Municipal Solid Waste Composition Analysis (Wet Season) Juba, South Sudan

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TABLE OF CONTENTS

1	Introduction ……... ……..	3
2.	Methodology ……	4
3.	Procedure ……	7
4.	Health and Safety ……..	10
5.	Results ……	11
6.	Comparison Between 2012 and 2013 Exercises ……..	20
7.	Conclusions …….	22
8.	Recommendations……..	24

ATTACHMENTS

Attachment 1 Waste Definitions	26
Attachment 2 Project Team	30
Attachment 3 Project Equipment	31
Attachment 4 Waste Analysis Form	32
Attachment 5 Details of Vehicles Sampled	34
Attachment 6 Results of Waste Characterization Exercise	37

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- Juba City Council
- Juba County Council
- Rajaf Pyam
- Juba University
- Japan International Cooperation Agency (JICA)
- UNEP South Sudan office (for coordinating the process).

1. INTRODUCTION

Supporting improved waste management to help contain the environmental impacts of development is one of UNEP's main focus areas in South Sudan.

The concentration of populations in cities, towns, and camps requires appropriate resources, infrastructure, and services to treat solid and liquid waste. In fast-growing urban areas, waste management has become increasingly important as the strain on infrastructure and treatment facilities can directly impact the environment and subsequently human health. UNEP has therefore undertaken a waste characterization exercise to support Juba City Council and other municipal entities in improving their waste management systems.

The first detailed analysis of Juba's municipal solid waste was undertaken by UNEP in December 2012 during the dry season. (The report is available in hard copy from UNEP's office in Juba or online at http://postconflict.unep.ch/publications.) In compliance with best practice, a second waste analysis exercise was completed in September 2013, during the wet season, in order to capture any seasonal variation in the waste composition through the wet and dry seasons. Both exercises took place at the Lagoon dump site.

This report documents the methodology, findings, and conclusions from the second exercise and provides a consolidation of the results from the two studies.

Waste-sorting activities ongoing at Lagoon dump site, September 2013

2. METHODOLOGY

2.1 Waste Characterization

The waste characterization exercise was undertaken at the Lagoon dump from 22 to 27 September 2013. The project team comprised 14 individuals; a list of team members is provided in Attachment 2.

All equipment and logistical support was provided by UNEP's office in Juba. The Juba City Council, Munuki Payam, and Rajaf Pyam's site management and staff cooperated in the exercise.

The exercise was conducted in compliance with two international publications:

- ASTM (American Society for Testing and Materials), *Standard Test Method for Determination of the Composition of Unprocessed Municipal Solid Waste* D5231–92 (2008)
- UNEP/International Environmental Technology Centre, *Developing Integrated Solid Waste Management Plan Training Manual, Volume 1, Waste Characterisation and Quantification with Projections for Future* (2009)

The approach developed for this exercise satisfied the need for methods to be structured, produce accurate and reliable results, and be repeatable.

Picture 2 – weighing of waste and bulk density calculations on-going during the sampling exercise.

As with the initial exercise in December 2012, the selected method was based on the collection and manual sorting 32 samples, in order to provide the desired level of statistical accuracy (90%) and confidence in compliance with ASTM D5231–92 (2008). Representative sampling undertaken during this exercise is the established international practice for accurately determining waste quantities and waste characteristics.

Vehicles were selected for waste sampling at random as they entered the Lagoon waste disposal site. By interviewing the drivers, care was taken to ensure that samples were captured from each of the three pyams and from the low-, medium-, and high-income communities therein.

The recommended sample weight of approximately 100 kg was used for the study. It has been established, through various studies that measurements taken at this level do not vary significantly from measurements made on far larger samples taken from the same waste.

Nine major waste categories were selected for sampling in compliance with international best practice and the terms of reference for this exercise. These nine waste categories were further broken down into some 45 subcategories, which are detailed in the sample form in Attachment 4.

The nine major waste categories for the characterization exercise are listed below in no order of importance of comparative size:

- Paper and paperboard
- Glass
- Metal
- Plastic
- Textiles
- Organics
- Construction and demolition (C and D) wastes
- Special care wastes
- Other wastes

In compliance with ASTM–D5231 (2008), each waste sample of approximately 100 kg was sorted manually into dedicated containers for each of the respective waste components by a team of ten local staff who had been trained by the team leader prior to the commencement of the exercise. Local staff were all familiar with the site and handling of waste as they were all informally employed at the site as waste pickers.

2.2 Bulk Density

The bulk density of the incoming waste was calculated by executing several steps:

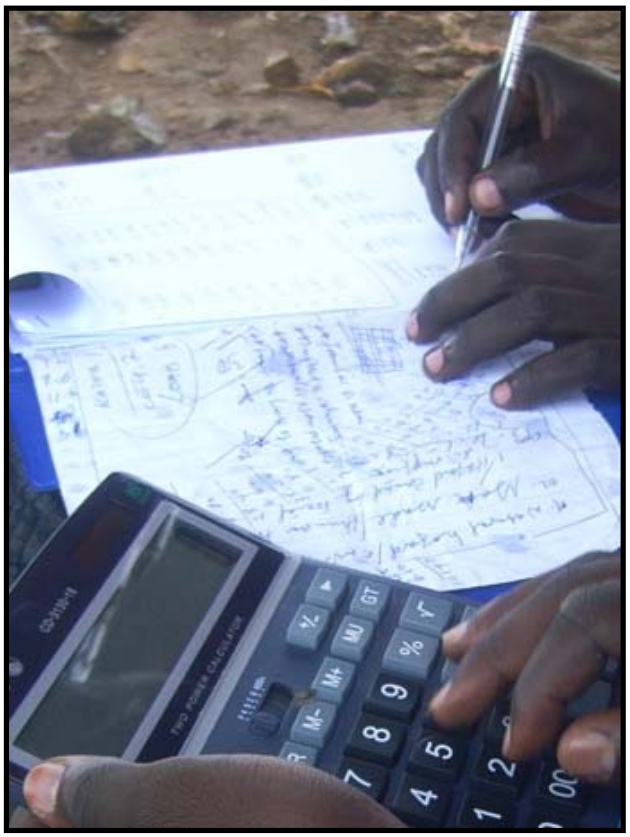
- All containers, each of a known volume (V1), were weighed, and the weight recorded (W1).
- Samples of each consignment of waste were placed in the containers until they overflowed.
- The contents of the containers were settled by dropping them three times onto the ground from an approximate height of 10 cm.
- The containers were then topped-up with additional waste from the selected sample.
- The containers were then weighed again and the weight recorded (W2).
- The bulk density was then calculated using the equation W2–W1/ V1.

Use of the site's bulldozer was extremely helpful throughout the exercise.

3. PROCEDURE

3.1 Equipment

A complete list of all equipment used throughout this exercise is provided in Attachment 3.



Calculation of waste components.

3.2. Waste Characterization

The following procedures were followed in the execution of the waste characterization exercise:

1. The area within the Lagoon site designated for the waste analysis exercise was demarcated using high-visibility traffic cones. This ensured the safety of the team by preventing vehicles and mobile equipment from randomly entering the area.
2. The demarcated area was as flat as possible and in close proximity to the tipping cell for ease of moving waste between the two zones.
3. Large tarps were spread on level ground within the designated area. The tarps minimized the amount of contamination of the waste samples from the underlying soil.
4. The 32 waste storage containers were each labelled with the waste components selected for sampling and were arranged around the perimeter of each tarp.
5. The tare weight of each of the containers was recorded and periodically re-checked. (The average tare weight was 2.2 kg.)
6. The bench scale was placed in the vicinity of the storage containers on a clean, flat wooden table.
7. The accuracy of the scale was periodically checked using a known (reference) weight.
8. Waste to be analyzed was obtained randomly from incoming waste collection vehicles, after first asking the driver the nature and source of the waste consignment.
9. Information on the sampled waste was obtained and recorded on the waste sampling form (see Attachment 4). The type of information collected for each waste sample included date, time, vehicle details, origin of waste, and weather conditions.

The HDPE cap from a PET water bottle being separated

10. Complete details of the source and type of each waste sample examined are provided in Attachment 5. Table 1 summarizes the pyams and communities from which samples were taken.

Table 1 - Communities Represented in the Waste Characterization Exercise

Pyam	Community
1. Juba Pyam	New Site, Tong Ping, Juba Town, Juba Area, Bulluk Area, Hai Jalaba
2. Munuki Payam	Rock City, Nyukuron, Nyukuron West, Block A, Block B, Block C
3. Kator Pyam	Malakai, Kator, Atlabra, Hai Kasaba, Market Area, Min Road, Jebel Area, Atlabra

11. Selected waste consignments were discharged, under supervision, from the collection vehicles adjacent to the sampling area.
12. The waste was then placed in the sample containers and weighed with the bench scales to obtain the desired sample weight of 100kg.
13. The 100kg of selected waste sample from a vehicle load was distributed over the designated tarp and the sorting personnel would commence the sorting.
14. All containers within the waste, such as capped jars, paper bags, and plastic bags, were emptied of their contents and the different materials segregated such as plastic bottle caps and metal lids from glass jars.
15. Following identification and segregation, each waste item was placed in the appropriately labelled storage container.

16. In the case of composite items found in the waste, the individual materials were separated, where practical, and the individual materials placed in the appropriate storage containers.
17. The gross weights of the storage containers were then recorded on the prescribed form, and the waste contents discarded.
18. When all the waste had been weighed and discarded, the next vehicle was selected and the process repeated.
19. On an average day, six waste samples were completed. The exercise was completed on the afternoon of Friday, 27 September, as planned.

Attachment 6 provides details of the 32 waste consignments analyzed throughout the exercise, as recommended in ASTM D5231.

