

# MUKONO TOWN COUNCIL



## Environmental Impact Statement for the Proposed Waste Composting Plant and Landfill in Katikolo Village, Mukono Town Council

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## **Abbreviations and Acronyms**

CBD	Central Business District
EIA	Environmental Impact Assessment
EIS	Environmental Impact Assessment
GHG	Green House Gases
MTC	Mukono Town Council
NEA	National Environment Act
NEMA Authority	National Environment Management
NWSC	National Water and Sewerage Corporation
PB	Project Brief
PPE	Personnel Protective Equipment
UEDCL Limited	Uganda Electricity Distribution Company

## **EXECUTIVE SUMMARY**

### **Introduction**

Solid waste in Mukono Town, like in most urban areas in Uganda is disposed off in open dumps, gardens and fields, along the roadway verges and streams or channels. To ensure effective disposal of the generated solid waste, MTC has acquired land located approximately 7 kilometres from the CBD at Katikoloto where waste composting and landfilling will be undertaken.

MTC has got a population of approximately 50,000 people engaged in different business undertakings ranging from hotel industry, educational institutions, trading, motor vehicle repairs, open markets for fresh foods, carpentry and wood works in addition to hospitals, operation of dispensaries and clinics among others. The immediate neighbourhood is has sub-urban areas and urban centres, as well as industries, including Seeta, Bweyogerere, Kato Aromatics and Namanve Industrial Park.

The proposed waste site is located in Katikolo Village, within Mukono Town Council, currently under secondary vegetation and shrubs. To the East of this Site is Katikolo Hill, and the access roads to Katikolo Landing site. To the north are residences with permanent houses located at about 500m away. To the far west and south is the Katikolo wetland which forms a buffer zone for Lake Victoria. There is also a water source point for domestic use by the residents of Katikolo Village to the south west of the proposed site.

The proposed site, which measures approximately 10 acres, is well isolated from homesteads, has secondary vegetation as the current land use and is intended for composting and disposal of MTC solid waste. The Town Council and its immediate catchment generates upto 200 tons of solid waste, composed of vegetable matter (80%), glass, clinical waste, waste paper, plastics especially low-density polyethylene, worn out tyres and wood shavings.

The Town Council has several 78 gazetted waste collection points, with 15 waste skips distributed around the Town, bunkers and garbage skips for temporal handling of waste. For waste transportation, MTC has one Skip loader truck, one tractor and a

dumper lorry to transport the solid waste. Upto 60% of the generated waste in the CBD is collected amounting to 70 tons. Todate no sorting of waste takes place thus all the generated solid waste (biodegradable and non-biodegradable, toxic and non-toxic, glass and metals) finds its way into the garbage skips and eventually to the disposal grounds.

The major components of the waste composting plant and landfill will include an access road, an office block, parking yard, fence, weighbridge, the different landfill cells, drainage channels, waste composting slab and shade, windrows for waste composting, a leachate collection and treatment plant, and slabs and shade for compost manure and other landfill products. The design capacity for the waste composting plant is 70 tons of green waste per day.

Other additional infrastructure to be extended to the site will include electrical power from the national grid, and NWSC water connection. Given the nature of the site, excavations will be required in constructing access roads, waste composting slab, office block, parking yard and installation of the weighbridge.

During the operational phase the major activities will involve maintenance of the waste composting plant and the landfill site to ensure effective performance and minimal injury to the environment. There will be composting of the vegetable matter and other easily biodegradable materials, packaging of the compost and daily landfilling of non-biodegradable waste. In the long term, acquisition of an incinerator is planned for handling hazardous waste.

### **Project Benefits**

Development of a landfill and waste composting plant will go a long way in ensuring safe and sound disposal and utilisation of municipal solid waste, an increased lifespan for the Waste disposal site, and when handled effectively it will turn into an income generating activity for the Town Council in addition to ensuring availability of rich compost manure to the farmers in Mukono District. With implementation of the proposed solid waste management strategy, a clean environment will be registered

within the Town Council, negative attributes associated with poor management of solid waste and cases of contamination done away with in addition to extending infrastructure currently lacking in the rural setting where this landfill and waste composting site will be located, which includes piped water and electricity, as well as improved roads. Upto 15 persons will be employed at this site, but a chain of beneficiaries in the waste management trajectory is expected with privatisation of waste collection and waste disposal site management.

Other benefits include elimination of odour problems and vermin infestation associated with existing dump sites, a longer lifespan for the 10 acre site, and improved capacity and efficiency in waste management for the Town Council.

### **Identified likely negative impacts**

Development of landfill and waste composting plants is associated with several negative impacts that should be addressed during the design, construction and operation phases. These among others include loss of vegetation during clearing for development, emission of odorous smell, vermin infestation, flies, disease occurrence due to poor practices at the site, contamination of ground water and other water sources from leachate, causing unsightly conditions from littered waste during transportation or delayed pickup, acting as habitats for rodents and breeding grounds for vermin, noise generation from trucks transporting the waste, dust, and likely accidents during transportation.

To ensure that the development and operation of this landfill and waste composting plant does not cause injury to the environment, a site suitability analysis has been undertaken, alternatives to composting evaluated, several mitigation measures recommended and an environmental monitoring and management plan developed for implementation by MTC. The key mitigation measures include;

- Undertaking composting of the vegetable matter hence doing away with the issue of leachate formation and the subsequent contamination of the ground and surface water;

- During transportation, the waste should be covered with tarpaulins or netting to deter waste falling off in case of open garbage skips or if tractors/dumpers are used to transport the solid waste;
- The proposed windrow technology provides an opportunity for sorting delivered solid waste, but this will be backed up by waste segregation practices at the waste source;
- Proper drainage system should be put in place to ensure no storm water from the upper area finds its way into the landfill;
- Where possible a liner should be introduced at the bottom of the landfill. To reduce on the immediate costs of landfill preparation, the only cell to be put to immediate use should be lined with clay, and a slab developed to hold the waste to be composted;
- The generated leachate from decomposing waste will be collected, treated and recycled to improve moisture content in the decomposing waste;
- The community should be provided with an alternative source of water considering that their current water source is likely to be affected by the development of the landfill. This can be in form of a borehole or having water kiosks extended to their area and prices subsidised;
- Planting of trees to improve the area aesthetics and visual impression;
- Truck drivers should desist from over speeding and funds allowing, the road to the waste site from the CBD should be paved. Creation of humps in densely populated area where the access road passes should be put in place to regulate speed of the trucks;

## **Mukono Town Council**

- A waste information system proposed in section 4 and capacity building should be implemented/emphasised to ensure waste management efficacy;
- Sensitisation programmes on waste segregation should be developed and promoted by the Town Council;
- Greater stakeholder involvement in the waste management trajectory should be emphasised. Privatisation of waste collection and implementation of the MTC solid waste management bye-law should be of priority to ensure sustainability of improved solid waste management in the municipality.

## **Conclusion**

To sustainably implement this project, MTC commissioned this study so as to be provided with practical advice on the mitigation of any potentially adverse environmental impacts of the project and also to comply with the environmental regulatory requirements.

The proposed landfill and waste composting site at Katikolo is suitable given its isolation from residential areas, sensitive habitats, and that this EIA has addressed all ecological and socio-economic concerns predictable, and has proposed mitigation measures for adverse impacts.

Mukono Town Council is committed to implementation of the proposed mitigation measures, and the developed environmental monitoring and management plan presented in section 8 of this report.

## 1.0 BACKGROUND INFORMATION

### 1.1 Introduction

Almost all human activities create waste in some form. Most individual items of waste, particularly wastes from homes and offices are not themselves a direct threat for public health, however it is the way these wastes are (or are not) handled, stored, collected and disposed that can pose risks to public health. Clean and health living conditions in cities, Municipals and urban centres cannot be achieved without reliable and regular collection and disposal of generated solid waste. Open dumping is neither safe nor hygienic and with more forethought, it is no longer realistic to simply remove the health risks from waste from city streets and accumulate them in a nearby suburb or rural area.

Uganda is among several countries that signed the United Nations Framework Convention on Climate Change (UNFCCC), making a commitment to combating Green House Gas (GHG) emissions. This protocol also put in place the Clean Development Mechanism (CDM) to allow developed countries invest in projects that realise reduction in GHG emissions.

Methane constitutes 50% of Land Fill Gas (LFG) emissions. The major factors driving LFG emission levels are the amount of organic material deposited in landfills, the type of landfilling practices, the extent of anaerobic decomposition, and the level of landfill methane recovery and combustion. Composting, when managed properly limits methane and carbondioxide missions only to transportation and mechanical turning.

**There are four main categories of waste generated in MTC namely:**  
**Domestic waste**, which comprises of wastes that are produced from household activities as food preparation, sweeping, cleaning, fuel burning/ash, garden wastes and of recent plastics.

**Commercial waste** includes wastes from markets, shops, offices, restaurants, hotels and similar commercial establishments. The waste is mainly comprised of packaging materials, office supplies and food wastes/remains.

**Institutional waste** is mainly from such establishments as government offices, schools, hospitals, hotels and other healthcare units, religious establishments and universities. The wastes are nearly similar to what is found in the commercial waste stream but with a high volume of paper than food waste in addition to a percentage of hazardous waste from the health institutions.

**Street sweeping** comprise part of the waste generated in the Municipal council and is mainly composed of dust and soil together with varying amounts of paper and litter picked off streets.

MTC CBD currently generates 120 tones per day, and is projected to produce approximately 1,095,000 tones in the next 25 years. Considering the likely catchment areas of Seeta, Bweyogere and Namanve, the projected waste generation for now is 200 tonnes per day, 80% of which can be composted. Therefore the proposed landfill and waste composting plant is a timely project that should be developed to be able to serve the fast growing Municipality. The proposed site is located approximately 7 kilometres from the centre of MTC in a sparsely populated area with the immediate household in a radius of about 500 metres away.

The site measures approximately 10 acres and is under secondary vegetation a result of periodic cultivation over a long period of time. Putting in place the above-proposed developments (landfill and waste composting plant) is likely to have both positive and negative impacts on the environment hence the need to undertake an assessment for this project to come up with an informed decision.

Section 20 (3) of the National Environment Act CAP 153, requires that all projects or policies that may, are likely to or will have significant impacts on the environment be subjected to EIA so that adverse impacts can be eliminated or mitigated. In addition Environmental Impact Assessment (EIA), as a tool for better planning, permits the integration of environmental concerns into the project planning process at the earliest possible planning and design stages. The assessment identifies, predicts, and evaluates foreseeable environmental impacts, both beneficial and adverse,

with the view to eliminating where possible, or minimising the negative impacts while optimising the positive impacts.

## **1.2 Objectives, scope and terms of reference of the EIA**

The overall objective of the EIA study was to identify possible environmental and social impacts resulting from the development of this waste composting plant and landfill and to ensure that the environmental considerations are incorporated into the project implementation plan before the pre-operational stage.

Other specific objectives as contained in the terms of reference included:

- \* Evaluation of the status and suitability of the identified waste disposal sites to be used for final disposal and composting of the wastes;
- \* To identify and assess the magnitude and duration of both positive and negative impacts resulting from the implementation and operation of the landfill and waste composting, and propose mitigation measures;
- \* Identify possible involvement of stakeholders and partners for sustainability of the project;
- \* Identification of existing and potential market opportunities for compost manure and other by-products of the project;
- \* Elaboration of an environmental management Plan to ensure compliance to the national environmental laws;
- \* Assessment of the training and capacity building needs necessary for successful project implementation; and
- \* Compiling an environment impact statement of the project to assist in the decision making process and serve as a basis for future environmental monitoring of the project – offer guidance.

## **1.3 Methodology**

The proposed landfill development project was a comprehensive assessment that had to be well organised and structured in order to achieve the stated tasks in the terms of reference. Several approaches were used including; document review, site visits and/or observation, interviews and Public consultations (focus group discussion).

### **1.3.1 Document Review**

Documents readily available relating to MTC and immediate neighbourhood were reviewed. These included waste generation factors such as population, economic activities, land use, area physical and proposed development plans among others. Other documents reviewed included the Mukono District State of Environment Report, the Mukono Town Council three year development plan, documentation of waste management in other municipalities, and legislation applicable to waste management.

### **1.3.2 Site Visits and Observation**

Transect walks were conducted through the proposed site and neighbourhood, assessing site suitability and the likely impacts as a result of project implementation. This enabled the consultants to physically make professional observation of the physical environment in addition to other social and environmental attributes likely to affect or be affected by the implementation of this project.

As a result of site visits and observation, consultants were able to triangulate findings from documents reviews, identify land use patterns, vegetation cover, population densities, settlement patterns and prevailing economic undertakings. Site topographic surveys and geophysical sounding were also undertaken to guide the design process.

