

Integrated Solid Waste Management Plan

For the City of Nairobi, Kenya

Developed by

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1. Introduction

Modern urban living generates a large variety of solid wastes that cannot be assimilated in the city environment. *Nairobi is no exception, with each of its estimated 3.5 million residents generating approx. 600 g of solid waste every day.*

Large improvements in urban cleanliness and health were realized when organized collection of solid waste and its disposal outside of city limits were introduced in European cities in the late 19th century. *In Nairobi, only half of the estimated 3000 ton of waste generated every day is collected.*

To prevent environmental degradation from the large dumpsites then arising, the practice of sanitary landfilling was invented, and more recently, it has been realized that state-of-the-art incinerators, whilst much more costly to operate, offer an even lower environmental footprint. *Nairobi has no means of safe disposal, and approx. 850 tons of its waste reaches the Dandora dumpsite everyday, and it has been documented that this dumpsite is negatively affecting the health of thousands of Nairobi residents. 2/3 of the waste generated in Nairobi is hard to account for.*

It has always been true that one person's waste can be another person's resource. Modern approaches to solid waste management incorporate strategies to reduce waste generation, to encourage re-use, and to enable recycling of materials and recovery of energy on an industrial scale. *In Nairobi, more than 2000 people earn a living through their engagement in resource recovery, but at less than 200 ton per day of recyclable material recovered, they account for only about 7% of the waste stream.* Recycling rates of the order of 20% are achieved in many other contemporary cities.

2. Origins of this ISWM plan

In response to this malaise, the Kenyan government has agreed to collaborate with the United Nations Environment Programme in order to develop an Integrated Solid Waste Management Plan for Nairobi. The project was initiated in March 2009. A national task team was formed. Local university teams took hundreds of samples of wastes during 2009 to determine origins, compositions and to estimate amounts. Several training sessions were run. Stakeholders were consulted on matters of concern in early December 2009, and a strategic approach to the integrated waste management plan was workshopped by the National Task Team.

This document presents a first draft of what the ISWM plan could look like. It will be workshopped with stakeholders, and will then be improved. This draft plan is limited to 30 pages, and is complemented by a situation analysis document that provides more details.

3. Vision and Strategy for Solid Waste Management in Nairobi

3.1 Vision

The vision underpinning this integrated solid waste management plan is one of ***a healthy, safe, secure and sustainable solid waste management system fit for a world-class city***, in a time of increasing resource scarcity. *Clean, healthy city environments form as much part of this vision as resource-efficient processes of production and consumption.*

3.2 Mission

The mission of those involved with solid waste management in Nairobi is to improve and protect the public health of Nairobi residents and visitors, to protect ecological health, diversity and productivity, and to maximise resource recovery through a participatory approach. *Delivery strategies should be inclusive, financially sustainable and based on sound policies and institutions.*

3.3 Goals

1. To significantly extend resource recovery, including but going beyond the creation of enabling environments and the development of markets for recyclables
2. To build (*awareness and capacity for*) source separation as an essential component of sustainable waste management
3. To restructure and extend efficient and equitable collection of source separated waste streams with a view of protecting public health and the environment
4. To build environmentally sound infrastructure and systems for safe disposal of residual waste, replacing current disposal sites which must be rehabilitated

3.4 Targets

The following 10 high-level targets were developed by the national task team proposed after soliciting stakeholder input in December 2009:

- i. Adoption of this ISWM plan by the City Council of Nairobi and approval by the Ministry of Local Government and acknowledgement by the Ministry of Nairobi Metropolitan Development and other relevant government agencies by 30th June 2010.
- ii. School curricula to include 4R at all levels, and relevant education material available by the year 2013.
- iii. Awareness among the general public about the 4Rs at 75% by the year 2015.
- iv. Attain a three-way waste stream separation at source in all zones by 2013 (hazardous, wet and dry).

- v. Streamline system of collection fees, type of collection vehicles, and complimentary roles of CBOs, NGOs, private sector, NEMA, City Council of Nairobi and other government agencies with regard to licensing and regulation for all zones by end of 2010.
- vi. Increase the level of collection from current 50% to 75% by 2013 for all zones.
- vii. Increase level of transportation of waste from all zones from 18% to 50% to designated waste disposal sites in 2015. (Appropriate transport systems to be utilized, including the railway).
- viii. Establish franchise based zone collection systems and at least four viable material recovery centers by 2015.
- ix. To create an enabling environment for resource recovery and the development of markets for different recyclables through a growth plan and capital outlay for the plan to be secured by end of 2011.
- x. For establishment of a sanitary landfill for the city, agreement to be reached by mid 2010 between CCN, MoLG, MoENR and MoNMD (and other key actors) for MoMND to take on the role of developing a safe disposal facility for residuals arising from the ISWM system. MoNMD to undertake to bring such a facility on stream by 2015.

Another way to consider the targets for the ISWM plan is in terms of tonnages of different types of waste generated and how these are managed. Table 1 shows an estimate of waste volumes in 2009, and predictions with / without ISWM plan for 2015 and 2020.

Table 1: Quantification of the status quo and possible futures for solid waste volumes in Nairobi

	Quantities in tons/day					
	Year 2009		2015		2020	
	Best	Worst	ISWM	BAU	ISWM	BAU
Total generated	3000	3200	3500	4400	4000	5400
OF valorised at source	2%	1%	10%	2%	25%	2%
OF otherwise valorised	1%	1%	4%	2%	5%	2%
OF rotting/scavenged/illegal	35%	39%	21%	36%	5%	36%
OF to official dump	13%	10%	15%	10%	15%	10%
Recyclables recovered	5%	3%	10%	6%	20%	6%
Recyclables to official dump	12%	10%	13%	10%	15%	10%
Recyclables burnt or illegally dumped	21%	25%	15%	22%	3%	22%
Residual to official dump	5%	5%	8%	5%	10%	5%
Residual burnt or illegally dumped	6%	6%	4%	7%	2%	7%
Total	100%	100%	100%	100%	100%	100%
<i>Total to dump</i>	<i>30%</i>	<i>25%</i>	<i>36%</i>	<i>25%</i>	<i>40%</i>	<i>25%</i>
<i>Total valorised</i>	<i>8%</i>	<i>5%</i>	<i>24%</i>	<i>10%</i>	<i>50%</i>	<i>10%</i>
<i>Total illegal</i>	<i>62%</i>	<i>70%</i>	<i>40%</i>	<i>65%</i>	<i>10%</i>	<i>65%</i>

3.5 Guiding principles

- ✓ **Waste minimizing** - through maximization of 4 R: reduce, reuse, recover, recycle
- ✓ **Polluter pays principle**
- ✓ **Competitiveness**- in waste collection, transportation and recycling
- ✓ **Multi-actor approach (PPPP)** in SWM
- ✓ **Sustainability**

3.6 Core values

- ✓ Clean, safe and secure environment for all
- ✓ Uphold the highest integrity and equity in all operations
- ✓ Being flexible, adaptable and pro-active - PPPP and technology

Stakeholders in SWM in Nairobi place strong value on being able to operate in a safe and secure environment, free of bribery, corruption and harassment.

