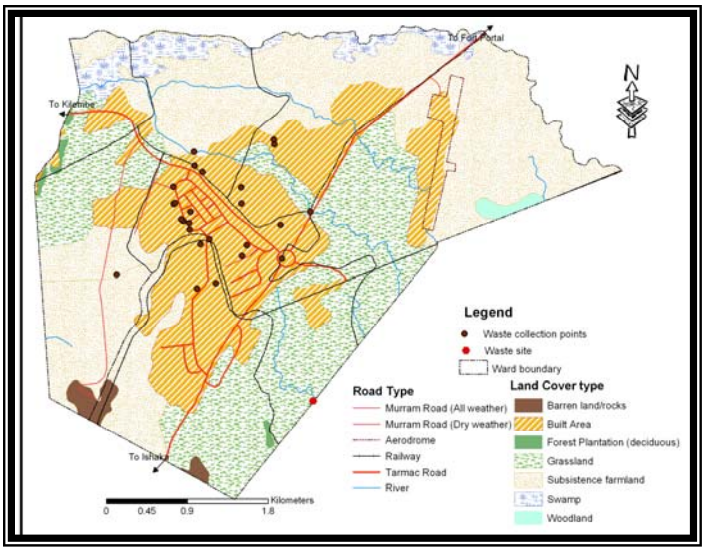
KASESE TOWN COUNCIL



Environmental Impact Statement for the Proposed Waste Composting Plant and Landfill for Kasese Town Council

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PREPARERS OF THIS REPORT

ENVIRO-IMPACT and MANAGEMENT CONSULTS was contracted by Kasese Town Council to undertake the Environmental impact Assessment study of the proposed Waste Composting Plant and Landfill, and prepare this EIS on their behalf.

Below is the description of the lead consultants who undertook the study.

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Acknowledgements

The Assessment Team would like to thank all those who provided information that made it possible to prepare this report. In particular, the Assessment Team would like to thank Kasese District Local Government and Town Council Officials, residents and the business community within KTC, neighbours to the proposed project site and the technical staff from NEMA.

Abbreviations and Acronyms

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

EXECUTIVE SUMMARY

Introduction

Kasese Town Council has for long not had an appropriate waste disposal site. Open dumping is practiced, with gardens, fields, roadwasy verges, and stream channels used for dumping. To ensure effective disposal of the generated solid waste, KTC has acquired land located approximately 3 kilometres from the CBD where waste composting and land filling will be undertaken.

KTC has got a population of approximately 55.167 people with 27.587 males and 27.630 females as of 2002 Population Census and at a growth of 9% per annum the present resident population is estimated at 77.872. These are 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 has sub-urban areas and urban centres, as well as industries, including Hima, Katwe and Kilembe.

Kasese is known for its mining industry including Hima Cement Works, Kasese Cobalt Processing Plant, Kilembe Mines, and the tourism industry based on Rwenzori Mountains, and the Queen Elizabeth protected areas.

The proposed waste site is located within Kasese Town Council, currently under savannah grassland and shrubs. To the East and south of this Site is the Queen Elizabeth National Park, an industrial area in the western and northern neighbourhood, and the Railway Station to the far north.

The proposed site, which measures approximately 6 acres, is well isolated from homesteads, is intended for waste composting and disposal of KTC solid waste. The Town Council and its immediate catchment generates solid waste, composed of vegetable matter (90%), glass, clinical waste, waste paper, plastics especially low-density polyethylene, worn out tyres and wood shavings. The Town Council collects only 42 tons of the well over 200 tons generated on a daily basis.

The Town Council has several waste collection points, with 6 waste skips distributed around the Town, and 2 bunkers for handling of waste. For waste transportation, KTC has two trucks (one TATA lorry

and one JIEFANG truck **– [broken down]**) and hires one Skip loader truck. Todate no sorting of waste takes place thus all the generated solid waste finds its way into the garbage skips and eventually to the pen dumping 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 proposed 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. Construction works will also be aimed at putting in place landfill cells access roads, waste composting slab, office block, parking yard and installation of the weighbridge.

During the operational phase the major activities will involve waste transportation, waste composting and land filling, and management of the waste site. 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 organic 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 Kasese 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 this area where this landfill and waste composting site will be located. This 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 composting site management.

Other benefits include elimination of odour problems and vermin infestation associated with existing dump sites, a longer lifespan for the 6 acre site, and improved capacity and efficiency in waste management for the Town Council.

Identified likely negative impacts

Development of waste composting plants and landfills 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 KTC. 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;

- 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 Kasese-Bushenyi Highway should be paved;

- 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.

- Development of a KTC solid waste management bye-law should be of priority to ensure sustainability of improved solid waste management in theTown Council. This will also help in the implementation of the Solid Waste Management Policy.

Conclusion

To sustainably implement this project, KTC 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 Railway Cell, Kasese Ward, KTC, Busongola County 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.

Kasese 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 of waste from urban 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 (UNFCC), 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 carbon dioxide missions only to transportation and mechanical turning.

Waste steams from KTC

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. KTC generates well over 200 tones per day, 90% of which can be composted. Therefore the proposed waste composting plant is a timely project that should be developed to be able to serve the fast growing urban centre. The proposed site is located approximately 3 kilometres from the centre of KTC in a sparsely populated area with the immediate neighbourhood a gazetted industrial area.

The site measures approximately 6 acres and is under savannah grassland and shrubs. Putting in place the above-proposed developments (waste composting plant and landfill) is likely to have both positive and negative impacts on the environment hence the need to undertake an environmental impact 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 waste composting plant and landfill, 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 waste composting and 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 KTC 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 Kasese District State of Environment Report, the Kasese Town Council three year development plan, Kasese Town Council Waste Management Policy, 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 Town Council.

The technical personnel interviewed included representatives of such institutions as KTC – Town Clerk's office, Hotels, NWSC, District and TC Health and Environment Officers, District Director of Health Services and Engineering department of KTC. Among the major waste generators interviewed were market operators, hotel and shop owners, School authorities, and generators of hazardous waste including clinics, hospitals, garages and Petrol Service stations.

1.3.4 Public Consultations

The consulting team held consultative meetings in Railways and Base-Camp, Kilembe Hospital villages among others and with the leadership of KTC to capture information on the acceptability and viability of the project, and on the effectiveness of waste management system in KTC. 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 drains into the Queen Elizabeth National Park, and into Lake Edward and George. 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 Hydro-geologist, 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 KTC 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 KTC 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.

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 (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, 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 Town 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 (Kasese District Land Board) is charged with the responsibility for land issues at the local government level.

2.3.6 Kasese Town Council

KTC 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.