### **1.3.3 Questionnaire**

Questionnaires were administered to two categories of respondents i.e. the technical people or professionals from relevant agencies whose infrastructure or services are likely to affect or be affected by the planned activity and the major waste generators in the Municipality.

The technical personnel interviewed included representatives of such institutions as MTC – Town Clerk’s office, Mukono Christian University, Rydar and College Inn Hotels, NWSC, District and TC Health and Environment Officers, District Director of Health Services and Engineering section within MTC. Among the major waste

generators interviewed were market operators, hotel and shop owners, and School authorities.

#### **1.3.4 Public Consultations**

The consulting team held consultative meetings in Katikolo village, and with the leadership of all MTC to capture information on the acceptability and viability of the project, and on the effectiveness of waste management system in MTC. It also helped to check on responses/information given by individuals interviewed privately.

It is also most important that people are aware of the impending developments more so when it involves their neighbourhood. Local communities have knowledge of their natural, physical, cultural and social environment and therefore best placed to assist in the identification of likely environmental and social issues in addition to proposing practical solutions for any adverse impacts. Advance warning of the likely project impacts allows the communities to plan for any likely eventualities especially if it is to lead to change of life styles.

Issues discussed centred on aspects of the projects like emission of odorous smell, vermin infestation, flies, and disease occurrence due to poor hygienic practices at the site, contamination of water sources, causing unsightly conditions from littered waste as it is being transported or delayed pickup, acting as habitats for rodents and breeding grounds for vermin's, noise generation from trucks transporting the waste, dust, likely accidents during transportation and attraction of foreign birds, flies and animals in the area where the landfill has been developed. Current uses of organic waste, and market for compost manure, as well as positive attributes of this project were also discussed during these consultative meetings.

#### **1.3.5 Expert and Scientific Data Analysis**

Scientific data collection and analysis was carried out around the proposed site and its area of influence. Of great concern was how the activities will relate to the hydrological set up of the area including impacting on the surface and ground water considering that the site is near a community water source point and lake Victoria. Geophysical measurement of the area was effectively

undertaken and results are appended in Annex 1. These have been used in guiding proposed landfill designs.

### **1.3.6 The Consulting Team**

The survey team was composed of the core consulting team, which was responsible for directing the study. It was composed of core consultants from different professional specializations and included an EIA expert and Team Leader, Solid Waste Management Specialist, an Economist, Spatial Environmental Analyst and a Hydrogeologist, three of whom are certified EIA Practitioners with NEMA. The consultants pooled together their varied expertise and experiences to be able to accomplish this assignment.

## **1.4 Structure of this EIS**

The remainder of this EIS is divided into the following principal sections:

- **Section 2** deals with the legislation taken into consideration that has a bearing on this project;
- **Section 3** provides a general outline of the existing environment in the area of the proposed project;
- **Section 4** describes the proposed project and its main components during the preparation and operation phases;
- **Section 5** presents the proposed MTC waste management and compost waste marketing strategy;
- **Section 6** discusses public consultations and disclosure.
- **Section 7** deals with each aspect of the environment in detail, providing an account of baseline conditions, prediction and evaluation of the impacts of the project and proposed mitigation measures, as well as a site restoration plan;
- **Section 8** comprises an Environmental Management Plan identifying the measures to be adopted during the operational life of the project to ensure its environmental acceptability to minimise any adverse impacts and provide for appropriate environmental monitoring;
- **Section 9** puts across main findings and recommendations of the consultancy team.

## 2.0 POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

Environmental Impact Assessments are a legal requirement and should be carried out for all proposed developments that are likely to have significant environmental impacts so that any negative impacts can be minimised or eliminated. This EIS addresses the proposed Katikolo Waste Composting and Landfill site, and the project falls under the third schedule of the National Environment Act 1995 (category 12), waste disposal including sites for solid waste disposal – hence the need to call for carrying out an EIA to conform to the regulatory requirements. The regulations that were considered during this exercise and which will be observed during project implementation (both during installation and operation phases) are stated in this section.

### 2.1 POLICIES

#### **The National Environment Management Policy, 1994**

Its overall goal is the promotion of sustainable economic and social development that enhances environmental quality without compromising the ability of future generations to meet their own needs. The policy clearly states that an EIA should be conducted for any policy or project that is likely to have significant adverse impacts on the environment.

#### **The National Policy for the Conservation and Management of Wetland Resources 1995**

This was put in place to curtail on the rampant loss of wetland resources and ensuring that benefits from wetlands are sustainable and equitably distributed to all people of Uganda. The wetland policy calls for undertaking environmental impact assessment on all activities to be carried out in a wetland to ensure that wetland development is well planned and managed. Development of this landfill and waste composting site has to take into consideration this policy since its going to be developed near the lake Victoria buffer zone, which therefore calls for undertaking an EIA to ensure that any likely leachate from waste composting or landfill does not impact on the wetland ecosystem.

### **National Water Resources Policy 1999**

The policy caters for safeguarding water sources. It also stipulates that the quality of drainage water shall be such as not to pollute the receiving water or ground water and that all measures must be taken by the users to prevent increase in salinity levels in receiving waters, to prevent the accumulation of dangerous or toxic compounds in the subsoil, capable of contaminating underground waters. Considering the nature of activity to take place in addition to the likely attributes as leachate, this policy offers guidance on how to execute the project diligently and cautiously.

## **2.2 THE LEGAL AND REGULATORY FRAMEWORK**

### **2.2.1 The Uganda Constitution (1995)**

The Uganda Constitution of 1995, Articles 39 and 41 provide that everyone has a duty to maintain and enjoy a sound environment. Every person in Uganda has a right to a clean and healthy environment and as such can bring action for any pollution or disposal of wastes. It states that government will promote development, utilisation and public awareness of the need to manage land, air and water resources in a balanced and sustainable manner for present and future generations. The constitution vests all land in the country in the citizens of Uganda, and protects property and other individual rights. The government, or local government, may acquire land in the public interest, subject to provisions of Article 26 of the Constitution. This gives every person in Uganda the right to own property, and stipulates that the land or property cannot be compulsorily acquired unless prompt, prior and adequate compensation has been paid to the owner of the land/property.

### **2.2.2 The National Environment Act CAP 153 and Regulations**

Section 19(1): This provides for a developer of a project described in the third schedule to this Act to submit a project brief to the lead agency, in the prescribed form and giving the prescribed information. Where a project/an activity is out of character with its

surroundings and likely to lead to changes in land use. The EIA Regulation specifies the projects to be subjected to EIA. These are:

- \* Where an environment impact review shall be required for small scale activities that may have significant impact;
- \* Where environmental impact evaluation for activities that are likely to have significant impacts; and
- \* Where environmental impact study for activities that will have significant impacts

Third schedule of the EIA regulations lists waste disposal sites as projects requiring EIA's.

**The National Environment (Waste Management) Regulations S.I. No. 52/1999**

Section 5 provides for a person who owns or controls a facility or premises, which generate waste, to minimise the waste generated by adopting cleaner production methods.

Subsection 1(b)(i): identifying and eliminating potential negative impacts of the product/waste.

(c): incorporating environmental concerns in the design and disposal of a product.

Section 6 makes it a requirement for a licence from the Authority for transportation or storage of waste upon fulfilment of standards described in section 7 including adequacy of facilities.

Section 13 provides for the requirement for a licence to operate a waste treatment plant or waste disposal site.

**The National Environment (standards for discharge of Effluent into Water or on Land) Regulations, S.I. No. 5/1999**

This regulation provides the standards or maximum permissible limits of effluents discharged into the natural environment, and makes it an obligation to mitigate pollution through installation of waste treatment facilities. This regulation has been considered considering the likelihood of leachate generation.

**The National Environment (Wetlands, River Banks and Lake Shores Management) Regulation, S.I. No. 63/2000**

Section 34(1) highlights the fact that any developer desiring to conduct a project which may have significant impact on a wetland, river bank or lake shore shall be required to carry out an environmental impact assessment in accordance with sections 19, 20, and 21 of the Act.

**The National Environment (Noise Standards and Control) Regulations, 2002**

The regulation provides standards for the maximum permissible noise levels to which a person may be exposed from a facility or activity, control of noise and for mitigating measures for the reduction of noise levels.

Section 5 (10) provides for the maximum permissible noise levels to which a person may be exposed from any area;

Section 6 (1) No person shall emit or engage in any activity that emits or likely to emit noise above a maximum permissible level specified in regulation 5 of these Regulations, unless permitted to do so by these Regulations;

Section 7 (1) emphasises the fact that it shall be the duty of the owner or occupier of a facility or premise or machinery to use the best practicable means of ensuring that the emission of noise from those facilities/premises do not exceed the standards and limitations set in these regulations.

**2.2.3 The Town and Country Planning Act 1964**

The Act provides for the orderly planning in urban and rural areas and establishes guidelines for planning schemes, acquisition of land and compensation for acquired lands, as well as considerations to safe guard the natural environment.

**2.2.4 The Public Health Act**

The Act consolidates the law in the respect of Public health and places duties on the Urban and local authorities in matters pertaining to public Health. It provides for measures to minimise water, air and noise pollution and empowers local authorities to take lawful, necessary and reasonably practicable measures for the prevention of any pollution dangerous to health of any supply of

water, which the public within its district has a right to use, and does use for drinking or domestic purposes.

### **2.2.5 The Water Act Cap. 152**

Section 5: All right to investigate, control, protect and manage water in Uganda is vested in the Government and in Section 31, it makes it an offence to pollute or cause risk of water pollution.

### **2.2.6 The Uganda Wildlife Act Cap 200**

Under the Wildlife Act, any person desiring to undertake any project, which may have significant effect on any wildlife species or community shall undertake an environmental impact assessment in accordance with the National Environment Act CAP 153.

### **2.2.7 The Local Governments Act, 1997**

This act provides for a district-based system of local governments. This system provides for elected councils that have both legislative and executive powers. Thus the district councils play an important role in land administration, land surveying, physical planning, and management of forests, wetlands, environment and sanitation services that are not the responsibility of the central government. They are therefore charged with the crucial role of acquisition of land for development/construction purposes and in the sensitisation and mobilisation of the local communities.

All the above regulations and policies are applicable to the proposed landfill development project and have been taken into consideration and will be observed during the construction and operations phases.

## **2.3 Institutions**

### **2.3.1 Ministry Of Water Lands And Environment**

The ministry is the institution responsible for the formulation of policies that govern environmental management in Uganda hence responsible for environmental issues in the country.

### **2.3.2 National Environment Management Authority**

This is the principal agency in Uganda responsible for the management of environment and is charged with the coordination,

## **Mukono Town Council**

supervision and monitoring of all activities related to environmental management.

### **2.3.3 The Uganda Land Commission**

It is responsible for sustainable management of land in Uganda especially holding and management of land, which is vested in or acquired by the government in accordance with the constitution.

### **2.3.4 The Municipal and Country Planning Board**

The board provides for the orderly planning in urban and rural areas. It defines building operations and development in relation to any land.

### **2.3.5 The District Land Board**

This (Mukono District Land Board) is charged with the responsibility for land issues at the local government level.

### **2.3.6 Mukono Town Council**

MTC was created under the Local Governments Act 1997 and is headed by His Worship The Mayor (LCIII – Chairman), who is assisted by the Council that acts as the legislative body. The Executive head is the Town Clerk (the Accounting Officer) and all departmental heads are answerable to her. The departments/sections/offices that are directly involved in this project include the Health Inspectors' Office, the Planning and Engineering Departments.

