Waste Characterisation Study
Hessequa Municipality

Report 2016

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EXECUTIVE SUMMARY

A lack of information regarding waste generation types and volumes was identified as a gap in Hessequa Municipality's Integrated Waste Management Plan. Therefore, Eden District Municipality, together with Hessequa Municipality and the participants of the Youth Jobs in Waste Programme implemented by the National Department of Environmental Affairs conducted a waste characterisation study in August 2016.

The objective of the waste characterisation study was to provide a breakdown of the composition and quantities of household and commercial waste that is being collected from households and commercial outlets in order to ensure proper integrated waste management planning.

As recommended by the Department of Environmental Affairs and Development Planning (DEADP), the Municipal Waste Characterisation Procedures of the Environmental Protection Agency, Ireland, was used as a guideline in determining the sample size for the Waste Characterisation Study.

Recommendations by the DEADP regarding the type of venue, equipment, sampling and sorting methods and data collection were used during the characterisation study.

It was decided that the waste would be categorised / sorted into fifteen (15) different waste types namely:

No.	Waste Type	Example
1	Soft Plastics	Plastic bags, plastic film.
2	Hard Plastics	Plastic bottles, containers, lids, hard plastic objects.
3	Cardboard	Office paper, newspaper, magazines, books, glossy paper.
4	Paper	Boxes, cardboard packaging.
5	Glass	Glass bottles, jars.
6	Metal	Ferrous and non-ferrous metals, cooldrink cans, tins, metal objects.
7	Food Waste	Any food, vegetable peels.
8	Garden Waste	Grass clippings, leaves, tree branches, flowers.
9	Textiles	Clothes, shoes, blankets, material.
10	Wood	Planks, manufactured wooden products.
11	Inert	Concrete, brick, sand, asphalt, stones.
12	Nappies	Disposable baby and adult nappies.
13	E-Waste	Any electrical or battery operated objects.
14	Hazardous Waste	Paints, resins, glues, fluorescent tubes, batteries, pesticides, asbestos.
15	Rest	All waste that cannot be sorted into abovementioned categories e.g. hair, dust.

When applying the total number of households (13 304) to the graph in Appendix B of the Municipal Waste Characterisation Procedures, EPA, Ireland, it was determined that a sample size of 550 would be adequate in order to ensure a representative sample.

The number of samples per sub area was then calculated relative to the percentage of the total number of households.

Of the 530 bags that were sampled a total mass of 2 576.07 kg (2.57 tons) of waste was recorded, with a compacted volume of 9.715 m^3 as indicated in Table 3.20 below.

Waste Type	Mass (kg)	Percentage of total Mass (%)	Calculated Volume (m^3)
Soft Plastics	150,05	5,82	0,962
Hard Plastics	180,57	7,01	2,508
Paper	171,37	6,65	0,752
Cardboard	157,55	6,12	1,212
Glass	209,66	8,14	0,510
Metal	94,22	3,66	0,294
Food Waste	824,60	32,01	0,801
Garden	98,80	3,84	0,222
Textiles	135,55	5,26	0,464
Wood	22,75	0,88	0,146
Inert	24,15	0,94	0,023
Nappies	207,55	8,06	0,914
E-Waste	8,50	0,33	0,071
Hazardous	19,00	0,74	0,055
Rest	271,75	10,55	0,781
Total	**2576,07**	**100,00**	**9,715**

Table 3.20: Results for Hessequa Municipality (530 samples)

38% of the waste types that were sampled by mass were recyclable materials: Glass (8%), Hard Plastics (7%), Paper (7%), Soft Plastics (6%), Cardboard (6%) and Metal (4%). However, by volume, 63% of the waste types that were sampled were recyclable materials: Hard Plastics (26%), Cardboard (12%), Soft Plastics (10%), Paper (7%), Glass (5%) and Metal (3%).

The results obtained from the different sub areas within Hessequa Municipality illustrated different trends in waste generation. These trends will be significant in identifying and prioritising the type of waste management and minimisation initiatives to be implemented in the various sub-areas. E.g. Home composting initiatives should be implemented in the sub areas where Garden Waste was the prominent component of the waste sampled.

The prediction of uniformity and consistency of waste type occurrence is complex due to the heterogeneous nature and variability of waste. Therefore it is not likely to determine accurate projections of the likelihood of the occurrence of particular waste types in a waste stream.

It is assumed that the recyclable portion (soft plastic, hard plastic, paper, cardboard, glass and metal) comprises of 38% of the total waste going to landfill on a monthly basis. This amounts to a total of approximately 677.60 tons and 2 555.10 m^3 of recyclable materials that could potentially be diverted from landfill.

CONTENTS

1. INTRODUCTION

Waste stream analysis can be defined as any programme which involves a logical and systematic approach to obtain and analyzing data on one or more waste streams or sub-streams. The analysis also provides an estimate of solid waste quantity and composition, referred to as waste characterisation.

A lack of information regarding waste generation types and volumes was identified as a gap in Hessequa Municipality's Integrated Waste Management Plan. Therefore, a waste characterisation study was conducted in order to determine the types and quantities of waste that is being generated in Hessequa. The analysis is essential to ensure proper planning in terms of collection, handling, minimisation and disposal of the generated waste.

Eden District Municipality, together with Hessequa Municipality and the participants of the Youth Jobs in Waste Programme implemented by the National Department of Environmental Affairs conducted a waste characterisation study from 11 - 19 August 2016.

The objective of the waste characterisation study was to provide a breakdown of the composition and quantities of household and commercial waste that is being collected from households or commercial outlets in order to ensure proper integrated waste management planning.

This study was also conducted to determine the quantity of recyclable material that still remains in the waste stream disposed at landfill. Any recyclable materials already recovered through the existing at source recycling programme implemented by the local service provider will not form part of this study.

The quantity of recyclable material recovered by the recycling service provider in Hessequa Municipality is being reported on a monthly basis.

The characterisation study provided the following information:

- The average mass and volume of waste per waste type per household;
- The average mass and volume of waste per waste type per household per socio-economic region;
- The average mass and volume of waste per waste type per business;
- The percentage by mass of each major category in the waste stream;
- The percentage by volume of each major category in the waste stream

A sample of a total of 530 bags were collected and sorted into the 15 different major waste types. The number of samples per sub area was determined by the number of households relative to the total number of households in Hessequa Municipality.

2. METHODOLOGY

2.1 GENERAL APPROACH

As recommended by the Department of Environmental Affairs and Development Planning (DEADP), the Municipal Waste Characterisation Procedures of the Environmental Protection Agency, Ireland, was used as a guideline in determining the sample size for the Waste Characterisation Study.

Recommendations by the DEADP regarding the type of venue, equipment, sampling and sorting methods and data collection were used during the characterisation study.

2.2 TRAINING

On 22 July 2016 a training session conducted by Eden District Municipality took place at the Hessequa Municipality Workshop in Riversdale. A practical training session was conducted with the Youth Jobs in Waste participants where they were trained in the sorting method, waste types, weighing, volume determination and data collection. Training in the proper use of Personal Protective Equipment, potential hazards and procedures were also discussed at this training session.