4. HEALTH AND SAFETY

Because of the numerous hazards associated with the sorting of solid waste, appropriate measures were undertaken to ensure the protection of the members of the sorting team. These measures included the provision of personal protective equipment (PPE) that included boots, overalls, gloves (leather and plastic), and disposal dust masks.

The previous exercise, in December 2012, identified the presence of hazardous medical waste within the municipal waste stream as a serious concern. The team of waste sorters therefore was instructed on the dangers posed by sharp objects present in solid waste, such as nails, razor blades, hypodermic needles, and pieces of glass.

Hazardous medical waste poses a particular threat to health and safety on the site

High levels of hygiene and sanitation were observed throughout the exercise

A further risk was from projectiles that may issue when the waste is unloaded from collection vehicles. Such projectiles include pieces of glass from breaking glass containers and metal lids from plastic and metal containers that burst under pressure when run over by vehicles and heavy equipment.

Throughout the exercise, the team leader ensured that sorting personnel adhered to all health and safety measures and precautions, including the use of PPE.

Exposure of the team to heat stress, dehydration, and fatigue were monitored, and risks were minimized by providing adequate drinking water, food, and shade during rest breaks following the completion of each waste consignment.

High levels of hygiene were emphasized and provided for throughout the six-day exercise by providing water, soap, and disinfectant for use during rest breaks, prior to eating, and at the end of each working day.

No injuries were recorded during the exercise. However, many of the local staff did complain of being afflicted by cuts, primarily on their hands and feet, throughout their routine waste-picking activities.

6. RESULTS

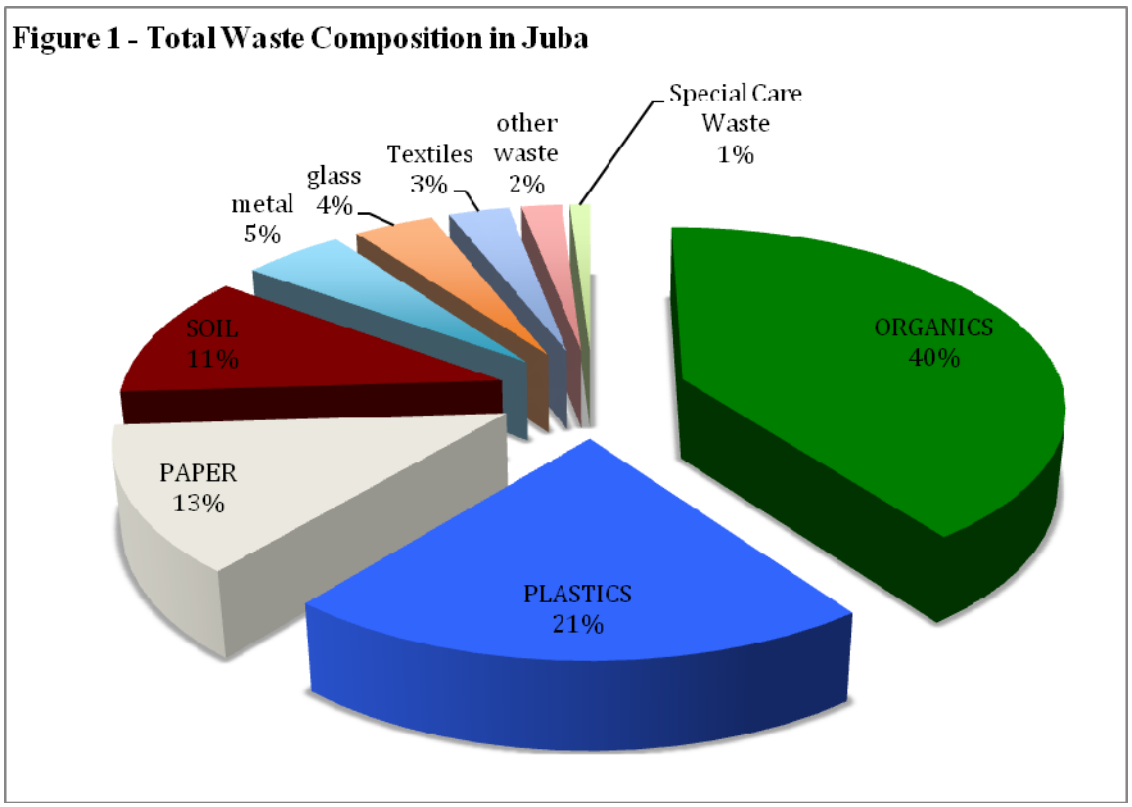
6.1 Waste Characterization

The main findings of UNEP's second waste characterization study, conducted in September 2013 at the Lagoon dump site, are provided in Table 2 and represented graphically in Figure 1.

Table 2 - Waste Composition Found in Waste Characterization Study, September 2013

No.	Waste component	% by weight
1.	Organics	40.0
2.	Plastics	21.0
3.	Paper and cardboard	13.0
4.	Soil/sand/ash	11.0
5.	Metal	5.0
6.	Glass	4.0
7.	Textiles	3.0
8.	Other waste	2.0
9.	Special care waste	1.0
	TOTAL	**100.0**

Figure 1 - Total Waste Composition in Juba



The main components of the municipal solid waste (MSW) from Juba are represented in Figure 1 above. Organic materials represented the single largest component of the MSW stream from Juba, accounting for 40% by weight. It is followed by plastics at 21%, paper 13 %, soil and ash 11%, metal 5%, glass 4%, textiles 3%, other waste 2%, and special-care waste 1%.

6.2 Major Waste Components

By far the most significant waste component of the September 2013 analysis was organic waste, at 40%, a figure comfortably within the range provided by UNEP's International Environmental Technology Centre, which derived average figures from studies in Accra, Ibadan, Dakar, Abidjan, and Lusaka.

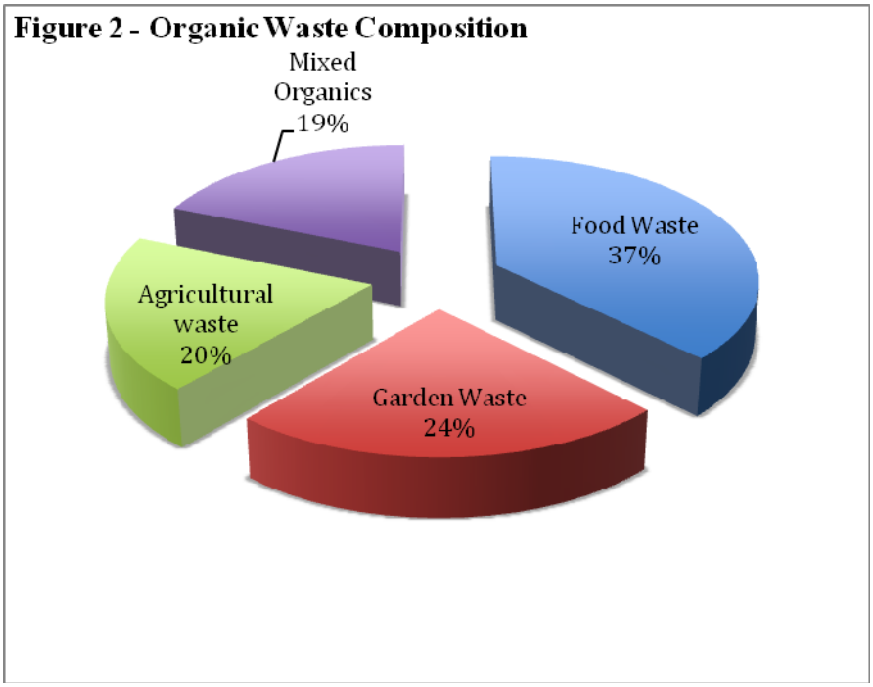
The figures obtained in this analysis for plastics (21%), paper (13%), metal (5%), and glass (4%) all show good correlation with UNEP's published figures.

Organic waste

Organic waste was the largest component of the overall waste stream, by weight accounting for 40%. Within the organic waste, food waste accounted for the largest component at 37%, with garden waste, agricultural waste, and mixed organics accounting for 24%, 20%, and 19% respectively.

It should be noted that during this sampling exercise and the earlier one in December 2012, it was observed that many of the waste pickers were eating items of food, such as fruit and kitchen waste, directly from the waste, and taking vegetables and carbohydrates from the site for cooking later in the evening.

Figure 2 - Organic Waste Composition



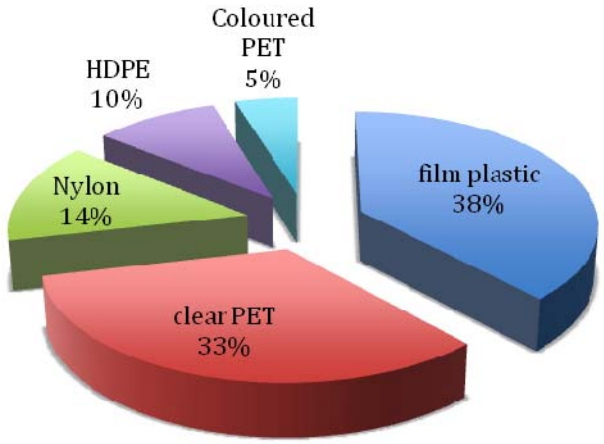
Plastic waste

Plastics were the second-largest component of the sampled waste, accounting for 21% of the total by weight.

The largest elements of plastic waste were film plastic (38%) and clear polyethylene terephthalate (PET) (33%).

The remainder of the plastic waste was made up of nylon (predominantly sacks), high-density polyethylene (HDPE), and coloured PET at 14%, 10%, and 5%, respectively.

Figure 3 - Plastic Waste Composition



Despite being the largest plastic waste component, there is no recycling activity for film plastic—probably a reflection of the low price offered for the product.