This came across very strongly during the stakeholder workshop of 1 December 2009.

4. The Situation before the ISWMP: A Summary

In this section, a summary is presented of the most important findings of the baseline study undertaken to support the development of this ISWM plan.

4.1 Composition of Solid Waste Streams

The overall average composition of waste at source was estimated to be 51% organic (OF), 38% recyclable (paper, plastic, glass and metal) and 11% residual. There is a significant variation in waste composition between the different types of generators, with the organic fraction in residential waste at source being as high as 60%. There appears to be no statistically significant variation in waste composition between the various zones of Nairobi.

It is noteworthy that the composition analysis of waste from collection points showed a marked decrease in organic fraction (down to 43%) and paper, but a doubling in the 'Other' from 11% to 22%. If one assumes that none of the 'Other' waste degrades or is removed for resource recovery between source and collection points, then the implications of this observation are:

- i) That only 50% of waste generated ends up in collection points;
- ii) That more than half of the organic fraction degrades / rots / is removed between source and collection;
- iii) That there is significant resource recovery taking place either at source or from collection points, esp. for paper and plastics, and probably also for metals.

4.2 Summary of Solid Waste Quantities and their Fate

The total amount of solid waste generated in Nairobi was estimated to be between 3000 and 3200 ton per day in 2009, which represents a doubling from the amount of 1530 t/day estimated by JICA 10 years earlier.

Current total waste collection levels are estimated at 50% at best, in general agreement with previous studies that found that over half of Nairobi's residents don't receive any waste collection service (Karanja (2005). This equates to total collection levels of about 1560 tons/day. Based on April 2009 CCN records, CCN collection levels at the moment are approximately an average of 430 tons/day. Weighbridge records at the Dandora dumpsite over the period 2006 – end 2008 indicated an average 830 tons/day were disposed there.

There is an active and well documented recycling sector operating in Nairobi, with several thousand people earning their livelihoods from this activity. This sector accounts for a sizeable fraction of the generated waste, but remains limited to less than 200 t/day, made up as follows:

- 44 t/day of paper (~8% of paper waste)
- 25 t/day of plastic (~5% of plastic waste)
- Up to 65 t/day of metal (most metal in waste is recovered)
- 3 t/day of organics is composte (~1% of organics).
- It is unknown how much organic waste is recovered for livestock feeding.
- Recycled glass volumes appear to be on the decline, possibly at ~50t/day.

4.3 Trends in solid waste management

Nairobi has been experiencing exponential population growth, which has in the past few years started to show signs of leveling off. Overall, the population of the Nairobi Metropolitan region is expected to keep growing, though at slower rates. Solid waste generation is however also a function of growth in wealth, and in this respect, Kenyans have experienced an average 3% growth in GDP/capita in the first decade of the new millennium.

Growth in waste is often the sum of the population and GDP/cap growth rates, and Nairobi in the 2000s seems to have experienced this too, resulting in a 7% p.a. growth rate in solid waste, or roughly a doubling of total quantity in 10 years.

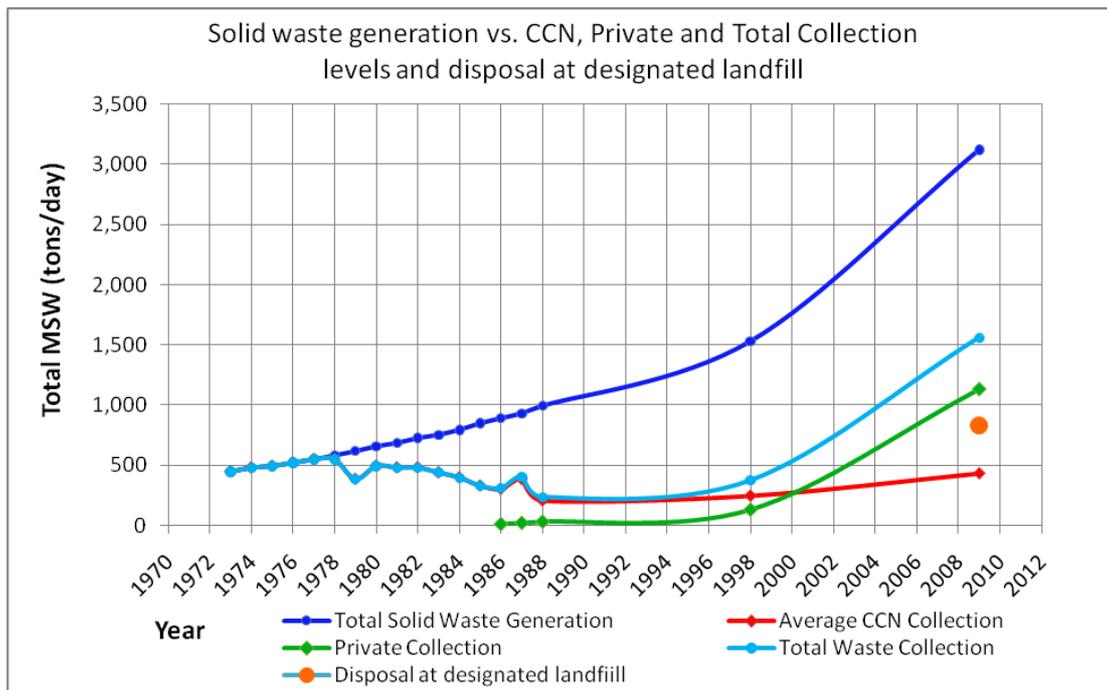


Figure 1: Solid waste trends in Nairobi

4.4 Systems analysis

Interestingly, private waste collectors appear to have been able to grow their operations at a similar rate as that shown by overall waste quantities, whilst the publically operated collection system falls further and further behind, despite some small growth. The ability to collect fees and/or access public budgets is key to these growth trends.

