CITY OF CAPE TOWN
ISIXEKO SASEKAPA
STAD KAAPSTAD

WASTE CHARACTERISATION AT SIX SPECIFIED WASTE MANAGEMENT SITES IN THE CITY OF CAPE TOWN

SUMMARY REPORT

JUNE 2018

ABOUT

A waste characterisation assessment was conducted at six specified sites in Cape Town over a 20-week period. This included an on-site assessment component over an eight-week period, which covered five-days of characterisation per site.

The key purpose of the study was to determine the waste characterisation at various City facilities, which was then deduced to give an indication of the waste characterisation across all City facilities.

One of the main reasons for determining the character of the City's municipal waste stream - generated at household levels - was to understand the percentage of organic waste being disposed of. The study, therefore, required organic/food waste to be characterised separately from green/garden waste.

The primary objectives of the study were to:

- Compare results from most recent studies, conclude on impacts, and report on findings in relation to substantive changes to waste types and volumes
- Determine the high level categorisation of solid waste being received at specific City-operated sites/ facilities, as defined in the Scope of Works, and in accordance with the City's priorities.
- Evaluate, combine and deduce data per catchment area to obtain a City-wide average
- Report on various results to give an indication of the waste characterisation that can typically be expected across all City facilities.

The following document is a summary report. To request the full report, email:

For attention Disposal Branch:
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EXPERIENCE QUALITY INTEGRITY

WASTE CHARACTERISATION AT SIX SPECIFIED WASTE MANAGEMENT SITES IN THE CITY OF CAPE TOWN: Coastal Park, Swartklip, Athlone, Bellville South, Kraaifontein & Vissershok

JUNE 2018

FINAL REPORT

CITY OF CAPE TOWN
ISIXEKO SASEKAPA
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Making progress possible. Together.

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SYNOPSIS

WASTE CHARACTERISATION AT SPECIFIED SITES IN CAPE TOWN MUNICIPAL AREA – Coastal Park, Swartklip, Athlone, Bellville South, Kraaifontein & Vissershok

KEY WORDS:

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QUALITY VERIFICATION

This report has been prepared under the controls established by a quality management system that meets the requirements of ISO9001: 2008 which has been independently certified by DEKRA Certification under certificate number 90906882

Verification	Capacity	Name	Signature	Date
By Author	Associate	B Edwards	B Edwards	28 June 2018
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DEFINITIONS

The definitions provided coincide with National (DEA) reporting guidelines (and Provincial Reporting guidelines) such as SAWIS and IPWIS.

MATERIAL	DEFINITION
GARDEN ORGANIC WASTE	Garden or Green Waste and means non-food organic material resulting from property landscaping and maintenance. This includes leaves, weeds, cut flowers, trees, branches and grass cuttings.
ORGANICS	Generally referring to food waste resulting from the processing, storage, preparation, cooking, handling and consumption or leftovers and scraps. This includes material from industrial, commercial, or residential sources. This type includes discarded meat scraps, dairy products, coffee grounds, tea bags, eggshells, fruit or vegetable peels, and other food items from homes, stores, and restaurants. Where segregation was possible the following separation was undertaken: o Meat / other protein – meat, fish and chicken etc o Fruit and Vegetables o Liquid waste – fruit juice, carbonated drinks, sauces etc o Dairy – cheese, yoghurt etc o Starches – grains, crisps, bread, rice etc o Mixed Food Waste – food waste that was mixed and could not be segregated. Other discarded household organic material that was included in this category were items such as pet food and animal faeces as well organic material that could not be put in any of the above categories. This included items made mostly of organic materials, but combined with other material types.
PLASTICS	• Plastics were separated in <u>hard plastics</u> which included the following items such as PET (polyethylene terephthalate) bottles, containers and punnets, • HDPE Containers (high-density polyethylene) such as milk jugs, water jugs, detergent bottles, some hair-care bottles, empty motor oil, empty antifreeze, and other empty vehicle and equipment fluid containers. • PVC (polyvinyl chloride), • PP (polypropylene) and PS (polystyrene), or mixed resins which include food containers such as bottles for salad dressings and vegetable oils, flexible and brittle yogurt cups, syrup bottles, margarine tubs and microwave food trays. This type also includes some shampoo containers and vitamin bottles, plastic outdoor furniture, plastic toys and sporting goods, and plastic housewares, 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. <u>Soft plastics</u> included the following: "Film Plastic" means flexible plastic sheeting. It is made from a variety of plastic resins including high-density polyethylene (HDPE) and low-density polyethylene (LDPE). This type includes plastic garbage bags, agricultural film, food bags, dry cleaning bags, grocery store bags, packaging wrap, and food-wrap and PVC film such as clingwrap. <u>Multilayer</u> materials are soft and consist predominantly of plastic were sorted and weighed in a separate category as they are not recyclable.
PAPER AND BOARD	This category includes • newspaper newspaper and all items made from newsprint, such as free advertising guides. • Cardboard which usually has three layers. The centre wavy layer is sandwiched between the two outer layers. It does not have any wax coating on the inside or outside. This