The waste is categorised / sorted into fifteen (15) different waste types namely:

No.	Waste Type	Example
1	Soft Plastics	Plastic bags, plastic film.
2	Hard Plastics	Plastic bottles, containers, lids, hard plastic objects.
3	Cardboard	Office paper, newspaper, magazines, books, glossy paper.
4	Paper	Boxes, cardboard packaging.
5	Glass	Glass bottles, jars.
6	Metal	Cooldrink cans, tins, metal objects.
7	Food Waste	Any food, vegetable peels.
8	Garden Waste	Grass clippings, leaves, tree branches, flowers.
9	Textiles	Clothes, shoes, blankets, material.
10	Wood	Planks, manufactured wooden products.
11	Inert	Concrete, brick, sand, asphalt, stones.
12	Nappies	Disposable baby and adult nappies.
13	E-Waste	Any electrical or battery operated objects.
14	Hazardous Waste	Paints, resins, glues, fluorescent tubes, batteries, pesticides, asbestos.
15	Rest	All waste that cannot be sorted into abovementioned categories e.g. hair, dust.

Figure 2.1: Training session

2.3 SAMPLE SIZE & PLANNING

2.3.1 REPRESENTATIVE SAMPLE

The estimated total number of households of 2016 as obtained from Hessequa Municipality's Integrated Waste Management Plan was used to determine a representative sample by using the graph in Appendix B of the Municipal Waste Characterisation Procedures, EPA, Ireland.

When applying the total number of households (13 304) to the graph mentioned above, it was determined that a sample size of approximately 550 would be adequate in order to ensure a representative sample.

The identified households from which the samples were to be obtained were not informed regarding the study in order to prevent any bias that may result by a temporary change in habits.

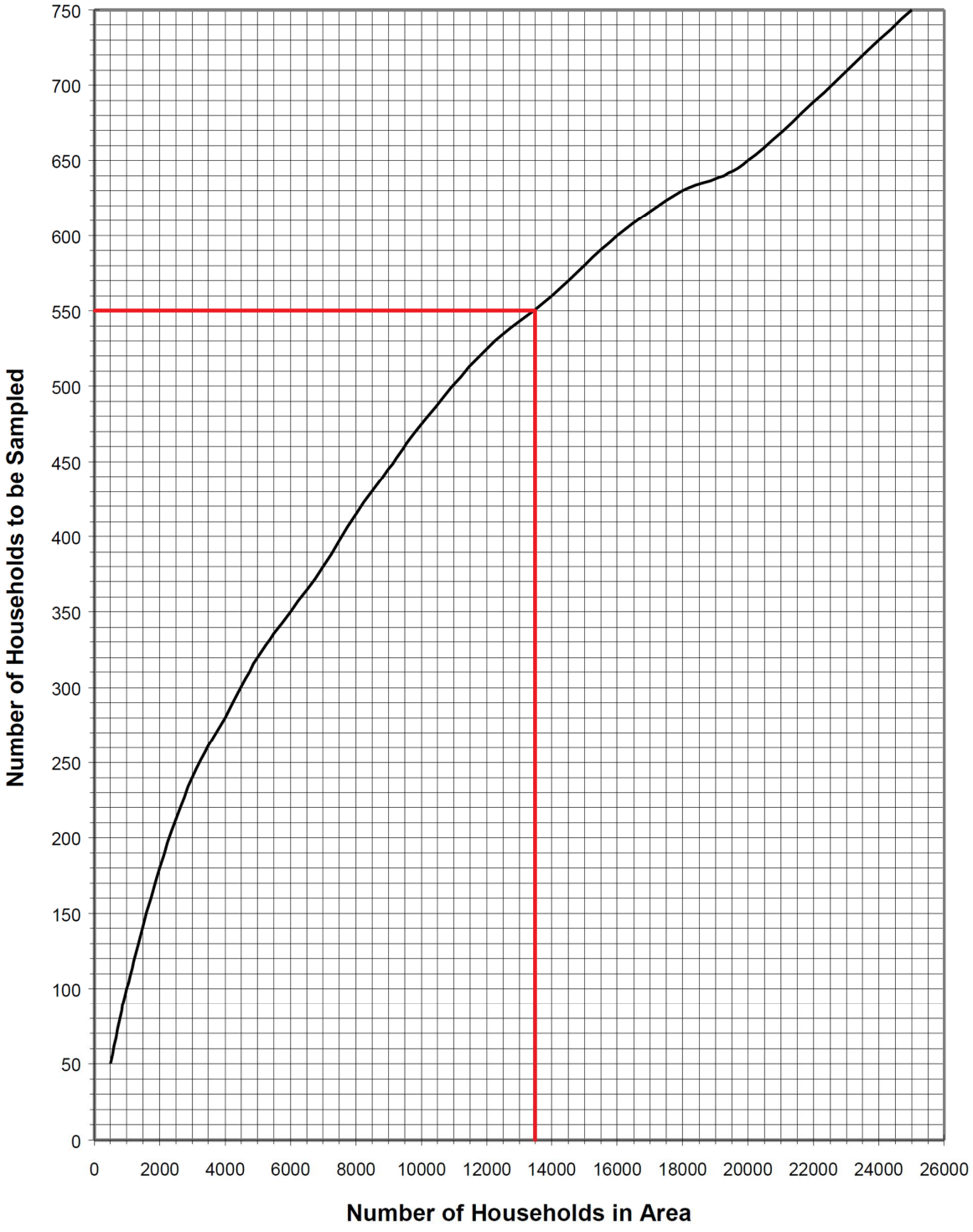


Figure 2.2: Graph determining sample size relative to no. of households

The number of samples per sub area was then calculated relative to the percentage of the total number of households (Table 2.3)

Sub Area	No. of Households (13 304)	Percentage of Sample (%)	Sample Size (550)
Albertinia	652	4.9	27
Theronsville	1 690	12.7	70
Gouritsmond	226	1.7	9
Heidelberg	2 381	17.9	98
Jongensfontein	200	1.5	8
Melkhoutfontein	679	5.1	28
Riversdale	4 656	35	193
Slangrivier	745	5.6	31
Stilbaai	1 889	14.2	78
Witsand	186	1.4	8
Total	**13 304**	**100**	**550**

Table 2.3: Sample size determination per sub area

A planning session was held on 7 July 2016 together with Eden District Municipality and Hessequa Municipality. Maps of each sub area were provided, and specific households were identified from which to sample. These identified households were evenly distributed in order to ensure a representative sample of that specific sub area.

The local knowledge of the Hessequa Municipality officials were relied upon in order to identify businesses in each sub area which was included in the sample size of that specific sub area.

It was decided that should no bags be available for sampling from the specified household, that a sample be taken from a household in the near proximity of the specified household.

2.3.2 LABELLING OF SAMPLES

In order to identify the sub area from which the sample was taken as well as to ensure the capturing of other relevant information, it was essential that the samples were properly labelled when collected. The following details were recorded on the labels when collection took place:

- Sub area from which sample was taken
- Date on which sample was taken
- The address from which the sample was taken
- Household or Business
- Total number of bags from which the sample was taken e.g. 1 of 3

2.3.3 SAMPLING PLAN

Hessequa Municipality was responsible for the sampling of bags. A sampling team was responsible for the collection and labelling of the samples from the identified households prior to the waste collection on that specific day of the week. The samples were then stored in the secure storage area prior to sorting. Samples were requested to be taken the day before the intended sorting in order to ensure that the Youth Jobs in Waste participants could commence with the sorting at the start of the working day.

2.4 VENUE & EQUIPMENT

2.4.1 VENUE

Hessequa Municipality was responsible for acquiring a venue with the following requirements:

- Under cover
- Ablution facilities
- Running water
- Electricity
- Proper ventilation
- Secure / no unauthorized access

The venue which was acquired was the Hessequa Municipality Workshop Riversdale.