At the time of this survey, informal recycling activities for all types of PET had ceased, apparently due to a global downturn in the price. As a consequence, large piles of clear PET, typically used in the sale of drinking water, remained stockpiled at the site.

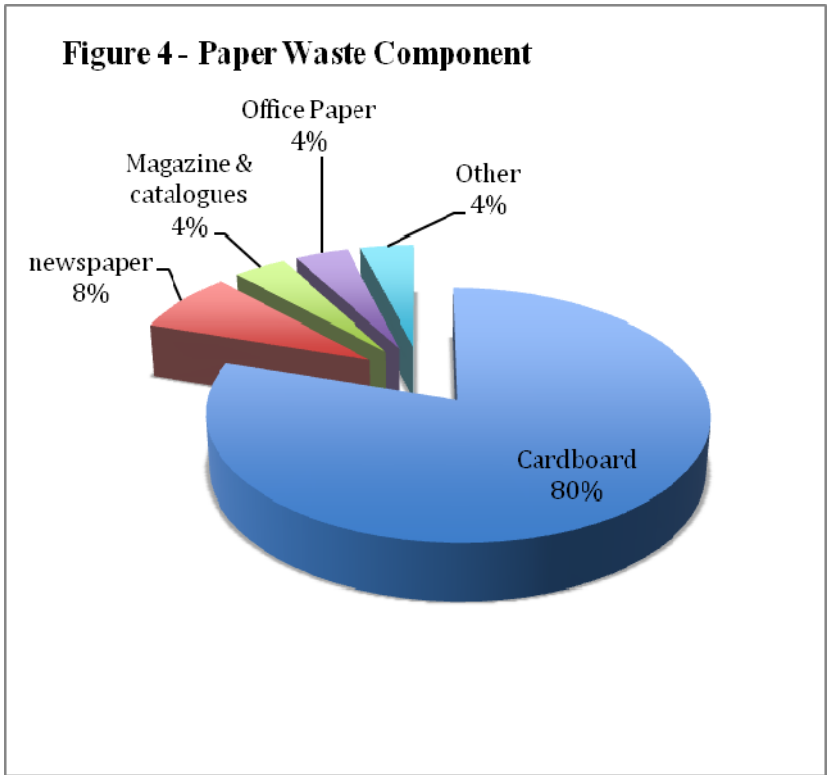
Recycling and selling of HDPE waste was, however, observed to be ongoing, whereas in 2012 there was no such activity for this product.

Paper and cardboard waste

Paper and cardboard waste made up the third-largest component of the waste stream at 13% by weight.

By far the largest component of this waste category was cardboard at 80%, followed by newspaper (8%), magazines (4%), office paper (4%), and other paper (4%).

The very high composition of cardboard is likely to reflect waste from the commercial sector, such as small shops, guest houses, and restaurants, disposing of their waste within the municipal waste-collection system. Presently there are no observed waste-recycling operations focusing on either cardboard or paper.

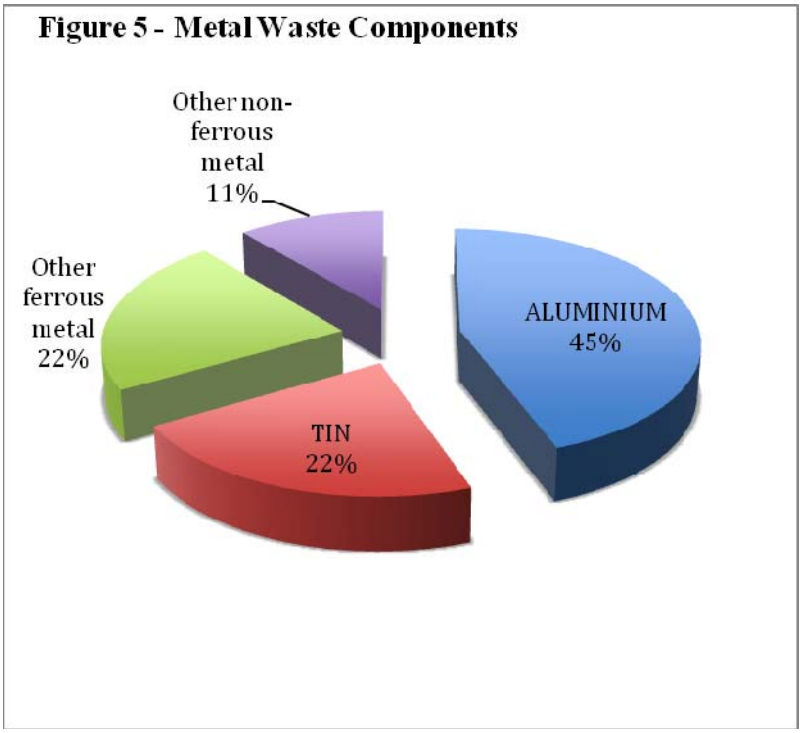


Soil, sand, and ash

This category accounted for the fourth-largest waste component at 11% by weight of the total. It was not possible to differentiate between the various differing components of soil, sand, and ash, most of which was the remaining residue within the tarp after all wastes had been placed in their respective containers. The surprisingly high total of this waste component is likely to be accounted for by the practice of yard sweeping commonly practiced throughout Juba. Soil is swept and removed, along with material collected through street sweeping.

Metal waste

Metal waste was the fifth-largest component, accounting for 5% of the total by weight.



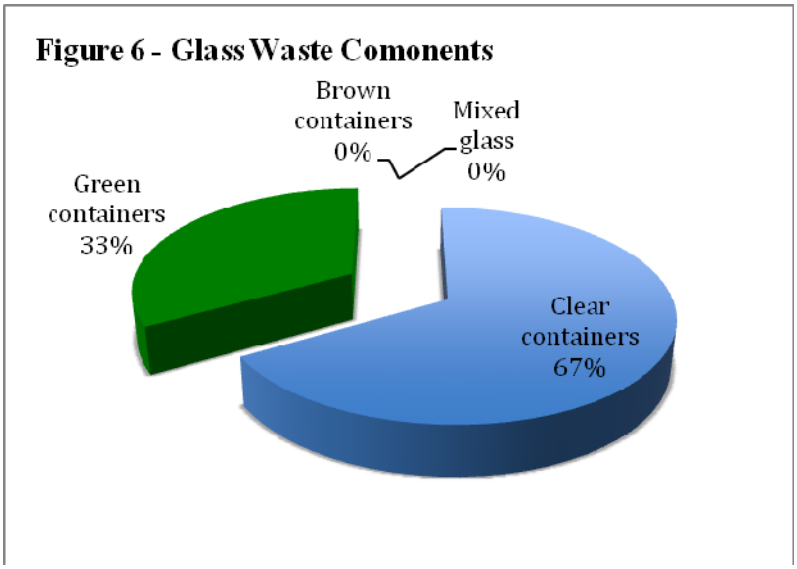
Aluminium containers, typically used for soft drinks, represents the largest component of the metal waste stream at 45%, followed by tin/steel containers at 22%, other ferrous metals at 22%, and other nonferrous metal containers at 11%.

Presently, waste-picking operations at the Lagoon dump site are removing a high proportion of the incoming aluminium containers. Middlemen who buy from the waste pickers are typically crushing the containers before transportation to either Kenya or Uganda—or, on a smaller scale, melting the aluminium to form small ingots.

Unlike during the previous exercise in 2012, waste pickers are now collecting tin/steel containers for sale to the middlemen.

Glass waste

Glass waste made up the sixth-largest component of the overall waste stream, accounting for 4% by weight of the total.



By far the largest component of the glass waste was clear glass containers at 67%, with green glass bottles at 33%. Brown glass and mixed glass were almost completely

absent from the waste stream.

Textile waste

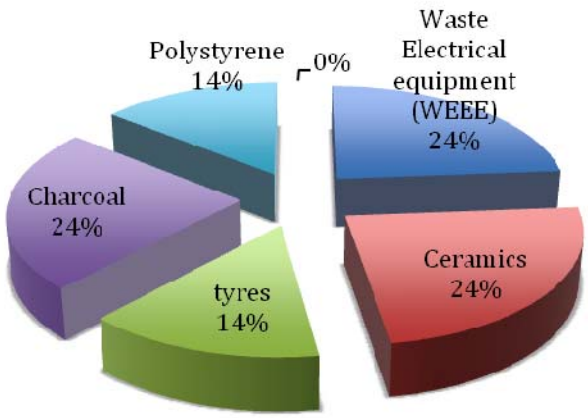
Textile waste made up the seventh-largest component of the waste stream, with 3% of the total weight. Textile waste was primarily old clothing, sheeting, and fabric.

Other waste

Other waste accounted for the eighth-largest waste component by weight. The largest elements of this category were ceramics, waste electrical equipment (WEEE), and charcoal, each at 24%, followed by tires and polystyrene, both at 14%.

Present waste-picking activities do target this category of waste in an ad hoc fashion, particularly for charcoal and waste electrical equipment.

Figure 7 - Other Wastes' Compnent

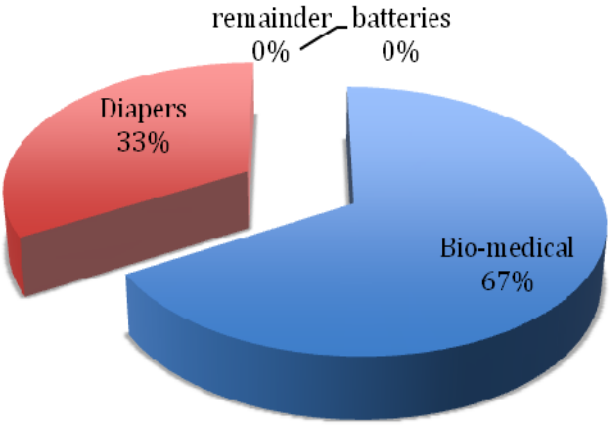


Special care waste

Special care waste accounted for the smallest component of the overall waste stream. By far the largest component of this category was biomedical waste (hazardous health care waste) —comprising a mixture of items such as syringes, needles, swabs, and soiled bandages at 67%.