MATERIAL	DEFINITION
	type does not include chipboard. This type includes entire cardboard containers, such as shipping and moving boxes, computer packaging cartons, and sheets and pieces of boxes and cartons. This type does not include chipboard. • Magazines and Catalogues means 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. • Office Paper means paper generated in an office setting and includes computer paper, white envelopes white window envelopes, notebook paper, ground wood computer paper, carbonless forms, goldenrod coloured paper and school construction paper. • Other miscellaneous paper items made mostly of paper that do not fit into any of the other paper types. This includes books and directories, items made of board, ground wood paper, and deep-toned or fluorescent dyed paper. Examples include unused paper plates and cups, perforated edge (fan-fold) computer paper, manila folders, manila envelopes, index cards, envelopes, butcher paper, and 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.
METAL	Includes • Tin/Steel Containers made mainly of steel. These items will stick to a magnet and may be tin-coated. This type is used to store beverages and food. This type includes beverage containers including bimetal containers with steel sides and aluminium ends. • Aluminium Containers means any beverage/food container made mainly of aluminium. This type includes aluminium soda, beer and food containers. This type does not include bi-metal containers with steel sides and aluminium ends. • Any other Ferrous Metal means any other ferrous metal items not mentioned above. • Aerosol cans made of steel or aluminium.
GLASS	Means clear, green and amber glass beverage/food containers. This type includes whole or broken clear soda, beer, fruit juice, liquor bottles, fruit, jam, mayonnaise containers etc. Other remainder/Composite Glass was also included here and includes flat (pane) glass as well as items made mostly of glass but combined with other materials such as window glass, Pyrex, Corningware, crystal and other glass tableware, mirrors, light bulbs (incandescent), and auto windshields.
CONSTRUCTION WASTE	Construction waste generally includes waste from home improvements and repairs such as: • Hard materials made from sand, aggregate gravel, cement mix and water as well as masonry bricks and mortar, • Construction and demolition material that may be difficult to separate such as ceramics, tiles, toilets, sinks, and fiberglass insulation, rock, stones, and sand, clay, soil and other fines or demolition debris that is a mixture of items such as plate glass, wood, tiles, gypsum board, and aluminium scrap, shingles and other roofing material.
WOOD	Wood waste includes lumber or processed wood for building, manufacturing, landscaping, packaging, and processed wood from demolition. This includes dimensional lumber, lumber cut-offs, engineered wood such as plywood and particleboard, wood scraps, pallets, wood fencing, wood shake roofing, and wood siding. Where large volumes of chopsticks or other material from wood were sorted, these were included as wood.
TETRAPAK	Tetrapak is a brand name that is used in South Africa for liquid multi-layer packaging that consists of paperboard, polyethylene and aluminium foil.
TEXTILES	Items made of thread, yarn, fabric, or cloth. This type includes clothes, fabric trimmings, draperies, carpets, cushions, carpet padding and all natural and synthetic cloth fibres,

MATERIAL	DEFINITION
	mattresses, pillows, leather shoes, leather bags, or leather belts, hair extensions and hairnets used as PPE.
HOUSEHOLD HAZARDOUS/HEALTH CARE WASTES	This category was sorted into five categories: • E-Waste which included computers, phones, old appliances and cables etc • Cleaning materials, toiletries and medication (e.g. pills, asthma pumps and epi-pens) • Fluorescent bulbs • Nappies • Batteries
OTHER WASTES	Other waste includes miscellaneous items that could not be sorted into any of the above categories and included items such as: o Tyres from trucks, automobiles, motorcycles, heavy equipment, and bicycles. The following items were noted as part of "Other": o Street sweepings, o Ash o Condoms, o Rubber, o Candles, o Dog faeces, dead birds and a small puppy (moved for inclusion under organic) o Soil, o Cigarette butts, and o Car parts and filters. o Oil Filters" means oil filters from automobiles

1 INTRODUCTION

JG Afrika were appointed to conduct a waste characterisation assessment at six specified sites within the City of Cape Town (CCT). The appointment was for a period of 20 weeks, including an on-site assessment component over an 8-week period and 5-day characterisation per site.

As per the Tender Scope of Works, the key purpose of the study is to determine the waste characterisation at various City facilities, which must then be extrapolated to give an indication of the waste characterisation across all the City facilities.

As discussed at the Inception Meeting for the project, in addition to the objectives below, one of the main aims in determining the character of the City's municipal waste stream generated at household levels is to understand the percentage of organic waste being disposed of. The study therefore required organic/food waste to be characterised separately from green/garden waste.

The primary objectives of the study were to:

- Determine the high level categorisation of solid waste being received at specific sites/ facilities being operated by the City of Cape Town, as defined in the Scope of Works, and in accordance with the City's priorities.
- Evaluate data per catchment area, aggregate and extrapolate to obtain a City-wide average
- Report on various results to give an indication of the waste characterisation that can typically be expected across all the City facilities.
- Compare results from most recent studies, conclude on impacts and report on findings in relation to substantive changes to waste types and volumes.