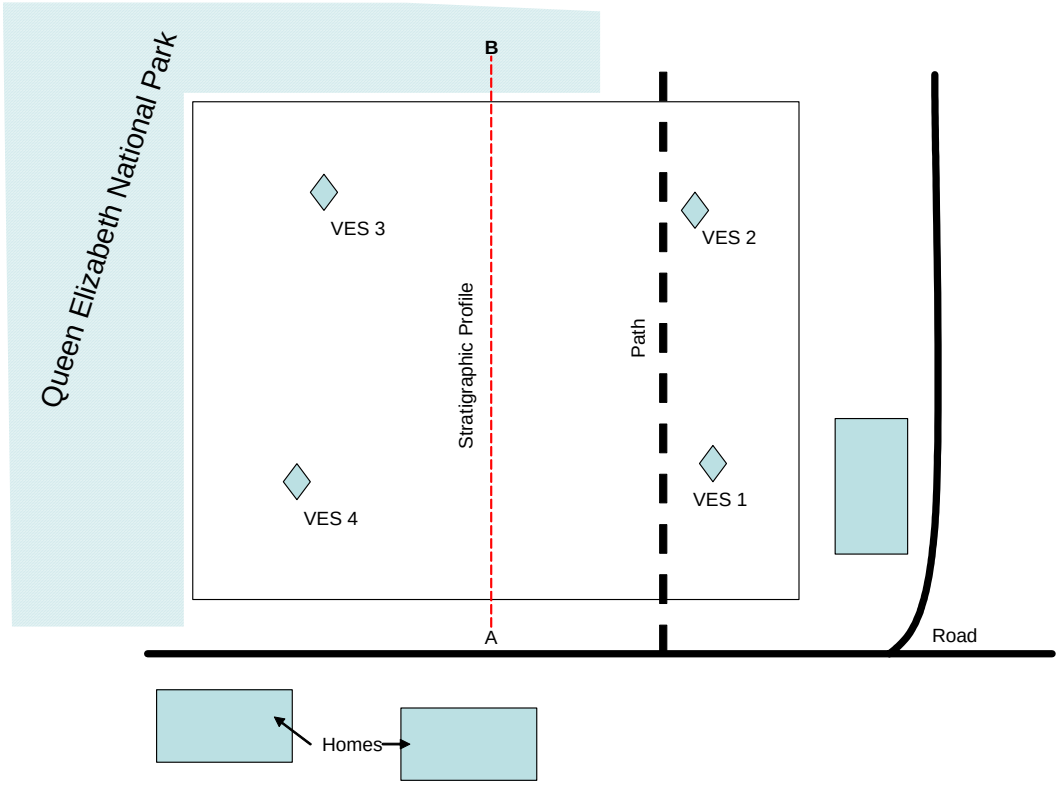
Though NEMA is charged with the coordination of sectoral environmental issues, KTC must ensure that environmental and social impact assessments for this landfill and waste composting plant is adequately carried out, mitigation properly incorporated and the construction process is environmentally and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

3.0 PROJECT SITE ENVIRONMENTAL BASELINE CONDITIONS

3.1 The Project Area

The proposed Waste Composting Plant and Landfill will be located 3km from the KTC CBD. The Site is 6 acres in extent and is under sannah grassland and shrub vegetation. The pictures below presents the site immediate neighbourhood, with the Queen Elizabeth National Park to the south. There are access roads in place to the site and temporary settlement on part of the industrial park land. The area has a few scattered homes to the north and west of the site.

Figure: Infrastructure around the waste site



The pictures below and on next page potray land use at the site and its immediate neighbourhood.

The site and the southern neighbourhood – QENP

The northern neighbourhood to the site

Part of the site and the western neighbourhood - KTC

Part of the site and the eastern neighbourhood

3.2 Geology and soils

The site is covered by Cainozoic rocks also found in the areas such as the plains in the areas of Kasese town council, Muhokya, Kitchwamba, Karusandara, and Lake Katwe, where rift valley sediments are evident. The site is mainly of the western rift valley geology comprising of inter bedded sands and clays. The area is generally thinly covered with loamy topsoil, sand and then clay. The area is generally flat at an average altitude of 949m above sea level. The soil cover is of sandy soils. The figure below presents the site stratigraphy.

Figure: Site stratigraphic setting

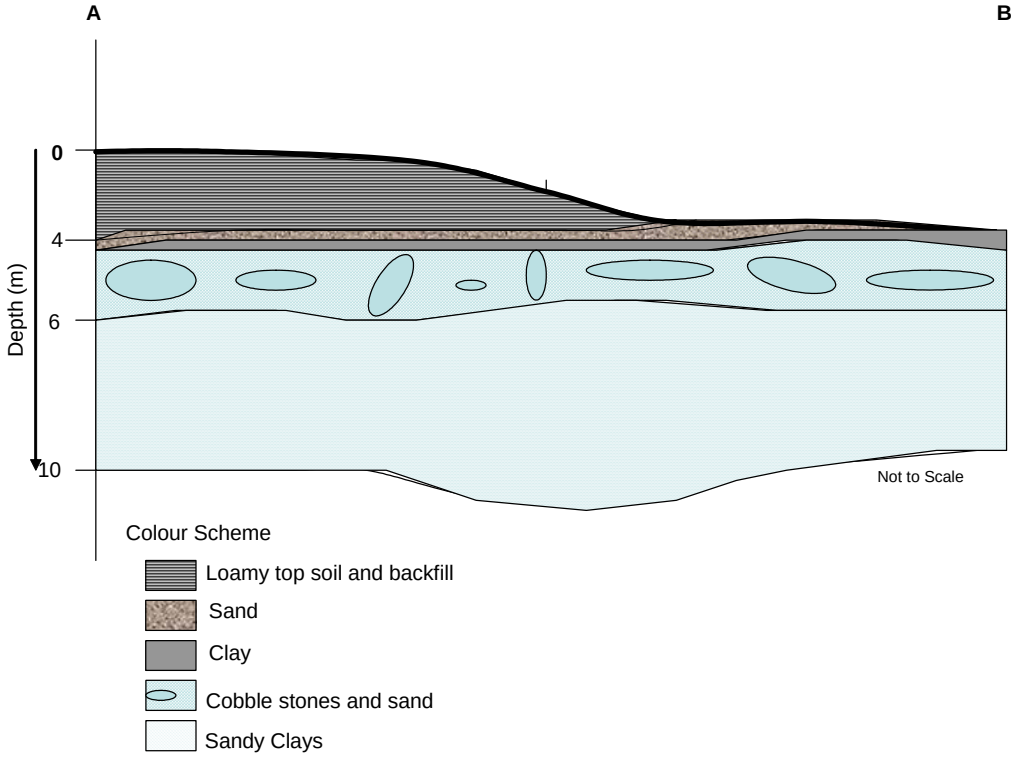
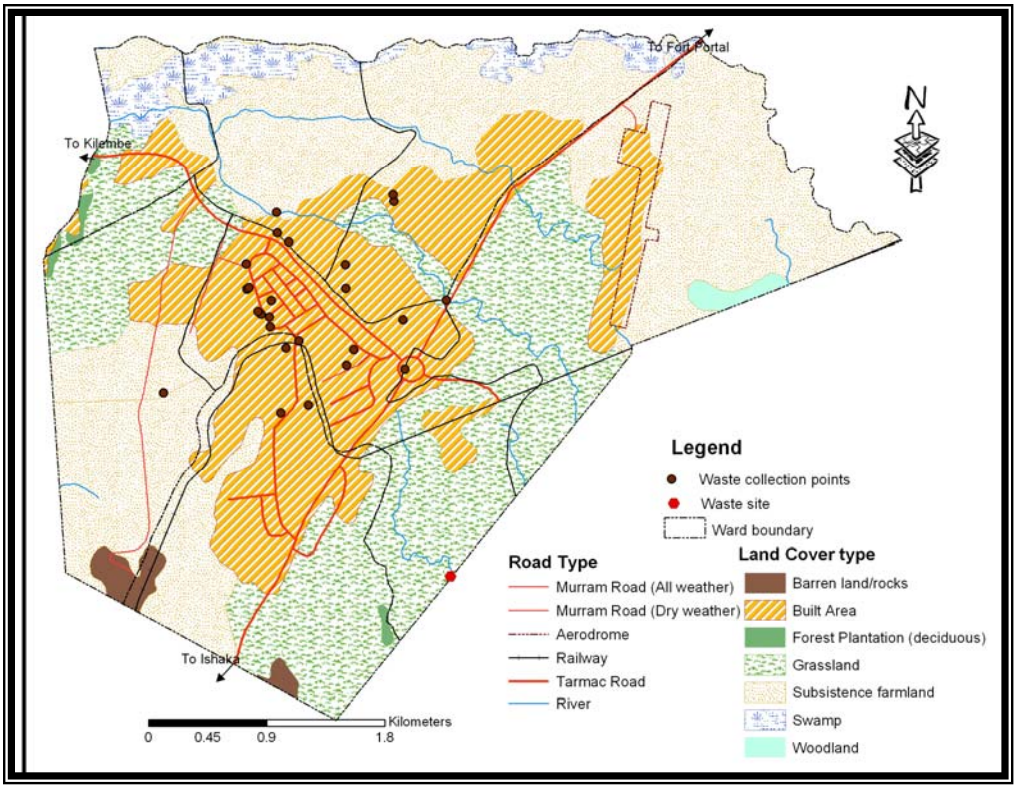


Figure: Kasese Town Council Land use, collection points and waste site



3.3 Geomorphology and Drainage

The geomorphology of Kasese district gives an impression that there is a line running diagonally southwest to northeast which roughly divides the district into two parts. The western half is mountainous terrain while the eastern half comprises the plains lying roughly between 900m and 1800m above sea level. On the slopes are remnants of lowland surface.