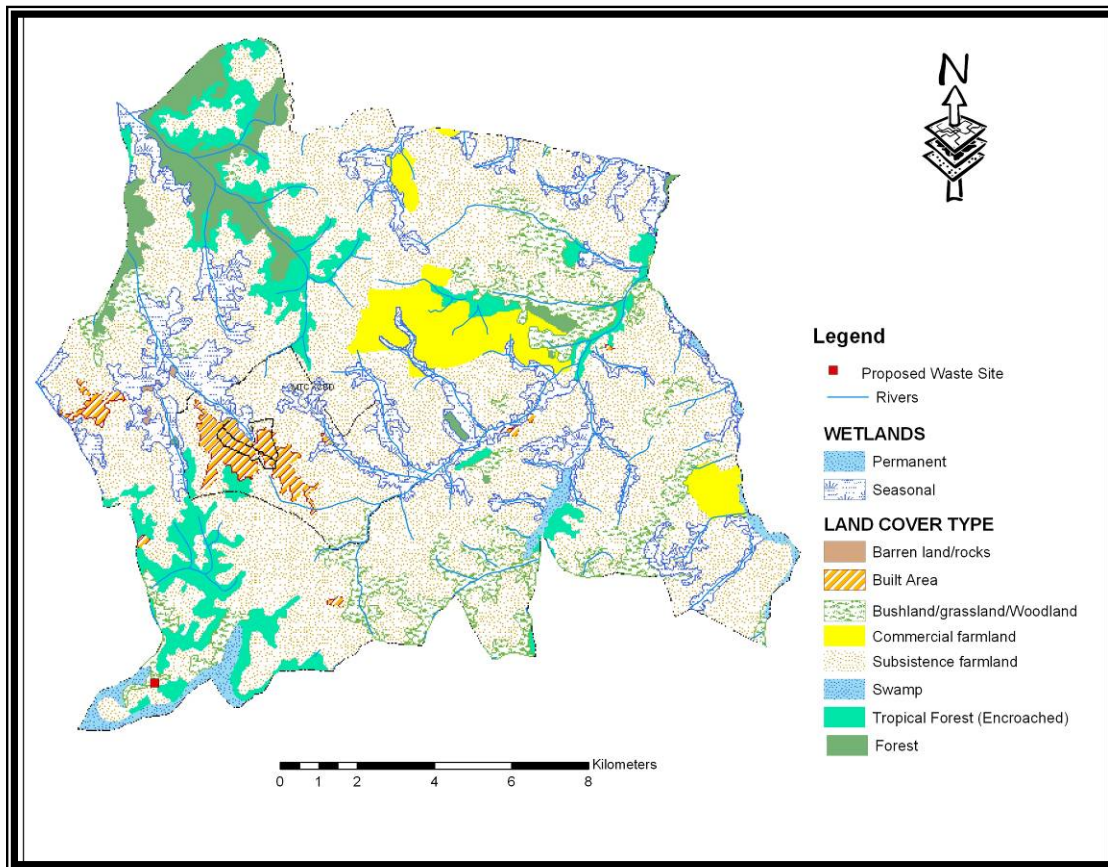
Though NEMA is charged with the coordination of sectoral environmental issues, MTC must ensure that environmental and social impact assessments for this landfill and waste composting plant is adequately carried out, mitigation properly incorporated and the construction process is environmentally and legally compliant.

### 3.0 PROJECT SITE ENVIRONMENTAL BASELINE CONDITIONS

#### 3.1 The Project Area

The proposed Waste Composting Plant and Landfill will be located in Katikolo Village within MTC. The Site is 10 acres in extent and is under secondary vegetation having previously been under cultivation. The southern, southeastern and western neighbourhoods are characterised by Katikolo wetland adjacent to lake Victoria while the northern and eastern neighbourhoods area characterised by Katikolo hill. The area is sparsely populated with the immediate communities involved in subsistence farming.

Below is the MTC map portraying the dominant land use.





*Above: part of the site for the proposed landfill, and the road to Kati Fish Landing site on lake Victoria shores*

### **3.2 Geology and soils**

Mukono district geology is underlain by the Pre-Cambrian rock system - crystalline metamorphic basement Complex and comprises of the granitoid and granitic gneisses, and later granitic intrusions and quartz veins. Tiny portions are underlain by recent deposits of alluvial and lacustrine formations in the valleys. The Katikolo area is overlain by tertiary and quaternary deposits on slopes and valleys respectively. The slopes are characterised by limonitic murrum while the valleys have swamp clay, sand, gravel and rock fragments.

The predominant soil types are mainly ferralitic with sandy-loams and clay loams as the main constituents, and of high to medium fertility, with relatively good porosity.

### **3.3 Geomorphology and Drainage**

Ancient denudation processes are responsible for the current formation in Mukono district, with a series of old erosional levels and lowland surface remnant: throughout the region. The processes include pleneplanation, slow uplift and consequent dissection by the active drainage system. The altitude ranges between 1099 to 1300m above sea level. The Landscape has broad valleys, which serve as areas of infill of the fine sediments carried by runoff water.

Mukono district is drained by numerous rivers and streams, the major one through the Town Council being the Mwola system. The major drainage feature near the waste site is the Katikolo wetland, that forms a buffer for lake Victoria.

### **3.4 Climate**

The lakes Kyoga and Victoria as well as Mabira Forest influence the area climate. The district experiences two rain seasons (March to May and September to December), with a mean annual rainfall of 1400-1600 mm, but 1400 - 2000 mm for areas closer to lake Victoria. The mean annual maximum temperature is 25-27.5°C while the minimum is 15-17.5°C.

### **3.5 Vegetative Cover**

The district vegetation is of the forest-savannah mosaic type characterised by patches of dense forest in the south and scattered trees in shrubs and grassland to the north. The project area vegetation is savannah bush land and grassland, and this is evident in the immediate northern, eastern and northwestern while the southern and western neighbourhoods have swamp communities found in areas of impeded drainage, consisting of perennial grasses, papyrus and sedges. Secondary vegetation as a result of periodic bush burning and cultivation is common within the immediate neighbourhood in addition to introduced ornamentals and food crops.

### **3.6 Biodiversity: Important Flora and Fauna**

The tree and shrub vegetation at the project site and its immediate neighbourhood include edible plants such as *Psidium guava* and herbs such as *Afromannum angustifolium* spp. Also swamp forest spp. such as *Calamus deetarus*, *Maesopsi eminii* (musiizi) and various grass species were observed located approximately 800 metres away to the west. Communities benefit from this flora in terms of food, fuel, building materials, medicines and materials for crafts.

The fauna is characteristic of low lying area of forest community, and includes birds (cattle egrets, Scotty chat, yellow fronted Canry), mammals (squirrel, white hare, wild rats), insects (ants, bees, termites), reptiles (puff adders, green snakes - *Chlorophis* spp) and fish present in the neighbouring streams/lake; the species being Lung fish and Tilapia.

### **3.7 Water sources**

The district is endowed with enormous water resources, including lake Victoria to the south of the site, River Nile to the East and Sezibwa River, which drains 90% of the district, and also ground water aquifers. The Mwola river feeds into

Sezibwa. However these surface water sources in the district suffer from industrial and domestic pollution.

The local community in the project area draws water for domestic use from a protected spring and an open well for watering animals. Given the nearness of the community's source of water to the proposed site, there is need for development of an alternative source like provision of a borehole or extending piped water to the area. Also, leachate from the landfill will have to undergo appropriate treatment prior to discharge into the natural environment, due to the wetland's values to the local communities and ecological functions.

### **3.8 Social Baseline**

#### **3.8.1 Land Tenure and Existing Land Use**

The predominant land tenure in the Town Council is leasehold though customary ownership is predominant in the district. The proposed site land is under leasehold tenure, for which a lease has been obtained from the Mukono District Land Board.

#### **3.8.2 Population and administrative structure**

Mukono Town Council is located 22 km East of Kampala City. According to the 2002 census results (UBOS 2002), Mukono Town Council had a population of upto 46,506, with 11,373 households and an urban population growth rate of 3.8 %.

#### **3.8.3 Administrative structure**

Mukono Town Council is a lower local Government under Mukono District Local Government. A Mayor heads the political wing and the Town Clerk heads the technical wing. Under the Town Council are lower Councils and zones.

#### **3.8.4 Economic Activity**

Mukono is predominantly an agricultural district. The main economic activities for communities surrounding the site area are subsistence agriculture including both crop and livestock farming, as well as clay mining for brick making and sand mining. Within the CBD, trading, employment income and the service industry dominate the core undertakings. Industrial developments in Namanve with as well add to the district economic base.

### 3.8.5 MTC Revenue and financial status

MTC is believed to have a relatively stronger economy than its counterparts at same status. MTC's budget for 2004/2005 was Ug. Shs 925,092,364 and for 2005/2006 Ug. Shs. 1,101,804,304. Local revenue sources are now limited following abolition of graduated tax, limited property tax and market dues. In the financial year 2004/2006 MTC spent Ug. Shs. 60m on waste management. Details of the financial status figures are presented below.

**Table Revenue in Million shillings**

Revenue	2004/2005		2005/2006
	Budgeted	Provisional Out-Turn	Budgeted
Local revenue	446,225,000	395,861,167	418,265,632
Central government	425,167,364	425,685,561	677,538,672
Donors/NGO	53,700,000	62,259,545	6,000,000
Loans	-	-	-
Total Revenue	925,092,364	883,806,273	1,101,804,304

**Table Expenditure in Million shillings**

Revenue	2004/2005		2005/2006
	Budgeted	Provisional Out-Turn	Budgeted
Total Expenditure	826,948,203	736,159,782	894,710,400

**Table Major Source of local Revenue**

Revenue	2004/2005		2005/2006
	Budgeted	Provisional Out Turn	
Graduated tax (Previously)	132,000,000	104,925,250	0
Property rate tax	40,000,000	3,512,555	39,960,816
User Fees/charges	221,775,000	211,106,167	308,154,816
Revenue from Departments	46,000,000	65,664,195	61,000,000
Urban Authority Permits	3,950,000	8,080,000	6,650,000
Other Charges	2,500,000	2,573,000	2,500,000
Total Local Own Source	446,225,000	395,861,167	418,265,632

### **3.8.6 Human Settlements and Housing**

There is a problem of unplanned settlements (slum areas), homelessness, substandard housing and no security of tenure. The tenure systems have greatly influenced the quality of housing and settlements in the town council. Most of the main government and private sector offices, specialised shops, major transportation facilities and some housing are concentrated in the town centre the town council offices inclusive. However, a series of smaller commercial and residential centres are starting to emerge in the outskirts of MTC. Seeta is developing into a residential area, and a number of Urban centres have come up that will require waste collection services.

### **3.8.7 Social Services and Physical Infrastructure**

The provision of social and infrastructure services plays a vital role in supporting accelerated and sustainable social, political and economic development. Social and physical infrastructures in MTC are relatively more developed than any other part of the district.

#### **Access to safe Water and Health Services**

MTC has only been recently connected to NWSC piped water. It previously depended on boreholes, in addition to springs, open wells and rainwater and boreholes. The major water requirement is for domestic and industrial use.

MTC enjoys the services of both government and privately owned health facilities. However being in the proximity of Kampala City, it enjoys the services of the prevailing health infrastructure that includes Mulago, Makerere University, Butabika, Mbuya Military, Luzira Prisons, Nsambya, Mengo and Rubaga Hospitals among others. The private sector now has a major stake in health service provision, running a number of Clinics, dispensaries, hospitals and maternity homes.

The major health concerns of the town council now include malaria, waterborne diseases such as cholera and dysentery, and respiratory diseases (a consequence of air pollution particularly from fossil fuel combustion and waste burning) and HIV/AIDS. Others include human resources for health services, funding for health projects and inadequate health infrastructure.

### **School Enrolment, Access and Quality**

The education sector plays a vital role in promoting sustainable development through capacity building of the population in various skills. It also raises awareness on various issues of national importance and improves general standards of living. Enrolment in all institutions has drastically increased; more schools, institutions, colleges and universities (Mukono Christian University) have sprung up, mainly under private ownership. Universal Primary Education has since been introduced, and with tremendous increment in Primary School enrolment.

The town council has government and privately run institutions, attracting students from the immediate catchments, countrywide and from the East African region. The private sector plays a significant role in providing education infrastructure for the town council community.

### **Transport and communication**

MTC has an extensive road network, transport terminals and parking facilities. MTC is located near the capital city that is at the centre of Uganda's road network and all roads to all parts of the country radiate from its Central Business District, and to the east through Mukono. Road transport is still the major mode of transport for both passenger and cargo traffic. MTC also has a Railway terminal.

MTC has a total of about 4.2 km of tarmac roads and 78 km of murrum/gravel and loose surface roads. Those under care of central government total up to 14 kilometres. The concentration of good roads in the town council has a direct impact on traffic, with most cars having to pass through the town centre.

### **Energy sources**

The major sources of energy in MTC and the district are charcoal, electricity, firewood, solar energy and petroleum products (fossil fuels) like Kerosene, petrol and diesel. Charcoal and firewood are mainly used for cooking while electricity is basically used for lighting. Use of biogas, wind energy and other renewable energy forms are not yet well developed in MTC and the district in general.

### **Electricity**

There is reasonable coverage of electricity though there are still few areas not yet connected to electricity. Electricity is mainly used for household lighting, used in medium and large-scale industries and street lighting. However, due to high charges

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per unit of electricity, and high cost of electrical appliances most households still prefer to use alternative sources for cooking e.g. charcoal and firewood, which have left their toll in the district forest resources. Industrial consumption of electricity is steadily rising.

Considering the likely waste collection catchment area, MTC intends to explore the possibility of energy generation using waste to serve its population requirements.

