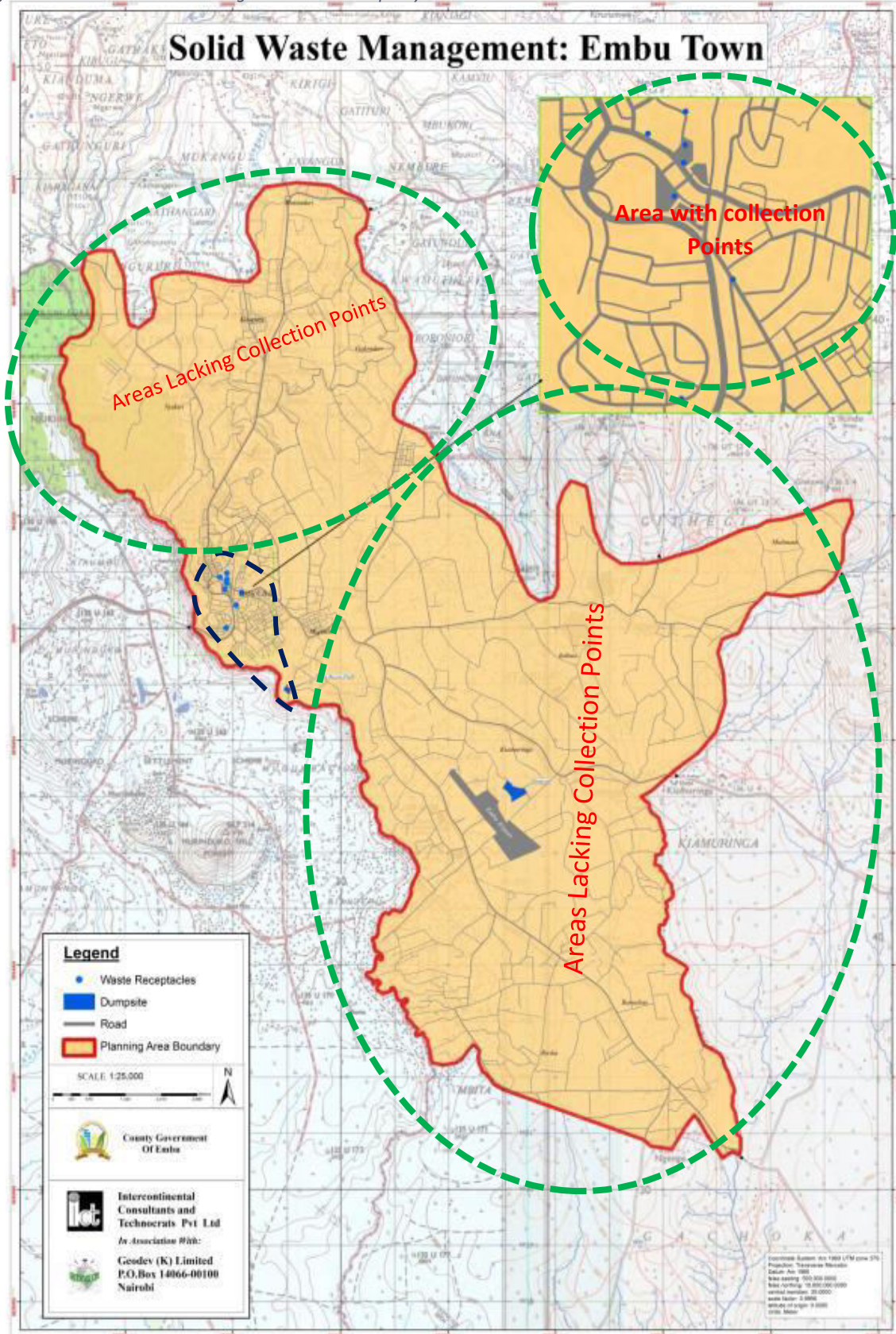
Issue	Existing situation	Remarks
Main areas covered with solid waste collection	CBD and residential areas within town	About 25% of Embu town planning area, see map on next page
Waste generated	Approximately 155 tons per day	Waste mainly includes: vegetable and food remains from domestic and market places, paper, plastic, cans,
Waste collected	84 tons per day which is about 54% of waste generated. Around 60 percent of waste generated in slums/informal settlements is collected daily	Inadequate collection and transportation facilities