Biomedical waste represents arguably the greatest threat to the health and safety of the waste pickers operating on the site. Even though the average amount of biomedical waste is only 1% of the total, it is of great concern that some sampled waste consignments were heavily contaminated with this waste stream, on occasions up to 4% by weight. Clearly, the degree of contamination in any waste consignment is a function of whether there is a hospital or medical clinic within the collection zone.

Figure 8 - Special Care waste



A worrying number of waste samples were contaminated with biohazardous waste that poses a real threat to the health and safety of waste pickers and site staff

6.3 Waste Density

The average density for Juba's waste in the September 2013 exercise was found to be 123kg/m^3, as compared to the average density of 112 kg/m^3 for the exercise in December 2012. This modest increase in density is probably a result of the higher proportion (9% more than 2012) of organic waste, which inherently has a higher density and moisture content than other waste types.

The average waste density—118kg/m^3 over the two exercises—is considered a low density for an African city, which would typically start at the range of 180kg/m^3 and could be as high as 500kg/m^3. Rather, the waste density figure for Juba falls more in the range of what would be expected within an OECD case study, which typically would have a higher plastics and a lower organics content.

The explanation for the lower density is probably that Juba itself is unlike a typical African city because it has a very large international humanitarian and development community with a higher level of income and associated purchasing patterns. This type of population typically produces more packaging waste (plastics, cans, boxes, and paper), all of which possess low densities.

Further, the low density value for household waste in Juba is also likely a reflection of the co-collection of household waste and waste produced by commercial establishments such as small shops, guest houses, and restaurants. Again, this would typically result in a higher ratio of packaging waste and thus is artificially lowering the overall density figure for municipal waste.

A comparatively low municipal waste density, such as has been recorded for Juba, would suggest that the use of compaction trucks may be a viable option to increase payloads, and hence lower operating costs. Indeed, Juba City Council recently purchased ten such compactor trucks from Europe and are using them throughout the city.

However, there are a number of reasons why the use of compactor trucks within Juba may not be a viable option. These include, but are not limited to the following:

- The extremely poor road conditions (unpaved and uneven) throughout the city and particularly the road to the dump site. These modern vehicles are not designed for such conditions and will soon start to break down, particularly having problems with the suspension, transmission, and tires.
- Market waste, for which the vehicles are being used, has an extremely high organic content—thus a very high density. It is unnecessary to further compact dense market waste of this nature and will, eventually, result in malfunctions with the hydraulic compaction mechanisms.
- Overloading the compactor vehicles with very dense market waste will further accelerate the rate of damage to the vehicles caused by the poor road conditions.
- The waste in Juba, particularly from the market, will have a high soil and sand content, which is very abrasive and will further wear and damage the compaction components of the vehicles.
- It is considered unlikely that Juba City Council will have the necessary human resources, expertise, and operational budget to deal with the frequent breakdowns and a need to purchase and import costly spare parts from Europe. Even if funds are available, this process can take several months, during which time the vehicles will remain unproductive.

- Ultimately, the absence of spare parts will likely result in the process of "cannibalization," whereby parts are borrowed from vehicles that are broken down and are used to keep other vehicles roadworthy. Unfortunately, experience suggests that this is a costly and irreversible process that will result in many of the vehicles being off the road permanently.

Road conditions such as these in Juba are having a serious impact upon waste collection vehicles, in particular the new compactors which carry a far higher pay-load

7. COMPARISON OF THE 2012 AND 2013 EXERCISES

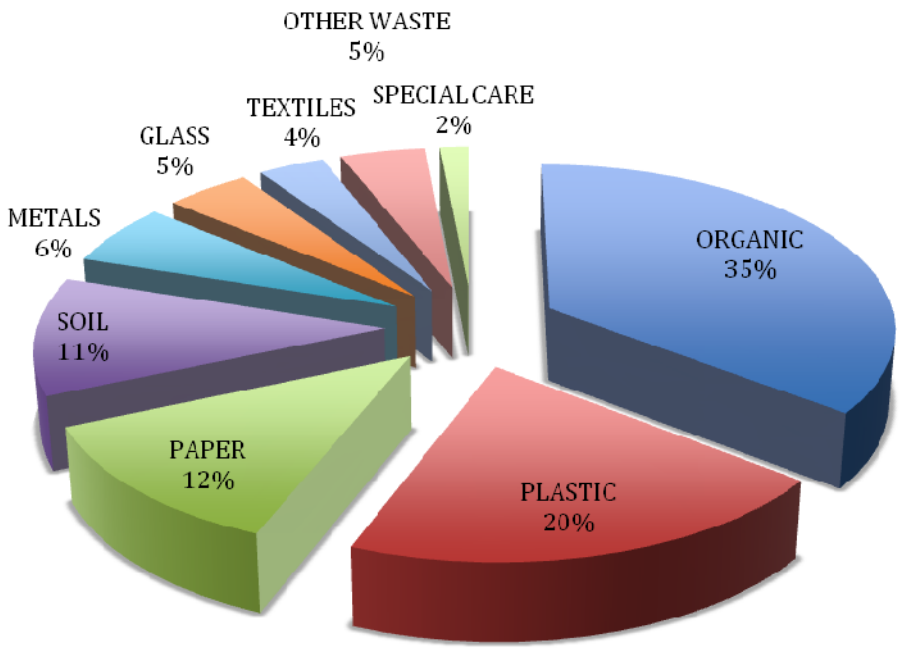
International best practice dictates that waste characterization/analysis exercises should be undertaken twice in one year, one in the wet season and one in the dry season, to capture any seasonal variations in waste trends. Accordingly, UNEP undertook waste analysis/characterization exercises of Juba's municipal waste during December 2012 and again in September 2013.

This section compares and combines the findings from the two exercises to arrive at an average representation from the combined 60 waste samples analyzed. The results are shown in Table 3 and Figure 9.

Table 3 - Average Waste Compositions, December 2012 and September 2013

No.	Waste Component	2012 (% by Weight)	2013 (% by Weight)	Average (% by Weight)
1.	Organics	31.0	40.0	35.5
2.	Plastics	20.0	21.0	20.5
3.	Paper and cardboard	12.0	13.0	12.5
4.	Soil/sand/ash	12.0	11.0	11.5
5.	Metal	7.0	5.0	6.0
6.	Glass	6.0	4.0	4.5
7.	Textiles	5.0	3.0	3.5
8.	Other waste	5.0	2.0	4.5
9.	Special care waste	2.0	1.0	1.5
	TOTAL	**100.0**	**100.0**	**100.0**

Figure 9 - Average Waste Composition 2012 - 2013



Generally, there was a very good correlation between the results obtained in 2012 and 2013, with the majority of waste categories only showing a variation of only one or two percentage points in quantity (% of total weight) between the two exercises.

The notable exception is organic waste, which increased from 31% in 2012 to 40% in 2013. One explanation may be that the actual amount of waste had not increased significantly. Rather, due to the rainy season, it may have simply contained a higher portion of water. However, this is not felt to be the case, as throughout the sampling period in September 2013 there was little, if any rain, and observations by the team leader confirmed that the organic waste was not excessively wet.

The more likely explanation is that this increase in the proportion of organic waste represents a legitimate seasonal variation—that is, that a greater amount of vegetables and fruit are locally produced and available in the market place in the wet season as compared to the dry season. However, the variation is not as large as may be expected due to the fact that a large proportion of agricultural produce is imported into the Juba area from Uganda.

8. CONCLUSIONS

1. The latest UNEP waste characterization exercise for Juba city was conducted during the last week of September 2013, during the latter part of the rainy season. The results from this exercise, coupled with those from the earlier exercise in December 2012, provide a comprehensive understanding of the city's waste composition and capture any seasonal variations in waste composition.

2. This waste characterization exercise provides important data for aiding future planning and implementation of appropriate and sustainable practices for solid waste management in Juba.

3. Waste recycling initiatives, whether formal or informal, should use the data generated by this exercise to help determine the viability and sustainability of recycling activities. At least three recyclers from Uganda, Kenya, and China have ceased operations in the last 12 months, which is in part attributed to three interrelated factors: (1) high capital start-up costs for processing equipment; (2) high transportation costs to regional hubs within Uganda and Kenya; and (3) fluctuating, and presently depressed, global prices for many recyclable materials, in particular PET.

3. However, a recently established NGO, the Environmental Rehabilitation Project (ERP), is making very promising progress in the local recycling market with technical and financial support from the French government and Southern Sudan Beverages Limited. ERP is primarily working with selected school environmental clubs, established with assistance from UNEP and community groups. It is aiming, by the end of this year, to collect and process one ton of PET waste per day—an extremely impressive figure. To date, ERP has overcome a lot of teething problems to make positive strides and may well, in the future, serve as a model of local sustainability within the recycling sector.

4. It is extremely concerning how many waste consignments were found to be contaminated with biomedical waste (hazardous health care waste) that contains such items as needles, syringes, soiled swabs, and bandages. Although accounting, on average, for only 1% of the total waste stream, some consignments had as much as 4% by weight of this extremely hazardous material. This represents arguably the greatest risk to the health and safety of the site's waste pickers and staff. Clearly, existing practices are not working, and some hospitals and clinics are abusing the system by recklessly disposing of hazardous materials.