The project site is within the lake George catchment area. The principle affluent rivers which feed the lake include Nyamwamba, Rukooki, Mubuku and Rwimi, which drain the eastern slopes of the Rwenzori mountains and enter the lake through extensive swamps on the north shore. The swamps are 21km long, up to 14m deep and occupy about 26sq.km. The lake surface supports dense floating vegetation and the peripheral swamps are dominated by *Cyperuspapyrus*.

3.4 Climate

The district experiences bimodal rainfall pattern. The first rains are short and occur during March - May, and the longer rains from August - November. Annual rainfall ranges from less than 800mm - 1600mm, and is greatly influenced by altitude. In terms of total annual rainfall, the extreme southern to south-eastern part of the district receives slightly less than 800mm (Figure 5). The savanna area especially covered by the Queen Elizabeth National Park and lakes George and Edward, receive 800 - 1000mm. For the central part of the district stretching diagonally in the south-west to the north-east direction, annual rainfall ranges from 1000 - 1200mm. At the foot-hills of the Rwenzori Mountains the amount is 1200 - 1400mm. From the foothills to the mid-slopes rainfall received is 1400 - 1600mm; and for the mid-slopes to the summit, 1600mm.

3.5 Vegetative Cover

this site and the neighboring Queen Elizabeth National Park is covered by savanna grasslands.

3.7 Water sources

River Nyamwamba with its numerous wetlands is a potential source of water to support urban agriculture through irrigation. The Town is also served with piped water supplied by the National Water & Sewerage Co-op from Kilembe, which is a potential for industrial domestic and commercial activities.

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 Kasese District Land Board. The site is in the neighbourhood of an area planned for industrial development.

The present Town covers a total land area of 18 square kilometers distributed as follows:

- Residential land 50%
- Commercial land use 20%
- Industrial land use 20%
- Institutional land use 5%
- Recreational land use 5%

Plans are underway to increase the land area to 78 sq km in preparation for elevation to a municipality.

3.8.2 Population and administrative structure

Kasese Town Council, measuring 18 sqkm is located 420 km south west of Kampala City. According to the 2002 census results (UBOS 2002), The Town has a total population of 55.167 people with 27.587 males and 27.630 females. At a growth of 9% per annum the present resident population is estimated at 77.872. Average daily transit population is also estimated at 40000 people per day.

3.8.3 Administrative structure

Kasese Town Council is a lower local Government under Kasese 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. Kasese Town has 9 administrative wards with 28 cells/villages.

Table: Population by gender & Parish

Parish	No. of cells	Population		Total 2002	Projected 06/07	no of household
		M	F			
Town Centre	3	4913	4830	9743		2161
Nyakabingo	3	1225	1156	2381		347
Kamaiba	4	3584	3808	7392		1327
Kanyangeya	4	2945	2947	5892		1111
Nyakasanga II	4	3816	3809	7625		1622
Nyakasanga I	6	9185	9224	18409		3059
Base-camp	2	1869	1856	3725		882
Kisanga	2					
Total	**26**	**27537**	**27630**	**55167**		**10509**

3.8.4 Economic Activity

Kasese is predominantly an agricultural district. The main economic activities for communities surrounding the site area are subsistence agriculture including crop and livestock farming, as well as sand mining. Within the CBD, trading, employment income mainly from KCCL, Kilembe Mines and Hima Cement, and the service industry dominate the core undertakings.

3.8.5 Human Settlements and Housing

There is a problem of unplanned settlements (slum areas), homelessness, substandard housing and no security of tenure. 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 KTC.

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 KTC are relatively more developed than any other part of the district.

Access to safe Water and Health Services

KTC is covered by NWSC. Water coverage is projected at 67.7% and the main source of water is piped water provided by NW & SC. This is based on the number of house holds who access water within 200 meters. Over 65% of the Town population relies on pit latrines with a few water borne toilets in Town Centre.

Transport and communication

KTC has an extensive road network, transport terminals and parking facilities. Kasese Town Council has a total road network of 63.3 km, of which 2 km is tarmac while 22.3 is gravel roads and the remaining are earth roads. Some peri-urban communities still lack accessibility to the central business area. Road transport is still the major mode of transport for both passenger and cargo traffic. KTC also has a Railway terminal though not functioning.

Energy sources

The major sources of energy in KTC 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 KTC and the district in general.

3.9 Solid waste management in Kasese Town Council

3.9.1 Solid Waste generation and collection

Waste collection is the responsibility of KTC and undertaken by three departments, including the Engineering department responsible for provision and maintance of trucks, and the Health Departments. KTC is only able to collect 42 tons of generated solid waste from the CBD, over 90% of which is biodegradable.

The town Council has six waste skips and 2 bunkers for temporary storage of waste. The table in appendix 2 provides details of waste generators in KTC. KTC targets to increase waste collection from 40% to 75% by 2009.

Table: Major waste generators in KTC

No.	Waste Generators	Numbers	Typical waste quantity per unit per day in kg
a.	Households	10509	9kgs
b.	Shops	1200	1kg
c.	Office, institutions, religious places	42	2kgs
d.	Market places	12	4000kgs
e.	Industries (coffee hullers & Cotton ginneries)	17	5000kgs
g.	Others (pl. Specify)		
	Construction debris	50 sites	20kgs
	Schools and Colleges Boarding	11	40kgs
	Schools and colleges day	37	10kgs
	Hotels and Restaurants	81	30kgs
	Bars and lodges	63	3kgs

Expenditure on waste collection remains low, the budgte for 2006/2006 for solid waste management at Ug. Shs. 42,368,000. Expenditure on private garbage collection for the same year stands at Ug. Shs. 37,368,000, and Investment on solid waste equipment at Ug. Shs. 25,000,000.

Hazardous waste management still remains a challenge, particularly from hospitals, pharmaceutical industries, chemical industries, garages, fuel depots and service stations. KTC has inadequate facilities for waste treatment or disposal such as landfills or incinerators, and also waste segregation and waste conversion

into useful products. 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.

3.9.2 Current uses of organic waste

As stated above, over 90% of the waste generated in Kasese Town Council CBD is organic waste, capable of conversion into compost manure. There are initiatives by residents of Habitat Village to undertake waste composting of domestic waste, but this is at subsistence level. Coffee husks are being purchased by farmers and spread on gardens to decompose naturally.

Some of the waste handling infrastructure in Kasese Town Council and their current status

The old incinerator at Kilembe Hospital used to burn medical waste. Kasese Town Council does not have one

Such special and hazardous waste from petrol stations finds its way into the municipal waste.

4.0 PROJECT CHARACTERISTICS AND WASTE DISPOSAL ALTERNATIVES

4.1 Introduction

The current waste disposal practice in KTC involves disposal of the solid waste in open dump sites. Coverage of Waste collection infrastructure and services remains low, with upto 40% (42 tons per day) of solid waste in the CBD collected. The waste composition includes 93.8% organic waste (including vegetable matter, food remains and tree cuttings), and 6.2% non biodegrable waste including plastics, polyethene, scrap metal, waste oils and pharmaceutical waste.

To ensure effective disposal of the generated solid waste, KTC has designate 6 acres of land in the industrial park located approximately 3 kilometres from 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 planned for by KTC. However the site meet the minimum requirements, such as isolation from residential areas, accessibility and short haulage distance of 3km, spacious site – 6 acres, and likely limited impact on the bio-physical environment.

Key Characteristics of MSW dumping sites

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

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 Town 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 KTC is openly dumped, 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 solid waste, as has been the practice for KTC over the last 8 years. 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 KTC 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 land, 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 KTC 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 during its lifespan, and decomissioning. The considerations for sound technical practices for MSW Landfills are:

- Siting;
- 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. This option is also not tenable given the costs involved, and the likely contamination of water sources with leachate if an impervious bottom lining (such as clay lining) and leachate treatment plant is not put in place.