2 WASTE CHARACTERIZATION METHODOLOGY AND SAMPLING PROCEDURE

2.1 Methodology

1. The approach developed for this exercise satisfies the need for methods to be structured, produce accurate and reliable results and to be repeatable.
2. Seldom in waste management is the total population measured - therefore, representative sampling was carried out.
3. The selected method is based on the collection and manual sorting of a number of samples of waste over a period of 5 consecutive week days per site.
4. The recommended sample weight of approximately 150-250kg was used for the study as it has been established, through various studies, that measurements made on this size of sample do not vary significantly from measurements made on far larger samples taken from the same waste.
5. Three randomly selected samples were analysed every day.
6. The following major waste categories for the characterization included:
    - Paper and Board (includes cardboard)
    - Glass
    - Metal
    - Plastic
    - Tetrapak
    - Multilayer/non-recyclable plastic packaging
    - Textiles
    - Organics, focusing of food waste and where segregation was possible the following separation was undertaken:
        - Meat / other protein
        - Fruit and Vegetables

    - Liquid waste (wet trade waste) – milk/yoghurt/oils etc
    - Starches
    - Mixed Food Waste
  - Garden organic waste
  - Construction Waste
  - Household hazardous waste / health care waste – this included nappies
  - Residual Waste
  - Other Wastes
7. Each waste sample of approximately 150-250kg was sorted manually into dedicated containers.
8. Samples were weighed on a small flat-bed calibrated electronic scale.

2.2 Procedure

The following procedure was followed in the execution of the waste characterisation exercise:

1. The designated area within the waste management facility / disposal site was demarcated to ensure the safety of the team by preventing vehicles and mobile plant and equipment from randomly entering the area.
2. The team used existing 240l wheelie bins, bags or crates on site and each container was labelled with the waste category selected for sampling and arranged around the perimeter of the sorting area.
3. The tare weight of each of the containers was recorded at the start of the sampling day. There were times when a plastic crate or plastic bag was used, but the container was always weighed separately to ensure the correct weight was recorded.
4. Complete details of the source and type of each waste sample examined was recorded
5. Waste samples obtained from incoming vehicles follow the following steps:
    a. Confirming the area from which the waste was collected
    b. Visual Check
    c. Mixing and Dividing
    d. Front end loader would then collect a sample of mixed waste and bring to the sorting area.

Samples were randomly collected and were based on the area that the trucks were collecting from in order to try and get the most representative geographic samples from the facility's catchment area. Samples collected were classed as either "commercial" and "residential" and in some cases, were mixed.

3 FINDINGS

3.1 Data Analysis

The data collected during the waste characterization was captured in an Excel Spreadsheet for further analysis, and various comparisons in terms of waste types per facility/site, number of different suburbs etc. In certain instances, waste categories have been combined to simplify comparisons and allow focus on other categories such as:

- Construction and Wood waste
- Packaging – combined category which includes plastic, metal, paper and cardboard, Tetrapak and multilayer material.

In addition, the residual waste was further split for analysis and interpretation purposes where samples contained visible organic waste that was unable to be further sorted or split to ensure that this portion is included as containing organic material.

3.2 Overview of findings

A total of 87 samples were assessed for the six facilities i.e. Coastal Park Landfill Site (LFS), Swartklip Refuse Transfer Stations (RTS), Athlone RTS, Bellville South LFS, Kraaifontein Waste Management Facility's (KWMF) RTS component and Vissershok LFS.

A broad area was covered in terms of the CCT's catchment area and included private contractors as well as CCT waste disposal vehicles. Where possible, multiple area samples were characterised to ascertain whether any trends could be established.

Table 1 provides an overview of the dates sampling was undertaken, the number and types of areas included. Selection and sampling was reliant on not interfering with the normal operations of the site. Trucks were selected to try and get a representative sample from the "catchment" area and the waste contractors coming onto site. The full set of data is presented in **Annexure A**.

Table 1: Sampling Overview and Summary

Facility Name	Type of Facility	Sampling Dates	No of Samples	Total Sample Weight (kg)	No of different Suburbs	No of Residential	No of Commercial (or mixed)
Coastal Park	Landfill Site	13/02/2018 to 23/02/2018	14	2831	13	9	5
Swartklip	Refuse Transfer Station	26/02/2018 to 02/03/2018	16	3321	13	16	0
KWMF	Refuse Transfer Station	05/03/2018 to 09/03/2018	14	2551	13	12	2
Bellville South	Landfill Site	12/03/2018 to 16/03/2018	14	2721	12	12	2
Vissershok	Landfill Site	26/03/2018 to 29/03/2018 and 06/04/2018	14	2540	12	11	3
Athlone	Refuse Transfer Station	09/04/2018 to 13/04/2018	15	2926	10	15	0
TOTAL			**87**	**16890**	**73**	**75**	**12**

Table 2 provides an overview of the proportion of samples regarded as from commercial and residential[1] areas with their total weight and contribution to the total percentage of waste sampled.

Table 2: Summary of Commercial and Residential samples

Type of Sample	TOTAL (kg)	% of waste	no of samples
Commercial	845.09	5.0	5
Residential	14645.07	86.7	75
Residential & Commercial (mixed)	1400.28	8.3	7
TOTAL	**16890.44**	**100.0**	**87**

[1] Based on interviews with drivers, it should be noted that this varies slightly from the CCT weighbridge data as some samples are classified as only household (i.e. residential) and not commercial or mixed.