5. By far the largest component of the local waste stream is organic waste, with an average value of 35% by weight. Presently, this material is simply being dumped into the Lagoon dump site and is using up a considerable volume of the site's void space. However, this organic waste material, coupled with the soil portion of 11%, indicates that almost half of Juba's waste stream is suitable for composting —a promising activity for the future.

6. The average waste density value over the two exercises of 118kg/m^3 is considered low for an African city, which would typically start at the range of 180kg/m^3 and be as high as 500kg/m^3. Rather, the waste density figure for Juba falls more in the range for an OECD case study. This is probably attributed to the large humanitarian and development community in Juba coupled with the co-collection of household waste with commercial waste from shops, guest houses, and restaurants. However, the use of modern compactor trucks throughout Juba may not be the right answer, due primarily to the very poor road conditions, which will likely cause a high incidence of costly vehicle breakdowns.

7. The large numbers of waste pickers within the Lagoon dump site are making an extremely valuable contribution to the city by salvaging large volumes of recyclable materials. Their salvaging significantly helps to extend the operational life of the site and thus defers capital expenditure for a new dump site for several years.

8. Looking at the larger solid waste management picture throughout Juba, significant operational improvements have been made at the dump site by JICA, and waste collection appears to be far more efficient through the recent efforts of Juba City Council. However, for waste management practices to be elevated to the desired level, and for them to be sustainable, a number of interrelated factors need to be addressed, including but not necessarily limited to:

    - institutional capacity building,
    - supportive policy and legislative frameworks,
    - public education and awareness raising, and
    - cost-recovery mechanisms.

9. RECOMMENDATIONS

1. UNEP should share this report, and its key findings, with both the local and international communities to help with the management of municipal waste within Juba and in particular to assist any existing or proposed waste-recycling activities.

2. Juba presents a very difficult operating environment in which to introduce sustainable waste-recycling initiatives. However, the work of the local NGO Environmental Rehabilitation Project is extremely promising and may serve as a sustainable model. UNEP, and the broader UN family, should support such initiatives and should commence waste segregation within their offices and residential camps at the earliest possible opportunity.

3. The greatest concern arising out of the completion of this exercise is the high level of contamination of municipal waste by biomedical waste (hazardous health care waste). This unacceptable situation represents the greatest risk to the health and safety of the site's waste pickers and staff. The appropriate authorities within Juba should, as a matter of priority, communicate with the health care sector and reinforce the correct measures to be taken and the penalties for noncompliance. At a minimum, biomedical waste should be stored, transported, and disposed of separately, including the use of dedicated bins and vehicles, and there should be a dedicated trench within the dump site that is covered daily.

4. Based upon the findings of this survey, serious consideration should be given to identifying the most efficient and economic way, at a pilot level, of separating off the organic material and soil fraction of the waste and producing compost. Part of this activity should be determining whether there is potentially a local market within the agricultural sector for waste-derived compost. If not, consideration should be given to using the waste-derived compost as cover material within the site, as there is a serious shortage of cover material. This topic merits a separate study from a suitably qualified expert.

5. Because the large numbers of waste pickers at the Lagoon dump site make a valuable contribution to the city by salvaging large volumes of recyclable materials, the relevant authorities—including JCC, Rajaf Pyam, and Juba County—should review the possibility of better protecting the health and safety of the waste pickers. In several countries waste pickers are better protected than in South Sudan. UNEP and other members of the UN family should help facilitate these discussions. Potential steps to be introduced at the site:

- Registering all waste pickers;
- Providing ID cards;
- Providing basic health and safety equipment including:
    - Boots;
    - Gloves;
    - Overalls;
    - High reflective vests;
    - Disposable dust masks.
- Introducing health screening and check-ups;
- Establishing a portable school to provide basic education for children on the site for at least a couple of hours in the afternoon.
- Providing basic toilet and bathing/washing facilities.
- Developing a code of conduct detailing the type of behaviour required at the site, including:
    - No fighting;
    - No drinking alcohol;
    - No lighting fires;
    - No abusive/threatening behaviour;
    - Use of personal protective equipment at all times.
- Failure to comply with these conditions would ultimately result in the offenders having their ID/pass removed and being banned from the site for a specific period of time or indefinitely.

There are a number of countries around the world, including some in Africa, where such measures have been successfully implemented.

6. UNEP should act as a catalyst to commence dialogue with the international humanitarian and development communities, including NGOs, to seek cooperation and potential funding to address the key factors that would improve solid waste management in Juba and ultimately make it sustainable, namely:

- Building institutional capacity;
- Developing supportive policy and legislative frameworks;
- Designing and implementing public education and awareness-raising activities;
- Identifying and implementing appropriate and affordable cost-recovery mechanisms.

ATTACHMENT 1
WASTE DEFINITIONS

Paper and paperboard

1. ***Newspaper***. Paper used in newspapers and all items made from newsprint, such as free advertising guides.

2. *Cardboard.* Three-layered, with the centre wavy layer sandwiched between two outer layers. It does not have any wax coating on the inside or outside. This type includes entire cardboard containers, such as shipping and moving boxes, computer packaging cartons, and sheets and pieces of boxes and cartons. It does not include chipboard.

3. *Magazines and catalogues*. Items made of glossy coated paper. This paper is usually slick, smooth to the touch, and reflects light. This type includes glossy magazines, catalogues, brochures, and pamphlets.

4. *Office paper*. Paper generated in an office setting, including computer paper, white envelopes, white window envelopes, notebook paper, ground wood computer paper, carbonless forms, goldenrod coloured paper, and school construction paper.

5. Other miscellaneous paper. Items made mostly of paper that do not fit into any of the other paper types. Includes telephone books and directories, items made of chipboard, ground wood paper, and deep-toned or fluorescent dyed paper. Examples are unused paper plates and cups, perforated edge (fan-fold) computer paper, manila folders, manila envelopes, index cards, white envelopes, butcher paper, hard cover and soft cover books, waxed corrugated cardboard, aseptic packages, plastic-coated paper milk cartons, waxed paper, tissue, paper towels, blueprints, sepia, onion skin, fast-food wrappers, carbon paper, self-adhesive notes, and photographs.

Glass

6. *Clear containers*. Clear glass beverage or food containers, including whole or broken clear soda, beer, fruit juice, and liquor bottles; fruit, jam, and mayonnaise containers.

7. *Green containers*. Green glass beverage containers, including whole or broken green soda and beer bottles and food jars.

8. *Amber containers*. Amber glass beverage or food containers; includes whole or broken brown soda and beer bottles and food jars.

9. *Remainder/composite glass*. Glass that cannot be put in any other category. It includes flat (pane) glass as well as items made mostly of glass but combined with other materials, such as window glass, Pyrex, Corning ware, crystal and other glass tableware, mirrors, light bulbs, and auto windshields.

Metal

10. ***Tin/steel containers***. Rigid containers made mainly of steel. These items, used to store beverages and food, will stick to a magnet and may be tin-coated. This type includes beverage containers, including bimetal containers with steel sides and aluminium ends.

11. ***Aluminium containers***. Any beverage/food container made mainly of aluminium. This type includes aluminium soda, beer, and food containers. It does not include bimetal containers with steel sides and aluminium ends.

12. ***Other ferrous metal***. Any ferrous metal items not mentioned above.

13. ***Other non-ferrous metal***. Any non-ferrous metal items not mentioned above.

14. ***Major appliances***. Discarded major appliances of any colour. These items are often enamel-coated. Examples include washing machines, clothes dryers, hot water heaters, stoves, and refrigerators. This type does not include electronics, such as televisions and stereos.

Plastics

15. ***Clear PET bottles/containers.*** Clear polyethylene trephthelate beverage/food containers. When marked for identification, it bears the number 1 in the centre of the triangular recycling symbol and may also bear the letters "PETE" or "PET." A PETE container usually has a small dot left from the manufacturing process, not a seam. It does not turn white when bent. This type includes juice, soft drink, and water bottles and some liquor bottles.

16. ***Green PET bottles/containers*.** Green polyethylene trephthelate beverage/food containers. See above for details.

17. ***Amber PET bottles/containers.*** Amber polyethylene trephthelate beverage/food containers. See above for details.

18. ***HDPE containers***. Natural and coloured high-density polyethylene containers. This plastic is usually either cloudy white, allowing light to pass through it (natural) or a solid colour, preventing light from passing through it (coloured). When marked for identification, it bears the number 2 in the triangular recycling symbol. This type includes milk jugs, water jugs, detergent bottles, some hair-care bottles, and empty motor oil, antifreeze, and other vehicle and equipment fluid containers.

19. ***Film plastic***. Flexible plastic sheeting made from a variety of plastic resins, including high-density polyethylene (HDPE) and low-density polyethylene (LDPE). It can be easily contoured around an object by hand pressure. This type includes plastic garbage bags, agricultural film, food bags, dry cleaning bags, grocery store bags, packaging wrap, and food wrap. It does not include rigid bubble packaging.

20. ***Other plastic items.*** Plastic items not mentioned above. This includes containers made of types of plastic other than HDPE (high-density polyethylene) or PETE (polyethylene trephthelate). Items may be made of PVC (polyvinyl chloride), LDPE (low-density polyethylene), PP (polypropylene), PS (polystyrene), or mixed resins. When marked for identification, these items may bear the number 3, 4, 5, 6, or 7 in the triangular recycling symbol. This type includes food containers such as bottles for salad dressings and vegetable oils, flexible and brittle yogurt cups, syrup bottles, margarine tubs, and

microwave food trays. It also includes some shampoo containers and vitamin bottles, plastic outdoor furniture, plastic toys and sporting goods, and plastic houseware, such as mop buckets, dishes, cups, and cutlery. It also includes building materials such as house siding, window sashes and frames, housings for electronics such as computers, televisions, and stereos, and plastic pipes and fittings.