5. Success factor analysis

Key observations that point to limited control of the CCN DoE over SWM in Nairobi, and therefore to the importance of multi-actor collaboration include:

- i) decreasing budget allocations whilst overall City budget increases;
- ii) realignment of roles of CCN and Ministry for Nairobi Metropolitan Development;
- iii) confusion around licensing and regulation roles of CCN DoE and NEMA as regards collectors, transporters and recyclers.

For the ISWM plan to be successful, it therefore has to recognize these realities and proactively plan to work within the constraints they impose.

- Financing of SWM remains a challenge and CCN experience has been poor in this regard – both as a direct service provider and in partnerships. Adequate budget allocation is required for those functions that only CCN DoE can provide, and DoE must seek to utilize multiple strategies – PPP, franchising, and application of the polluter-pays principle.
- Harmonization of roles/ mandates of CCN, MoLG, MENR/NEMA, MoNMD, the relevant Acts and Regulations (Cap. 265; Cap. 286; Public Health Act, Occupational Health Safety Act, and Factories Act) are essential.
- Current consensus is that Dandora’s closure/ decommissioning is long over due. However, the problem is not the site but poor management, allowing open burning and control by criminal gangs. CCN considers that after closure Dandora can be rehabilitated (26 hectares), to provide for a transitional material recovery centre and transfer station through controlled tipping to allow for development of a suitable sanitary landfill. There is hardly any viable option for immediate use.
- Enforcement of relevant laws and regulations (EMCA, Cap. 265, etc) with regard to SWM will remain essential.

6. Gap Analysis

The following gaps have already been identified and need to be complemented by others, and elaborated on:

	Issues	Gaps	Proposed Interventions
1.	Prevention:	<ul style="list-style-type: none"> ✓ NEMA is yet to develop a law governing e-waste management in Kenya ✓ Country lacks appropriate technologies/ know-how to handle e-waste ✓ Lack of policies for handling toxic and hazardous wastes such as radioactive material and clinical waste. 	<ul style="list-style-type: none"> • Develop policy / law on e-waste • Develop technologies on e-waste • Develop policies for handling toxic and hazardous wastes
2.	Minimization (Reduce)	<ul style="list-style-type: none"> ✓ Excess packaging ✓ Weak enforcement of policy on minimum thickness of plastic bags ✓ No active policy on establishment of eco-industrial parks built around waste exchange and/or industrial symbiosis 	<ul style="list-style-type: none"> • Discourage through levies • Enforce minimum thickness of plastic bags • Promote industrial production of recyclable material e.g plastics
3	Reuse:	<ul style="list-style-type: none"> ✓ Limited access to suitable technology, e.g. for re-use of C&D wastes ✓ Limited access to finance to fund acquisition of such technology ✓ Unhelpful attitude that “poor people reuse” 	<ul style="list-style-type: none"> ✓ Promote safe re-use of C & D wastes by small operators ✓ Awareness and attitude change on re-use
4.	Recycling:	<ul style="list-style-type: none"> ✓ Insufficient infrastructure, and no active land-use planning for such infrastructure ✓ Insufficient incentives ✓ Too many grades/types of plastic on the market ✓ No technology incubation (this also relevant to the next heading) 	<ul style="list-style-type: none"> ✓ Provide infrastructure and space for recycling ✓ Provide incentives ✓ Enforcement of plastic laws and regulations ✓ Develop incubation centres for recycling
5.	Recovery:	<ul style="list-style-type: none"> ✓ A significant gap exists around recovery of carbon-bound energy from the organic fraction (OF). It seems that composters currently handle in a year the amount of material that arises in 2-5 days. Can composters scale up significantly? Would (decentralized) biogas generation be a key technology to fill this gap? ✓ No policy in place to encourage / regulate 	<ul style="list-style-type: none"> ✓ Introduce technology and know-how on composting and biogas production ✓ Promote the use of compost and biogas ✓ Enact by-laws to regulate composting and biogas generation and use
6.	Disposal	<ul style="list-style-type: none"> ✓ New landfill project not proceeding with required urgency due to conflicting interests. ✓ Limited financial and technical capacity 	<ul style="list-style-type: none"> ✓ Consultations to ensure speedy implementation ✓ PPP and requisite technology transfer

7. Themes for Action

A plan of action is proposed as the centre-piece of the integrated solid waste management plan. 15 actions are identified so as to respond to the identified gaps in waste management, and to reach the set objectives and targets. For better oversight, and to enable proper assessment of progress, the actions are grouped into 5 themes. These themes and actions are summarized in Table 2, with each of the themes discussed in the following sections. The actions themselves are described in section 8.

Table 2: Themes and Specific Actions

1: Strategic Alignment and Recognition of Partners			
1.1 Strategic Alignment DoE Mission	1.2 Recognition of Partners	1.3 Waste Information System	
Links to:	2.3, 3.1,3.2,3.4, 4.1, 4.2		
1: Waste Reduction and Source Separation			
2.1 End-of-life levies for problematic wastes	2.2 Source separation of recyclable and pure organic wastes with incentives	2.3 Stream-lined (weight-based) collection fees	2.4 Awareness campaigns and education
Links to: 4.2, 5.1	1.2, 2.3, 3.2, 3.3, 4.1, 4.2, 5.1	1.2, 3.1, 3.2, 3.4	2.2
2: From Source to Valorisation or Disposal			
3.1 Zoning of waste collection	3.2 Formalised waste collection contracts	3.3 Development of material recovery & transfer stations	3.4 Regulation, Enforcement and Oversight of Private/CBO waste collection
<i>Links to:</i> 1.2, 2.3, 2.2, 3.2, 3.4	1.2, 2.2, 2.3, 3.1, 3.4	1.2, 2.2, 4.1, 4.2, 5.1	2.2, 2.3, 3.1, 3.2
3: Resource Recovery: Materials and Energy			
4.1 Recovery of value from organic wastes	4.2 Strengthening of Specific Recycling Strategies		
Links to: 2.2, 3.2, 3.3	2.1, 2.2, 3.2, 3.3		
4: Infrastructure and systems for residual waste			
5.1 Development of new engineered landfill site	5.2 Rehabilitation of Dandora dumpsite		
Links to: 2.1, 2.2, 3.3, 3.4	3.3		

It should also be noted that, in terms of targets, Table 1 implies:

- ✓ A strong valorization at source programme for OF
- ✓ Strong controls to phase out burning, and to restrict illegal disposal
- ✓ Strengthening of the recycling value chain and industry
- ✓ More material going to safe disposal (but please still only a minority!)