### **Fossil fuels**

Kampala district and the immediate catchment urban centres such as MTC are the major consumers of petroleum products in Uganda, having the highest district proportion of vehicles on the road, and consumes an estimated 65% of petroleum products imported into the country. Kerosene is used mainly for lighting while petrol and diesel play a major role in the transport sector. This catchment area (Kampala city and MTC) has close to 200 Fuel Service Stations.

#### **3.9.8 Historical/cultural Site**

There are no major historical/cultural sites around the proposed area however cultural sites do exist within the immediate neighbourhood of the district - Kampala City at Kasubi tombs (the ancestral burial grounds for Buganda Kingdom Kings).

### **3.9 Solid waste management in Mukono Town Council**

#### **3.9.1 Solid Waste generation and collection**

Waste collection has in the past been the responsibility of MTC and undertaken by three departments, including the Engineering department responsible for provision and maintenance of trucks, and the Health Departments. MTC is only able to collect 60% of generated solid waste from the CBD estimated at 70 tons per day. Considering the catchment area that includes urban Centres such as Seeta, upto 200 tons of waste are generated per day, most of which is not collected. Within the CBD of MTC, 80% of household waste is not accessed or collected.

The town Council has 78 gazetted waste collection points, with a total of 15 skips, 12 of which are distributed within the CBD, the

## Mukono Town Council

others in the town outskirts. 3 vehicles are used including a tractor (18 tonnes per day), a Jeiphang truck (32 tonnes per day), and a skip loader (20 tonnes per day). They are a range of waste bunkers, in the CBD but in poor state.

Upto 16 persons are involved in waste collection, but the budget of 60 million remains limiting. The fuel requirement per week is 876l of diesel. Waste collection is yet to be privatised, but the TC is promoting private – public partnership in waste management. This will be backed up a bye- law in advanced stages of development.



Above: waste collected infrastructure in MTC including waste skips at transfer station, waste bin, and garbage bunker.

### 3.9.2 Waste Stream and Sources

The waste stream comprises of vegetable matter and food waste (comprising of approximately 80%), paper, plastics, metal, glass, garden waste, street cleaning, wood and wood shavings, rubber, leather and textile. This is mainly generated from:

#### Residential:

- o Single and multiple dwellings

#### Commercial:

- o Markets
- o Offices
- o Rental stores;
- o Entertainment centres;
- o Restaurants;

## **Mukono Town Council**

- o Hotels/motels
- o Service stations

### **Town council Services and developments**

- o Street Sweeping
- o Debris

### **Institutional**

- o Schools/Colleges/Universities/churches
- o Hospitals;
- o Prisons.

Hazardous waste management still remains a challenge, particularly from hospitals, pharmaceutical industries, chemical industries, garages, fuel depots and service stations. There is as well inadequacy in Clean Technology practices that would greatly limit waste generation at source, as well as inadequate facilities for waste treatment or disposal such as landfills or incinerators, and also waste segregation and waste conversion into useful products. The development of industrial parks at Namanve and Kato Aromatics require such facilities. For institutions such as schools, initiatives in waste management and collection such as purchase of coded waste bins and development of waste management plans is being encouraged.

### **3.9.3 Current uses of organic waste**

As stated above, upto 80% of the waste generated in Mukono Town Council CBD is organic waste, capable of conversion into compost manure. Some of this waste waste, including banana peelings, leaves and stems, and some food remains are sorted and used as animal feed (for cattle, goats and pigs), but this represents a small proportion of the organic waste.

There have been attempts to undertake waste composting by Seeta Garbage Recycling Project supported by Talent Calls Club, a local NGO. During Its operations in 2001 to 2003, this project utilised waste from Seeta Town Council. The consumers of the compost waste included farmers in Mukono district with one ton sold at Ug. Shs. 10,000. This makes a case of economic viability of the proposed waste composting plant. Other than those involved in

**Mukono Town Council**

collection of peelings, no notice was made of other persons/entities involved in waste management.



Inside the waste composting house: sorted waste and waste composting units



The shell house for waste composting at Seeta

## 4.0 PROJECT CHARACTERISTICS AND WASTE DISPOSAL ALTERNATIVES

### 4.1 Introduction

The current waste disposal practice in MTC involves disposal of the solid waste in open dump sites. Coverage of Waste collection infrastructure and services remains low, with upto 60% (70 tons per day) of solid waste in the CBD collected. The waste composition includes 80% organic waste (including vegetable matter and tree cuttings), 5.5% street debris, 5.4% paper, 1.6% plastics – especially LDPE, 3.1% metal and 1.7% wood shavings. The conservative estimate of waste generation per day including the catchment of Seeta is 200 tons.

To ensure effective disposal of the generated solid waste, MTC has acquired 10 acres of land located approximately seven kilometres south of the CBD for solid waste composting and landfilling.

Landfills are the most widely used waste management method for municipal solid waste. Developing a landfill is an engineering investment that involves planning, designing and construction skills in addition to analysing the scientific, logistical and social factors associated with location alternatives. Both construction, maintenance and land acquisition are costly for Uganda Municipalities/Urban Centres given their limited revenue base. The option to undertake waste composting for organic waste alongside landfilling for non-biodegradable waste is proposed in this chapter.

For this site, location alternatives have not been considered due to the fact that the site had already been identified and acquired by MTC. However the site meet the minimum requirements, such as isolation from residential areas, accessibility and short haulage distance of 7 km, spacious site – 10 acres, and likely limited impact on the bio-physical environment.

Key Characteristics of MSW dumping sites

TYPE	Characteristics	Advantages	Disadvantages
Open dump	<ul style="list-style-type: none"> <li>-Poorly sited</li> <li>-Un known capacity</li> <li>-No cell planning</li> <li>-Little or no site preparation</li> <li>-No leachate* Management</li> <li>-No gas management</li> <li>-Only occasional Cover</li> <li>-No compaction of waste</li> <li>-No fence</li> <li>-No record keeping</li> <li>-Waste picking and trading.</li> </ul>	<ul style="list-style-type: none"> <li>-Easy access</li> <li>-“Extended” lifetime</li> <li>-Low initial cost</li> <li>-Low initial cost</li> <li>-Low initial cost</li> <li>-Low initial cost</li> <li>-Low initial cost, aerobic decomposition</li> <li>-Low initial cost, Aerobic decomposition</li> <li>-Low cost, access to waste pickers</li> <li>-Low initial cost</li> <li>-Material recovery, income</li> </ul>	<ul style="list-style-type: none"> <li>-Environmental contamination</li> <li>-Over use, many noxious sites</li> <li>- Environmental contamination</li> <li>-Un sightly, needs remediation</li> <li>-GW and SW contamination</li> <li>-Risk of explosion, GHGs</li> <li>-Vectors/disease, unsightly</li> <li>-Shorter lifetime, little</li> <li>-Indiscriminate use, vermin</li> <li>-No record of landfill content</li> <li>-Least efficient format record.</li> </ul>
Controlled Dump	<ul style="list-style-type: none"> <li>-Site wrt hydro-geology</li> <li>-Planned capacity</li> <li>-No cell planning</li> <li>-Grading, drainage in site prep</li> <li>-Partial leachate mgmt</li> <li>-Partial or no gas mgmt</li> <li>-Regular (not usually daily) cover</li> <li>-Compaction in some cases</li> <li>-Fence</li> <li>-Basic record keeping</li> <li>-Controlled waste picking</li> <li>-Controlled waste keeping and trading</li> </ul>	<ul style="list-style-type: none"> <li>-Less risk of Environmental contamination</li> <li>-Permits long-term planning</li> <li>-Low initial cost</li> <li>-Easier rainfall runoff, reduced risk</li> <li>-Moderate cost, reduced risk</li> <li>-Moderate cost, reduced risk</li> <li>-Moderate cost, reduced risk</li> <li>-Extended life time</li> <li>-Controlled access and use</li> <li>-Valuable information</li> <li>-Materials recovery, income, lower risk to pickers</li> </ul>	<ul style="list-style-type: none"> <li>-Perhaps less accessible</li> <li>-(None)</li> <li>- Environmental contamination</li> <li>-Cost</li> <li>-Cost</li> <li>-Cost</li> <li>-Cost, slower decomposition</li> <li>-Cost</li> <li>-Cost, maintenance</li> <li>-Cost</li> <li>-Harassment, possible displacement of pickers and buyers, loss of recyclable resources.</li> </ul>
Sanitary Landfill	<ul style="list-style-type: none"> <li>-Site based on EnRA</li> <li>-Planned capacity</li> <li>-Designed cell development</li> <li>-Extensive site preparation</li> <li>-Full leachate management</li> <li>-Full gas management</li> <li>-Daily and final cover</li> <li>-Compaction</li> <li>-Fence and gate</li> <li>-Record volume, type, source</li> <li>-Controlled waste picking</li> </ul>	<ul style="list-style-type: none"> <li>-Minimised Environmental risk</li> <li>-Permits long-term planning</li> <li>-Minimised Environmental risk</li> <li>-Reduced risk f and from site</li> <li>-Reduced risk from leachate</li> <li>-Reduced risk from gas</li> <li>-Vector control, aesthetics</li> <li>-Extended life time</li> <li>-Secure access, gate records</li> <li>-Valuable information</li> <li>-Eliminate risk to pickers</li> </ul>	<ul style="list-style-type: none"> <li>Access, longer siting process</li> <li>(None)</li> <li>Cost</li> <li>Cost, preparation time</li> <li>-Cost</li> <li>-Cost</li> <li>-Cost, slower decomposition</li> <li>-Cost</li> <li>-Cost, maintenance, staff</li> <li>-Cost, equipment</li> <li>-Displacement of pickers and buyers, loss of recyclable resources.</li> </ul>

ERA – Environmental Risk Assessment, GHG – Greenhouse Gas, GW – Ground Water, SW – Surface Water, wrt – with respect to.

## **4.2 Waste site Development Options**

Preparation and use of waste disposal sites necessitates that a number of activities be carried out. These start from the design stage to the construction, operation and restoration phases. Waste disposal sites range from uncontrolled open dumps to secure sanitary landfills. Uncontrolled, open dumps are not a sound practice, but controlled dumps and sanitary landfills can provide effective disposal of MSW. The option to be taken up will depend on the capacity of the Town Council after weighing the analysed alternatives. Options evaluated are:

- **The NO ACTION;**
- **The Open Dump;**
- **The development of a SANITARY LANDFILL Option; and**
- **Undertaking WASTE COMPOSTING alongside development of a LANDFILL.**
- **Energy generation alongside development of landfill**

The Municipal council should select the best option taking into consideration the already acquired piece of land, size of the Municipal council, quantity of waste generated and availability of resources among other crucial considerations. This will guide them to come up with the most cost effective option.

### **4.2.1 The NO ACTION Option**

Currently waste in MTC is openly dumped, in sensitive ecosystems such as wetlands, in gardens, along road verges, drainage channels and valleys, especially for areas not covered by the Town Council waste collection services. The CBD bunkers are not regularly emptied leading to foul smell, leachate, flies and wind-blown loose solid waste invading the immediate neighbourhood.

The “no action” alternative would mean continued deterioration of the already worse sanitation situation and sacrifice of the benefits that would have accrued as a result of developing a controlled

waste dump or sanitary landfill, or even undertaking waste composting or energy generation. It also means continued emission of GHG especially methane from the decomposing waste.

Current utilization of organic and other forms of waste is rather minimal, with attempts undertaken by individuals and homesteads.

#### **4.2.2 The Open Dump Option**

The open dump option is characterized by open disposal of collected MSW with no waste management option applied. As portrayed from the above table, it has the lowest initial investment and operating cost (such costs normally include site acquisition and construction of access roads) but poses significant risks to human health and the environment especially given the site location near a sensitive aquatic ecosystem.

Considering the location of MTC proposed site, this option would greatly lead to contamination of surface and ground water, pollution of the immediate neighbourhood with unpleasant smell, result in the area being littered with wind-blown solid waste, attract vermin and rodents among others, and also significantly contribute to GHG emissions. Open dumps can turn out to be breeding grounds for disease carrying pests such as flies, mosquitoes, and vermin (rats). It will also mean a shorter life span for the acquired landfill, which is not tenable given the increasing difficulty in obtaining spacious land for waste disposal purposes.

#### **4.2.3 Development of a SANITARY LANDFILL Option**

Development of a sanitary Landfill is necessary considering the waste generation rate from MTC and its catchment and the rate at which it is growing, as well as ongoing industrial and institutional developments. Landfill development requires proper planning, siting, designing, construction, operation, environmental monitoring, closure and post-closure. The considerations for sound technical practices for MSW Landfills are:

- o Siting;
- o Leachate management and environmental impact minimization;

- Gas management and risk reduction;
- Secure access and maintenance of gate records;
- Compaction and daily cover;
- Documented operating procedures, and worker training and safety programs;
- Establishment and maintenance of good community relations and closure and post-closure planning.