Textiles

21. ***Textiles***. Items made of thread, yarn, fabric, or cloth. This type includes clothes, fabric trimmings, draperies, carpets, carpet padding, and all natural and synthetic cloth fibres. It does not include cloth-covered furniture, mattresses, leather shoes, leather bags, or leather belts.

Organics

22. ***Food waste***. Food material resulting from the processing, storage, preparation, cooking, handling, or consumption of food. This type includes material from industrial, commercial, or residential sources. It includes discarded meat scraps, dairy products, eggshells, fruit or vegetable peels, and other food items from homes, stores, and restaurants. It also includes processed residues or material from canneries, distilleries, breweries, or other industrial sources.

23. ***Garden waste***. Non-food organic materials resulting from property landscaping and maintenance. This type includes leaves, trees, and grass cuttings.

24. ***Agricultural waste***. Food organic materials resulting from agricultural harvesting of vegetables, including pruning, shrubs, branches, stumps, and tree trunks.

25. ***Abattoir waste***. Non-food organic materials resulting from property maintenance and construction activity. Includes branches, stumps, and tree trunks.

26. ***Remainder/composite organic***. Organic material that cannot be put in any of the above categories. This category includes items made mostly of organic materials but combined with other material types. Includes leather items, cork, hemp rope, garden hoses, rubber items, hair, cigarette butts, diapers, feminine hygiene products, small wood products (such as Popsicle sticks and tooth picks), agricultural manures, and animal feces.

Construction and demolition (C and D) materials

27. ***Concrete***. A hard material made from sand, aggregate gravel, cement mix, and water, as well as masonry bricks and mortar. This type includes pieces of building foundations, concrete paving, concrete blocks, and clay bricks.

28. ***Lumber.*** Processed wood for building, manufacturing, landscaping, packaging, as well as processed wood from demolition. Includes dimensional lumber, lumber cut-offs, engineered wood such as plywood and particleboard, wood scraps, pallets, wood fencing, wood shake roofing, and wood siding.

29. ***Remainder/composite construction and demolition***. Construction and demolition material that cannot be put into any of the above categories. This type may include items from different categories combined, which would be very difficult to separate. It includes ceramics, tiles, toilets, sinks, fiberglass insulation, rock, stones, and sand, clay, soil, and other fine material. It may also include demolition debris that is a mixture of items such as plate glass, wood, tiles, gypsum board, aluminium scrap, shingles, and other roofing material.

Special care wastes

30. ***Paint***. Containers with paint in them. Examples: latex paint, oil-based paint, and tubes of pigment or fine art paint. This type does not include dried paint, empty paint cans, or empty aerosol containers.

31. ***Hazardous materials***. Containerized liquids, solids, and gases that are potentially hazardous to human health or the environment. This type includes acids, bases, oxidizers, and flammable materials used in domestic and industrial applications. It also includes aerosol cleaners and lubricants, drain cleaner, paint solvent, antifreeze, brake fluid, and pressurized propane cylinders.

32. ***Biomedical***. Waste materials specifically associated with hospital and health care services and requiring specialized management. This type includes syringes, lab glass, heavily soiled dressings, tissue samples, and pharmaceutical wastes. It does not include non-hazardous health-care facility wastes generated through food preparation, building maintenance, and administrative functions.

33. ***Batteries***. Any battery, such as lead acid batteries and dry cell batteries, from all sources.

34. ***Oil filters***. Oil filters from vehicles

35. ***Remainder/composite special care waste***. Material that cannot be put in any other of the above categories.

Other wastes

36. ***Waste electrical products***. Includes cables, wires, switches, and computer appliances.

37. ***Tires***. Vehicle tires, including those from trucks, automobiles, motorcycles, heavy equipment, and bicycles.

38. ***Furniture***. Household and office furnishings not defined previously. This type includes all sizes and types of furniture, including mattresses, box springs, tables, and chairs.

39. ***Ceramics***. Domestic utensils such as cups, saucers, and plates.

40. ***Other***. Material that cannot be put in any of the categories listed above. This category includes mixed residues that cannot be further sorted.

ATTACHMENT 2
PROJECT TEAM

No	Name	Position
1.	Mr. Michael J. Cowing	Team leader
2.	Mr. Makur Jacob Akuei	Supervisor
3.	Mr. Bahadin Hassan.	Supervisor
4.	Mr. Justin Justin Lokudu Elia	Coordinator
5.	Ms. Susan Ben Emmanuel	Waste sorter
6.	Ms. Margret Abalo Amin	Waste sorter
7.	Mr. John Ogikki Lado	Waste sorter
8.	Mr. James Lodule Peter	Waste sorter
9.	Ms. Sarah Bilal Joseph	Waste sorter
10.	Ms. Lucia Jaguru Luti	Waste sorter
11.	Mr. Joseph Wurjo Lado	Waste sorter
12.	Mr. Jacklin Alexander Wachja	Waste sorter
13.	Ms. Cecilia Bernardo Loful	Waste sorter
14.	Ms. Susan Ben Emmanuel	Waste sorter

ATTACHMENT 3
PROJECT EQUIPMENT

1.	The site's tracked loader to transport, when necessary, samples of waste to the area designated for the analysis exercise and to clear away the waste following each sample analysis.
	One bench scale
2.	One crane scale with a capacity of 125 kg
3.	Four heavy-duty tarps
4.	Four shovels
5.	Four rakes
6.	Four hand brooms
7.	Thirty-five waste containers, labelled for each subcategory of waste
8.	Two wheel barrows
9.	One large canopy to provide shade and shelter during heavy rain
10.	Twenty traffic cones
11.	One large first aid kit
12.	One eye bath
13.	Personal protective equipment (PPE) for the ten staff members, including overalls, leather and
14.	latex gloves, rubber boots, and disposable face masks
15.	Portable wash-water facilities with soap and disinfectant
16.	Drinking water and lunch for samplers each day

ATTACHMENT 4
WASTE ANALYSIS FORM

- **DATE:**
- **TIME:**
  - **STARTED:**
  - **FINISHED:**
- **WEATHER CONDITIONS:**
- **VEHICLE I.D:**
- **WASTE ORIGINATING FROM:**
- **FORM COMPLETED BY:**
  - **NAME:**
  - **SIGNATURE:**

	MATERIAL TYPE	Gross (kg)	Tare (kg)	Net (kg)	% of Total
	PAPER AND PAPERBOARD				
1	Newspaper				
2	Cardboard/boxboard				
3	Magazines/catalogues				
4	Office paper				
5	Other/miscellaneous paper				
	GLASS				
6	Clear containers				
7	Green containers				
8	Amber containers				
9	Remainder/composite glass				
	METAL				
10	Tin/steel containers				
11	Aluminium containers				
12	Other ferrous metal				

13	Other non-ferrous metal				
14	Major appliances				

	PLASTICS				
15	Clear PET bottles/containers				
16	Green PET bottles/containers				
17	Amber PET bottles/containers				
18	HDPE containers				
19	Film plastics				
20	Other plastics				
	TEXTILE				
21	Textiles				
	ORGANICS				
22	Food waste				
23	Garden waste				
24	Agricultural waste				
25	Abattoir waste				
26	Remainder/composite organics				
	CONSTRUCTION AND DEMOLITION MATERIAL				
27	Concrete				
28	Lumber				
29	Remainder/composite C and D				
	SPECIAL CARE WASTES				
30	Paint				
31	Hazardous materials				
32	Biomedical				
33	Batteries				
34	Oil filters				
35	Remainder/composite S.C. waste				
	OTHER WASTE				
36	Waste electrical equipment (WEEE)				
37	Tyres				

ATTACHMENT 5
DETAILS OF VEHICLES SAMPLED, 22–27 SEPTEMBER 2013

Sample no.	Sample date	Sample time	Waste source	Waste type	Vehicle and collection type	Vehicle registration
1.	22 Sept 2013 Sunday	09.45 hrs.	Kator Payam	Residential (low income)	Tipper Community dump	CE 189D
2.	22 Sept 2013 Sunday	10.30 hrs.	Juba Payam Hai Jalaba	Residential (middle/high income	Tipper Community dump	EE 050B
3.	22 Sept 2013 Sunday	11.45 hrs.	Kator Payam Atlabra	Residential (low income)	Tipper Community dump	CE 680E
4.	22 Sept 2013 Sunday	12.00 hrs.	Munuki Payam Block A	Residential (middle income)	Tipper Community dump	CEG 119A
5.	23 Sept 2013 Monday	09.30 hrs.	Kator Payam Jebel area	Residential (high income)	Tipper Community dump	CE 979C
6.	23 Sept 2013 Monday	09.45 hrs.	Munuki Payam Block B	Residential (low income)	Dump-truck Community dump	CE 719H
7.	23 Sept 2013 Monday	10.30 hrs.	Kator Payam Main road area	Residential (high income)	Compactor Door to door	CEG 225A
8.	23 Sept 2013 Monday	11.00 hrs.	Kator Payam Juba area	Residential (middle income)	Tipper Community dump	CEG 224A
9.	23 Sept 2013 Monday	12.15 hrs.	Munuki Payam Block A	Residential (low income)	Tipper Community dump	CEG 120A
10.	23 Sept 2013 Monday	12.30 hrs.	Juba Payam Tong Ping and Hai Thoura	Residential (middle income)	Tipper Community dump	CE 543E