Figure 2.4: Layout of the venue at the Hessequa Municipality Workshop Riversdale

2.4.2 EQUIPMENT

The following equipment was required in order to conduct the Characterisation Study, which was purchased and provided by Eden District Municipality:

- 4 x 150kg electronic platform scales
- 80 x 46cm plastic basins
- 6 x yard brooms
- 20 x vapour & organic respirator masks incl. replacement filters
- Plastic aprons
- Safety glasses
- Red PVC gloves
- Surface disinfectant
- Hand sanitizer
- Cleaning Rags
- Disposable towels with stands
- Data sheets
- Stationery

- Labels
- Permanent markers and pens

Hessequa Municipality was responsible for the provision of the sorting tables, recycling and refuse bags as well as a hosepipe for the cleaning of the sorting basins during and after each working day.

2.5 CHARACTERISATION, WEIGHING & DATA COLLECTION

The samples were stored per sub area in order to ensure that the data collection was done per sub area which eases the analysis of the data and ensures that the analysis is done per sub area.

Figure 2.5: Samples stored per sub area

2.5.1 STEP 1:

The unopened black bag (sample) was weighed and the mass and the particulars of the label recorded on the data sheets.

2.5.2 STEP 2:

The contents of the sample was then categorised into the fifteen different waste types using the 46cm plastic basins.

Figure 2.6: Waste being sorted into different waste types

2.5.3 STEP 3:

Each categorised waste type was then weighed individually. The Scales were tarred before weighing and therefore only the contents of the basin were recorded. The mass of each waste type from that specific sample was recorded. The individual masses of the waste types should add up to the total mass of the unopened bag.

Figure 2.7: Basin with sorted waste type being weighed

2.5.4 STEP 4:

All the recyclable waste types / materials were placed into recycling bags (red) and the non-recyclable waste was placed into black bags. It was decided at the planning session to recover all the recyclable materials during the study. The local recycler was contacted at the end of each working day to collect the recovered recyclable materials.

2.5.5 DATA CAPTURING

Eden District Municipality was responsible for the data capturing of the raw data to an electronic format in order to simplify the data analysis.

2.6 VOLUME DETERMINATION

It was recommended by DEADP to determine the volume of waste by estimating the volume percentage occupied by the sorted waste types per basin. However, each waste type occupies a different volume when compacted which is determined by the density of each waste type. The volume was therefore determined by obtaining the general compacted densities of each waste type and converting the mass to volume in cubic metres (m^3).

It is imperative to determine the volume of the waste as this determines the lifespan of a landfill site as well as transport costs as the waste is compacted and then transported to the landfill site. The general compacted densities were sourced from the Environmental Protection Authority, Victoria, Australia.

The general compacted densities of the different waste types are indicated in Table 2.8 below.

Waste Type	Density (Compacted)
Soft Plastics	156 kg/m³
Hard Plastics	72 kg/m³
Paper	228 kg/m³
Cardboard	130 kg/m³
Glass	411 kg/m³
Metal	320 kg/m³
Food Waste	1029 kg/m³
Garden	445 kg/m³
Textiles	292 kg/m³
Wood	156 kg/m³
Inert	1060 kg/m³
Nappies	227 kg/m³
E-Waste	120 kg/m³
Hazardous	348 kg/m³
Rest	348 kg/m³

Table 2.8: General densities of the various compacted waste types

It should be noted that the calculated volumes are representative of the specific waste types should they be compacted separately.

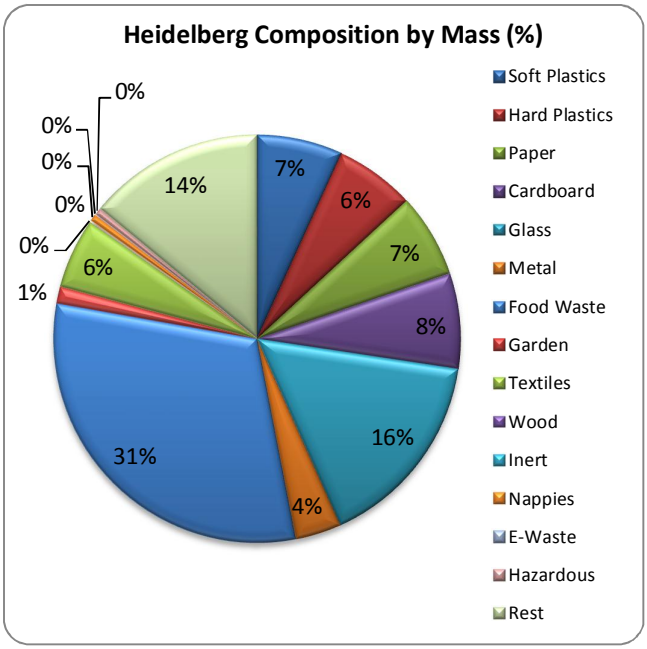
3. RESULTS

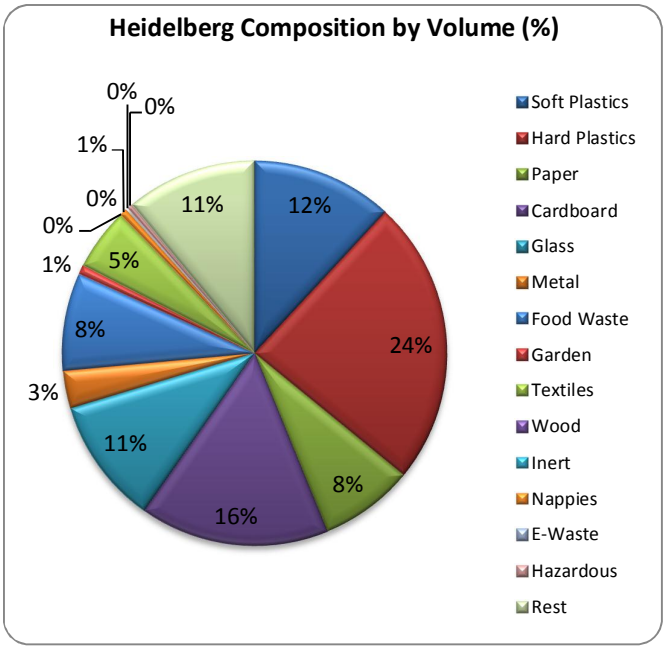
3.1 RESULTS PER SUB AREA

3.1.1 HEIDELBERG (80 SAMPLES)

Waste Type	Mass (kg)	Percentage of total	Calculated Volume
Soft Plastics	20.66	6.81	0.132
Hard Plastics	19.25	6.34	0.267
Paper	20.15	6.64	0.088
Cardboard	23.00	7.58	0.177
Glass	48.35	15.93	0.118
Metal	11.05	3.64	0.035
Food Waste	93.65	30.86	0.091
Garden	4.05	1.33	0.009
Textiles	16.90	5.57	0.058
Wood	0.05	0.02	0.000
Inert	0.35	0.12	0.000
Nappies	1.65	0.54	0.007
E-Waste	0.20	0.07	0.002
Hazardous	1.70	0.56	0.005
Rest	42.50	14.00	0.122
Total	**303.51**	**100.00**	**1.112**

Table 3.1: Results for Heidelberg (80 samples)