7.1 Strategic alignment and recognition of partners

The mandate of the Department of Environment, City Council of Nairobi, stems from a time when the emphasis on the 4R of waste management was much weaker than it is today. For the DoE to be able to effectively lead an ISWMP in which the 4R activities are to be equally effective as collection, transportation and safe disposal, it is imperative that the mandate of the DoE be inspected and restated. This is also an opportunity to ensure that the new mandate is appropriately funded.

Equally, on setting out on the path of an ISWM plan, a good opportunity presents itself to formally recognize the multiple partners that already exist and that will need to be strengthened for the goals of the plan to be realized.

7.2 Waste reduction and source separation

An essential starting point for ISWM in Nairobi is develop a strong drive for material separation at source. However the main barriers are- negative attitude, lack of awareness, vested interests and unaffordable technology. There is need to build awareness and capacity through: enactment and enforcement of appropriate laws and regulations, effective pricing signals enabled by functioning resource recovery systems, media campaigns, and mainstreaming of environmental education.

There are opportunity to link this theme of the ISWM plan to:

- The Nairobi River Basin Programme
- The new e-waste management plant in Embakasi
- Existing recycling industries

7.3 From generation to valorization or disposal

The current level of waste collection is estimated at 50%. It is higher in middle, higher income areas, offices, businesses and industry. There is poor collection in informal settlements and informal business areas. The ISWMP seeks to restructure and extend efficient and equitable collection and transportation services. Strong controls to phase out burning, and to restrict illegal disposal shall be implemented.

Major features of this theme of the ISWM plan are:

- Streamlining of collection fees, complimentary roles of CBO collectors and private collectors, with licensing and regulatory clarity.
- Non-motorized and frequent movement of the source-separated organic fraction for valorization close to source
- Strong controls to phase out burning, and to restrict illegal disposal

- Establishment of zones for controlled waste collection and management
- Establishment of at least four eco-parks for material recovery and composting by 2015, and bulking of residual waste for onward transportation
- Streamlining of collection fees, type of collection vehicles, and complimentary roles of CBOs, NGOs, private sector, NEMA, City Council of Nairobi and other government agencies with regard to licensing and regulatory clarity to be achieved for all zones by end of 2010.

7.4 Resource recovery: Materials and Energy

In Nairobi 51% of the waste is of an organic nature, allowing for energy recovery by anaerobic digestion to produce biogas and/or nutrient recovery by means of composting. Another 38% of the waste is recyclable (plastic, paper, glass and metal). There is considerable material recovery in Nairobi particularly by small scale operators and waste pickers. However, the recyclers are faced with numerous challenges among them lack of operational space, harassment by officials, insecurity, multiple taxation by government agencies and illegal groups. Market uncertainty persists and often fluctuates.

The purpose of this theme of the ISWM plan is for as much as possible of the utilizable 89% of wastes as possible to end up in resource recovery operations instead of disposal sites. If by 2020, half of the organic fraction (= 25% of total waste, or 1000 t/day) plus 25% of the 38% of recyclables (another 1000 t/day) could be diverted to valorization, a major battle would have been won for sustainable development of Nairobi!

An interesting link could possibly be made to:

- Kenya Industrial Estates Microfinance Programmes

7.5 Infrastructure and systems for residual waste

In Nairobi 38% of the waste is recyclable (plastic, paper, glass and metal). However it is estimated only 10% recyclables are recovered. 10% recyclable end up in the dumpsite while 5% are disposed off through open burning. The City has not established transfer stations. Currently Nairobi does not have a sanitary landfill. The existing open dumpsite at Dandora is both a health and environmental hazard and is overdue for decommissioning. Dandora to be rehabilitated and transformed to a material recovery/transfer centre with controlled tipping.

The purpose of this part of the ISWM plan therefore is to establish at least one sanitary landfill for the city, possibly for the metropolitan area. Agreement will be reached by mid 2010 between CCN, MoNMD and other key actors for MoMND to take on the role of developing a safe disposal facility for residuals arising from the ISWM system. MoNMD to undertake to bring such a facility on stream by 2015.

8. Specific actions for implementation

Name of Action	Strategic Alignment	Number:	1.1
Introduction	It was noted that the mission of the Department of Environment within the NCC needed to be inspected relative to its inherited and legal mandates, so as to align with this ISWM plan.		
Purpose	To ensure that the DoE's mission sufficiently specific to solid waste management To ensure that the philosophy of ISWM sufficiently strongly present in the DoE's mission		
Description			
Implementation steps			
Lead agency	CCN DoE	Support from:	
Location			
Budget	Small		
Timeframe	By end 2010		
Examples of successful implementation of similar actions:			
Inter-linkages with other actions			

Name of Action	Recognition of Partners	Number:	1.2
Introduction	In addition to the current registration and oversight of Private Waste Collection Companies in Nairobi by the CCN, there is a need to similarly recognize, formalise and streamline the operation of CBO's, actors involved in Waste Recovery and Trading activity, and to formalise the waste material supply chains to the recycling industry		
Purpose	To enable the amplified participation and contribution of CBOs and Waste Recovery and Trading activity to Nairobi's Solid Waste Management. There is evidence for the success of this approach from the emergence of Participatory Solid Waste Management defined as "Solid waste recovery, reuse and recycling practices with organized and empowered recycling co-ops supported with public policies, embedded in solidarity economy and targeting social equity and		