Sample no.	Sample date	Sample time	Waste source	Waste type	Vehicle and collection type	Vehicle registration
11.	24 Sept 2013 Tuesday	09.15 hrs.	Munuki Payam Nyukuron West	Residential (low income)	Flat-bed Community dump	CE 768E
12.	24 Sept 2013 Tuesday	10.30 hrs.	Kator Payam Market area	Residential (high income)	Compactor Door to door	EEG 225A
13.	24 Sept 2013 Tuesday	11.00 hrs.	Juba Payam Hai-Jalaba	Residential (high income)	Tipper truck Community dump	CEU 236A
14.	24 Sept 2013 Tuesday	11.30 hrs.	Munuki Payam Block C	Residential (low income)	Tractor and trailer Community dump	CEG 119A
15.	24 Sept 2013 Tuesday	12.00 hrs.	Juba Payam Bulluk Area	Residential (low income)	Tractor and trailer Community dump	CEG 117A
16.	24 Sept 2013 Tuesday	12.30 hrs.	Kator Payam Atlabara	Residential (low income)	Compactor truck Community dump	CEG 224A
17.	25 Sept 2013 Wednesday	09.00 hrs.	Juba Payam Tong Ping	Residential (high income)	Tipper truck House to house	CE 449E
18.	25 Sept 2013 Wednesday	09.00 hrs.	Munuki Payam Rock City	Residential (low income)	Tipper truck Community dump	CE 915C
19.	25 Sept 2013 Wednesday	09.30 hrs.	Munuki Payam Nyukuron	Residential (low income)	Tipper truck Community dump	CE 719H
20.	25 Sept 2013 Wednesday	10.00 hrs.	Kator Payam Malakia	Residential (middle income)	Tipper truck Community dump	CEG 225A
21.	25 Sept 2013 Wednesday	10.30 hrs.	Juba Payam Tong Ping	Residential (high income)	Tipper truck House to house	EG 1181A
22.	25 Sept 2013 Wednesday	11.30 hrs.	Juba Payam Juba Town	Residential (high income)	Tipper truck House to house	EE 050B

Sample no.	Sample date	Sample time	Waste source	Waste type	Vehicle and collection type	Vehicle registration
23.	26 Sept 2013 Thursday	08.30 hrs.	Juba Payam Tong Ping	Residential (high income)	Tipper truck Community dump	CE 485F
24.	26 Sept 2013 Thursday	08.30 hrs.	Munuki Payam Nyukuron	Residential (low income)	Tipper truck House to house	CE 719H
25.	26 Sept 2013 Thursday	09.30 hrs.	Kator Payam Malakia	Residential (Middle income)	Tipper truck Community dump	CEG 225A
26.	26 Sept 2013 Thursday	09.30 hrs.	Juba Payam New Site	Residential (middle income)	Tipper truck House to house	CE 448E
27.	26 Sept 2013 Thursday	11.00 hrs.	Kator Payam Hai Kasaba	Residential (low income)	Tipper truck Community dump	CEG 226D
28.	26 Sept 2013 Thursday	11.30 hrs.	Kator Payam Atlabra	Residential (middle/high income)	Tipper truck House to house	CEG 224A
29.	27 Sept 2013 Friday	08.00 hrs.	Munuki Payam Nyukuron	Residential (low income)	Tipper truck Community dump	CE 719H
30.	27 Sept 2013 Friday	09.00 hrs.	Kator Payam Kator	Residential (middle income)	Flat-bed truck Community dump	CE 768E
31.	27 Sept 2013 Friday	10.30 hrs.	Munuki Payam Rock City	Residential (low income)	Flat-bed truck House to house	CE 935H
32.	27 Sept 2013 Friday	11.00 hrs.	Kator Payam Malakia	Residential (low/middle Income)	Tipper truck House to house	CEG 225A

ATTACHMENT 6
RESULTS OF WASTE CHARACTERIZATION EXERCISE

	SAMPLE NUMBER										
	1	2	3	4	5	6	7	8	9	10	11
ORGANICS											
Food Waste	13.00	15.00	5.00	18.00	20.00	24.50	10.50	10.00	9.50	11.50	21.00
Garden Waste	10.00	14.00	7.50	15.00	2.00	2.50	7.50	7.00	26.00	16.00	13.00
Agricultural waste	8.00	6.00	8.00	8.00	1.00	21.00	10.00	17.00	0.00	16.50	10.50
Remainder/composite Organics	6.00	5.00	16.00	0.00	9.00	1.00	7.50	1.00	8.00	0.00	7.50
	37.00	40.00	**36.50**	**41.00**	**32.00**	**49.00**	**35.50**	**35.00**	**43.50**	**44.00**	**52.00**
SOIL/ SAND/ ASH											
Soil/ Sand/ ash	**5.50**	**5.00**	**4.00**	**14.00**	**7.00**	**8.00**	**7.00**	**8.00**	**9.00**	**9.00**	**14.50**
PLASTICS											
Clear PET Containers	10.00	12.00	11.50	3.50	12.00	6.50	13.00	8.00	5.00	8.00	4.50
Green PET containers	0.50	0.50	0.50	0.00	1.00	0.50	0.50	0.50	0.00	0.00	0.50
Brown PET containers	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00
HDPE containers	2.00	3.00	1.50	7.50	1.00	3.50	5.50	1.50	1.00	1.00	0.50
Film Plastic	9.00	11.00	6.00	8.50	14.00	7.00	6.50	11.00	12.00	11.50	5.00
Nylon	2.00	3.00	1.00	2.00	4.00	2.00	0.00	2.50	5.00	1.00	3.00
	26.00	**29.50**	**20.50**	**21.50**	**32.00**	**20.00**	**25.50**	**23.50**	**21.00**	**21.50**	**13.50**
TEXTILES											
Textiles/ fabric/ leather	**4.00**	**5.00**	**1.50**	**5.00**	**4.00**	**2.00**	**4.50**	**2.00**	**2.00**	**6.00**	**3.50**
PAPER & CARDBOARD											
Newspaper	0.50	0.50	0.50	4.00	0.50	1.00	1.00	1.00	1.50	1.50	1.00
Cardboard	11.00	7.00	18.50	4.50	18.00	8.00	9.50	14.00	12.00	3.00	3.00
Magazine & catalogues	0.00	1.50	0.00	0.50	0.00	1.00	0.00	0.50	0.00	1.00	0.50
Office Paper	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00
Other/ miscellaneous	3.00	0.00	0.00	3.00	0.00	1.00	0.00	0.00	0.00	0.00	2.00
	14.50	9.00	**19.00**	**12.00**	**18.50**	**11.00**	**10.50**	**15.50**	**13.50**	**6.00**	**6.50**
GLASS											
Clear containers	3.00	1.00	2.00	0.50	0.00	1.00	4.00	3.00	2.00	3.00	2.00
Green containers	0.50	0.00	6.00	0.00	1.00	0.50	0.00	0.50	1.00	2.50	0.50
Brown containers	1.00	0.00	0.50	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00
Remainder/ composite glass	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4.50	1.00	**8.50**	**0.50**	**1.00**	**2.00**	**4.00**	**3.50**	**3.00**	**5.50**	**2.50**
METAL											
Tin/ Stell containers	2.00	1.50	2.00	0.50	5.00	3.00	1.00	1.00	2.00	1.50	1.00
Aluminium containers	3.00	0.50	2.00	1.50	0.00	2.00	5.00	3.00	2.50	2.50	2.00
Other ferrous metal	0.00	0.50	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other non-ferrous metal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5.00	2.50	**4.00**	**3.00**	**5.00**	**5.00**	**6.00**	**4.00**	**4.50**	**4.00**	**3.00**
CONSTRUCTION & DEMOLITION WASTE											
Concrete	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lumber	4.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Remainder/ Composite C&D Wa	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00
	0.00	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.50**	**0.00**	**0.00**	**0.00**	**0.00**
SPECIAL CARE WASTE											
Paint	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hazardous materials	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bio-medical waste	0.50	0.50	4.00	0.50	0.00	0.00	0.00	1.50	0.50	1.00	0.50
Disposalable Nappies/ diapers	1.00	0.50	0.00	0.50	0.00	1.50	0.00	1.00	1.00	0.00	1.00
Batteries	0.00	0.00	0.00	0.00	0.50	0.50	0.00	0.00	0.00	0.50	1.00
Oil Filters	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Remainder/ composite S.C.Wast	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	1.50	**1.00**	**4.00**	**1.00**	**0.50**	**2.00**	**0.00**	**2.50**	**1.50**	**1.50**	**2.50**
OTHER WASTE											
Waste Electrical equipment (WE	0.50	0.00	1.50	0.50	0.00	0.00	0.00	1.00	0.50	1.50	0.50
Ceramics	0.00	2.00	0.00	0.50	0.00	0.00	1.00	1.50	0.00	1.00	0.50
Charcoal	1.00	3.00	0.50	1.00	0.00	1.00	5.50	0.00	0.00	0.00	1.00
Polystyrene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.50	0.00	0.00
Tyres	0.00	2.00	0.00	0.00	0.00	0.00	0.00	3.50	0.00	0.00	0.00
	2.00	**7.00**	**2.00**	**2.00**	**0.00**	**1.00**	**6.50**	**6.00**	**2.00**	**2.50**	**2.00**
TOTAL (%)	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**