Sanitary landfills are the only feasible way to dispose of some types of waste, such as batteries, paints, expired chemicals, among others. However, this option still has the disadvantage of a short lifespan. At the estimated waste generation rate of 200 tons per day, and exaction limited to 10 acres, the lifespan will be limiting. This option is also not tenable given the costs involved, and the likely contamination of water sources with leachate if the clay lining and leachate treatment plant is not put in place.

#### **4.2.4 Waste composting alongside land filling**

Given the quantity of organic waste generated, development of a waste composting plant together with a sanitary landfill is an admirable option. With up to 60% of waste generated in the MTC CBD collected per day, the proposed composting plant capacity of 70tons can consume all this waste. Besides there is an opportunity to reduce GHG emissions and to trade under the CDM. The design also provides for a leachate treatment plant allaying fears of water source or aquatic ecosystem contamination.

The landfill development requires proper planning, siting, designing, construction, operation, environmental monitoring, closure and post-closure. Taking a case of 200 tons generated collected per day for the design, upto 20% would end up in the landfill per day, greatly reducing the mass land filled compared to open dumping or landfilling only and extending the site lifespan. The challenge will then be improved waste segregation at source and at the landfill, improved capacity for landfill and composting plant management, and ensuring good relations with the local community, and site restoration planning.

The local issues raised during consultations include extension of piped water and electricity, improvement of the access road to 1<sup>st</sup> Class murrum, and employment opportunities.

#### **4.2.5 Energy generation alongside landfilling**

This option considers energy generation or tapping methane from the decomposing waste alongside landfilling for hazardous waste from which heat cannot be generated. The initial investment for this option will be upto 2 million dollars, and for now needs further study. Mukono Town Council is advised to explore this option further and the opportunity of Kiira Town Council as part of the catchment area for the waste.

### **4.3 Design Considerations**

#### **4.3.1 Area Hydro-geology in design considerations;**

The area hydro-geological investigation results allow for excavations upto 15m most of the site. The waste generation rate for MTC and the neighbouring urban centers for the waste site design has been estimated at 200 tons per day. However with excavation to 10m, waste segregation well practiced, and appropriate designs for the landfill cells developed, the acquired acreage will be adequate over 25 years. The excavated material during construction will be stored and used as cover material at the landfill.

The lifespan of the landfill however is expected to be longer given the fact that not all waste is collected.

#### **4.3.2 Design and operations of the composting plant**

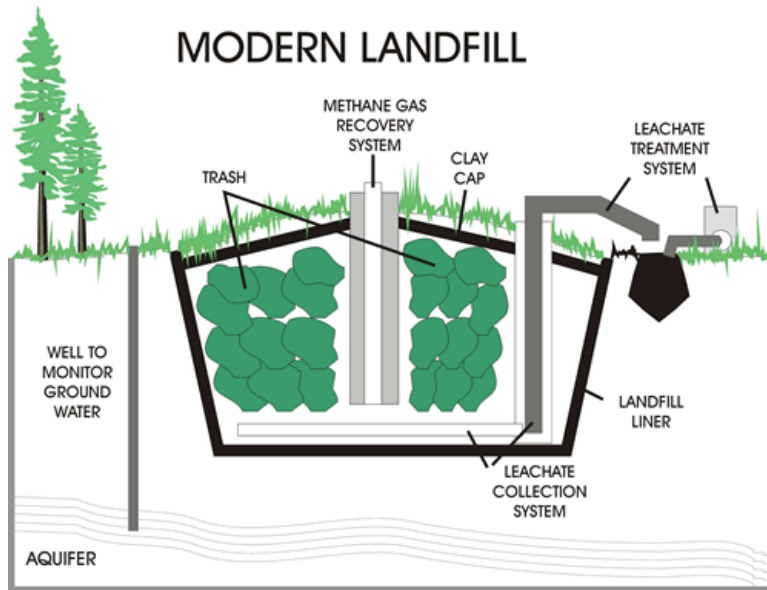
The composting plant will utilize windrow technology. Its design capacity is 70 tons of organic waste. The major equipment used here will include a back hoe and forklift for turning waste and moving it to the next windrow, but waste sorting will be undertaken manually. Upto 15 persons will be employed at the site.

In coming waste will be weighed and checked and sorted of any non-biodegradable material. KTC will ensure no hazardous/special waste such as clinical waste reaches the composting site. This will be ensured during issuing of licenses to those operating clinics and dispensaries. They must have handling facilities for such waste.

The plant will be designed to slope towards the leachate tank, with leachate or slurry recycled to improve moisture content of the decomposing waste.

The leachate collection and removal system will consist of a series of drains and pipes designed to collect all of the leachate, which has drained through the waste mass and each windrow and directed to the leachate tank from where the leachate can be recycled.

**Figure: Design of a modern landfill**



## **Factors Affecting Compositing:**

### **Moisture**

Improper moisture content slows down the decomposition process especially in the early stages of operation. The waste composting plant will utilize treated leachate to improve moisture content.

### **Oxygen**

Composting is an oxygen-dependent process and turning or forced aeration aids the composting process. Turning of waste once a week will enhance quick decomposition to take place.

### **Nutrients**

Nutrient levels referred to are nitrogen to carbon ratio and the high the ratio, the faster the decomposition process. Nitrogen can sometimes be added to quicken the decomposition process.

#### **4.4.2 Design and Construction of the Landfill**

Combining waste composting with landfilling implies a much-reduced requirement for landfilling space. Initially Mukono Town Council will develop two landfill cells each of capacity 40,000m<sup>3</sup> after excavation. The bottom will be lined with an impervious layer of clay.

#### **4.3.3 Construction of the Storm Water Drainage System**

When developing the site, there is need to ensure minimal storm water finds its way into the landfill. This will be effected by putting in place a drainage system around the proposed site to deter storm water invading the landfill and enhancing leachate development. Surface water diversion is an important matter as not only will it significantly reduce leachate quantities but it also removes flooding by surface water, which can destabilise the site embankments.

#### **4.3.4 Vermin and litter control**

Vectors and vermin common to dump sites include insects, rodents and birds. The proposed windrow shade, and waste composting activity will greatly limit vermin at this site. Covering transportation trucks or proper securing of transported waste will be emphasised.

#### **4.3.5 Record Keeping and waste information system**

Record keeping at the landfill and waste composting site will be part of the larger waste information system. At the waste site, there will be a weighbridge to track quantities of waste deposited and manure leaving the composting plant. Other records that must be kept include equipment status and maintenance; Daily operation schedules and activities; Environmental monitoring; Personnel matters; and Financial revenues and expenditures.

Initially, the major waste collection points in the Municipality have been mapped. But this will be related with waste generation rates, waste generation factors, land use and economic activities and utilised in waste management planning.

#### **4.3.6 Site Security**

A barbed wire fence will be erected around the landfill and waste composting site to restrict access by animals and to prevent unauthorized entry. The site itself will be accessed by a gate.

#### **4.3.7 Connecting the Site to Electricity And Piped Water**

There is need for power and water supply on the site. The likely national grid connection point is about 2km, and NWSC water pipes as far as Mukono Town.

#### **4.3.8 Site Landscaping**

Given the proposed waste composting along side landfilling, not all the acquired 10 acres will be utilized over a long period of time if the waste composting activity succeeds. Up to 3 acres of the land can be planted with trees as part of the landscaping process. This will help in aesthetic improvement of the area, provide a buffer for migration of landfill gas and hold any windblown waste.

#### **4.3.9 Site Restoration**

As part of the restoration process a final cover will be placed over the waste at the end of the active life of the landfill. This is intended to isolate the waste from direct contact with the environment in addition to complementing the visual aesthetics as a result of the introduced vegetation cover. The final cover to be introduced will

include murrum gravel, and humic soils to be planted with grass and suitable tree species.

#### **4.3.10 Gas Control Systems**

Despite the composting operation, minimal landfill gas will be generated. The primary concern is methane gas, a potent greenhouse gas, which is normally produced in concentrations of up to 65% of the landfill gas and is potentially explosive at concentrations of between 5 and 15% methane in air on confined spaces.

Landfill gas should be vented out through vertical pipes.

#### **4.3.11 Fire control**

Open fires should not be allowed in better-managed landfills and in case of any breakout it should be extinguished. Fire fighting equipment will be kept at the site.

#### **4.3.12 Construction Of The Office Block/Reception Facilities**

An office block to house manager's/supervisors offices, changing rooms, VIP latrine facilities for the management and staff, and establishment of a parking yard for the staff vehicles will be constructed.

#### **4.3.13 Construction Of Access Road, Weighbridge, Parking Yard, Washing Bay**

An access road to the landfill exists - the same road going to Kati leading site which lies adjacent the site will be utilised. It will only require upgrading/paving to ensure that dust emission is suppressed. There will be navigation routes established within the landfill itself in addition to construction of the parking yard and washing bay where periodic washing of the garbage delivery truck will be undertaken.

The weighbridge will be installed to help in effective and efficient levying of fees from private garbage collectors who will be utilising this landfill for waste disposal.

#### **4.3.14 Site Security**

A chain link fence will be erected around the waste composting plant and landfill to restrict access by animals and to prevent unauthorized entry. The waste site itself will be accessed by a gate.

#### **4.3.15 Acquisition of a murram gravel source point and its periodic excavation**

Murram gravel will be required for daily land filling activities. The geophysical investigation revealed lots of murram in the sub-surface of the site which be excavated during landfill construction. This will be stored and used for covering waste in the landfill.

## **5.0 STRATEGY FOR IMPROVED WASTE MANAGEMENT**

In the course of this study, priority initiatives have been identified that if implemented will see through improved solid waste management in Mukono Town Council.

### **5.1 Priority initiatives**

#### **5.1.1 Integrated waste management planning**

The primary objective of introducing an integrated waste management planning system is to integrate and optimise waste management so that the efficiency of the waste management system is maximised and the impacts and financial costs associated with waste management are less. Integration will be addressed within institutional arrangements and in all waste generating sectors and throughout the "waste life-cycle".

A number of stages are addressed in the integrated waste management planning process, which takes into account the need to develop clear objectives, while maintaining the existing system and investigating possible alternatives and selecting the most appropriate waste management system. The stages that will be followed in implementing the waste management planning process include: identifying baseline needs; review of existing legislation; establishing objectives and system components; and developing and implementing a waste management plan.

Chapter 3 outlines the baseline waste management gaps, and chapter 2 the existing legislation and institutional framework for waste management. Mukono Town Council is yet to have in place a waste management ordinance that clearly spells out institutional roles including roles for Local administrative Units (Parish, Village Councils, Local Environment Committees), as well as the private sector and Civil Society. There is no emphasis on waste segregation which will be required to turn waste management into an economic activity, and no fees paid for waste generated and the use of disposal sites.

It is proposed here that the headquarters maintains the planning, monitoring and coordination roles and technical advise leaving

actual activities (such as waste collection) to the Local Administrative Units, and the private sector. However, the lower levels will make a useful input in terms of preparation of local waste management plans, updating the waste information system, and enforcement of regulations such as the waste management ordinance developed by the Town Council.

This strategy stresses public and private participation for its success. Multi-sectoral workshops, awareness campaigns through radio and posters, public hearings and presentations may be used to ensure the participation of a broad spectrum of the public. It is crucial that stakeholders are involved during the development of waste management plans, particularly at the level of the local administrative units by those communities that will be directly affected, and appropriate public participation programs will be initiated for this purpose. Coordination of these planning activities should be encouraged and linked to similar ones like environmental and health management plans. Partnerships in waste management planning will be encouraged and facilitated, including public-private and public-public partnerships.

Waste management plans for major waste generators such as institutions, industries, Petrol stations, hotels and other businesses should be prepared by developers/owners and submitted to MTC headquarters for review and approval. The developers/owners of such facilities will be required to comply with the waste management regulations, particularly the requirement to keep an inventory on wastes generated and on cleaner production practices.

### **5.1.2 Waste information system**

Initially, a WIS will serve the purpose of developing waste management plans and guiding waste management operations. The information required for general waste plans includes the waste category, as well as the amount of waste generated, collected, transported, recycled, treated and disposed off. The WIS will also supply information on the amount of hazardous waste generated to assist in the planning and the siting of hazardous waste treatment facilities.

However this strategy has taken into account spatial issues related to waste management, including the need for mapping of locations of major waste sources, land use and physical plans, property developments, and waste generation factors in order to optimize required waste management infrastructure, sites of gazetted waste collection points and transfer stations.

A Geographical Information System (GIS) as part of the WIS has been proposed and will require broader participation from the other departments such as physical planning, works, health, environment and development partners. The UN-Habitat is piloting the Local Urban Observatory in which Lira, Jinja and Entebbe Municipalities are among the beneficiaries. Such opportunity should be further explored.