Table 3 provides an indication of the collection vehicles sampled and is based on information obtained when interviewing the driver of the vehicle.

Table 3: Summary of samples from the various vehicles/contractors

Vehicle/Contractor	No of Samples
CCT	66
Johdel	1
Just Breeze	1
KE Daniels	1
Masiqame	1
Mhonko's Waste Removal	11
Private Contractor - white compactor vehicle	1
Waste Control	1
WasteMart	4
TOTAL	**87**

3.3 Consolidated Data for all Six facilities

General characteristics of the waste sampled (by weight) at all six facilities is presented in **Figure 1**.

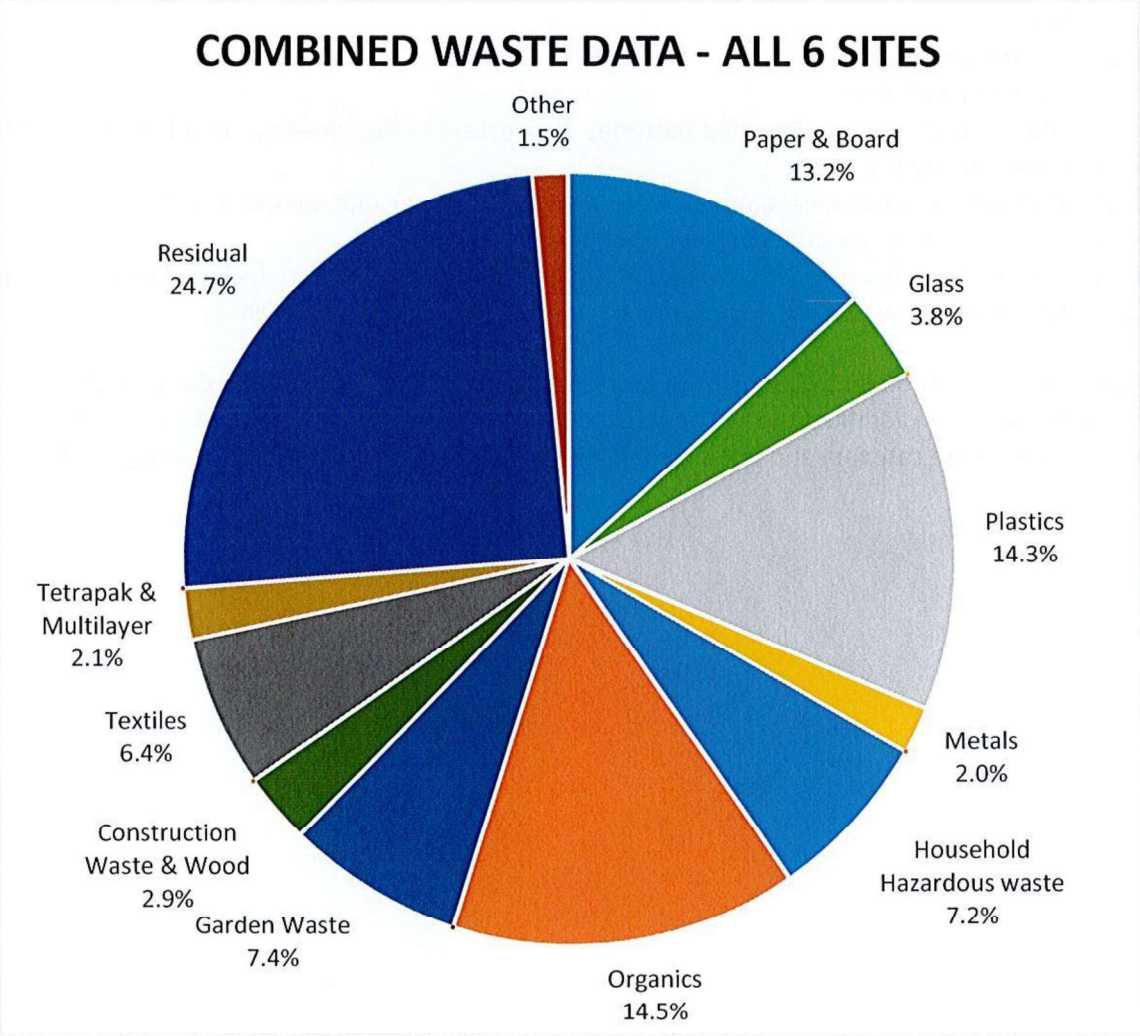


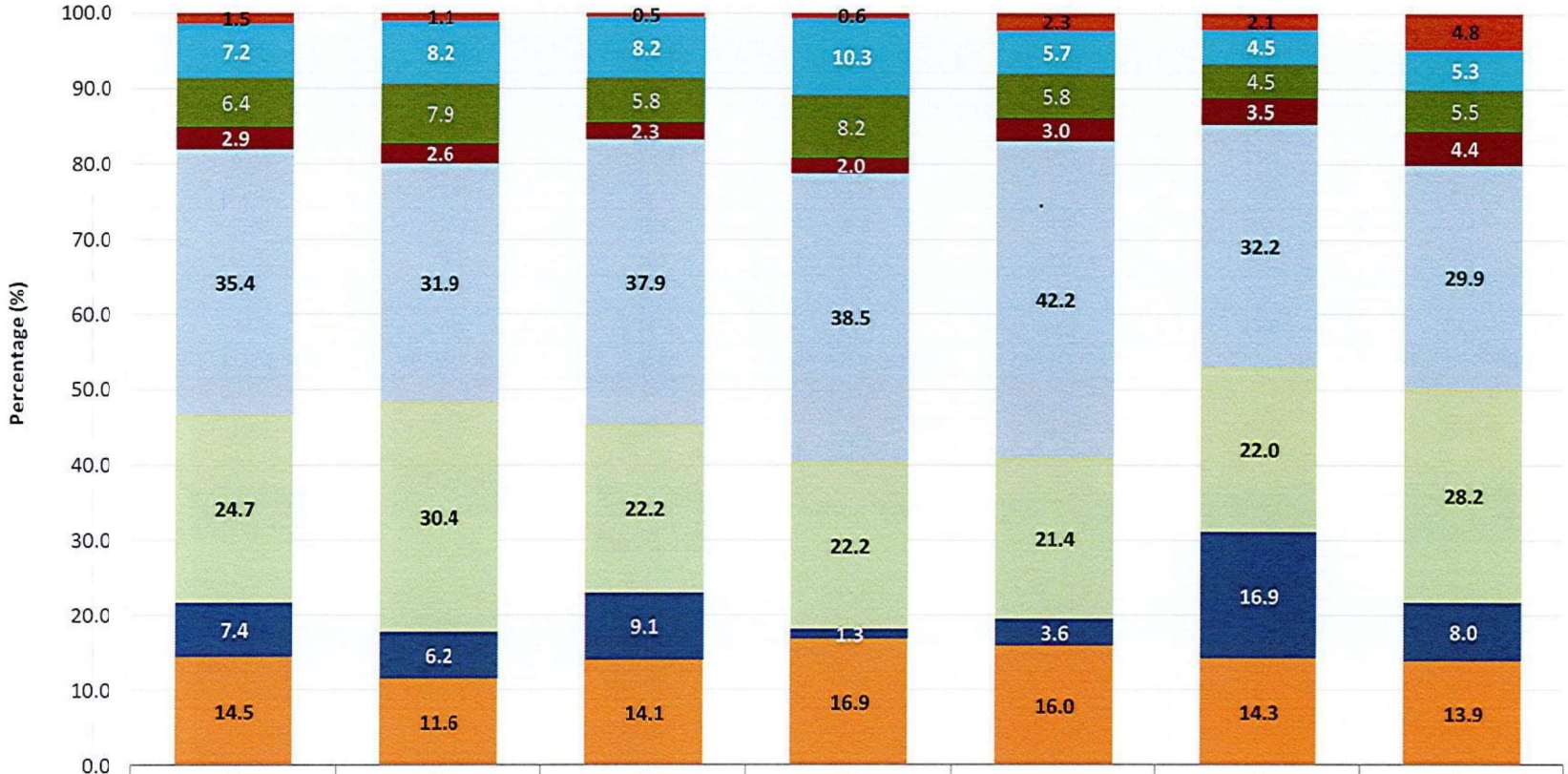
Figure 1: Waste Characterisation Data

It should however be noted that the information contained above is based directly on the actual data collected without further interpretation or analysis.

The following should be noted:

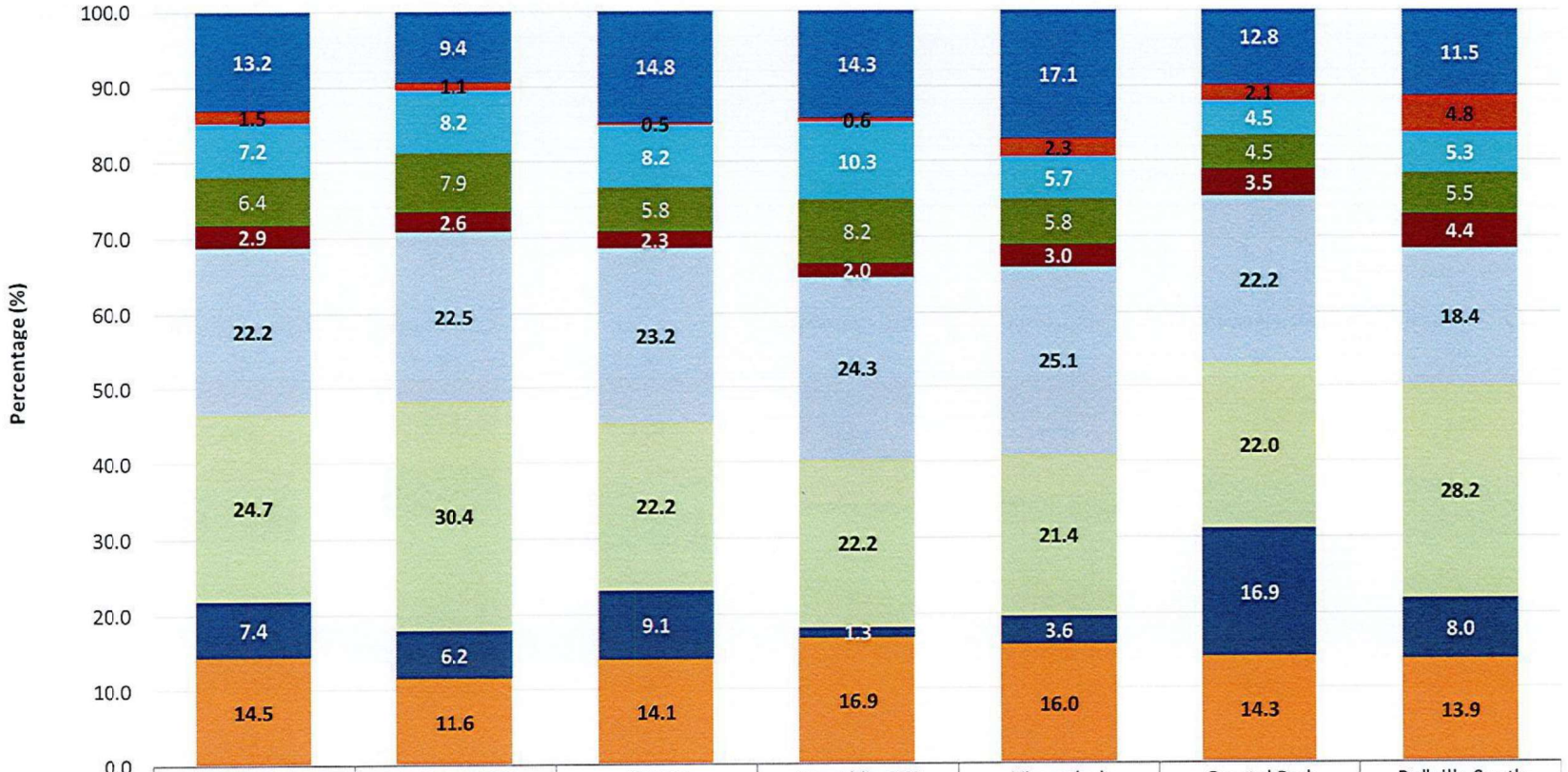
- Characterisation was conducted using weight (kilograms) and not volume (m^3). This is particularly important to note when assessing the plastic and paper components of the waste stream.
- The residual waste is waste that could not be characterised any further in terms of the visual characterisation that was conducted. Photographs and on site observations provide an idea of the character of this fraction and in cases where possible, an indication of high organic content was provided. One of the findings for a large number of the samples was that up to 50% of the residual component/fines could be regarded as organic waste. This was more evident in samples obtained from roto-press collection vehicles and is assumed to be due to the method of compaction within the vehicle.
- "Other waste" included a vast array of items and these were noted separately for each sample but are not represented separately in **Figure 1**. Where items contributed to the organic content, they were included as such. The following items were noted as part of "Other":
    - Street sweepings,
    - Condoms,
    - Rubber,
    - Candles,
    - Dog faeces, dead birds and a small puppy (moved for inclusion under organic)
    - Soil,
    - Cigarette butts, and
    - Car parts and filters.
- Household Hazardous Waste included batteries, fluorescent bulbs, cleaning chemicals, medical waste, nappies and sanitary products.
- Where possible Area Cleaning samples were avoided however one sample was received at Bellville which contained a large amount of street sweepings.
- Informal area/blue bag waste was avoided although a few blue bags were included in the samples and their waste composition did not appear to very vastly from the rest of the waste.

Figure 2 illustrates the broader fractions from each site as well as the consolidated data for all the sites for comparison purposes. In addition, the CCT requested that a similar graph be included with Paper and Board illustrated as a separate category and not included with packaging, this is represented in **Figure 3.**



	% ALL/ COMBINED	% Athlone RTS	% KWMF	% Swartklip RTS	% Vissershok	% Coastal Park	% Bellville South
Other	1.5	1.1	0.5	0.6	2.3	2.1	4.8
Household Hazardous waste	7.2	8.2	8.2	10.3	5.7	4.5	5.3
Textiles	6.4	7.9	5.8	8.2	5.8	4.5	5.5
Construction Waste & Wood	2.9	2.6	2.3	2.0	3.0	3.5	4.4
Packaging	35.4	31.9	37.9	38.5	42.2	32.2	29.9
Residual	24.7	30.4	22.2	22.2	21.4	22.0	28.2
Garden Waste	7.4	6.2	9.1	1.3	3.6	16.9	8.0
Organics	14.5	11.6	14.1	16.9	16.0	14.3	13.9