	environmental sustainability” (Jutta, 2010).		
Description	Recognize, formalise and streamline the operation of CBO’s in waste collection so they have the same legal and operational status as Private Collectors; formalise the operation and roles of actors involved in Waste Recovery and Trading activity (i.e. waste pickers - operating at the neighbourhood, street and dump level, Waste dealers and suppliers to Large scale Recyclers); and formalise waste material supply chains to the recycling industry itself to minimise exploitation of informal recyclers and negotiate pricing This pursuit of Participatory Solid Waste Management combines environmental and social issues such as employment generation, increased income generation, improved occupational health and the promotion of human development opportunities and environmental health in general (Jutta, 2010).		
Implementation steps	1) Legally recognise and support the operations of CBOs and Actors involved in Waste Recovery and Trading through CCN By-law 2) Provide seed funds and research, develop waste collection physical infrastructure appropriate for the activities of CBOs and actors in Waste Recovery and Trading to encourage these activities and increase their reach		
Lead agency	- CCN Legal Dept - CCN DoE	Support from:	- NEMA - MoLG - MoNMD
Location	All wards of Nairobi		
Budget	Small		
Timeframe	2010-2012		
Examples of successful implementation of similar actions:			
Organized Recyclers’ Movement in Brazil, officially created in 2001 during the 1st National Recyclers’ Congress in Brasilia, with the participation of more than 1700 recyclers from all over Brazil. The “Brasilia document” expresses the needs of the people who make a living from recovering recyclables. The first Latin American Congress of recyclers was held in Caxias do Sul where the “Caxias document” was produced; disseminating the conditions of recyclers in various countries in Latin America. The movement has gone onto gain momentum through strengthening of regional networks.			
Inter-linkages with other actions	Strong links with “Formalised Waste Collection Contracts ”, “Zoning of Waste Collection”, “Streamlined Collection fees”, “Regulation, Enforcement and Oversight of Private/CBO waste collection”, “Recovery of value from organic wastes” and “Strengthening of Specific Recycling Strategies”		

Name of Action	Continual monitoring and research of Waste Character, Quantities and Related solid waste information to aid future planning (Establishment of Waste Information & Reporting Systems)	Number:	1.3
Introduction	The future planning of solid waste management in Nairobi, measurement of policy performance, and execution of decisions by relevant decision makers will rely on the provision of accurate and timely information.		
Purpose	To make provision for the regular update of waste and its related information in Nairobi City for future planning		
Description	<p>Activities proposed to keep tabs on solid waste and related information in Nairobi City include:</p> <ul style="list-style-type: none"> - Week long waste characterizations, quantifications and related waste research twice a year every five years by CCN/NEMA Officers, or organised into regular waste research projects conducted in collaboration with local academic institutions. Research would also go into local solid waste management and reuse/recycling technology development - Establishment and regular maintenance of Weighbridge at designated disposal sites - Regular update of population and macro/micro economic data - Accurate register and record keeping on the numbers and nature of the various actors involved in Nairobi's waste collection and management 		
Implementation steps	<ol style="list-style-type: none"> 1) Development of internal CCN DoE Policy on regular record collection and keeping 2) Liaison with NEMA, KNBS, Academic Institutions and NGOs 		
Lead agency	- CCN DoE	Support from:	<ul style="list-style-type: none"> - NEMA - KNBS - Academic Institutions
Location	CCN DoE		
Budget	Modest to large recurrent costs		
Timeframe	2010 onwards		
Examples of successful implementation of similar actions:			
	- City of Cape Town Solid Waste Management		
Inter-linkages with other actions			

Name of Action	End-of-Life Levies on Problematic Wastes	Number:	2.1
Introduction	Some waste materials generated do not currently have recycling infrastructure in the City or are altogether not readily recyclable and therefore pose end-of-life disposal burdens to the City.		
Purpose	The institution of <i>(city/national level)</i> landfill levies on problematic waste materials that would go into a central pool fund enabling the purchase and/or development of appropriate recycling capacity or end of life treatment infrastructure for problem materials.		
Description	<p>Problematic waste materials include broken glass which has limited appropriate recycling infrastructure; plastic bags (esp. less than 30 microns, polystyrene food packaging, some grades of paper (e.g. waxed) which are either non-recyclable or hard to recycle, laminated beverage containers, and Construction & Demolition waste. Other candidates to this list would include e-waste, for which no recycling capacity and legislature currently exists.</p> <p>A proposal is made to institute city/national landfill levies on problematic materials, which may also be interpreted as end-of-life treatment or disposal planning taxes. These taxes would be payable at the gate of manufacturers, importers or relevant sellers whichever is appropriate, in line with the ethos of Extended Producer Responsibility, and would flow into a central pool fund to enable the purchase and/or development of appropriate recycling capacity or end of life treatment infrastructure. In instances where national tax disincentives for such materials already exist such as in the case of plastic bags, these must be rigorously implemented.</p>		
Implementation steps	<ol style="list-style-type: none"> 1) Further Identification and discussion of problematic waste materials for which no or insufficient recycling capacity exists currently, or for which the only option at end of life is disposal 2) Development of policy and active enforcement of End-of-Life planning taxes on such materials targeting manufacturers, importers or sellers as appropriate 		
Lead agency	NEMA	Support from:	<ul style="list-style-type: none"> - CCN DoE - KNCPC
Location	All wards in Nairobi City		
Budget	Modest costs to unlock large new revenue flows		
Timeframe	2010 – 2012		
Examples of successful implementation of similar actions:			
<p>KNCPC Plastic Wastes Strategy resulting in the 2008 Government exercise duty of 120% on plastic carrier bags and a ban on production of the same of less than 30 micron thickness. Enforcement/Implementation however remains unclear.</p> <p>Municipal Council of Nakuru which stipulates under Section 197(i) of their environmental management by-laws “Any person who uses polythene bags for whatever purpose in his business or elsewhere shall bear the cost of treating or disposing of that polythene. (ii) The cost shall not exceed 20% of the Business Permit fee unless the Council otherwise decides.”</p>			
Inter-linkages with other actions	“Strengthening of Specific Recycling Strategies“ and “Development of New Engineered Landfill Site”, ,		