House-to-House Collection	A private group called Solid Waste Management that collects waste in Blue Valley at a fee of Ksh150/month. CBO called Unity for Development in Dallas at a cost of Ksh150/month per plot (charged	
Waste receptacles/skips	There are six skips in Embu town located in Blue Valley (1), Dallas (1), and four in CBD	Only Dallas and Blue Valley where waste is collected and deposited in specific designated locations (skips).
Transportation	About 68% of the total waste is collected and transported to the dumping site. There is one tractor and three Isuzu trucks for solid waste collection which are not adequate	Inadequate collection and transportation facilities
Transfer Stations and Dumpsite	The town has two transfer stations located in Majimbo and Koimugo areas. There is no landfill but a dumpsite at Kagunga area measuring 15 acres approximately 7km from the heart of the town	The current unfenced dumping site is not suitable as it is near the airstrip. There is no recording of the quantity of waste deposited there. Presence of a number of scavengers. Lacks a protection



Figure 2: Waste Collection Coverage in Embu Municipality



10.0 WASTE TREATMENT OPTIONS

The primary options for the treatment of solid waste include, in order of environmental benefit:

1. Anaerobic Digestion;
2. Composting (windrow, aerated static pile, in-vessel and vermi-composting);
3. Incineration with or without energy recovery;
4. Pyrolysis and gasification;
5. Plasma pyrolysis and palletization;

11.0 WASTE PRODUCTION PROJECTIONS

Table 3: Waste Production Projections (Based on Current Projections)

Year	Population	Quantity per head/day (kg)	Total/day (kg)	Total/day (tonnes)
2015	84,530	1.80	152 154	152
2025	115,279	1.80	207 502	208
2035	157,956	1.80	284 321	284

Note: Average waste production per person per day is expected to increase with time due to an anticipated increased income levels and lifestyle changes. The above figures may therefore be exceeded in practice

12.0 EXISTING AND PROPOSED WASTE MANAGEMENT INFRASTRUCTURE

There are no organized and advanced waste management systems such as collection, transport and disposal. The current municipal waste management practices are not formally organized. According to a situational analysis done in year 2015, the town lacks adequate solid and liquid waste collection and disposal facilities. Solid waste from Embu Town is largely managed by each independent household actively removing their own waste. There are some industrious citizens and youth groups that have begun waste collection from commercial establishments using donkey carts.

The generation of solid waste is higher than the capacity to remove it and many areas are left with waste uncollected either completely or on time. With urban expansion and population increase, the available vehicles won't be able to handle transportation adequately. More staff and vehicles are required to match the collection and disposal requirements/standards. Mechanisms for waste treatment also need to be put in place.

Based on data analysis and stakeholder consultation, the following issues have been identified:

- The current dumping site is not suitable as it is near the airstrip. It is currently not fenced.
- There are no management practices at the dumpsite currently.
- The town lacks mechanisms for formal separation, recycling and treatment of the waste collected



- Inadequate collection and transportation facilities
- Vandalism of waste collection facilities
- Lack of modern technology to treat waste in the town and probably produce energy from the waste

Embu Municipality intends to designate a landfill site to be located at Kamwimbi area. Preparations are underway to develop the designated landfill site and to complete fencing in the current fiscal year. In addition, in an effort to assist in formalizing the waste collection practices of the town, the Embu Municipality purchased a waste truck with compactor bin and another with skip loader. The trucks are especially designed for solid waste collection.