Figure 2: Waste Characterisation Data comparing sites and consolidated data



	ALL/ COMBINED	Athlone RTS	KWMF	Swartklip RTS	Vissershok	Coastal Park	Bellville South
Paper & Board	13.2	9.4	14.8	14.3	17.1	12.8	11.5
Other	1.5	1.1	0.5	0.6	2.3	2.1	4.8
Household Hazardous waste	7.2	8.2	8.2	10.3	5.7	4.5	5.3
Textiles	6.4	7.9	5.8	8.2	5.8	4.5	5.5
Construction Waste & Wood	2.9	2.6	2.3	2.0	3.0	3.5	4.4
Packaging (excl Paper & Board)	22.2	22.5	23.2	24.3	25.1	22.2	18.4
Residual	24.7	30.4	22.2	22.2	21.4	22.0	28.2
Garden Waste	7.4	6.2	9.1	1.3	3.6	16.9	8.0
Organics	14.5	11.6	14.1	16.9	16.0	14.3	13.9

Figure 3: Waste Characterisation Data comparing sites and consolidated data with paper and board removed from the broader Packaging category

The following should be noted with regards to the categories illustrated:

- Packaging is a broad category where data has been combined to includes the glass, metal, plastic, paper and board, Tetrapak and multilayer fractions for ease of comparison as the focus of this report is on organic percentage.
- Household Hazardous Waste included batteries, fluorescent bulbs, cleaning chemicals, medical waste, nappies and sanitary products.

3.4 Adjusted Data for all Six facilities highlighting the organic waste fraction

As part of the characterisation, a visual inspection was made of the residual waste component which remained once all the other fractions had been removed. The organic content was estimated as part of the visual assessment.

Very dry samples had a much lower organic component within the residual fractions but wet samples and samples from roto-press collection vehicles had a much higher remaining organic fraction (based on visual inspection). Based on the visual inspection, each sample was split into a further category named the "Residual Organic %" component and the data is reflected in the adjusted data.

Figure 4 illustrates the consolidated data for all the sites with the inclusion of the estimated organic component of the residual waste for comparison purposes and this additional organic category brings to **total organic fraction up to 28%** including garden waste.

Figure 6 illustrates the waste from each site and composition by means of a Sankey diagram and provides the actual mass of the various stream that were characterised**. Figure 5** provides the detailed categories of the adjusted data.

Figure 7 provides a breakdown of the Organic Waste Fraction into organics (14.5%), Garden Waste/Greens (7.4%) and estimated Residual Organic component (5.9%).