Name of Action	Source separation of recyclable and pure organic wastes with incentives	Number:	2.2
Introduction	The longer term successful diversion of waste necessitates the early (source) separation of waste to ease downstream recovery and improve captured material quality at minimal cost.		
Purpose	<p>The early implementation of source separation in Nairobi's waste management system would help the City avoid the trap of more expensive and inflexible mixed-waste mechanical separation systems as is the used in much of the developed world, where considerable effort and expense has long gone into trying to disintegrate wastes that are collected mixed.</p> <p>The amplified economic value of minimally contaminated recyclable and pure organic waste as a result of source separation should create a reinforcing loop towards more resource recovery and trading activity, strengthening material reuse and recycling.</p>		
Description	<p>Reduced streamlined charges for separated high purity recyclable and pure organic wastes are proposed to incentivise the source separation of waste by generators to aid down-stream waste recovery, recycling, value derivation and thereby waste diversion from landfill.</p> <p>The reduced waste collection fees for separated recyclable/pure organic waste, in light of the small profit margin above bare disposal costs used in determining streamlined collection charges, are also designed to encourage waste collectors to interact with the Waste Recovery and Trading market to sell their collected quality recyclables, and also potentially sell their quality organic waste to Anaerobic digestion facilities so as to realise improved profit margins and reduce their own disposal transportation costs.</p>		
Implementation steps	<ol style="list-style-type: none"> 1) Development and enforcement of by-law stipulating reduced streamlined collection fees for separated recyclable and pure organic wastes 2) Media campaign encouraging residents and generators to claim for reduced streamlined collection fees for decently separated recyclable and pure organic wastes from waste collectors 		
Lead agency	CCN DoE	Support from:	NEMA
Location	All Wards		
Budget	Modest to large investment into new systems		
Timeframe	2011 – 2013		
Examples of successful implementation of similar actions:			
Inter-linkages with other actions	Strong links with "Recognition of Partners", "Streamlined Collection fees", "Formalised Waste Collection Contracts", "Zoning of Waste Collection", "Development of Material Recovery & Transfer stations", "Recovery of value from organic wastes", "Strengthening of Specific Recycling Strategies" and "Development of new engineered landfill site".		

Name of Action	Stream-lined (weight-based) collection fees	Number:	2.3
Introduction	The collection of arbitrary service charges directly from generators by private collectors as is the case under the regime of open unregulated competition, especially from households, promotes the provision of service to those who can pay the desired arbitrary rates, and leads to the alienation of lower income areas by the majority of private collectors due to perceived lower ability to pay.		
Purpose	The official streamlining of collection charges including source separation costs, (along with the formalisation and encouragement of CBOs as private collection entities), can help to increase collection service provision with source waste separation under reasonable rates. The use of weight-based collection fees provides a direct behavioural feedback along the full spectrum of income levels, with excessive waste generation as is usually the case for more affluent communities penalised by higher charges, and lower charges accruing in the case of lower income communities that usually naturally put out less for disposal. Private/CBO participation in waste collection however generally needs to appeal both to economic viability and the common good, and streamlined collection charges should try to balance the two goals.		
Description	Using average CCN disposal costs per ton of waste for disposal at Dandora 7.5 km East of the CBD, and elevated future disposal costs on account of the factor increase in transportation distance to the proposed new landfill at Ruai 30 km East of the CBD; calculations are done to estimate the necessary disposal charges due from households and businesses, institutions and other non-domestic waste generators for waste disposal , so as to support a viable and environmentally benign waste collection sector in the city.		
Implementation steps	<ol style="list-style-type: none"> 1) Development and enforcement of by-law stipulating streamlined residual and recyclable/pure organic waste collection fees 2) Media campaign to sensitize residents 3) Rigorous regulation and oversight to avoid illegal dumping 		
Lead agency	CCN DoE	Support from:	<ul style="list-style-type: none"> - NEMA - MoLG
Location	All wards in Nairobi City		
Budget	Small investment to set up systems that will unlock large cash flows		
Timeframe	2011 – 2013		
Examples of successful implementation of similar actions:			
	Pay as you Throw schemes in countries such as Sweden, Belgium, Denmark leading to decreased waste generation through genuine behavioural change and increased separation of waste for recycling to decrease amounts set out for disposal; however in some instances also through evasion by illegal dumping; (Dahlén and Lagerkvist, 2009)		
Inter-linkages with other actions	Strong links with “Recognition of Partners”, “Zoning of Waste Collection”, “Formalized Waste Collection Contracts”, and “Regulation, Enforcement and Oversight of Private/CBO waste collection”		

Name of Action	Awareness campaigns and education	Number:	2.4
Introduction	The source separation actions in this ISWMP, which are critical to its success, will depend strongly on habits of waste generators.		
Purpose	To inform waste generators of required changes to separation and disposal habits, and to educate about resource recovery and safe disposal.		
Description	<p>There need to be:</p> <ul style="list-style-type: none"> i) Targeted awareness raising campaigns, timed to coincide with introduction of source separation systems in specified zones. ii) General education interventions, esp. in the school system, to ensure better general knowledge of effects of unsafe disposal, and of the importance of resource efficiency. 		
Implementation steps			
Lead agency	CCN DoE Education department	Support from:	Communication agencies
Location	Nairobi, its wards, the metropolitan area		
Budget	Modest to large recurring costs		
Timeframe	2011-2013		
Examples of successful implementation of similar actions:			
	Pune (India)		
Inter-linkages with other actions	Source separation (action 2.2)		

Name of Action	Zoning of Waste Collection	Number:	3.1
Introduction	<p>Nairobi has an estimated 200 registered Resident Associations (RA) which have formed two umbrella associations 'We Can Do It' and Kenya Alliance of Residential Associations (KARA), to lobby for improved service provision and delivery in areas such as solid waste management, water, street lighting, housing and roads. Additionally, Nairobi City is administratively broken down into several units with the Ward level comprising the smallest administrative unit.</p>		
Purpose	<p>The zoning of waste collection areas for private collector and CBO operations would result in minimised transport and thereby disposal costs to residents and legally bind residents to use the same collector; resulting in reduced waste non-collection on account of elevated costs or use of different unscrupulous companies, reduced competition of private collectors/CBOs in localities that's been noted previously as a potential barrier of entry into the sector (Karanja, 2005), and greater equity in service delivery as a result of providers having to spread out.</p>		
Description	<p>With the zoning of waste collection, contracts for collection service provision can then be tendered for by private entities and CBOs based on their capacities relative to the size of the service area, and agreed to by the relevant Resident Association for the area in question and renewed annually by the residents based on performance.</p>		
Implementation steps	<ol style="list-style-type: none"> 1) Development of by-law 2) Areas currently without RAs would be encouraged to form some for this purpose <p>To aid this action, develop a breakdown of ward level population densities and household numbers throughout Nairobi at the Regulator level (CCN) to determine and monitor waste collector allocations based on capacity.</p>		
Lead agency	CCN Urban planning department	Support from:	CCN DoE Ward councillors
Location	All wards in Nairobi city		
Budget	Modest		
Timeframe	2010-2012		
Examples of successful implementation of similar actions:			
	200 existing resident associations, organized into 2 umbrella organizations		
Inter-linkages with other actions	<p>Strong links with "Recognition of Partners", "Source separation of recyclable and pure organic wastes", "Streamlined Collection fees", Formalised Waste Collection Contracts" and "Regulation, Enforcement and Oversight of Private/CBO waste collection",</p>		