In the short term however, the information required for the WIS will include:

- Mapped solid waste facilities – location, owner, operator, operations, transportation/pick up frequency, regulatory status;
- Waste sources, and generation rates;
- Waste flow diagrams including waste categories, origins and quantities, materials recovered, disposed, composted, and landfilled.

The WIS will also be helpful in the implementation of the proposed waste management bye - law, such as collection of service fees linked to property development and business licenses. However for the success of the WIS, guidelines describing details and operation of both the WIS database and its reporting structures need to be well defined by the TC headquarters. The focus of the WIS Guidelines is to ensure that all people submitting information to the WIS understand why they are being required to report, what their responsibilities are, the formats for the information, and what will happen to the information.

The waste management byelaw implementation guidelines should as well spell out clearly the requirement to provide waste

information to the Local Authorities who will be responsible for entering it into the WIS. The TC headquarters will be responsible for WIS implementation and operation, as well as data processing and quality assurance.

Sufficient capacity is currently not available for the implementation and operation of the WIS, although limited capacity for data collection does exist at the TC headquarters, as well as in the private sector. MTC will define the responsibility and the competency profile required for staff who will be involved with the WIS, as well as identify the shortfall of skills and develop an appropriate capacity development programme. The necessary skills may be acquired through attendance of specialised courses.

Non-governmental organisations and the general public will also be informed about the WIS, to enable them to understand the issues of integrated waste management and the need for their participation. Public awareness programmes may include the regular distribution of reports on the WIS in the printed and broadcast media.

### **5.1.3 Waste minimization and segregation**

Waste minimisation comprises any activity to prevent the formation of waste or reduce the volume and/or environmental impact of waste that is generated, treated, stored or disposed of. The strategy aims at reducing waste at source by generators and also limit what will be landfilled through recycling, reuse, segregation and composting.

For waste sources such as households, markets, hotels, shops, petrol stations and institutions (clinics, schools, hospitals, offices), waste segregation has been suggested. This requires provision of waste collection facilities including coded poly bags, coded waste bins and waste skips, and their strategic placement near waste generation points. There should be an emphasis of placement of coded waste bins along streets, in institutional premises, public places, among others.

Success of waste segregation practices will require clarity on waste categories, and enabling instruments including public awareness, initial funding for required infrastructure, and strengthening waste segregation provisions in the Town Council waste ordinance. The ordinance implementation guidelines should also emphasise regulations requiring waste minimisation assessments and plans as part of specified business permits, phasing out and/or prohibition of the creation, use or transfer of certain priority pollutants such as polythene bags. Guidelines for sorting and disposal of medical and other hazardous wastes should be developed.

#### **5.1.4 Waste collection: improving service coverage and waste collection**

During field surveys, the need for improved waste collection service coverage and efficiency was expressed, as well as limited resources. There is also limited infrastructure to aid waste collection, and little provision for transportation. Private sector participation has as well been successful in collecting and transporting waste.

Given the environmental and health risks posed to the community by uncollected waste, the central business district, identified high waste generation points and high population density residential areas will be prioritized in providing waste collection services. These areas will have coded waste skips where households can take their waste. For low-density areas, door-to-door collection has been suggested.

For high waste generation sources, such as markets, coded waste skips will be used and their numbers and services improved. Institutional waste collected in coded waste bins will be emptied into coded waste skips prior to transportation to the waste composting/ landfill site. The WIS will be key in improving service coverage and efficiency. It will reveal the major waste sources and generation factors, waste categories and resource requirements for waste collection.

The long-term objective for hazardous domestic waste is to provide central waste collection facilities at the local level. Separation of the hazardous component from domestic waste will enhance the

sustainability of recycling projects and render domestic waste collection and disposal a safer process.

Participation of the private sector in waste collection and transportation needs to be supported and emphasized. Waste should be collected at a fee, and this should be backed by a Waste Management Bye-Law.

For the estimated waste generation rate of 200 tons per day in the CBD and immediate catchment, the TC needs 2 trucks fitted with fork lifts of capacity 20 Tons to make ten trips each a day. This will improve waste collection efficiency and maintenance costs.

#### **5.1.5 Waste treatment and disposal**

Infrastructure for treatment of generated or collected waste, and its eventual disposal needs to be addressed. Given the scope of this strategy, treatment has been considered for hazardous solid waste and composting for organic waste.

First, segregation practices have to be emphasised to ensure hazardous and non-biodegradable waste does not mix with other waste to be composted. Secondly siting of incinerators meant to provide thermal treatment should limit impact of their operations on the environment. Other options for treatment of hazardous waste include solidification, immobilisation and cementation, which reduce the leachability and mobility of hazardous constituents. Purchase of an incinerator is a preferred option and it is proposed it is located at Katikolo Waste site.

Chapter 4 provides details of the proposed waste composting plant components and landfill.

#### **5.1.6 Long term strategy instruments**

The long term waste management strategy enabling instruments include increased public awareness, Institutional strengthening and capacity building, Increased involvement of Private Sector and Civil Society, development of a Waste Management Bye – Law and guidelines for its implementation, and Review and enforcement of

legislation/regulations and sustainable funding for waste management.

### **5.2 Waste composting and compost product market**

Section 3.9.3 presents one case of waste composting. A local in the neighbouring Seeta Town Council has been able in the recent past to undertake waste composting and sell manure to local farmers. Other identified clients by MTC include NARO (CORI, FORI) and several farmers in Mukono who are eager to improve their produce as advocated for under NAADS. The market rates for organic manure stand at Ug. Shs. 10,000 per ton, implying an additional income of Ug. Shs. 300,000 per day or UG. Shs. 1,168,000,000 per year to the TC for 30 tons of compost manure per day.

### **5.3 Funding for waste management**

Given the range of suggested priority initiatives for improved waste management in the Municipality, funding requirements will rise, hence modalities need to be worked out to ensure effective implementation of this strategy. MTC will have to look into the possibilities of increased funds from Central Government, Local Government allocations, Donor funding, NGO's and user fees, taxes, fines, licences all related to the waste management chain.

The table below provides some of the possible sources of funding for the waste management strategy.

Table: Funding sources for the waste management strategy

Funding sources	Programmes	Priority initiatives
LGDP II	<ul style="list-style-type: none"> <li>• Capacity building</li> <li>• Infrastructure improvement</li> </ul>	<ul style="list-style-type: none"> <li>• Waste treatment and disposal</li> <li>• Integrated waste management planning</li> <li>• Development of a Waste information system</li> </ul>
UN-Habitat	Local Urban Observatory (LUO)	<ul style="list-style-type: none"> <li>• Development of a Waste information system</li> </ul>
UNDP/UN-Habitat	Urban Ecosystems Programme	<ul style="list-style-type: none"> <li>• Waste treatment and disposal</li> </ul>
GEF, DFID	<ul style="list-style-type: none"> <li>• Cleaner Development Mechanism (CDM)</li> <li>• Carbon trading</li> </ul>	<ul style="list-style-type: none"> <li>• Waste treatment and disposal</li> </ul>
NGO's	<ul style="list-style-type: none"> <li>• Public awareness and capacity building</li> </ul>	<ul style="list-style-type: none"> <li>• Waste minimisation and segregation</li> <li>• Public awareness</li> </ul>
Local Government sources	<ul style="list-style-type: none"> <li>• Property Tax</li> <li>• Fees and Fines</li> <li>• Development Tax</li> <li>• Market dues</li> <li>• Trading licences</li> <li>• Waste site use fees</li> </ul>	<ul style="list-style-type: none"> <li>• Improved waste collection services coverage</li> <li>• Waste disposal site management</li> </ul>

## **6.0 PUBLIC CONSULTATIONS AND DISCLOSURE**

The few households within one kilometre radius around the proposed site were consulted using questionnaires and focus group discussions, which enabled us to get views of different groups of people at the same time in addition to capturing a lot of information in the shortest time possible. Community members were very positive about the proposed project and wanted the construction process to start as soon as possible.

The responses from sector agencies MTC in particular was that long-term positive attributes associated with the development of a waste composting plant and landfill outweigh the negative impacts as long as the recommended measures are properly and effectively implemented. In particular they requested the need for increasing on the site acreage for a longer shelf life.

The local community requested for employment at the proposed landfill instead of importing workers outside the village and requested for good conduct especially of the truck drivers that would be delivering the MSW.

Existing initiatives and experiences in waste composting further make a case for the project economic viability. The local communities are eager to benefit from the organic manure to improve their agricultural yields.

## **7.0 EVALUATION OF SIGNIFICANT ENVIRONMENTAL AND SOCIAL IMPACTS**

The physical, natural or sociological environment determines the magnitude of the environmental impacts of waste composting and landfill sites development, operation/usage and decommissioning. Poor site management and designs leads to significant environmental impacts to the immediate environment, including ground water contamination, noise, air, and dust pollution, litter from wind blown litter, vehicular accidents, vermin infestation and incidences of fire explosions. When effectively and efficiently managed, it will lead to improved sanitation within the MTCl and its immediate catchment, employment will be created in addition to enhancing organic production through making available the organic compost to the farmers. Income will accrue to the municipality through trading in carbon.

The project in question does not have irreversible environmental impacts on the environment, however the likely impacts if not mitigated can lead to degradation of the environment. This chapter identifies and evaluates significant environmental consequences of the development, operation/use and restoration of the landfill and waste composting site. While positive impacts should be enhanced, mitigation measures should be put in place to minimise or eliminate negative environmental impacts.

### **7.1 Physical and Biological Environment**

#### **7.1.1 Surface and Ground water contamination by leachate**

The major issue during the operation of a landfill is development of leachate that contains a combination of pollutants, and its siting near lake Victoria and local water sources. Leachate is created from water already present in the waste or entering from outside moving through the decomposing waste, and these may contain pollutants such as:

- Heavy metals such as manganese, chromium, nickel, lead and cadmium;
- Microbiological components;

- High COD and BOD levels which can be of particular concern; and
- Major elements and ions such as calcium, magnesium, iron, sodium, ammonia, carbonate, sulphate and chloride.

The design of the waste composting plant provides for a leachate tank unit, and an impervious lining for the landfill such that any run off into the cells will end up in the tank. The collected leachate will be recycled to the composting section to increase the moisture content of the decomposing waste. For the landfill, an impervious underground lining has been proposed which will trap any run-off water and will be directed to a sump and pumped back to the leachate tank.

To avoid any eventualities or in case systems break down, relocation of the water source within the immediate proximity where the community draws water from should be undertaken. A borehole should be availed to this community in addition to extending piped water and constructing water kiosks.

Pollution from heavy metals is unlikely given the measures proposed to ensure no hazardous waste reaches the waste composting plant. Some of these include waste segregation at source and purchase and installation of a hazardous waste incinerator.

#### **7.1.2 Effects of Landfill Gas: GHG emissions, fires**

Landfills generate a mixture of gases consisting predominantly of methane and carbon dioxide. The primary concern is methane gas, a potent green house, which is normally produced in concentrations of up to 65% of the landfill gas and is potentially explosive at concentrations of between 5 and 15% methane in air on confined spaces.

Waste composting will limit any GHG gas emissions, and the little generated at the landfill allowed to escape through pipes fitted at the landfill. Weekly turning of waste in the windrows will provide the required aeration to oxidise all the methane gas that would be produced.

The option of trapping the methane gas, or its use in generation of electricity has not been explored given the limiting costs involved in terms of investment, and the little organic waste generated compared to Kampala City.

### **7.1.3 Pollution**

Pollution of air, dust, and noise will mainly be from daily transportation of the waste to the disposal/composting site by the delivery trucks, periodic or daily excavations and covering/turning of the waste using mechanical means. During the construction and operation phase the equipment used will cause a lot of the noise, dust and exhaust fumes.

Emissions from the vehicles, plant machinery and equipment will cause air pollution. These emissions mainly contain sulphur dioxides, nitrogen oxides, and suspended particulate matter, all of which have great impact on public health, soils and crops.

Dust emissions will be a result of earthworks, transportation of MSW from the Municipal Council and its catchments to the landfill especially during the dry season. The impacts will be greatly felt by communities in the immediate proximity of where the access road passes. Fugitive dust has the potential of affecting the health of the workforce and area resident population. Noise is normally associated with construction works, transportation of the waste and the land filling activities.

Given the amount of waste to be disposed here, the level of mechanised works will be low. At the composting plant, only a backhoe will be required, and upto 4 trucks are required for delivery of waste. One wheel loader/bull dozer will be required once or twice a week for compacting waste at the landfill.