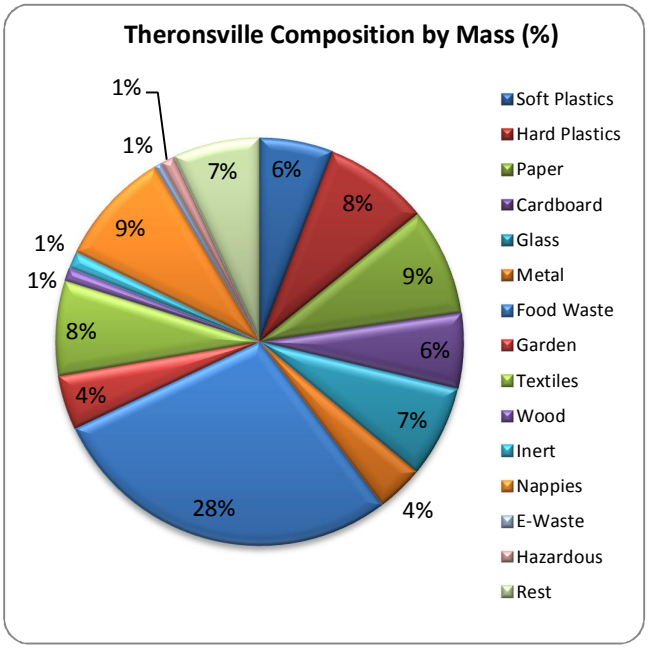


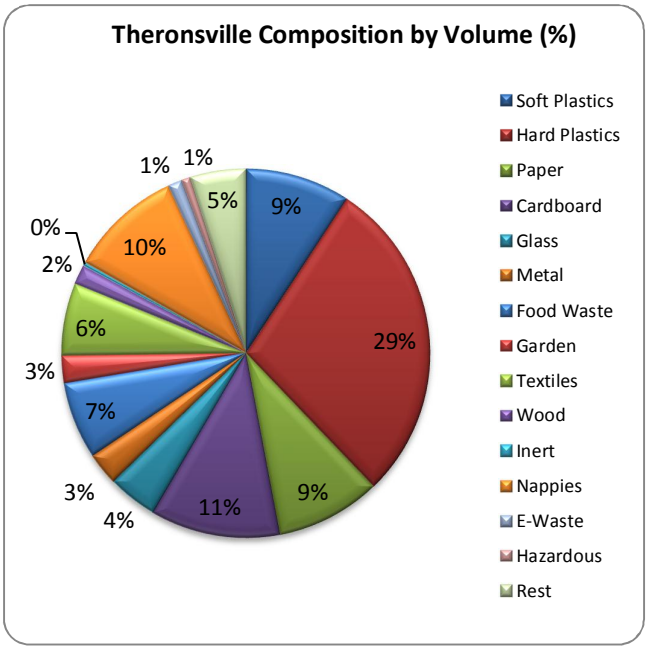


3.1.2 THERONSVILLE (60 SAMPLES)

Waste Type	Mass (kg)	Percentage of total	Calculated Volume
Soft Plastics	22.10	5.83	0.142
Hard Plastics	31.65	8.34	0.440
Paper	32.45	8.56	0.142
Cardboard	22.70	5.98	0.175
Glass	27.65	7.29	0.067
Metal	14.15	3.73	0.044
Food Waste	107.25	28.28	0.104
Garden	16.40	4.32	0.037
Textiles	28.55	7.53	0.098
Wood	4.00	1.05	0.026
Inert	5.05	1.33	0.005
Nappies	34.80	9.17	0.153
E-Waste	2.25	0.59	0.019
Hazardous	4.15	1.09	0.012
Rest	26.15	6.89	0.075
Total	**379.30**	**100.00**	**1.538**

Table 3.2: Results for Theronsville (60 samples)

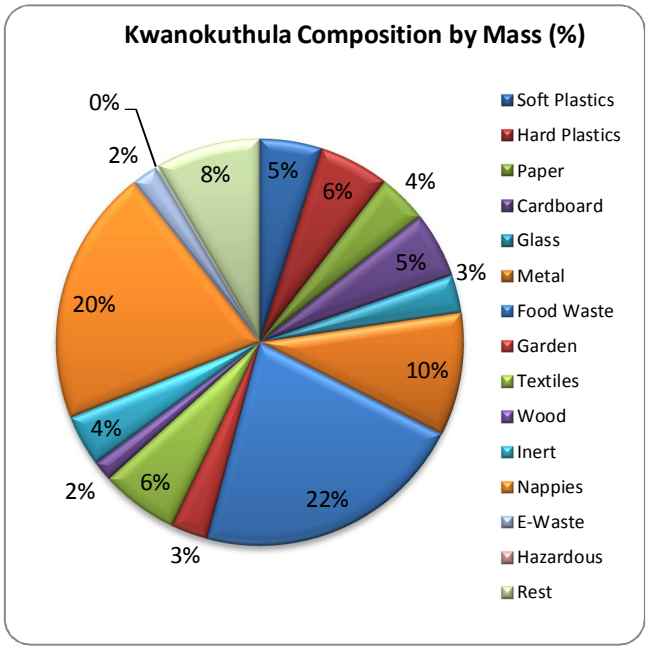


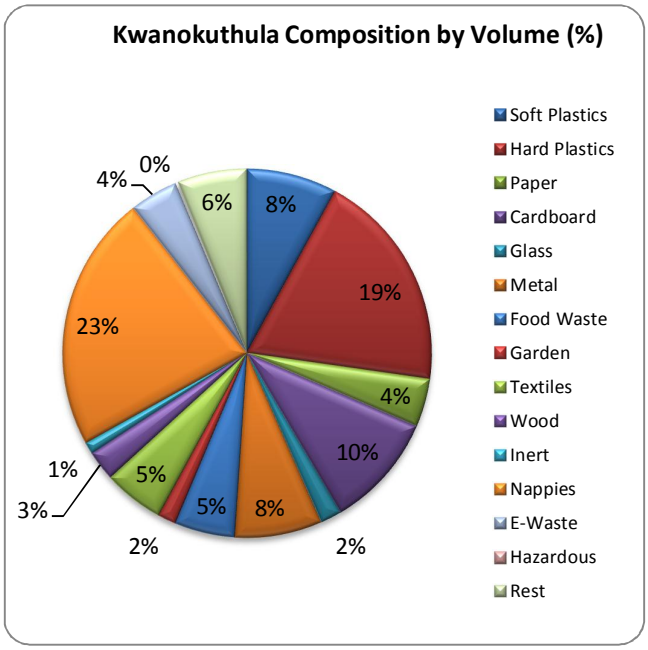


3.1.3 KWANOKUTHULA (15 SAMPLES)

Waste Type	Mass (kg)	Percentage of total	Calculated Volume
Soft Plastics	4.65	4.93	0.030
Hard Plastics	5.25	5.56	0.073
Paper	3.70	3.92	0.016
Cardboard	4.95	5.24	0.038
Glass	2.85	3.02	0.007
Metal	9.25	9.80	0.029
Food Waste	20.50	21.72	0.020
Garden	2.75	2.91	0.006
Textiles	5.85	6.20	0.020
Wood	1.50	1.59	0.010
Inert	3.85	4.08	0.004
Nappies	19.30	20.44	0.085
E-Waste	1.95	2.07	0.016
Hazardous	0.20	0.21	0.001
Rest	7.85	8.32	0.023
Total	**94.40**	**100.00**	**0.377**

Table 3.3: Results for Kwanokuthula (15 samples)