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Name of Action	Formalised Waste Collection Contracts	Number:	3.2
Introduction	With the zoning of waste collection in Nairobi, contracts for the provision of collection service will need to be tendered for by private entities and CBOs based on their capacities relative to the size of the service area, agreed to by the relevant Resident Association for the area in question, and renewed annually by the residents based on performance.		
Purpose	Contracts entered into between Private waste collectors/CBOs and Resident Associations will provide legal protection to both parties regarding fee collections and service provision as per set standards. These contracts will need minimum stipulations for the efficient provision of the collection service.		
Description	<p>Minimum stipulations envisaged in collection contracts include:</p> <ul style="list-style-type: none"> - Explicit mention of service charges in line with streamlined collection fees - Legal requirement for all generators to adequately separate waste at source into recyclables, pure organic/biodegradables and residual waste; or else risk non-service provision - Provision of 9 separation-at-source waste/bin bags per month by collectors to small generators. Legal requirement for large generators to buy and use their own waste separation containers. - Stipulation of minimum area cleanliness standards, collection frequency ,and penalties accrued on failure to achieve agreed terms - Penalties on generators if found to be engaged in illegal dumping - Explicit mention of entity that will transport collected waste to designated landfill if different from contracted waste collector/CBO, and attachment of associated sub-contract for this purpose 		
Implementation steps	<ol style="list-style-type: none"> 1) Development of by-law 2) Encouragement for formation of resident associations 3) CCN to develop generic Contract Template for use by Resident Associations & Private Collectors/CBOs stipulating collection arrangements 		
Lead agency	CCN Legal department	Support from:	<ul style="list-style-type: none"> - CCN DoE - Ward councillors
Location	All wards in Nairobi City		
Budget			
Timeframe	2010 – 2012		
Examples of successful implementation of similar actions:			
	Collection Service Agreements between <i>Karengata</i> Residents Association and Private Collectors for fee collection and service provision arrangement		
Inter-linkages with other actions	Strong links with “Recognition of Partners”, “Source Separation of recyclable and pure organic wastes”, “Streamlined Waste Collection fees”, “Zoning of Waste Collection”, and “Regulation, Enforcement and Oversight of Private/CBO waste collection”		

Name of Action	Development of Material Recovery and Transfer Facilities	Number:	3.3
Introduction	Plans are underway for the establishment of 3-4 Material Recovery and Transfer Facilities in Nairobi City		
Purpose	Aim to reduce waste volumes for disposal through the extended recovery of recyclables and quality organic waste not already captured, and to reduce residual disposal transportation costs.		
Description	These facilities reduce waste volumes for disposal through the extended recovery of recyclables and quality organic waste not already captured through previously discussed mechanisms and would also help to reduce residual waste transportation costs to landfill through the compression of residual waste and use of bulk transportation as opposed to smaller trucking. Working with formalised waste collection, waste recovery and trading, and recycling supply structures, these facilities have the potential to reduce waste volumes to landfill and overall disposal costs.		
Implementation steps	<ol style="list-style-type: none"> 1) Secure land at suitable sites 2) Concept design and cost estimation, develop management and operations model 3) Secure approval and capital investment 4) Build and operate 		
Lead agency	NEMA??	Support from:	<ul style="list-style-type: none"> • MoNMD • CCN
Location	Across Nairobi		
Budget	Very large capital investment		
Timeframe	2013 – 2015		
Examples of successful implementation of similar actions:			
	<ul style="list-style-type: none"> - Cape Town Material Recovery and Transfer Facilities, (It should however be noted here that labour intensive material recovery at the Cape Town mixed-waste Recovery & Transfer Facilities is very low; underlining the critical importance of separation of wastes at source to ease downstream recovery, as opposed to relying heavily on central recovery facilities – whether labour intensive or mechanical.) 		
Inter-linkages with other actions	Strong links with “Recognition of Partners”, “Source Separation of recyclable and pure organic wastes”, “Recovery of value from Organic wastes”, “Strengthening of Specific Recycling Strategies” and “Development of new engineered landfill site”		

Name of Action	Derivation of value from the Organic Waste fraction	Number:	4.1
Introduction	Organic waste comprises Nairobi's largest waste fraction at approx. 51% of total waste generation. A significant gap exists around recovery of value from the organic fraction. Composting accounts for less than 1% of daily organic waste generation, and seems to be currently uncompetitive against synthetic fertilizers on a cost per nutrient value basis. Further, the waste arriving at Dandora is strongly depleted of the organic fraction, with much of it rotting at collection points due to delayed and/or selective collection.		
Purpose	The fast and effective derivation of value from this fraction would divert a large percentage of Nairobi's waste to landfill; radically reducing transport and disposal costs, reduce pathogen prevalence, and with its capture at source also help to reinforce the recycling and reuse of other waste materials which would be less contaminated.		
Description	<p>Alternative and/or parallel routes for the derivation of value from, and diversion of organic waste from landfill are proposed including;</p> <ul style="list-style-type: none"> - Semi-decentralized biogas generation for energy at anaerobic digester facilities adjacent to planned Material Transfer Facilities as a primary urban organic waste treatment route - Encouragement of bio-digestion or composting at source by large organic waste generators such as institutions (e.g. schools), markets, large caterers like hotels etc - CBO (or other entities) involvement in the quick movement of fresh organic waste from restaurants and markets to livestock farmers as income generating activity. Options also exist for private entity involvement in organic waste pre-treatment for animal feed - Smaller scale composting of dried sludge from anaerobic digesters and of other non-digester suitable organic wastes e.g. hard biodegradables such as wood chips, hard greens etc 		
Implementation steps	<ol style="list-style-type: none"> 1) Development of by-laws for organic waste source separation 2) Sourcing of funding, and Development of Urban organic waste Digester infrastructure through a partnership between CCN DoE and KenGen. 3) Development of a CCN DoE program to provide expert advice to large OF generators for onsite digestion or composting 4) NGO involvement in organisation of CBOs (or other entities) in the movement of fresh organic waste from restaurants and markets to livestock farmers as income generating activity, and in value composting 		
Lead agency	CCN, KenGen	Support from:	<ul style="list-style-type: none"> - CCN DoE - NEMA - MoNMD
Location	At source for large OF generators, and adjacent to 3-4 planned Material Transfer Facilities across Nairobi City with initial concept pilot in one		