4.2.4 Waste composting alongside landfilling

Given the quantity of organic waste generated, development of a waste composting plant together with a sanitary landfill is an admirable option. With improved waste collection up to 75% per day of waste generated in the KTC CBD, 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 leachate treatment allaying fears of water source or aquatic ecosystem contamination.

Just over 10% of the collected waste will end up in the landfill, extending the lifespan of the waste site. 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.

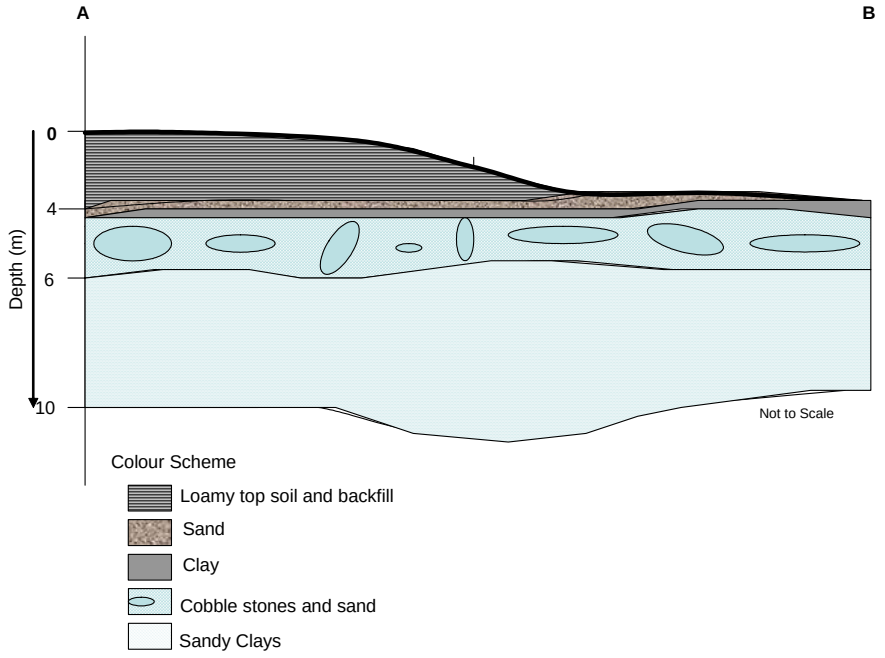
4.2.5 Energy generation alongside landfilling

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 is out of range for the Town Council finances (estimated at over 2 million dollars), and for now needs further study. Kasese Town Council is advised to explore this option further.

4.3 Design Considerations

4.3.1 Area Hydro-geology in design considerations;

The area hydro-geological investigation results allow for excavations on the northern section of the site to 4m, where sand mining has not been undertaken.



4.3.2 Design and operations of the composting plant

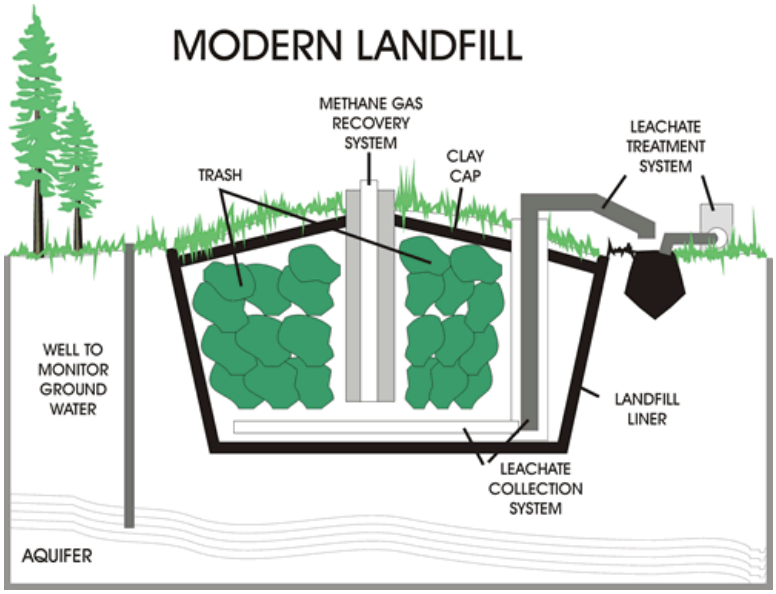
The composting plant will utilize windrow technology. Its design capacity is 70 tons of organic waste. The major equipment used here will include a back hoe and forklift for turning waste and moving it to the next windrow, but waste sorting will be undertaken manually. Upto 15 persons will be employed 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 higher 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 Kasese Town Council will develop two landfill cells each of capacity 16000m^3 (80 x 50 x 4) after excavation. The bottom will be lined with an impervious clay lining to ensure that any run off water is directed to a leachate collection sump and pumped to the treatment plant.

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 waste composting plant and 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 embarkments.

In developing this site, the natural drainage will be re-inforced and embarkments stabilised. No landfill cell should be created in the middle section of the landfill site as this is a natural waterway.

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 Town Council 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 national power grid and NWSC water pipes already cover the industrial area.

4.3.8 Site landscaping

Given the nature of the site due to previous activities like sand mining, there will be need for site landscaping. More land should be acquired adjacent to the industrial area to 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 murram 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 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.

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, wash rooms and VIP latrines for the management and staff, and a parking yard for vehicles will be constructed.

4.3.13 Construction Of Access Road, Weighbridge, Washing Bay

An access road to the waste site exists. It will only require upgrading/paving to ensure that dust emission is suppressed. There will be navigation routes established within the waste site itself. 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, and aid collection of waste disposal information.

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 Kasese 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. Kasese 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. The current institutional framework for solid waste management in Kasese Town Council is centralized with little public participation. Solid waste management is perceived as a responsibility of the Urban Authority. There is limited involvement by institutions such as Local Councils, Households, NGOs and CBOs, as well as production/health and environment committees.

However, a draft policy for waste management in KTC has since been developed.

KTC Waste Management Policy Strategies

- Put in place an organized system of collection, transportation and disposal of garbage.
- Formulation of community by laws and ensure effective enforcement.
- Encourage waste sorting, reduction, re-using, recycling.
- Mobilize and involve all stakeholders including the private sector.
- Increase public awareness on the need for proper solid waste management.

Proposed Actions

Households

- Ensure that they provide 3 separate containers for peels, food leftovers and plastics, glass and kevera.
- Required to sort the garbage at household level.
- Transportation at the collection centre or to the collection tracks on agreed schedules.
- Maintenance of hygiene at their premises
- Ensure compliance with bylaws.

Villages/cells

- Form/strengthen the existing environment/ health committees at LC I level.
- Train the committees in best practices of solid waste management.
- Facilitate them to carryout the supervisory and mobilization role.
- Ensure that waste is sorted at household level.
- Monitor compliance by households and enforce bylaws.

Parishes/wards

- Form /strengthen the environment/health committees.
- Monitor operations of village committees and compliance with the bylaws.
- Ensure that funds for facilitating Lower Councils are disbursed.
- Coordinate the lower council with KTC
- Prepare and approval of budget/ action plans for solid waste management.

Kasese Town Council

- Make policies to guide LLCs to execute the work.
- Budget and facilitate SWM activities adequately.
- Carryout monitoring and supervision regularly
- Provide technical and financial support to Lower administration Units
- Introduce and Operationalise the "cash for kavera prograam" program and recover all scattered polyethylene at shs 500 per kilogram.
- Provide for incentives and bonus for better performing cells/communities.
- Adhere to the collection schedules agreed upon with the communities.
- Procure and install street litterbins.
- Ensure proper disposal of SW.
- Make bylaws on solid wastes.
- Provide equipment for SWM

There is an emphasis on institutional roles in the draft policy, including involvement and roles of Village Environmental Committees, Parish Environmental and Health committees, NGOs

and CBOs, Relevant technical departments, political leaders, and involvement of the business community.