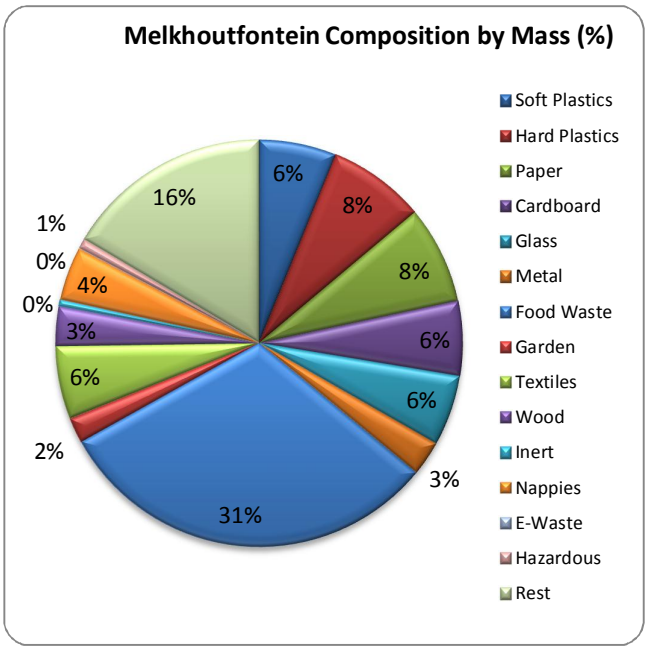


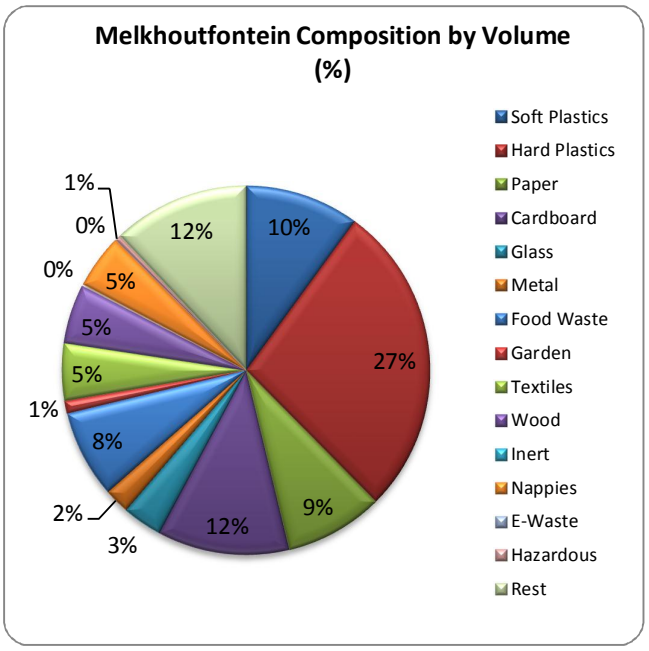


3.1.4 MELKHOUTFONTEIN (56 SAMPLES)

Waste Type	Mass (kg)	Percentage of total	Calculated Volume
Soft Plastics	11.25	6.16	0.072
Hard Plastics	14.15	7.74	0.197
Paper	14.20	7.77	0.062
Cardboard	10.81	5.92	0.083
Glass	10.26	5.61	0.025
Metal	5.05	2.76	0.016
Food Waste	56.66	31.01	0.055
Garden	3.65	2.00	0.008
Textiles	10.60	5.80	0.036
Wood	5.70	3.12	0.037
Inert	1.00	0.55	0.001
Nappies	7.75	4.24	0.034
E-Waste	0.05	0.03	0.000
Hazardous	1.50	0.82	0.004
Rest	30.10	16.47	0.086
Total	**182.73**	**100.00**	**0.717**

Table 3.4: Results for Melkhoutfontein (56 samples)

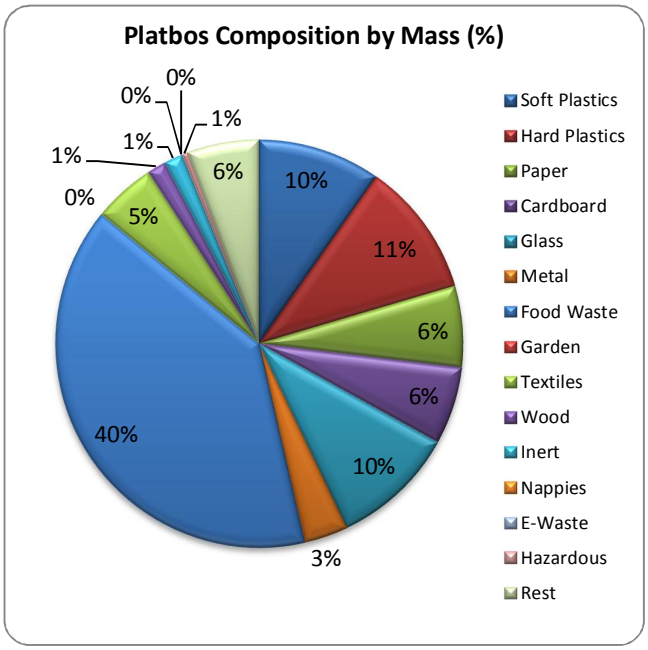


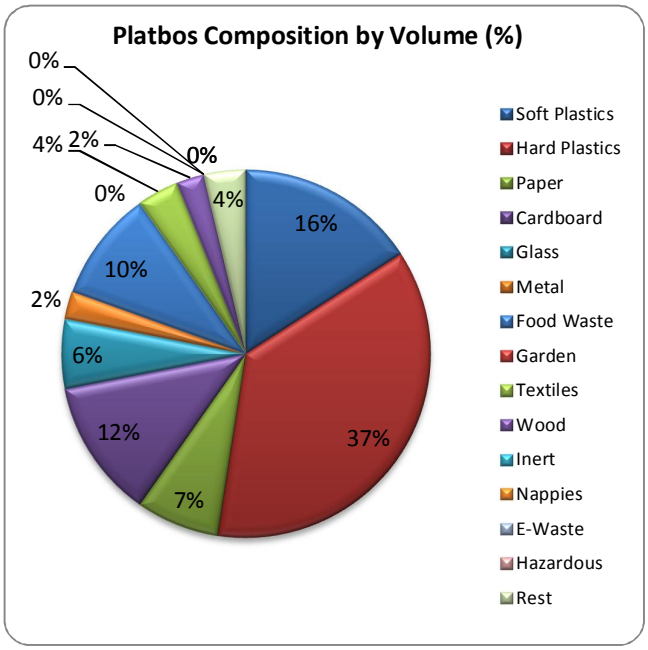


3.1.5 PLATBOS (9 SAMPLES)

Waste Type	Mass (kg)	Percentage of total	Calculated Volume
Soft Plastics	1.97	9.73	0.013
Hard Plastics	2.17	10.72	0.030
Paper	1.30	6.42	0.006
Cardboard	1.25	6.18	0.010
Glass	2.00	9.88	0.005
Metal	0.70	3.46	0.002
Food Waste	8.00	39.53	0.008
Garden	0.00	0.00	0.000
Textiles	1.00	4.94	0.003
Wood	0.30	1.48	0.002
Inert	0.30	1.48	0.000
Nappies	0.00	0.00	0.000
E-Waste	0.00	0.00	0.000
Hazardous	0.10	0.49	0.000
Rest	1.15	5.68	0.003
Total	**20.24**	**100.00**	**0.082**

Table 3.5: Results for Platbos (9 samples)