WASTE TYPE	12	13	14	15	16	17	18	19	20	21	22
ORGANICS											
Food Waste	18.50	12.00	13.00	15.00	16.00	15.00	21.50	22.50	22.00	8.50	16.00
Garden Waste	3.50	17.00	9.00	11.00	9.50	7.00	15.00	10.00	6.00	12.00	10.00
Agricultural waste	7.50	15.00	7.50	5.00	7.00	4.00	2.00	5.00	2.50	9.00	6.00
Remainder/composite Organics	8.50	7.00	3.50	11.00	4.00	4.50	0.00	5.00	13.00	13.00	6.50
	38.00	**51.00**	**33.00**	**42.00**	**36.50**	**30.50**	**38.50**	**42.50**	**43.50**	**42.50**	**38.50**
SOIL/ SAND/ ASH											
Soil/ Sand/ ash	**10.50**	**10.50**	**12.50**	**13.50**	**14.00**	**11.00**	**9.00**	**12.00**	**12.00**	**9.00**	**8.50**
PLASTICS											
Clear PET Containers	3.00	4.00	4.50	7.00	9.00	4.50	3.00	5.50	5.00	13.00	3.00
Green PET containers	0.50	1.00	1.00	0.00	0.50	0.50	0.00	0.50	0.00	1.50	1.50
Brown PET containers	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00
HDPE containers	5.00	2.50	2.00	2.50	2.50	1.00	5.00	2.50	3.00	1.00	5.00
Film Plastic	11.00	7.00	6.00	9.50	10.00	15.00	8.00	12.00	6.00	7.50	9.00
Nylon	3.00	1.00	5.00	2.50	0.50	7.00	7.50	11.00	2.00	0.00	1.50
	24.00	**15.50**	**18.50**	**21.50**	**22.50**	**28.00**	**23.50**	**32.00**	**16.00**	**23.00**	**20.00**
TEXTILES											
Textiles/ fabric/ leather	**5.00**	**2.00**	**5.00**	**3.00**	**3.50**	**4.00**	**4.00**	**6.00**	**4.00**	**3.50**	**1.00**
PAPER & CARDBOARD											
Newspaper	0.50	0.50	0.00	1.00	1.00	0.00	2.50	0.50	0.50	1.50	0.50
Cardboard	8.00	9.50	13.50	5.50	15.00	13.00	6.50	4.00	14.50	9.50	11.00
Magazine & catalogues	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Office Paper	1.00	0.50	0.00	0.50	0.00	0.00	0.00	0.00	0.50	0.00	2.00
Other/ miscellaneous	0.00	0.00	0.00	1.50	0.00	2.00	0.00	0.00	0.00	2.50	0.50
	9.50	**10.50**	**13.50**	**9.50**	**16.00**	**15.00**	**9.00**	**4.50**	**15.50**	**13.50**	**14.00**
GLASS											
Clear containers	4.00	1.00	2.50	2.50	2.00	2.00	2.00	1.50	2.50	1.50	2.00
Green containers	0.50	2.50	0.00	0.50	0.00	3.50	2.50	0.00	0.00	2.50	4.00
Brown containers	0.50	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	1.50
Remainder/ composite glass	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5.00	**4.00**	2.50	**3.00**	**2.00**	**5.50**	**5.00**	**1.50**	**2.50**	**4.00**	**7.50**
METAL											
Tin/ Stell containers	1.00	2.50	1.50	0.50	0.50	0.50	1.50	0.50	0.50	0.00	0.50
Aluminium containers	2.00	1.50	0.50	1.50	3.50	2.00	3.50	0.50	0.50	1.50	1.50
Other ferrous metal	1.00	0.00	0.00	3.50	0.00	1.00	0.00	0.00	2.00	6.50	4.20
Other non-ferrous metal	0.00	0.00	5.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4.00	**4.00**	**7.50**	**5.50**	**4.00**	**3.50**	**5.00**	**1.00**	**3.00**	**8.00**	**6.20**
CONSTRUCTION & DEMOLITION WASTE											
Concrete	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lumber	0.00	0.00	5.50	0.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00
Remainder/ Composite C&D Waste	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	**0.00**	**5.50**	**0.00**	**0.00**	**0.00**	**2.00**	**0.00**	**0.00**	**0.00**	**0.00**
SPECIAL CARE WASTE											
Paint	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hazardous materials	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bio-medical waste	0.50	0.50	0.50	0.50	0.00	2.00	0.00	0.50	2.50	0.00	2.50
Disposalable Nappies/ diapers	0.50	0.50	1.00	0.00	0.50	0.00	1.00	0.00	0.50	0.50	0.00
Batteries	0.00	0.00	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Oil Filters	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Remainder/ composite S.C.Waste	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	1.50	**1.00**	**2.00**	**2.00**	**0.50**	**2.00**	**1.00**	**0.50**	**3.00**	**0.00**	**2.50**
OTHER WASTE											
Waste Electrical equipment (WEEE)	0.00	0.50	0.00	0.00	1.00	0.50	1.50	0.00	0.00	0.50	0.50
Ceramics	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Charcoal	1.50	0.50	0.00	0.00	0.00	0.00	1.50	0.00	0.00	0.00	1.30
Polystyrene	0.50	0.50	0.00	0.00	0.00	0.00	1.50	0.00	0.50	0.00	0.00
Tyres	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2.50	**1.50**	**0.00**	**0.00**	**1.00**	**0.50**	**4.50**	**0.00**	**0.50**	**0.50**	**1.80**
TOTAL (%)	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**101.50**	**100.00**	**100.00**	100.00	100.00

WASTE TYPE	23	24	25	26	27	28	29	30	31	32	AVE (%)
ORGANICS											
Food Waste	7.50	17.00	12.00	8.50	23.50	19.50	19.00	8.50	16.00	19.00	15.00
Garden Waste	10.00	11.00	7.00	6.50	8.00	4.00	12.00	7.00	13.00	0.00	9.50
Agricultural waste	8.50	19.50	5.00	6.50	3.50	4.50	11.00	0.00	17.00	9.50	8.00
Remainder/composite Organics	13.50	5.00	12.00	13.00	9.00	14.00	5.50	10.50	8.00	15.00	7.50
	39.50	**52.50**	**36.00**	**34.50**	**44.00**	**42.00**	**47.50**	**26.00**	**54.00**	**43.50**	**40.00**
SOIL/SAND/ASH											
Soil/Sand/ash	**15.50**	**16.00**	**14.00**	**8.00**	**9.50**	**13.00**	**19.00**	**10.50**	**12.00**	**9.50**	**11.00**
PLASTICS											
Clear PET Containers	3.50	4.00	9.00	6.00	6.50	6.50	2.50	4.50	4.00	5.50	6.50
Green PET containers	0.00	1.00	0.00	0.50	0.50	0.00	0.00	0.00	0.50	0.00	0.50
Brown PET containers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HDPE containers	4.50	1.00	5.00	5.00	2.50	1.50	1.00	6.00	2.00	3.00	3.00
Film Plastic	13.00	7.00	3.50	10.00	7.00	11.00	6.50	15.00	9.50	9.00	9.00
Nylon	0.50	4.00	2.50	4.50	2.50	3.50	1.50	3.50	1.00	2.50	3.00
	21.50	**17.00**	**20.00**	**26.00**	**19.00**	**22.50**	**11.50**	**29.00**	**17.00**	**20.00**	**21.00**
TEXTILES											
Textiles/fabric/leather	**3.00**	**1.00**	**2.50**	**5.00**	**3.00**	**1.50**	**10.00**	**6.50**	**3.50**	**7.00**	**3.00**
PAPER & CARDBOARD											
Newspaper	0.00	1.00	0.50	0.50	0.50	0.50	0.00	0.00	1.00	0.00	1.00
Cardboard	8.50	6.00	11.50	9.00	8.50	10.00	9.00	12.00	5.50	9.00	10.00
Magazine & catalogues	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50
Office Paper	0.00	0.50	0.00	0.50	0.00	0.50	0.00	0.50	1.00	0.00	0.50
Other/miscellaneous	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.50
	8.50	**8.00**	**12.00**	**10.00**	**10.00**	**11.00**	**9.00**	**12.50**	**7.50**	**9.00**	**12.50**
GLASS											
Clear containers	6.00	2.00	2.00	6.00	1.50	2.50	0.50	1.50	0.50	2.50	2.00
Green containers	0.50	1.00	0.00	0.50	0.50	0.00	0.00	3.00	0.00	0.00	1.00
Brown containers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Remainder/composite glass	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#REF!
	6.50	**3.00**	**2.00**	**6.50**	**2.00**	**2.50**	**0.50**	**4.50**	**0.50**	**2.50**	**4.00**
METAL											
Tin/Stell containers	1.50	0.00	1.00	0.50	1.50	2.50	0.00	0.00	0.50	0.50	1.00
Aluminium containers	2.50	0.50	1.00	1.50	0.50	0.50	0.50	1.50	0.50	2.50	2.00
Other ferrous metal	1.00	1.50	6.00	5.50	1.50	0.50	1.00	8.00	1.50	0.00	1.00
Other non-ferrous metal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50
	5.00	**2.00**	**8.00**	**7.50**	**3.50**	**3.50**	**1.50**	**9.50**	**2.50**	**3.00**	**5.00**
CONSTRUCTION & DEMOLITION WASTE											
Concrete	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lumber	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.00	0.00
Remainder/Composite C&D Waste	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2.00	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**2.00**	**0.00**	**0.00**
SPECIAL CARE WASTE											
Paint	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hazardous materials	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bio-medical waste	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	1.00
Disposalable Nappies/diapers	0.50	0.00	0.00	2.50	0.00	0.00	0.00	1.50	1.50	0.50	0.50
Batteries	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Oil Filters	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Remainder/composite S.C Waste	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.50	**0.50**	**0.00**	**2.50**	**0.00**	**0.00**	**0.00**	**1.50**	**2.00**	**0.50**	**1.50**
OTHER WASTE											
Waste Electrical equipment (WEEE)	0.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.50
Ceramics	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	3.00	0.50
Charcoal	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.00	0.00	0.50
Polystyrene	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.20
Tyres	0.00	0.00	0.00	0.00	9.00	3.50	0.00	0.00	0.00	0.00	0.30
	0.00	**0.00**	**5.50**	**0.00**	**9.00**	**4.00**	**1.00**	**0.00**	**1.00**	**5.00**	**2.00**
TOTAL (%)	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

More technical information available at:
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