13.0 SOLID WASTE MANAGEMENT

Enterprises and households within the Municipality will be required to segregate waste at source to ensure the value of the wastes are optimized through recovery, reuse and recycling. By providing an enabling environment the success rate of correct waste practices being implemented are increased. Segregation should be by generators and into three main waste streams:

- i. Wet (biodegradable);
- ii. Dry (plastic, paper, metal and wood); and
- iii. Domestic hazardous wastes (diapers, napkins, empty containers of cleaning agents, mosquito repellents etc.).

Collection of the segregated waste is to be undertaken by an authorized waste collector. As a minimum wet and dry wastes should be segregated (2-bin system) by the waste generators as in see Figure 2 below. Source segregation of waste optimizes waste processing and treatment technologies. The bio-degradable waste should be processed, treated and disposed of through composting or bio-methanation within the premises as far as possible. The ideal situation is Embu Municipality to be a zero waste facility and therefore all residual waste from the bio-methanation or composting will need to be managed on site. Plots or sheds within the waste management site are to be designated for recovery and recycling facilities.

Figure 3: Example of Waste Separation of Inorganic and Organic Wastes at Source

A bio-



methanation (waste to energy) facility is being proposed at the waste management site, Kamwimbi, for the treatment of the wet waste component generated. This involves the anaerobic



decomposition of wet organic wastes to produce a methane-rich biogas fuel and a small amount of residual sludge that can be used for making enriching compost. It is currently proposed that the biogas will supply fuel to a 25KVA capacity engine which will be used for generating power from the biogas produced. The generated power can be used for internal electrification and street lighting.

Anaerobic digestion is best suited to the treatment of wet organic feed stocks such as high moisture agricultural biomass, food waste, and animal wastes including manure and domestic sewage. Construction and demolition waste should be handled separately. Opportunities to repurpose this waste as secondary aggregate to the construction industry should be investigated to ensure this waste is either utilized or is sold as a product to the construction industry. No construction or demolition waste should be disposed of to landfill. No hazardous wastes shall be permitted to be disposed of outside the boundary of the waste management site.

The Municipality of Embu must place the responsibility of safe disposal of hazardous waste on the generator. It will be the generators responsibility to ensure that the waste collector which will be transporting the waste for disposal has obtained a permit from the Urban Administration to do so in terms of NEMA waste regulations. In addition, the Generator will need to provide evidence in writing from the receiving disposal site of its capacity to recycle or dispose of the waste in an environmentally sound manner. Proof of safe disposal should be provided to the Municipality of Embu, such as a waste disposal ticket issued and date stamped by the Waste Management Site staff.

Within the Municipality there will be primary collection of waste from the industries, households, markets and other commercial establishments. This waste will be taken directly to the treatment site. Primary collection will occur by either 'door to door' collection using segregated bins or containers which will be placed on the streets for collection. This waste will be taken to a solid waste intermediate storage facility. The use of an intermediate site allows for the optimization of transport devices and manpower which in addition allows for timely collection of waste from source and onward treatment.

Secondary transportation occurs from the storage area to the final destination of the waste. Wet waste will go to the bio-methanation plant and dry wastes will go to the recycling depot. The dry waste such as paper and plastic and cardboard and glass are to be recycled. The Municipality must provide a site with a covered storage area for recyclable waste. The size of the area provided should be suitable for the bulk storage of up to 7 days of waste generation. Waste collection from generators will need to occur on a daily basis in order to prevent garbage containers overflowing and waste littering the streets. To maintain a hygienic environment regular waste clearance is required.



14.0 PERFORMANCE MONITORING INSPECTIONS

Site inspections must be performed by the Municipality of Embu. The Waste Management site should be inspected on a regular basis with a formally-documented inspection each month. Inspections will ensure that all commitments in this Plan are being enforced and that specific waste management elements are verified.

15.0 DATA COLLECTION

Implementation of the waste hierarchy principles requires that destinations and quantities of residual matter are monitored. A register of waste material should be maintained to ensure the measurement of eliminated waste and of residual matter sent for reuse, recycling and reclamation.