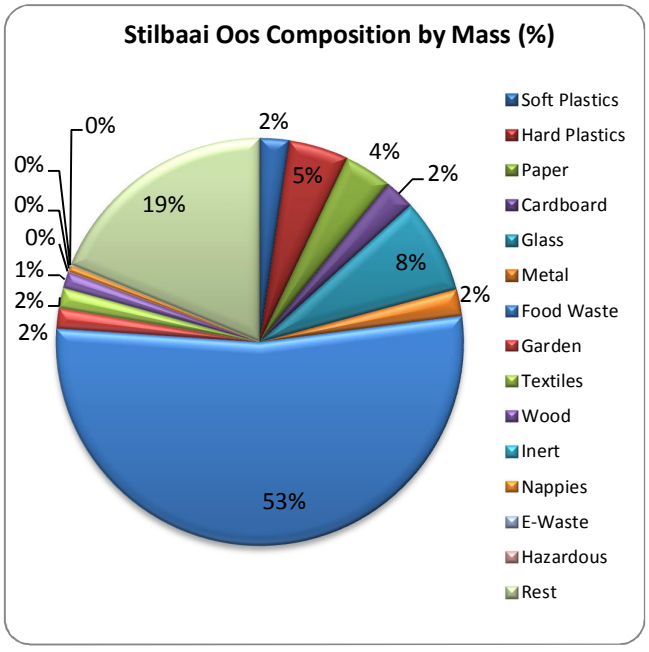


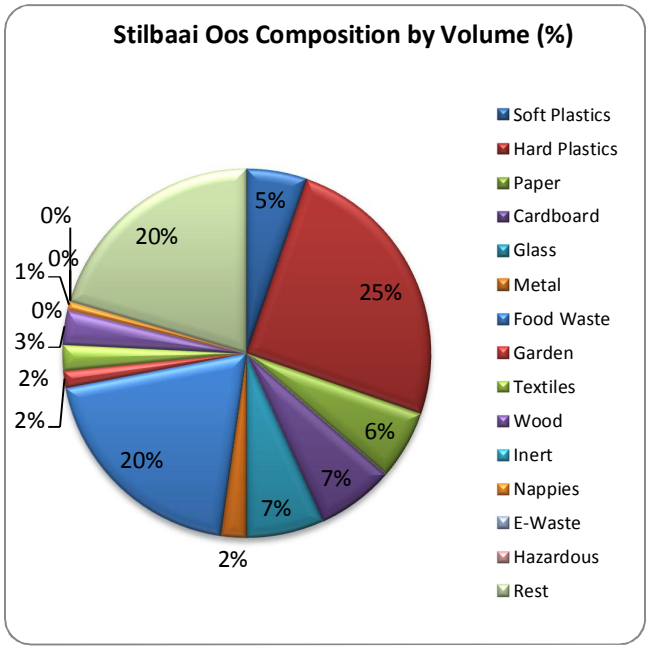


3.1.6 STILBAAI OOS (14 SAMPLES)

Waste Type	Mass (kg)	Percentage of total	Calculated Volume
Soft Plastics	1.15	2.31	0.007
Hard Plastics	2.35	4.73	0.033
Paper	1.90	3.82	0.008
Cardboard	1.20	2.41	0.009
Glass	3.75	7.55	0.009
Metal	1.05	2.11	0.003
Food Waste	26.40	53.12	0.026
Garden	0.80	1.61	0.002
Textiles	0.80	1.61	0.003
Wood	0.65	1.31	0.004
Inert	0.00	0.00	0.000
Nappies	0.25	0.50	0.001
E-Waste	0.00	0.00	0.000
Hazardous	0.05	0.10	0.000
Rest	9.35	18.81	0.027
Total	**49.70**	**100.00**	**0.132**

Table 3.6: Results for Stilbaai Oos (14 samples)

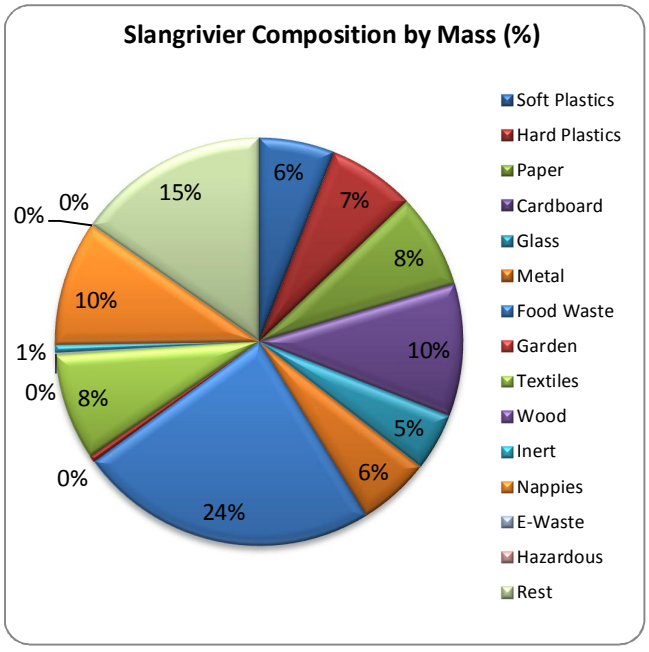


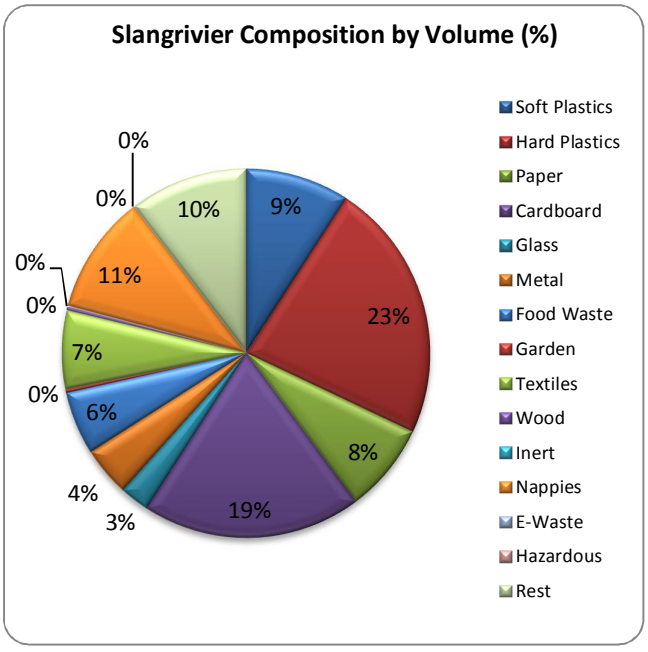


3.1.7 SLANGRIVIER (34 SAMPLES)

Waste Type	Mass (kg)	Percentage of total	Calculated Volume
Soft Plastics	10.01	5.99	0.064
Hard Plastics	11.50	6.89	0.160
Paper	12.60	7.54	0.055
Cardboard	17.55	10.51	0.135
Glass	7.60	4.55	0.018
Metal	9.55	5.72	0.030
Food Waste	39.75	23.80	0.039
Garden	0.85	0.51	0.002
Textiles	14.10	8.44	0.048
Wood	0.35	0.21	0.002
Inert	1.00	0.60	0.001
Nappies	16.55	9.91	0.073
E-Waste	0.05	0.03	0.000
Hazardous	0.00	0.00	0.000
Rest	25.55	15.30	0.073
Total	**167.01**	**100.00**	**0.701**

Table 3.7: Results for Slangrivier (34 samples)