The impact of noise, dust, body waste and oil contamination will be mitigated as follows:

### **Dust**

The Town Council should consider upgrading the access road (stretch still under murrum gravel cover) to the landfill to bitumen status.

### **Noise**

A code of conduct should be put in place and observed by the workforce along the access road to the landfill. Proper maintenance/servicing of equipment and machinery in addition to sensitising the workforce on how best to minimise equipment noise will ensure reduced noise emission. Sensitisation of truck drivers not to hoot anyhow and introduction of signages about noise pollution will help reduce noise pollution.

### **Body Waste**

Body waste should be properly disposed of to avoid unsanitary and unhygienic environs at the waste disposal site. VIP latrines will be constructed for use by staff.

#### **7.1.4 Degradation of Material Source Points**

At this site, waste composting and landfilling will be undertaken. There will be a requirement for murrum gravel/earth cover at the landfill, but this will be low given the quantities of waste to be landfilled. Murrum will be obtained from part of the Katikolo waste site. The murrum excavated during landfill cell preparation will be set aside for landfilling purposes.

During earth extraction, excavations should be inclined at an angle to avoid development of steep flanks. The operators of other quarries (stone and sand) should have a management plan for them and during their operation water stagnation should not be allowed to take place. After use of the quarry, proper restoration should be carried out.

Acquisition of sand and rock materials to put in place the required office infrastructure, compost shade etc, is also associated with negative attributes like noise during blasting, dust and accidental

rock fall especially during transportation. Suppliers of these materials should have management plans or licences for their operations.

#### **7.1.5 Loss of Vegetation and Tree cover**

The proposed site development will result in loss of vegetation cover existing on the site to be developed and for the future expansion. This will be as a result of cell development/landfill development in addition to the infrastructure associated with the waste site such as access roads, office block, compost shade, drainage system, parking yard etc.

During the run-through survey, it was noted that all the vegetation cover and greenery is secondary due to the agricultural activities that have been on-going there. No endangered species were seen at the site. The lost vegetation should be compensated through planting additional trees during landscaping of the site along the buffer zone and when restoring the area upon closure.

#### **7.1.6 Raised Flanks**

Development of the landfill cells (2) and murrum extraction from the borrow pit will create relatively steep flanks that can cause accelerated soil erosion and accidental fall over if left unprotected.

#### **7.1.7 Erosion and Subsequent Development of Gullies**

Among the major issues during the operation of the landfill is soil erosion at the earth cover material source point as a result of the earth works and clearing of the vegetation cover in addition to raised flanks.

The speed of the runoff is one of the main contributing factors to erosion, siltation and increase in sediment load into the neighbouring lake ecosystem. Excavation at the material source point (murrum gravel) should be at a gentle inclined angle to reduce the speed of the storm water run-off. Proper drainage system should be put in place around the quarry. Earth works should be undertaken during the dry season and enough stocks prepared to reduce on the possibility of soil being washed down the slope. The embankments of the landfill and other undeveloped parts should be planted with grass and trees.

## **7.2 Socio-economic and Cultural Environment**

### **7.2.1 Social Order Disruption**

The proposed development will inevitably emit some noise and dust to the immediate neighbourhood. This will be a result of mechanised works, and waste transportation trucks. The development will induce reasonable vehicular volume in the area. This will especially be from vehicles ferrying waste. This poses the danger of accidents along the Mukono – Kati road.

The level of activities is of low key nature, not highly mechanised, and only 4 trucks will be involved. Transportation guidelines will be developed for delivery of waste including speed limits and use of netting on trucks to avoid waste dropping off the trucks and accidents. The engineering department should as well consider having humps along the delivery route to the Katikolo site.

### **7.2.2 Odour Generation, vermin eliminated**

Odours will emanate from decomposing waste and landfill gas. This will automatically inconvenience the neighbourhood and create unpleasant environment. But if the composting works are well managed, these gases will be eliminated by aerobic activity aided by daily mechanical and manual turning in the windrows. Foul smell will be highly localised to the plant premises. The composting works for a design capacity of 70 tons per day and periodic mechanical turning implies little room for vermin and scavenging birds.

### **7.2.3 Litter along the access road and wind blown waste**

Solid waste on uncovered trucks being ferried to the landfill normally falls off as it is being transported. This creates unsightly conditions in addition to causing poor sanitation conditions along the access road. The same is true with windblown waste from the landfill. This can be avoided by having roofs over the windrows. The sorted non-biodegradable waste will be landfilled. It is proposed that the MTC acquires an incinerator that could be used to burn hazardous wastes. Guidelines for implementation of the solid waste management ordinance should come out strongly against the use of polyethylene bags as packaging material and their disposal.

#### **7.2.4 The safety and health of the workforce, site scavenging community and the community within the proximity of the landfill**

Waste disposal sites/composting plant operations are associated with the possibility of accidental injury that may be either minor or major. The same is true for the community living along the murrum section of the access road where garbage trucks will be passing. Because of the likely increased vehicular volumes, there is a likelihood of increased incidence of accidents.

The impact of foul smells, noise and dust pollution can easily be reduced/mitigated by instituting the following measures.

- o As a long-term measure the section of the access road still under murrum cover should be upgraded to bitumen status or 1<sup>st</sup> Class murrum;
- o Careful driving should be the norm and observed by truck drivers hence they should limit their speed to 20km/hour when along populated sections of the Kati access road;
- o Truck delivering the MSW should be covered with tarpaulins;
- o Proper maintenance/service of equipment and machinery in addition to sensitisation of the workforce will ensure reduced noise emission;
- o Sensitisation of motor vehicle owners not to hoot anyhow and to leave vehicles on idling will reduce on emission of fumes hence minimal pollution of the air.
- o Periodic covering of the waste should be undertaken at the landfill and if the biodegradable waste is being composted, its regular turning will do away with any likely odours smell from being emitted.

Hygiene and sanitation issues have to be taken into consideration. The scavenging community should be provided with pit latrines at the landfill.

Protective gear should be accorded to the workforce in addition to having first aid kits on site for any emergency case. Training and knowledge of first aid administration should be given priority. The

workforce and scavenging community should have access to clean water for drinking.

The kind of activities to be undertaken including waste sorting, mechanical turning of compost, effluent treatment and sorted waste land filling require appropriate equipment and PPE. The equipment to be used will include a backhoe, spades, rakes, a forklift, wheelbarrows among others. The required PPE has to cater for eye, ear, nose, head, feet and hands protection, and will include eye glasses, ear muffs, respirators, gumboots, gloves, and where necessary helmets.

### **7.2.5 Lost opportunities for dependent communities**

The impact of this project on existing organic waste users will be minimal if not positive. With improved waste segregation practices, the few collectors of banana peelings and leaves will have easier access, and the rest transported for composting at Katikolo. The existing waste composting plant at Seeta is inadequate to serve market demands for compost and depends on only waste from Seeta urban area not Mukono Town Council CBD. Besides activities at this Seeta plant have since ceased. This gap is to be addressed by the waste-composting project at Katikolo.

It was noted and confirmed that establishment of this project will not in any way affect the incomes of communities so far involved in waste scavenging/reuse as they mainly limited to reuse of peelings.

### **7.3 Positive Attributes Associated with development of the Landfill**

Development of this Waste Composting site alongside a landfill will go a long way in ensuring safe and sound disposal of solid waste and when handled effectively it will turn into an income generating activity for the Town Council in addition to ensuring availability of rich compost manure. A clean environment will be registered within the Town Council, negative attributes associated with poor management of solid waste and cases of contamination done away with in addition to extending infrastructure currently lacking on this stretch of the road (Mukono – Kati) that includes piped water and electricity.

Employment is another factor that will arise as a result of locating this landfill in this area. This will be through direct employment and scavenging in addition to improving the Town Council's aesthetics.

Another major advantage is the extension of landfill life span. The quantities of materials, which require disposal at the landfill will be significantly reduced once the bulk of the largely organic waste is composted. This also means that the area required for landfill will be much smaller, in this case initially two cells, and hence also easier to manage. Thus the waste dumpsite puzzle that has for long haunted the Town Council will be resolved.

The possibility for revenue generation through sale of compost makes the project rather attractive in economic terms. The local community will be particularly eager to benefit from the compost plant manure product to improve productivity of their banana plantations.

The waste composting project also provides an opportunity for improved waste collection within the Municipality. This being an economic activity, privatisation of waste collection, transportation and management of the waste composting site will be possible. It offers an opportunity for carbon trading under the CDM. This will save the Municipality from previous scenes of delayed collection of waste.

The Waste Management Strategy presented in section 5 is expected to trigger privatisation of waste collection, starting with a bye-law and guidelines for implementation. The new initiatives will be waste segregation practices, and fees paid for waste generation.

However an action plan for this strategy needs to be further developed by the Town Council so that **ACTIONABLE** programs can attract funding.

## **8.0 ENVIRONMENTAL MONITORING AND MANAGEMENT PLAN**

There is need for putting in place a monitoring process to check the progress and the resulting effects on the environment by the proposed waste composting and landfill site at Katikolo. The process begins during the construction stage and continues throughout the waste site lifespan. Monitoring determines the effectiveness of recommended mitigation measures and includes regular reviews of the impacts that cannot be adequately assessed before commencement of operations at the waste site at Katikolo or which arise unexpectedly. In such cases, appropriate new actions to mitigate any adverse effects should be undertaken.

The management plan presents an overview of the considerations to be taken into account during the design, construction, operation and closure phases.

### **Environmental and social impact issues to be monitored include;**

- o Leachate management;
- o Surface and ground Water quality monitoring;
- o Efficiency of waste composting operations;
- o Efficiency of erosion control measures;
- o Availability of first aid facilities and emergency readiness;
- o Drainage system effectiveness;
- o Impacts of odours, flies, vermin, rodents, dust and noise pollution;
- o Health and safety of the scavenging community, neighbouring community and the site landfill workforce;
- o Occupational health and safety concerns at the waste site;
- o Containment of litter to the waste site;
- o Road safety measures in place and their impact on the immediate community;
- o Impacts on current waste user communities; and
- o Changes in land use and resultant effects.

Environment Management Plans provides a link between the mitigation measures or enhancing attributes put forward in the assessment report and the integration of these measures during the

design, construction, operation and closure phases. They provide details of impacts, measures to mitigate the impacts, whose responsibility, time frame and the cost of mitigation. Therefore the above has to be incorporated in the planning phase early enough to ensure that they are taken care of. Next page is the proposed Environmental Monitoring and Management Plan for Katikolo Waste Composting Plant and Landfill.

Environmental Monitoring and Social Management Plan

Activity	Environmental/Social Impact	Action Required/Mitigation Measures	Frequency of monitoring	Responsibility
<b>PLANNING PHASE</b>		-Incorporate EIA process and Source for consultant to undertake the EIA		Mukono Town Council
<b>CONSTRUCTION PHASE</b>				
Earthworks during construction phase, landfill excavation	-Possible contamination of the surface waters through increased suspended solids; -Accelerated erosion; -Destruction of vegetation and property -Air pollution; -Noise pollution -Interference with other physical infrastructure.	--Protect exposed slopes using conventional civil engineering structures in conjunction with bio-engineering techniques, such as planting embankments with grass; -Protect areas susceptible to erosion by planting trees and grass -Prevent ponding; -Cover trucks ferrying in materials with tarpaulins -Impose speed limits for construction vehicles and sensitising the workforce; -Undertake re-vegetating of exposed flanks; -Provide protective gear to workforce; -Provide first aid services on site and use nearby health services in case of an emergency; -Promote public involvement at the start of the project -Sensitising the local communities about the waste site development project; -Inform stakeholders of the impending works	<ul style="list-style-type: none"> <li>• Once before commencement of activities;</li> <li>• Weekly during construction</li> </ul>	<ul style="list-style-type: none"> <li>• Contractor</li> <li>• Mukono Town Council</li> </ul>