16.0 WASTE AUDIT

After a year of operation, a waste audit should be performed, on all waste data collected, to identify waste streams and fate and develop ways to reduce waste production.

17.0 PERFORMANCE INDICATORS

Measurement is an important tool in improving performance, and performance indicators will help the Municipality of Embu to define and measure progress towards their goals. The results reflect current conditions and allow orientation and coordination of further actions towards sustainability.

18.0 ENVIRONMENTAL AUDIT RESULTS

Environmental auditing is a key process in the implementation of the Environmental and Social Management Plan (ESMP), of which the WMP forms a part. The findings of each audit should be registered in a database, where corrective and/or preventive actions are prescribed, responsibilities assigned to people, deadlines established and necessary resources mobilized. In compliance with the procedure, audit reports should categorize findings as being either “major”, “minor” or “observation”. The number of findings shall be decreasing every year until the ultimate goal of zero major findings is achieved.

19.0 PERCENTAGE WASTE GENERATED

During the operational phase, the quantities and types of waste produced should be tracked and activities examined to identify waste reduction opportunities. Specific reduction target ratios should be determined and the rate of waste production is required to reduce annually relative to production volumes. Waste includes packaging and any residual product sent for disposal, both hazardous and non-hazardous.

20.0 RESPONSIBILITIES

Table 4: Responsibilities

Entity	Responsibilities
Municipality of Embu	<ul style="list-style-type: none">▪ Enforce the Waste Management Plan.



	<ul style="list-style-type: none"> ▪ Contractually obligate the Enterprises to meet the requirements of the Waste Management Plan. ▪ Manage the Solid Waste Management Area or appoint an appropriate contractor. ▪ Manage the Solid Waste Treatment plant or appoint an appropriate contractor. ▪ Manage the Recycling and Recovery area or appoint an appropriate contractor.
Enterprises and Households	<ul style="list-style-type: none"> ▪ Provide a minimum of two garbage receptacles to each waste generator to allow for wet and dry waste segregation. An additional bin for hazardous waste is highly recommended. ▪ Develop an Enterprise specific Waste Management Plan for the activities of said Enterprise. - Enterprise specific Waste Management Plan must be aligned with the municipal WMP and must be approved by the Municipality of Embu prior to commencement of operations. ▪ Educate all members of staff on the waste hierarchy ▪ Educate all members of staff on the Enterprise WMP and the Waste Management Plan ▪ Education is to be provided to each staff members prior to commencement of work, and regular refresher sessions are to be undertaken in the form of toolbox talks or training sessions throughout the operation of the facility.
Contractors/Institutions/CBOs	<ul style="list-style-type: none"> ▪ Provide a minimum of two garbage receptacles to allow for wet and dry waste segregation. An additional bin for hazardous waste is highly recommended. ▪ Develop a specific Waste Management Plan for the activities they are undertaking- Site specific Waste Management Plan must be aligned with the municipal WMP and must be approved by the Municipality of Embu before commencing. ▪ Educate all members of staff on the waste hierarchy. ▪ Educate all members and staff on specific WMP and the Waste Management Plan for the Municipality - Education is to be provided to each staff member prior to commencement of work, and regular refresher sessions are to be undertaken in the form of toolbox talks or training sessions throughout the contract period.



21.0 RECORD KEEPING

Data on waste production and disposal should be gathered continually via logbooks and registers. Records should be maintained on site and made available to the Municipality of Embu, authorities and any other party contracted to audit or assess the waste management practices on site. The data should include the final destination of each waste stream and where disposal has occurred proof of safe disposal will be required, such as a date stamped waste disposal ticket issued by a sanitary landfill. A cost should be paid for safe disposal of wastes. Evidence of waste disposal should also be maintained.

22.0 REVIEW PROCESS

The WMP is to be reviewed and updated after every two years.