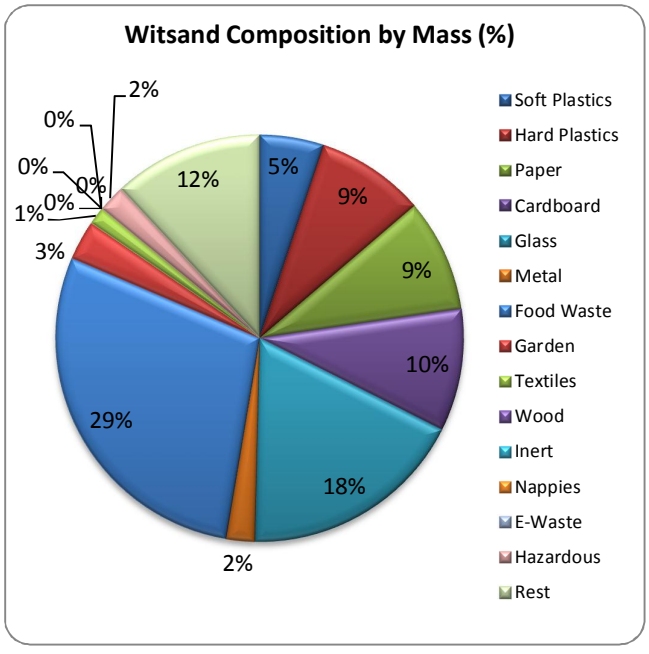


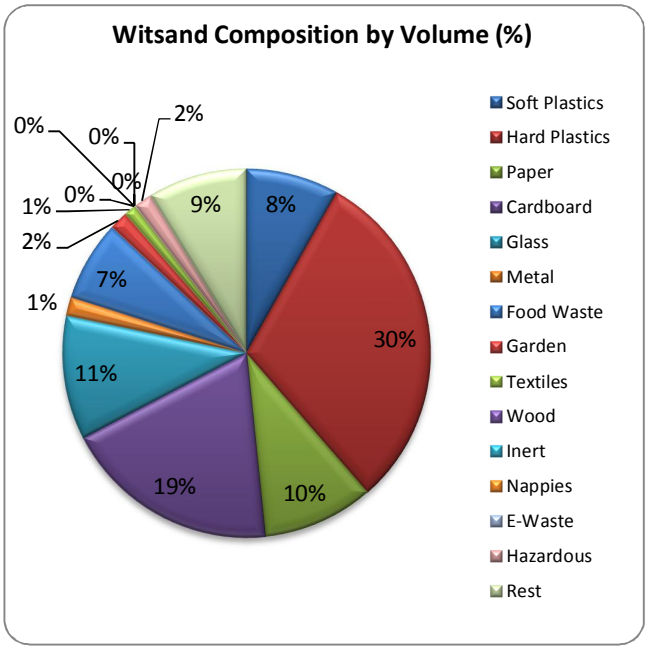


3.1.8 WITSAND (8 SAMPLES)

Waste Type	Mass (kg)	Percentage of total	Calculated Volume
Soft Plastics	2.35	5.08	0.015
Hard Plastics	4.00	8.65	0.056
Paper	4.15	8.97	0.018
Cardboard	4.50	9.73	0.035
Glass	8.30	17.95	0.020
Metal	1.05	2.27	0.003
Food Waste	13.30	28.76	0.013
Garden	1.45	3.14	0.003
Textiles	0.65	1.41	0.002
Wood	0.00	0.00	0.000
Inert	0.00	0.00	0.000
Nappies	0.00	0.00	0.000
E-Waste	0.00	0.00	0.000
Hazardous	1.00	2.16	0.003
Rest	5.50	11.89	0.016
Total	**46.25**	**100.00**	**0.184**

Table 3.8: Results for Witsand (8 samples)

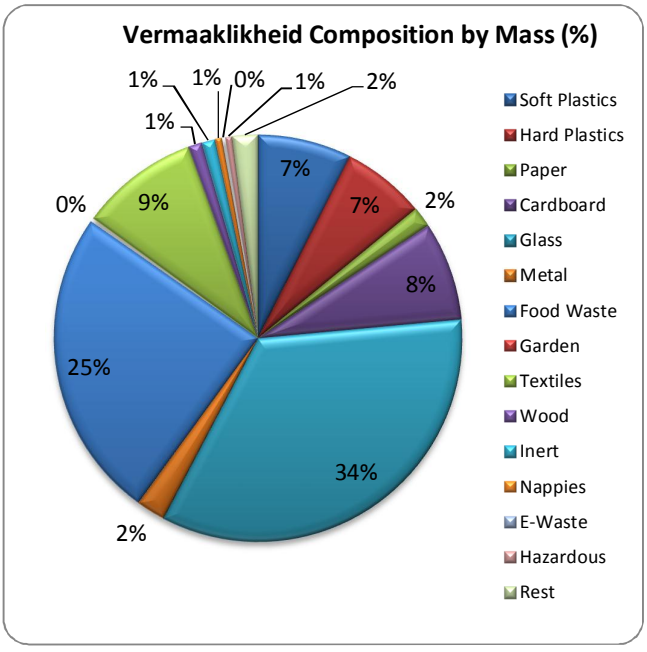


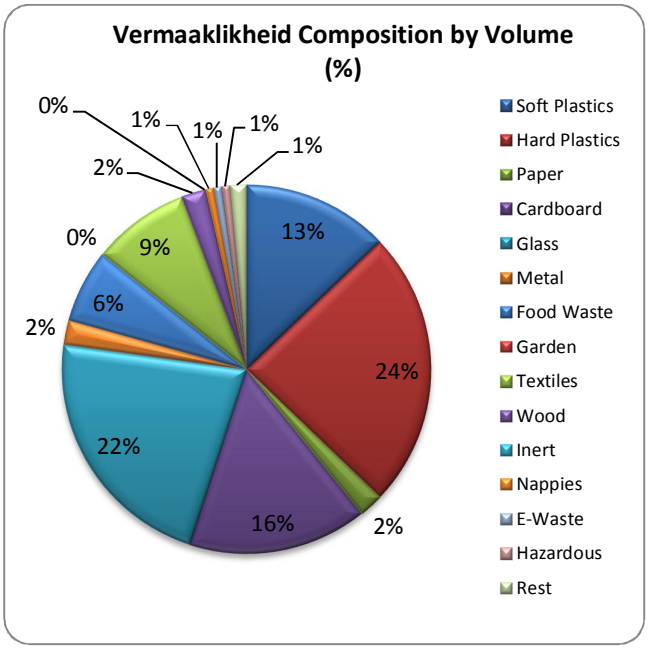


3.1.9 VERMAAKLIKHEID (5 SAMPLES)

Waste Type	Mass (kg)	Percentage of total	Calculated Volume
Soft Plastics	2.75	7.43	0.018
Hard Plastics	2.45	6.62	0.034
Paper	0.60	1.62	0.003
Cardboard	2.90	7.84	0.022
Glass	12.64	34.17	0.031
Metal	0.85	2.30	0.003
Food Waste	9.15	24.74	0.009
Garden	0.10	0.27	0.000
Textiles	3.50	9.46	0.012
Wood	0.40	1.08	0.003
Inert	0.40	1.08	0.000
Nappies	0.20	0.54	0.001
E-Waste	0.10	0.27	0.001
Hazardous	0.20	0.54	0.001
Rest	0.75	2.03	0.002
Total	**36.99**	**100.00**	**0.138**

Table 3.9: Results for Vermaaklikheid (5 samples)