**Mukono Town Council**

Activity	Environmental/Social Impact	Action Required/Mitigation Measures	Frequency of monitoring	Responsibility
Excavation of murrum gravel/earth cover material	<ul style="list-style-type: none"> <li>-Development of dangerous un-stable steep sides</li> <li>-Ponding of water</li> <li>-Loss of land and vegetation cover</li> <li>-Noise and Air pollution</li> </ul>	<ul style="list-style-type: none"> <li>-Develop part of site to supply murrum gravel;</li> <li>-Do not site borrow pits on steep slopes</li> <li>- Do not site pits near settlements</li> <li>-While excavating murrum avoid ponding of water and development of steep flanks</li> <li>-Restore borrow pits after use</li> </ul>	<ul style="list-style-type: none"> <li>• Once before commencement of operations;</li> <li>• Monthly during landfill operations</li> </ul>	<ul style="list-style-type: none"> <li>• Contractor</li> <li>• Mukono Town Council</li> </ul>
Transportation of waste and construction materials such as gravel, hardcore, rock aggregate etc	<ul style="list-style-type: none"> <li>-Waste fall from trucks</li> <li>-Air pollution (dust)</li> <li>-Noise</li> <li>-Traffic accidents</li> <li>-Rock fall from trucks</li> </ul>	<ul style="list-style-type: none"> <li>-Limit speed of trucks and construct speed curbing devices as humps;</li> <li>-Put in place broad and clear signage's along access roads;</li> <li>-Trucks delivering construction material should be covered with tarpaulins;</li> <li>-Limit construction activities to day time only – no transportation of materials at night</li> <li>- Cover waste and materials transportation trucks with tarpaulins</li> </ul>	<ul style="list-style-type: none"> <li>• Daily during operations</li> </ul>	<ul style="list-style-type: none"> <li>• Contractor</li> <li>• Mukono Town Council</li> <li>• Local Community</li> </ul>
Sanitation at the waste site for workers	<ul style="list-style-type: none"> <li>-Creation of unsanitary conditions</li> <li>-Vulnerability to disease outbreaks, such as cholera</li> </ul>	<ul style="list-style-type: none"> <li>-Construct pit latrines on site for use during site development, and operations</li> </ul>	<ul style="list-style-type: none"> <li>• Monthly inspections by the Health Inspector, daily by contractor</li> </ul>	<ul style="list-style-type: none"> <li>• Contractor</li> <li>• Mukono Town Council</li> </ul>
Equipment Servicing	<ul style="list-style-type: none"> <li>-Contamination of soils and water due to oil spills</li> </ul>	<ul style="list-style-type: none"> <li>-Undertake equipment servicing in designated places</li> </ul>	<ul style="list-style-type: none"> <li>• Monthly inspections by MTC</li> </ul>	<ul style="list-style-type: none"> <li>• Mukono Town Council</li> <li>• Contractor</li> </ul>
Recruitment of construction workforce	<ul style="list-style-type: none"> <li>-If sourced outside construction area likely to increase incidences and spread of diseases</li> <li>-Pressure on social services</li> <li>-Improved household incomes</li> <li>-Creation of employment opportunities</li> </ul>	<ul style="list-style-type: none"> <li>-Recruit workforce from around the waste site area</li> <li>-Sensitise workforce about the risk of diseases</li> <li>-Supplement health services</li> </ul>	<ul style="list-style-type: none"> <li>• Once prior to commencement of operation, bi-annually during operations</li> </ul>	<ul style="list-style-type: none"> <li>• Mukono Town Council</li> <li>• Contractor</li> </ul>

**Mukono Town Council**

<b>Activity</b>	<b>Environmental/Social Impact</b>	<b>Action Required/Mitigation Measures</b>	<b>Frequency of monitoring</b>	<b>Responsibility</b>
Storm water management	-Accelerate soil erosion --Destabilised landfill flanks	-Construct drainage system for proper direction of storm water, preventing entry into waste site and landfill -Avoid storm water reaching the landfill -Cover compost yard with roof	<ul style="list-style-type: none"> <li>Once before construction, monthly during construction and operations</li> </ul>	<ul style="list-style-type: none"> <li>Mukono Town Council</li> <li>Contractor</li> </ul>
<b>OPERATION PHASE</b>				
Vehicular traffic delivering waste	-Increased human accidents -Increased noise generation -Increased dust pollution -Litter along access roads	-Put up informative and warning signage's -Erect speed control devices like speed humps near populated areas -Undertake vehicle/equipment servicing -Upgrade the access road -Local communities are encouraged to report cases of bad conduct by the drivers	<ul style="list-style-type: none"> <li>Weekly during operations</li> </ul>	-Mukono Town Council -Contractors
Use and servicing of Equipment	-Air pollution -Land Pollution -Body Accidents	-Plant trees along the buffer zone and the access road to filter particulates -Service equipment from designated areas -Accord protective gear to workforce -Ensure proper vehicles, machinery, equipment maintenance	<ul style="list-style-type: none"> <li>Monthly checks by the municipality, weekly by the contractors</li> </ul>	<ul style="list-style-type: none"> <li>Mukono Town Council</li> <li>Contractor</li> </ul>
Maintenance of Storm water Drainage system	-Increased turbidity of water -Development of gullies along the drainage channels and down slope	-Put in place outfall drains with erosion protection measures -Ensure drainage channels are regularly desilted	<ul style="list-style-type: none"> <li>Once Monthly</li> </ul>	<ul style="list-style-type: none"> <li>Mukono Town Council</li> <li>Contractor</li> </ul>

**Mukono Town Council**

Activity	Environmental/Social Impact	Action Required/Mitigation Measures	Frequency of monitoring	Responsibility
Waste sorting and disposal	<ul style="list-style-type: none"> <li>-Gas Development</li> <li>-Leachate development, contamination of water sources</li> <li>-Attraction of birds</li> <li>-Attraction of rodents, vermin, flies</li> <li>-Disposal of hazardous waste in landfill</li> </ul>	<ul style="list-style-type: none"> <li>-Promote waste segregation at source;</li> <li>-Undertake waste sorting at the waste site;</li> <li>-Undertake composting of the biodegradable waste</li> <li>-Have an HDPE or clay liner for the bottom of landfill cell, and sump to collect any leachate</li> <li>-Undertake periodic covering of the rest of landfill waste</li> <li>-Pick the litter within the buffer zone;</li> <li>-Ensure proper immobilisation of hazardous waste, including incineration, cementing</li> <li>-Privatise management of landfill and composting plant</li> <li>-Provide PPE for workers involved in waste sorting</li> <li>-Expedite efforts to develop waste management bye-law and implementation guidelines</li> </ul>	<ul style="list-style-type: none"> <li>• Weekly operations during</li> </ul>	<ul style="list-style-type: none"> <li>• Mukono Town Council</li> <li>• Contractor</li> <li>• NEMA</li> <li>• NGO's and other civil society</li> </ul>
Waste Scavenging	<ul style="list-style-type: none"> <li>-Contraction of infections resulting from direct contact with waste</li> <li>-Body/eye respiratory infections</li> </ul>	<ul style="list-style-type: none"> <li>-Offer and use protective gear to workforce while sorting waste</li> <li>-Periodic check up and treatment of workforce</li> <li>-Promote waste sorting at source to minimise scavenging</li> <li>-Make recyclable waste freely available after sorting to scavengers</li> <li>-Maintain First Aid Kit at waste site</li> </ul>	<ul style="list-style-type: none"> <li>• Weekly operations during</li> </ul>	<ul style="list-style-type: none"> <li>• Mukono Town Council</li> <li>• Contractor</li> </ul>
Landscaping at the landfill	<ul style="list-style-type: none"> <li>-Improves the area aesthetics</li> </ul>	<ul style="list-style-type: none"> <li>-Proper maintenance of the landscaped buffer zone</li> <li>-Tree and grass planting on unused parts of the site</li> <li>-Fencing off the area to prevent trespassing</li> </ul>	<ul style="list-style-type: none"> <li>• Once before operations</li> <li>• Monthly once commissioned</li> </ul>	<ul style="list-style-type: none"> <li>• Mukono Town Council</li> <li>• Contractor</li> </ul>

**Mukono Town Council**

<b>Activity</b>	<b>Environmental/Social Impact</b>	<b>Action Required/Mitigation Measures</b>	<b>Frequency of monitoring</b>	<b>Responsibility</b>
Excavating murrum gravel	<ul style="list-style-type: none"> <li>-Development of dangerous un-stable steep sides</li> <li>-Ponding of water</li> <li>-Loss of land and vegetation cover</li> <li>-Noise and Air pollution</li> </ul>	<ul style="list-style-type: none"> <li>-While excavating murrum avoid ponding of water and development of steep flanks</li> <li>-Restore borrow pits after use</li> <li>-Contrators to have licences and site management plans</li> </ul>	- Weekly during operations	<ul style="list-style-type: none"> <li>- Mukono Town Councill</li> <li>- Contractor</li> </ul>
Composting of sorted MWS, leachate	<ul style="list-style-type: none"> <li>-Odour development</li> <li>-Leachate development</li> <li>-Acidity of nearby soils</li> <li>-Contamination of surface and ground water</li> <li>-Toxic final product</li> <li>-Pathogens</li> <li>-Likelihood of diseases by the workforce/scavenging community</li> </ul>	<ul style="list-style-type: none"> <li>-Frequent turning of the compost on windrows, weekly by backhoe</li> <li>-Provide a roof for the windrows</li> <li>-Construct waste composting slabs, leachate collection sumps and treatment plant</li> <li>-Train workers and provide protective gear</li> <li>-Test the final compost product</li> <li>-Have first aid kits on site</li> <li>-Develop existing groundwater source to monitor water quality</li> <li>-Provide alternative water sources for residents, including piped water</li> </ul>	<ul style="list-style-type: none"> <li>-Daily during operations</li> <li>-Monthly water quality monitoring by MTC, and quarterly by DWD</li> </ul>	<ul style="list-style-type: none"> <li>-Mukono Town Councill</li> <li>-Contractor</li> <li>-NEMA</li> <li>-DWD</li> </ul>
<b>LANDFILL CLOSURE</b>				
Restore landfill/landscaping	<ul style="list-style-type: none"> <li>-Improved aesthetics</li> </ul>	<ul style="list-style-type: none"> <li>-Put liner of earth material on top of waste</li> <li>-Carry out re-grassing and tree planting in the area</li> <li>-Undertake proper landscaping</li> <li>- Monitor water sources</li> </ul>	Once prior to decommissioning, Quarterly after decommissioning	<ul style="list-style-type: none"> <li>-Mukono Town Councill</li> <li>-Contractor</li> <li>- NEMA</li> </ul>

## **9.0 MAIN FINDINGS AND RECOMMENDATIONS**

Much of the generated waste from MTC and the immediate catchment is composed of about 80% vegetable matter with the rest (glass, clinical waste, waste paper, plastics especially low-density polyethylene, worn out tyres and wood shavings) constituting nearly 20%.

Currently, the Municipal Council disposes off the waste on open grounds and on people's farms on request. Communities within the Municipal Council and its immediate neighbourhood that do not have access to waste handling infrastructure normally dispose of their waste along the roadway verges and channels. Waste segregation is not practised.

The municipality has limited infrastructure and resources for effective management of the generated solid waste, hence the delays in waste collection, and disposal. This project provides an opportunity to improve waste management within the Town Council. Weaknesses in the waste collection and disposal trajectory have been identified, and waste collection and disposal can turn out to be an economically viable venture. Mukono Town Council should expedite completion of the waste management bye-law and develop guidelines for its implementation. The current council resolutions encouraging private – public partnerships in waste management are commendable. The waste management strategy presented in section 5 identifies priority action areas that the Town Council should address.

A major issue will be costs for development of appropriate infrastructure at the waste composting and landfill site, and ensuring sustainability of its operations. The proposed action plans for the proposed strategy presented in section 5 should be developed to address these concerns, including capacity building and funding.

With waste composting alongside landfilling, probable impacts from leachate and GHG's, the costs associated with short lifespans for landfills, are all eliminated, and an opportunity presented in terms of sales of organic manure per day, trade in GHG's under CDM, and reduced impact of waste on public health within the Municipality. Section 7 presents mitigation measures for significant impacts and 8 environmental and social management and monitoring plan that calls for multi stake holder involvement, for which MTC will take a lead role in implementation.

Based on the above, MTC seeks approval of the environmental component of the proposed waste composting plant and landfill. For any activities in future to be introduced at this site, which were not considered under this assessment, an additional impact study will be done.

## **10.0 References**

1. Forestry Department (2003). *National Biomass Study: Technical Report*. Kampala, Uganda.
2. Mukono District Local Government, 2005: *State of Environment Report, 2005*.
3. Mukono Town Council, 2003: Three Year Development Plan 2003/2006;
4. NEMA, 2004: *Environmental Legislation of Uganda*. Kampala, Uganda.
5. NEMA, 2005: *National State of Environment Report for Uganda, 2004/2005*. Kampala, Uganda.
6. Uganda Bureau of Statistics, 2005: *Statistical Abstract, 2005*. Kampala, Uganda.

## **11.0 Appendices**

- Site Geophysical measurements Report
- Site lay out plan for the proposed waste composting plant and landfill
- Consultees contacted during the study
- Summary of recommended national effluent standards

**Site Geophysical measurements Report**

**Appendix 2**

**Site lay out plan for propose waste composting plant and landfill**

**Appendix 3**

**Consultees contacted during the study**

**Appendix 4**

**Summary of recommended national effluent standards**

**Appendix 5**

**Terms of reference for EIA of the Waste Composting Plant**