	zone or at one facility
Budget	Large investment into new infrastructure, much of it public, some private
Timeframe	2010 – 2015
Examples of successful implementation of similar actions:	
	<ul style="list-style-type: none"> - Prevalent interest in the use of organic waste as animal feed in Nairobi City (Karanja, 2005 ; Onduru et al, 2009; ISWM Secondary Report) - 700m³ Organic Waste Digester on Sisal Estate in Kilifi, Coastal Kenya (Onduru et al, 2009) - 124 m³ and 91 m³ medium scale organic waste digesters at Egerton University (Njoro) and in Moi University respectively (Onduru et al, 2009) - 70 ton/day Organic MSW treatment facility for the stabilisation of organic waste, electricity generation through anaerobic digestion and production of soil conditioner in Rayong municipality, Thailand. Produces 5100 MWh electricity per annum and 5600 tons/year of soil conditioner. Plant is expected to pay the invested cost of US\$ 4.3 million in 10 years from financial gains from electricity sales and soil conditioner (Polprasert, 2007).
Inter-linkages with other actions	Strong links with “Source Separation of recyclable and pure organic wastes with incentives”, “Formalized waste collection contracts” and “Development of material recovery and transfer stations”

Name of Action	Strengthening of Specific Recycling Strategies	Number:	4.2
Introduction	The current total recycling capacity in Nairobi City is low relative to total waste amounts of recyclable waste being generated.		
Purpose	To increase total recycling capacity in Nairobi City to take up the increased volumes of separated quality recyclable material so as to realise significant waste diversion from landfill.		
Description	<p>In 2006, the KNCPC finalized a Comprehensive Plastic Waste Strategy for Nairobi City centred on the reduction, reuse and recycling of plastic wastes in the city. While its progress to date is not yet officially documented, there is a need to develop similar strategies for other recyclable waste streams, chiefly paper.</p> <p>Paper is not a problematic material besides its capture with minimal contamination, and options exist for its profitable use in direct recycling in Nairobi, and for its anaerobic digestion for energy and/or thermal energy recovery in the form of briquetting technologies. Strategy efforts similar to the KNCPC Plastics Strategy should therefore be steered towards the encouragement of private enterprise in paper recycling, organisation and securing of dependable supply chains for quality waste paper material, into research and development of various technologies to tap into its value, and provision of seed funding for intending entrepreneurs or participants.</p>		
Implementation steps	<ol style="list-style-type: none"> 1) Development of Policy and Specific Recyclable Waste Strategies for currently non-targeted recyclable wastes such as paper, to increase total recycling capacity in the city 2) Encourage private enterprise in paper and other recyclable waste recycling, organise and secure supply chains for quality waste material, invest in appropriate technology research and development, and provide seed funding for intending participants 		
Lead agency	- KNCPC - NEMA	Support from:	- CCN DoE
Location	Across Nairobi		
Budget	Modest for policy development, large capital investments by recyclers.		
Timeframe	2010 – 2015		
Examples of successful implementation of similar actions:			
	- KNCPC Comprehensive Plastics Waste Strategy for Nairobi City launched 2006. Official documentation of success to date pending.		
Inter-linkages with other actions	Strong links with “End-of-life levies for problematic wastes”, “Source Separation of recyclable and pure organic wastes with incentives”, “Formalized waste collection contracts” and “Development of material recovery and transfer stations”		

Name of Action	Development of New Engineered Landfill Site	Number:	5.1
Introduction	The official designated dumpsite at Dandora has reached full capacity, and has been noted to be responsible for gross environmental and public health hazards (UNEP, 2006)		
Purpose	There is an urgent need to accelerate the movement of residual waste disposal to the proposed new engineered landfill at Ruai as per JICA's (1998) recommendations to reduce the environmental and public health effects of the City's generated waste.		
Description	The accelerated development of a new engineered landfill would result in minimised environmental pollutions from the waste, and have long term implications towards the future ecological and general health of Nairobi City. It is envisaged that such an engineered landfill facility would be primarily for the end disposal of residual waste, with greater emphasis placed on waste diversion for recyclable and organic/biodegradable materials via value derivation in order reduce overall disposal distances and costs, and extend landfill life expectancy.		
Implementation steps	1) Sourcing of funding for, and development of closed-off, controlled engineered landfill site		
Lead agency	NEMA	Support from:	- MoNMD - CCN
Location	Ruai		
Budget	Very large		
Timeframe	2013 – 2015		
Examples of successful implementation of similar actions:			
	- Cape Town Hazardous and Non-hazardous sanitary waste landfills		
Inter-linkages with other actions	Strong links with “End-of-life levies for problematic wastes”, “Source Separation of recyclable and pure organic wastes”, “Development of material recovery and transfer facilities” and “Regulation, Enforcement and Oversight of Private/CBO waste collection”.		

Name of Action	Rehabilitation of Dandora dumpsite	Number:	5.2
Introduction	The Dandora dumpsite is reaching the end of its capacity, and is already causing significant environmental pollution and damages to human health.		
Purpose	To end disposal of waste at Dandora, to stabilize and close the disposed waste, and to develop a material recovery facility and transfer station.		
Description	These will be a number of costly engineering projects that have to be carried out in close dialogue with interested and affected parties.		
Implementation steps	<ol style="list-style-type: none"> 1) Engineering study of constraints and possibilities 2) Design of future infrastructure 3) Stabilization and closure 4) Construction of MRF and transfer stations (possibly in parallel with 3) 		
Lead agency	CCM DoE	Support from:	Ministry of Environment
Location	Dandora		
Budget	Very large		
Timeframe	This can only start once a new disposal site is operational!		
Examples of successful implementation of similar actions:			
Inter-linkages with other actions	Development of transfer stations and MRFs.		

9. Prioritization of actions

A mix of different approaches should be used to develop the sequence in which actions could be implemented:

- Importance
- Quick wins / low-hanging fruit
- Logical order – building one action on another
- Investing in flexible platforms
- Financial logic – using savings/revenue from one action to invest in another

10. Outlook

This document has laid out a first draft of an integrated solid waste management plan for Nairobi. It is open for discussion, and input is being sought from the client (Department of Environment of the City Council of Nairobi) and from stakeholders.

Once input has been received, a final draft of the plan will be developed.

In the final plan, attention will be paid to:

- Policies (Regulatory, Fiscal, etc.)
- Technology (Equipment and Operational Strategy)
- Voluntary Measures
- Implementation Strategy for the ISWM System (Institutional Structure)