It is proposed here that the headquarters maintains the planning, monitoring and coordination roles and technical advice 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 to be 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 KTC 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. Generators of hazardous waste and clinical waste should indicate their disposal plans prior to issuance of trading licences.

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 gazzetted 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. KTC 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 limits 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 targeted collection of 75% the TC needs one new truck of capacity 20 Tons to make **Five trips** each a day, which can be hired out to private waste collectors. This will improve waste collection efficiency and reduce 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 Kilembe hospital for clinical waste.

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

Identified clients for compost manure by KTC include several farmers in Kasese who are eager to improve their produce as advocated for under NAADS, such as the Mobuku area. Other buyers include various hotels for their flower gardens. The market rates for organic manure stand at Ug. Shs. 7,000 per ton, implying an additional income of Ug. Shs. 210,000 per day 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. KTC 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 waste composting project also presents an opportunity in terms of carbon trading under the CDM.

6.0 PUBLIC CONSULTATIONS AND DISCLOSURE

The few households within two 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 particularly in alleviating the waste situation in the Town Council.

The responses from sector agencies KTC 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. The town Council will address the need for increased acreage for landfill development.

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. When effectively and efficiently managed, it will lead to improved sanitation within the KTC 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 TC 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 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 the impervious lining for the landfill such that any run off into the cells will end up in a sump and pumped to the leachate treatment unit. The treated effluent 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 treatment plant.

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.

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 3 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, and human waste will be mitigated as follows:

Dust

The Town Council should consider upgrading the access road (stretch still under murram 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 and workforce.

7.1.4 Degradation of Material Source Points

At this site, waste composting and landfilling will be undertaken. There will be a requirement for murram gravel/earth cover at the

landfill, but this will be low given the quantities of waste to be landfilled. Murram will be obtained from part of the waste site. The murram 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, no endangered tree or shrub species was seen. 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 murram extraction from the borrow pits will create relatively steep flanks that can cause accelerated soil erosion and accidental fall over if left unprotected. The natural drainage through the site will not be encroached on, and the embankments will be reinforced with grass and trees.

The speed of the runoff is one of the main contributing factors to erosion, siltation and increase in sediment load into the neighbouring ecosystem. Excavation at the material source point (murram 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, and purchasing organic manure. This poses the danger of accidents along the access road.

The level of activities is of low key nature, not highly mechanised, with few trucks 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.

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 landfiilled. It is proposed that KTC 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 murram 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.

- As a long-term measure the section of the access road still under murram cover should be upgraded to bitumen status or 1st Class murram;
- Careful driving should be the norm and observed by truck drivers hence they should limit their speed to 20km/hour when along populated sections to the waste site;
- Truck delivering the MSW should be covered with tarpaulins;
- Proper maintenance/service of equipment and machinery in addition to sensitisation of the workforce will ensure reduced noise emission;
- 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;
- 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 VIP 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, and wheelbarrows among others. The required PPE has to cater for eye, ear, nose, head, feet and hands protection, and will include eye glasses, ear murphs, 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. There is no waste utilisation at commercial level in Kasese and this gap is to be addressed by the proposed waste-composting project.

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 to the Kasese farmers. 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.

Employment is another factor that will arise as a result of the waste composting and landfill project.

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 gardens.

The waste composting project also provides an opportunity for improved waste collection within the Town Council. 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 TC from previous scenes of delayed collection of waste.

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

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

Environmental Monitoring and Social Management Plan

Activity	Environmental/Social Impact	Action Required/Mitigation Measures	Frequency of monitoring	Responsibility
PLANNING PHASE		-Incorporate EIA process and Source for consultant to undertake the EIA		Kasese Town Councill
CONSTRUCTION PHASE				
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	• Once before commencement of activities; • Weekly during construction	• Contractor • Kasese Town Councill

Activity	Environmental/Social Impact	Action Required/Mitigation Measures	Frequency of monitoring	Responsibility
Excavation of murram gravel/earth cover material	-Development of dangerous un-stable steep sides -Ponding of water -Loss of land and vegetation cover -Noise and Air pollution	-Develop part of site to supply murram gravel; -Do not site borrow pits on steep slopes - Do not site pits near settlements -While excavating murram avoid ponding of water and development of steep flanks -Restore borrow pits after use	• Once before commencement of operations; • Monthly during waste site operations	• Contractor • Kasese Town Councill
Transportation of waste and construction materials such as gravel, hardcore, rock aggregate etc	-Waste fall from trucks -Air pollution (dust) -Noise -Traffic accidents -Rock fall from trucks	-Limit speed of trucks and construct speed curbing devices as humps; -Put in place broad and clear signage's along access roads; -Trucks delivering construction material should be covered with tarpaulins; - Cover waste and materials transportation trucks with tauplins	• Daily during operations	• Contractor • Kasese Town Councill • Local Community
Sanitation at the waste site for workers	-Creation of unsanitary conditions -Vulnerability to disease outbreaks, such as cholera	-Construct VIP latrines on site for use during site development, and during operations	• Monthly inspections by the Health Inspector, daily by contractor	• Contractor • Kasese Town Councill
Equipment Servicing	-Contamination of soils and water due to oil spills	-Undertake equipment servicing in designated places	• Monthly inspections by KTC	• Kasese Town Councill • Contractor
Recruitment of construction workforce	-If sourced outside construction area likely to increase incidences and spread of diseases -Pressure on social services -Improved household incomes -Creation of employment opportunities	-Recruit workforce from around the waste site area -Sensitise workforce about the risk of diseases -Supplement health services	• Once prior to commencement of operation, bi-annually during operations	• Kasese Town Councill • Contractor

Activity	Environmental/Social Impact	Action Required/Mitigation Measures	Frequency of monitoring	Responsibility
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 waste composting slabs/landfill -Do not interfere with the natural storm water way existing in the middle part of the landfill -Cover compost yard with roof	• Once before construction, monthly during construction and operations	• Kasese Town Councill • Contractor
OPERATION PHASE				
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 on the route to the waste site -Undertake vehicle/equipment servicing -Upgrade the access road -Local communities are encouraged to report cases of bad conduct by the drivers	• Weekly during operations	-Kasese Town Councill -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	• Monthly checks by the municipality, weekly by the contractors	• Kasese Town Councill • Contractor
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 -Ensure natural drainage is reinforced and not interfered with	• Once Monthly	• Kasese Town Councill • Contractor

Activity	Environmental/Social Impact	Action Required/Mitigation Measures	Frequency of monitoring	Responsibility
Waste sorting and disposal	-Gas Development -Leachate development, contamination of water sources -Attraction of birds -Attraction of rodents, vermin, flies -Disposal of hazardous waste in landfill	-Promote waste segregation at source; -Undertake waste sorting at the waste site; -Undertake composting of the biodegradable waste -Have an HDPE or clay liner for the bottom of landfill cell, and sump to collect any leachate -Undertake periodic covering of the rest of landfill waste -Pick the litter within the buffer zone; -Ensure proper immobilisation of hazardous waste, including incineration, cementing -Privatise management of landfill and composting plant -Provide PPE for workers involved in waste sorting -Expedite efforts to develop waste management bye-law and implementation guidelines	• Weekly during operations	• Kasese Town Councill • Contractor • NEMA • NGO's and other civil society
Waste Scavenging	-Contraction of infections resulting from direct contact with waste -Body/eye respiratory infections	-Offer and use protective gear to workforce while sorting waste -Periodic check up and treatment of workforce -Promote waste sorting at source to minimise scavenging -Make recyclable waste freely available after sorting to scavengers -Maintain First Aid Kit at waste site	• Weekly during operations	• Kasese Town Councill • Contractor
Landscaping at the landfill	-Improves the area aesthetics	-Proper maintenance of the landscaped buffer zone -Tree and grass planting on unused parts of the site -Fencing off the area to prevent tresspassing	• Once before operations • Monthly once commissioned	• Kasese Town Councill • Contractor