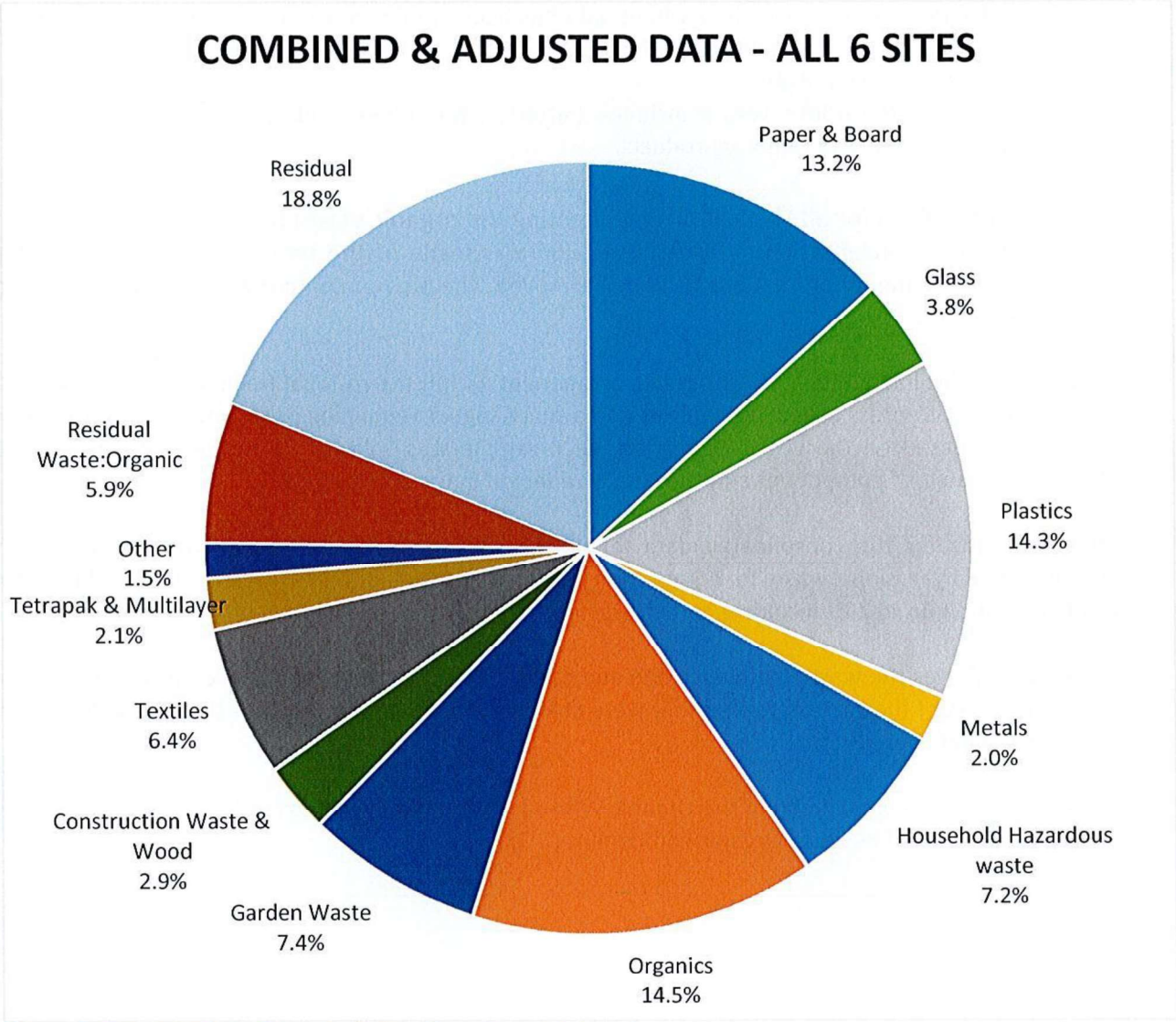


Figure 4: Adjusted Waste Characterisation Data: Broad Categories

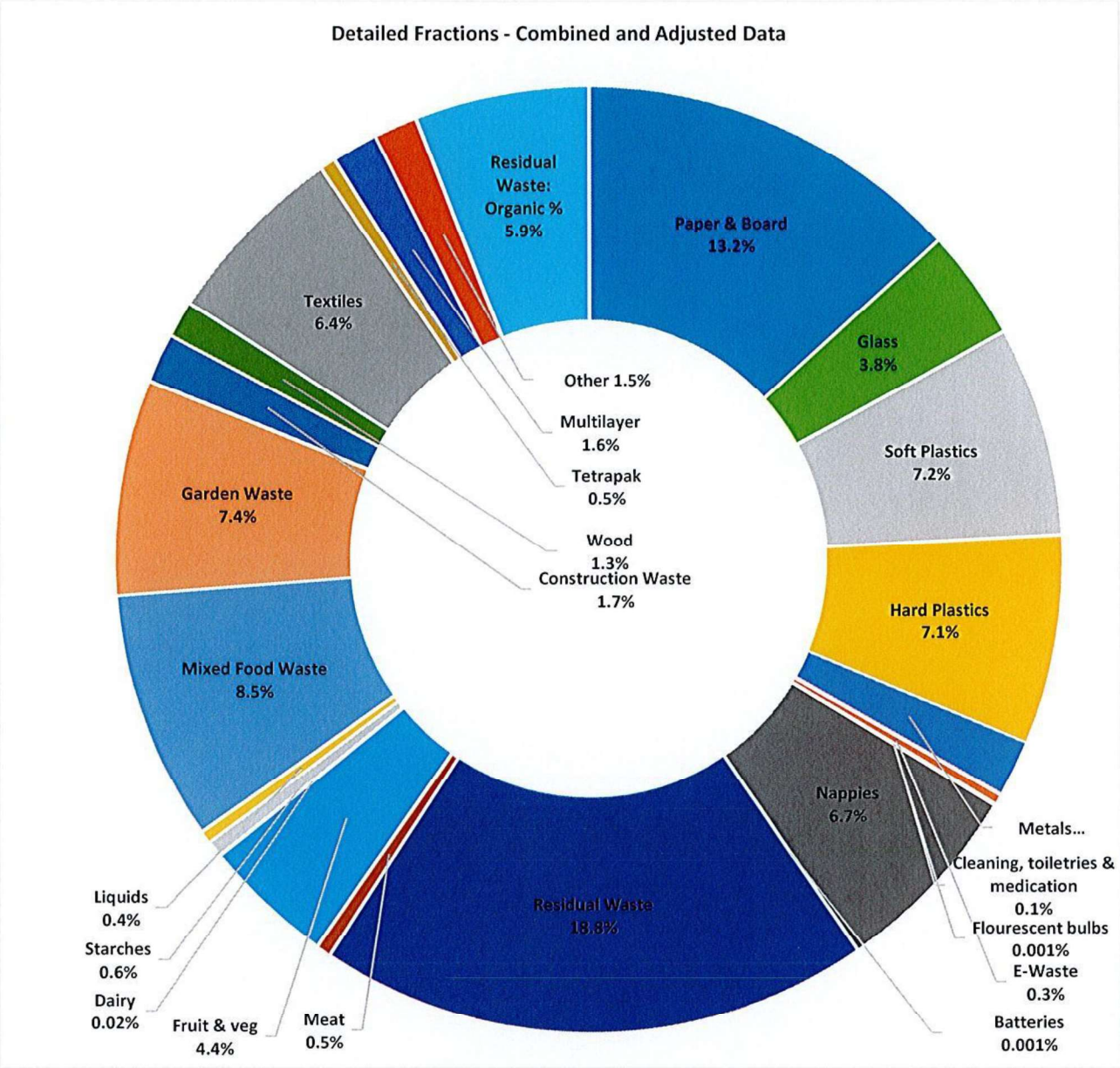


Figure 5: Adjusted Waste Characterisation Data: Detailed Categories

Please note that the decimal places represented have been adjusted specifically for the smaller fractions to provide a full illustration and detail of the various categories. It is however clear from **Figure 5**, that including all fractions in one graph can be cluttered and therefore the data is represented in different broad groupings in different graphs in this report.