Activity	Environmental/Social Impact	Action Required/Mitigation Measures	Frequency of monitoring	Responsibility
Excavating murram gravel	-Development of dangerous un-stable steep sides -Ponding of water -Loss of land and vegetation cover -Noise and Air pollution	-While excavating murram avoid ponding of water and development of steep flanks -Restore borrow pits after use -Contrators to have licences and site management plans	- Weekly during operations	- Kasese Town Councill - Contractor
Composting of sorted MWS	-Odour development -Leachate development -Acidity of nearby soils -Contamination of surface and ground water -Toxic final product -Pathogens -Likelihood of diseases by the workforce/scavenging community	-Frequent turning of the compost on windrows, weekly by backhoe -Provide a roof for the windrows -Construct waste composting slabs, leachate collection sumps and treatment plant -Train workers and provide protective gear -Test the final compost product -Have first aid kits on site -Develop existing groundwater source to monitor water quality -Provide alternative water sources for residents, including piped water	-Daily during operations -Monthly water quality monitoring by KTC, and quarterly by DWD	-Kasese Town Councill -Contractor -NEMA -DWD
LANDFILL CLOSURE				
Restore landfill/landscaping	-Improved aesthetics	-Put liner of earth matereal on top of waste -Carry out re-grassing and tree planting in the area -Undertake proper landscaping - Monitor water sources	Once prior to decommissioning, Quarterly after decommissioning	-Kasese Town Councill -Contractor - NEMA

9.0 MAIN FINDINGS AND RECOMMENDATIONS

Much of the generated waste from KTC and the immediate catchment is composed of about 90% vegetable matter with the rest being non-biodegradable material.

Currently, the Town Council undertakes open dumping at this designated waste site. Communities within the Town Council and its immediate neighbourhood that do not have access to waste handling infrastructure normally dispose of their waste along the roadway verges, gardens and channels. Waste segregation is not practised.

Save for those involved in sale of banana/potatoes peelings and coffee husks, there is minimal community involvement in waste management. **NO HUMAN SCAVENGING WAS ENCOUNTERED AT ANY OF THE WASTE TRANSFER STATIONS OR THE DUMPING SITE.** The establishment of this project will enhance income generation for the communities that will get involved in composting, extend skills to the nearby community in as far as waste composting is concerned

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. Kasese Town Council should expedite completion of the waste management bye-law waste management policy 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 TC. 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 KTC will take a lead role in implementation.

Based on the above, KTC 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. Kasese District Local Government, 2005: *State of Environment Report, 2005.*
3. Kasese Town Coucil, 2003: Three Year Development Plan 2003/2006;
4. Kasese Town Coucil, 2003: Waste Management Policy, 2006;
5. NEMA, 2004: *Environmental Legislation of Uganda.* Kampala, Uganda.
6. NEMA, 2005: *National State of Environment Report for Uganda, 2004/2005*. Kampala, Uganda.
7. Uganda Bureau of Statistics, 2005: *Statistical Abstract, 2005*. Kampala, Uganda.

11.0 Appendices

- Consultees contacted during the study
- Kasese Town Council Waste Transfer Sites
- Summary of recommended national effluent standards
- Terms of Reference for the Waste Composting Project
- Sample Questionnaire Used during the study
- Site Geophysical measurements Report

Appendix 1

Consultees Contacted during the Study

No.	NAME	DESIGNATION	INSTITUTION	COMMENTS
1	Mr. Asa Kule Musinguzi	DEO	Kasese District	Awaits Study Report
2	Mr. Bujara	Town Clerk	Town Council	Supports the Project
3	Mr. Joachim Tibamwenda	Senior Enforcement Officer	Town Council	Supports the project
4	Ms. Annette Mutabazi	Community Development Officer	Town Council	Supports the project
5	Mr. Isaiah Kule	Town Treasurer	Town Council	Supports the project
6	Mr. Louis Muhwezi	Senior Health Inspector	Town Council	Supports the project
7	Mr. Sarapio	Coordinator	KADE NET	Supports the project
8	Mr. Baruku Joseph	Resident	Near the Landfill	**In supports as long as they are not displaced**
9	Mr. John Kamagara	Police Constable	Town Council	Supports the project
10	Mr. Joseph Isengesa	Police Constable	Town Council	Supports the project
11	Ms. Felly Namusaana	Sister	Kilembe Mines Hospital	Supports the project
12	Mr. Paul Rutagarana	Chairman	Kasese Town Council Abattoir	Supports the project
13	Mr. Mathias Kalimbe	Doctor	AFYA Medical and Diagnostic Centre	Supports the project
14	Mrs. Proscovia Tindyebwa	Proprietor	Kitookye Restaurant	Supports the project
15	Mr. Muhindo	Operations Manager	Nyakatonzi Cooperative Union Ltd	Supports the project
16	Ms. Jane Masika	Resident	Habitat Village Project	In Support
17	Mr. Enoch Mate	Manager	Amil Abdul Coffee Factory	In Support
18	Mr. Johnson Byarugaba	Manager	TOTAL Kasese Service Station	In Support
19	Mr. Abubaker Katera	Chairman for Health	Shauri Yako Market	In Support

Appendix 2

Kasese Town Council Waste Transfer Sites

Kasese municipal council Mapping of waste Transfer sites

Name	N reading	E reading	Waste type	Disposal method	Site Characteristics
Shauri Yako Market	N 00° 10.576′	E 030o 04.529′	Food wastes from the market and polythene	The waste are periodically burnt (3times a week)	Open disposal No skip No bunker
Shauri Yako Market (site 2)	N 00o 10.525′	E 030o 04.565′	Food wastes from the market. Also includes plastics and polythene	The wastes are occasionally taken to the municipal landfill site or else burnt from the site.	Open disposal site Skip occasional brought on site
Kogere – Stanley Junction	N 00o 10.466′	E 030o 04.684	House hold (biodegradable wastes) and plastics from the central market and nearby homes.	The skips are taken to the municipal on a daily basis	2 skips on site 1built bunker
3rd street, Town centre parish	N 00o 10.365′	E 030o 04.879′	Household wastes from eating places and from the Taxi park	The wastes are burnt 2 – times a week.	Bunker available but over filled.
Taxi park	N 00o 10.430′	E 030o 04.907′	Household wasted including plastics	The wastes on this site are burnt.	No skip available – a skip is occasionally brought on site.
Kiteso cell – Kamaiba parish (Mbarara road)	N 00o 09.565′	E 030o 04.563′	Household wastes (vegetable materials and plastics)	The wastes are collected and loaded on to a skip which is brought on site once a week.	There was no skip on the site but the skip is occasionally brought on site.
Kiteso cell – Site 2	N 00o 09.588′	E 030o 04.516′	Household wastes (vegetable materials and plastics)	A skip is brought on site to collect the waste and taken to the municipal landfill.	No skips available on site but the skips are occasionally brought on the site.
Habitat Village – Kiteso cell	N 00o 09.681′	E 030o 04.471′	Household wastes from homes	The wastes are burnt at the site	No skips are available for this site.
Habitat Village Site 2	N 00o 09.784′	E 030o 04.467′	Household wastes from homes	Composting is done after sorting and the composted manure is used in Kitchen gardens.	There are no skips and no bunkers
Kamaiba market – Mbogo road junction.	N 00o 09.865′	E 030o 04.533′	Household wastes and from the	The wastes are burnt from the site.	No skips are available.

Name	N reading	E reading	Waste type	Disposal method	Site Characteristics
			market		
Kisiga road	N 00o 09.996′	E 030o 04.591′	Household wastes from homes	The wastes are periodically burnt from the site	No skips available here.
Kisiga road – near Adventist school	N 00o 09.911′	E 030o 04.594′	Household wastes from homes comprising of vegetative materials and plastics	The wastes are collected twice a week and taken to the municipal disposal grounds or else they are burnt from the site.	No skips available here.
Kilembe quarters playground	N 00o 10.436′	E 030o 04.631′	Household wastes from homes	The wastes are disposed twice a week to the municipal landfill site or burnt from the site.	No skips are available on the site.
Kilembe quarters – Mugulusi – Kisiga Junction	N 00o 10.168′	E 030o 04.609′	Household wastes	The wastes are burnt twice a week	There are no skips on the site.
Kogere – Kisiga Junction	N 00o 10.201′	E 030o 04.722′	Household wastes comprising of vegetative materials and plastics	Burning once a week	There was no skip on the site.
Town centre village - Alexander santery lane.	N 00o 10.633′	E 030o 04.571′	Household wastes comprising of vegetative materials and plastics	The wastes from this site are burnt three times a week.	There was no skip at this site.
Base camp – Lower village	N 00o 11.252′	E 030o 04.128′	Household wastes from homes	The wastes are occasionally collected from the site and taken to the municipal disposal grounds.	There was no skip available on this site.
Kisenga B Village	N 00o 10.874	E 030o 4.642′	Household wastes	Collected once a week and disposed at the municipal disposal grounds	No skips
Kilembe Stage – Town center	N 00o 10.687′	E 030o 04.769′	Household wastes	Wastes are collected and disposed off at the municipal disposal grounds on a daily basis.	1 skip at the site.
White house-	N 00o 10.683′	E 030o	Household	Wastes are	1 skip

Name	N reading	E reading	Waste type	Disposal method	Site Characteristics
kisanga B		04.876′	wastes	disposed off at the municipal landfill 3 time a week.	
Cresent road	N 00o 10.781′	E 030o 04.873′	House hold wastes	The wastes are burnt from the site 3 times a week.	No skip on the site.
Kizungu market – Nyakasanga parish	N 00o 11.041′	E 030o 05.073′	Vegetative Wastes from the market	The wastes are collected daily and taken to the municipal landfill	There is 1 skip
Nyakasanga market	N00o 11.069′	E 030o 05.452′	Vegetative wastes from the market	The wastes are disposed on a daily basis	There is 1 skip
Bagambe site	N 00o 10.635′	E 030o 05.287′	Household wastes from homes	The wastes are disposed once a week.	There is no skip on the site.
Kisanga market	N 00o 10.553′	E 030o 05.109′	Vegetative wastes from the market	The wastes are disposed off twice a week	There is no skip on the site.
Asaba market – Nyakatonzi village.	N 00o 10.349′	E 030o 05.117	Vegetative wastes from the market	The wastes are occasionally collected and taken to the municipal dumping site or burnt from the site.	There is no garbage skip on this site

Appendix 3

Summary of recommended national effluent standards

EFFLUENT STANDARDS

Summary of recommended national effluent standards

pH	6.0-8.0
BOD_5	30mg/l
COD	100
TDS	1000mg/l
Chloride	30mg/l
Sulphate	500mg/l
SULPHIDE	1.0mg/l
Cyanide	0.1mg/l
Detergents	10mg/l
Oil and grease	10mg/l
Nitrate	20mg/l
Aluminium	0.5mg/l
Arsenic	0.2mg/l
Barium	10mg/l
Calcium	100mg/l
Tin	5mg/l
Iron	5mg/l
Manganese	1mg/l
Chloride	1mg/l
Cadmium	0.5mg/l
Chromium (total)	1mg/l
Chromium (VI)	0.05mg/l
Copper	1mg/l
Lead	0.1mg/l
Mercury	0.01mg/l
Nickel	1.0mg/l
Selenium	1.0mg/l
Cobalt	1.0mg/l
Nitrite	2.0mg/l
Silver	0.5mg/l
Zinc	5mg/l
Magnesium	100mg/l
Boron	5mg/l
Nitrogen (total)	10mg/l
Phosphate (total)	10mg/l
Phosphate (soluble)	5mg/l
Total suspended solids	50mg/l
Coliform organisms	5000 counts/100ml
Phenols	0.2mg/l
Temperature	$20\text{-}35^0$c
Colour	100TCU
Turbidity	100NTU
Ammonia nitrogen	10mg/l
Trichlopromethylene	0.3mg/l
Tetra chloro ethylene	0.1mg/l

Appendix 4

Terms of reference for EIA of the Waste Composting Plant

Appendix 5

Sample Questionnaire Used during the study

Appendix 6

Site Geophysical measurements Report

Preface

The Kasese Town Council intends to create a new refuse damp at the Railway village site.

The above works require an Environment Impact Assessment detailing the expected impacts on the surrounding environs and communities directly or indirectly and the proposed mitigation measures that will negate these effects.

It is generally agreed that a geological estimation of a site is most usefully made very early in the development of any project. It is therefore one of the first tasks to be undertaken. The survey will involve the examination of the ground in considerable detail, leading to the generation of a geological stratigraphy of the area. In any site that will require excavations, damping of toxic waste and any other activity which can affect the environment, it is thus essential to establish the subsurface conditions, and to accomplish this, geophysical measurements using resistivity surveys can suffice to provide the relevant information on the suitability of the soil properties and the depth to the water table at the target site. As part of the exercise to develop the appropriate mitigation measures for the improvement of the refuse damp, a geophysical study over the proposed pit was instituted and geophysical measurements over selected areas performed.

Kasese Town is built over an old river bed. The river beds are very good conduits for groundwater and this underlies the proposed refuse damp. Activities at the refuse damp can therefore contaminate the groundwater in the area. The refuse damp however, has a thin layer of clay which over lays the cobble stones that form the river bed. This clay layer should be maintained and areas in which the clay layer has been punctured should be restored before refuse is damped there.

TABLE OF CONTENTS

Glossary

Duricrust - Hard compacted and reworked marram forming a hard Impervious crust of rock layer.

VES - Vertical Electrical Sounding

Introduction

In order to assess the impact of the refuse damp on the surrounding environs and the subsurface, geophysical measurements were performed at randomly selected points within the refuse damp. The geo-analyses performed will identify the different soil types existing, the physical qualities of the soil types and their possible use in the development of any mitigation measures that maybe necessary to alleviate negative impacts on the environment. Particular emphasis will be placed on the groundwater occurrences at this location, as any disturbance on the groundwater balance and quality will adversely affect the surrounding communities.

Location and Geography

The refuse damp is located within the town council boundaries and is bordered on one side by the Queen Elizabeth National Park. The coordinates of the site are 175642E and 18040N. The area is generally flat at an average altitude of 949m above sea level. The soil cover is of sandy top soils.

The area has a few scattered homes to the north and west of the site. The main economic activity that is taking place within the refuse damp is sand mining.

Geology

The area is mainly of the western rift valley geology comprising of inter bedded sands and clays. The area is generally thinly covered with loamy topsoil, sand and then clay.

Methodology

The soil types, their depths relative to each other and some of their physical properties have to be known in order to make a viable assessment of the possible impacts of the refuse damp on the environment and create mitigation measures to avert them. This was achieved by doing a geophysical survey over the refuse damp using an instrument known as a terrameter. This instrument sends and electric current into the ground and measures the different resistivities of the soil layers underground. From the resistivity variations of the different soil or rock types, the soil or rock types can be differentiated.

Vertical Electrical Soundings (VES) to a depth of 30m were performed at various points over the refuse damp. The VES were then interpreted both in the field and using the ResSound computer soft ware and compared. A stratigraphic column (soil profile) of the area was then generated. From this column, the possible transmissions of the leachet into the ground to contaminate water sources both under and above ground can be studied and solutions devised to alleviate this.

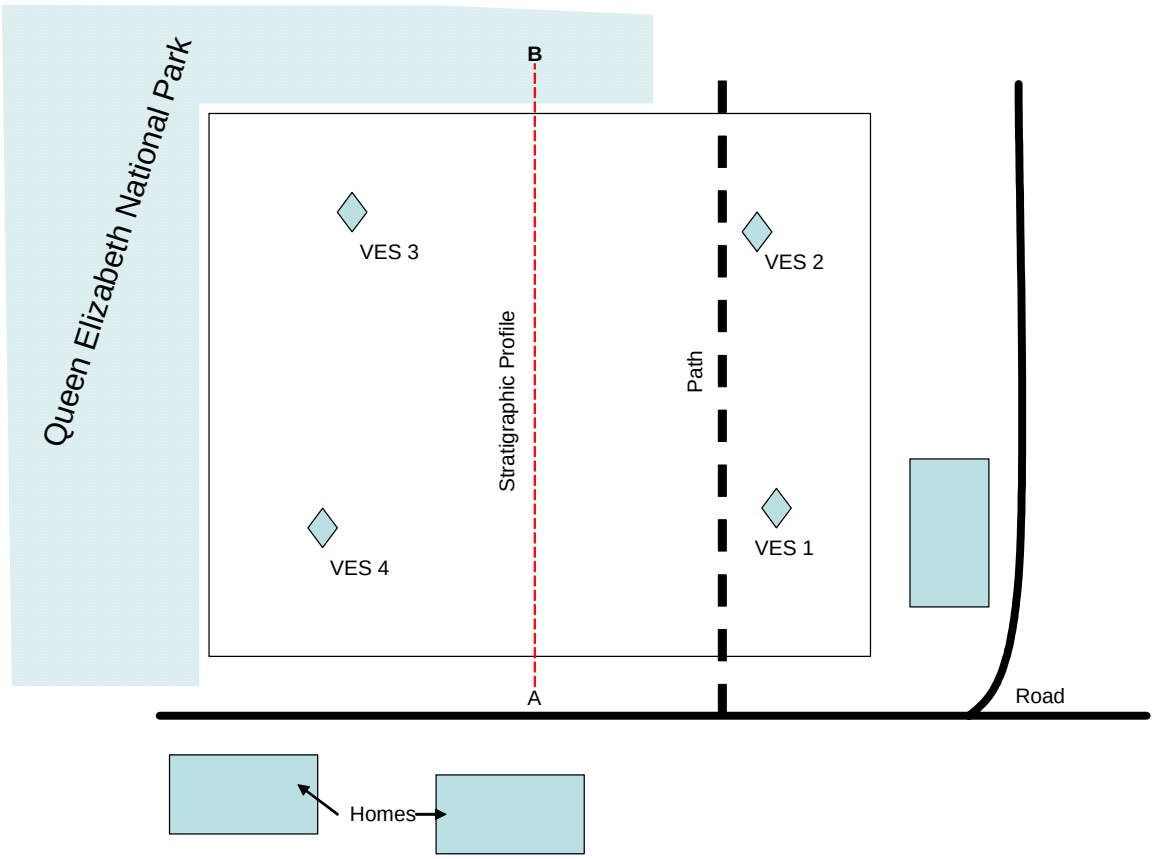


Fig 1: Kasese Town Council Refuse Damp Sketch Map showing points of geophysical measurement

Workdone and Analysis of Measurements

Four points randomly selected within the proposed damp were sounded and can provide an overall picture of the underground of the refuse pit because the refuse pit area is very small such as to make a very big difference in geology.

VES 1

The original field data showed a slow and gradual increase in the apparent resistivities of the soil layers with depth. The computer modelling of the field data using the computer programs gives a 6-layered model. This progressive increase in resistivities with depth is a sign that compaction levels were increasing downward and therefore the soil layers were becoming increasingly impervious with depth. The generated stratigraphy at that point is; Topsoils to 0.3m deep, clay from 0.3m-1.5m, uncompacted river washed stones from 1.5-3m increasing in compaction to 6m deep. Inter bedded clays and sands then continue as in the rift valley geology.

VES 2

The original field data showed constant apparent resistivities of the soil layers with depth to a depth of 4m then a gradual drop in resistivity. The computer modelling of the field data using the computer programs gives a 5-layered model. The resistivities are quite high in the range of 1000 ohm-m showing the compaction levels is quite high right from the surface. Stripping of the topsoils has thus taken place here. The generated stratigraphy at that point is; river washed stones increasing in compaction from 0-4m followed by inter bedded clays and sands as common found in the rift valley geology.

VES 3

The original field data showed a sharp decrease in the apparent resistivities of the soil layers. The computer modelling of the field data using the computer programs gives a 5-layered model. The sharp decrease in resistivities of the layers is a sign that the clays are close to the surface at this point. The generated stratigraphy here is; almost no topsoil, sand layer of 0.7m followed by clays.

VES 4

The original field data at this point showed a sharp decrease and then increase in the apparent resistivity at 0.5-2 and then 2-13m respectively. The computer modelling gives a 5-layered model. This point has not been affected by stripping and the trend in resistivities is partly dictated by the presence of heavy vegetation. The generated stratigraphy at this point is; loamy soils to a depth of 0.5m, clays from 0.5-2m and then the inter-bedding of the sands and clays.

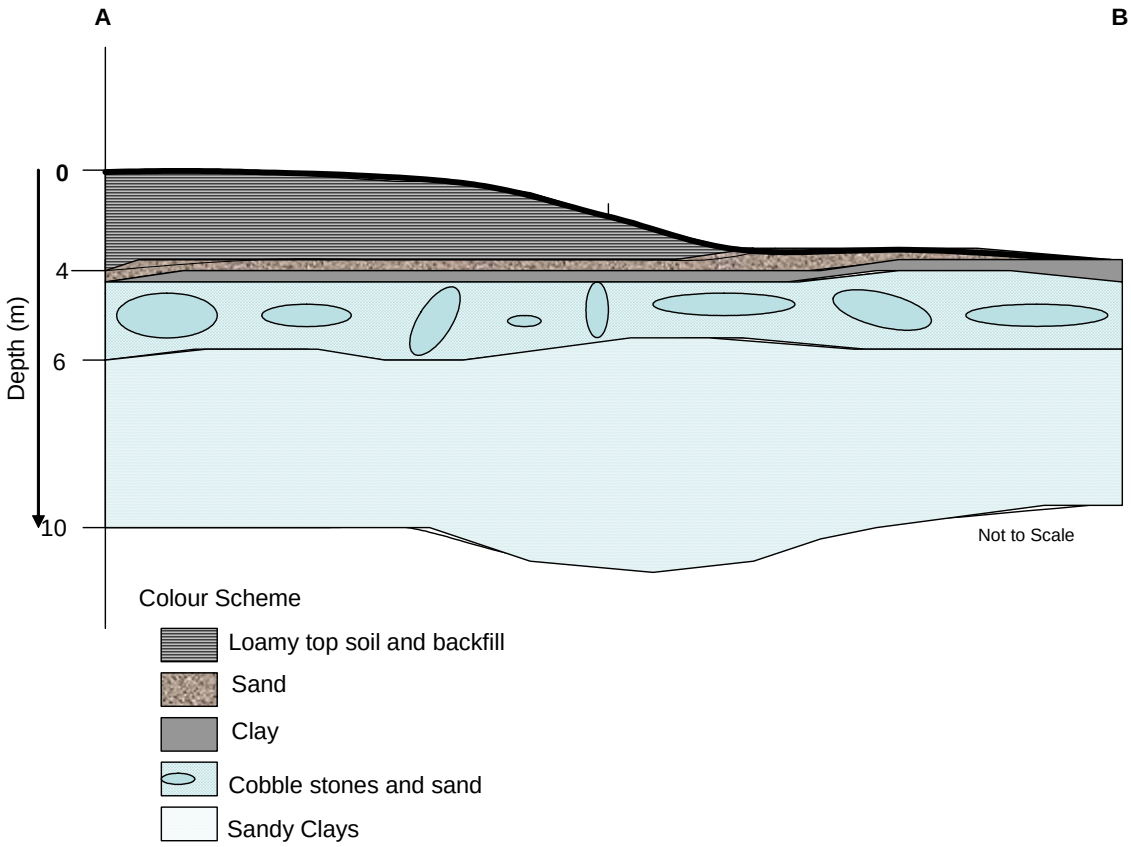


Fig 2: Soil Profile **AB** Over Refuse Damp as seen in Fig 1

Conclusion and recommendations

Kasese area was a river bed as can be seen from the abundant cobble stones dug up in every pit. River beds are good conduits for groundwater therefore excavations at the proposed refuse damp site should not puncture the thin clay layer overlying the cobble stones. Areas containing the cobble stones that were exposed by the activities of the sand diggers should be covered with clay.

Appendix 1

Combined ResSound & ResixP Computer Models
of the Vertical Electrical Soundings