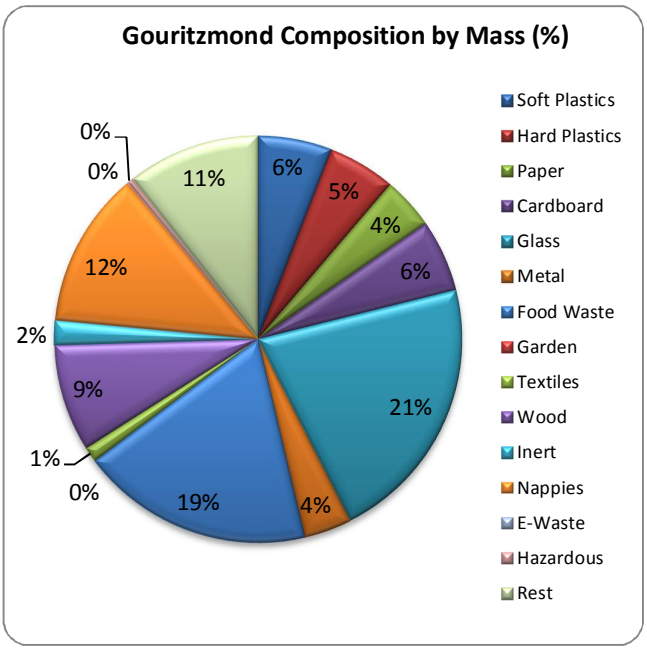


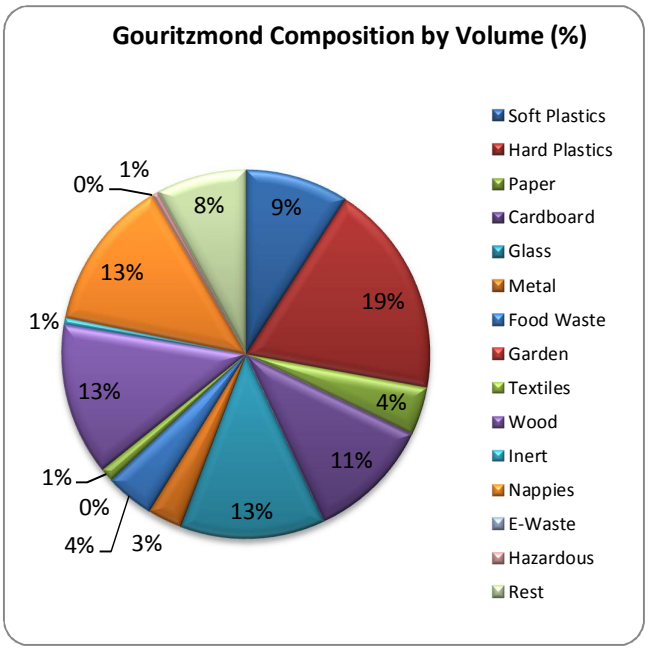


3.1.10 GOURITZMOND (9 SAMPLES)

Waste Type	Mass (kg)	Percentage of total	Calculated Volume
Soft Plastics	2.41	5.87	0.015
Hard Plastics	2.20	5.36	0.031
Paper	1.70	4.14	0.007
Cardboard	2.35	5.72	0.018
Glass	8.80	21.44	0.021
Metal	1.55	3.78	0.005
Food Waste	7.59	18.49	0.007
Garden	0.00	0.00	0.000
Textiles	0.50	1.22	0.002
Wood	3.50	8.53	0.022
Inert	0.80	1.95	0.001
Nappies	5.10	12.42	0.022
E-Waste	0.00	0.00	0.000
Hazardous	0.20	0.49	0.001
Rest	4.35	10.60	0.013
Total	**41.05**	**100.00**	**0.166**

Table 3.10: Results for Gouritzmond (9 samples)

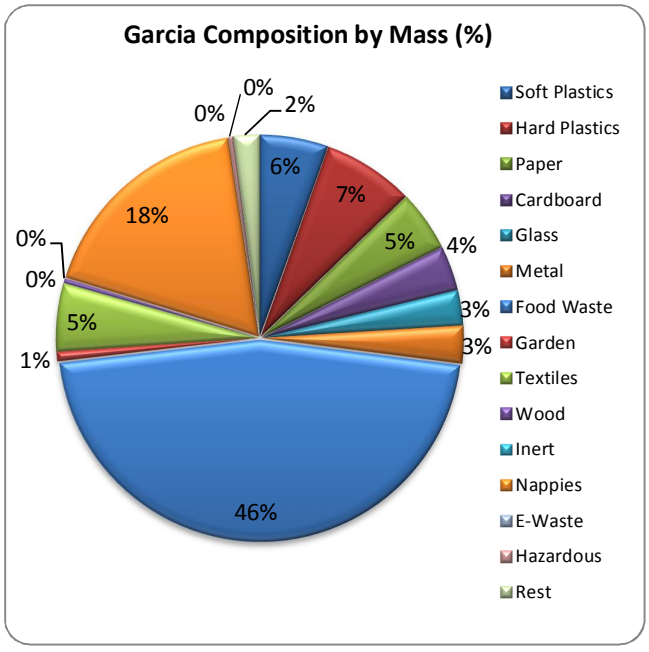


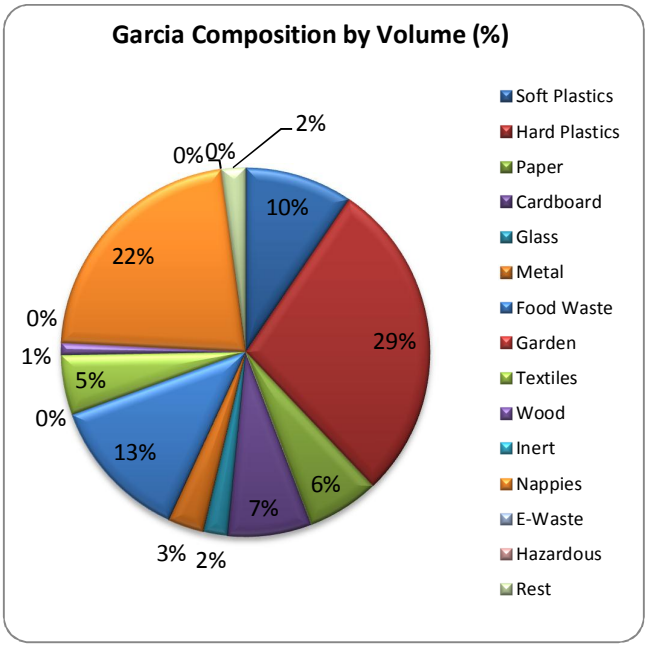


3.1.11 GARCIA (5 SAMPLES)

Waste Type	Mass (kg)	Percentage of total	Calculated Volume
Soft Plastics	1.45	5.44	0.009
Hard Plastics	1.95	7.32	0.027
Paper	1.30	4.88	0.006
Cardboard	0.95	3.56	0.007
Glass	0.75	2.81	0.002
Metal	0.80	3.00	0.003
Food Waste	12.30	46.15	0.012
Garden	0.20	0.75	0.000
Textiles	1.45	5.44	0.005
Wood	0.10	0.38	0.001
Inert	0.00	0.00	0.000
Nappies	4.75	17.82	0.021
E-Waste	0.00	0.00	0.000
Hazardous	0.10	0.38	0.000
Rest	0.55	2.06	0.002
Total	**26.65**	**100.00**	**0.095**

Table 3.11: Results for Garcia (5 samples)

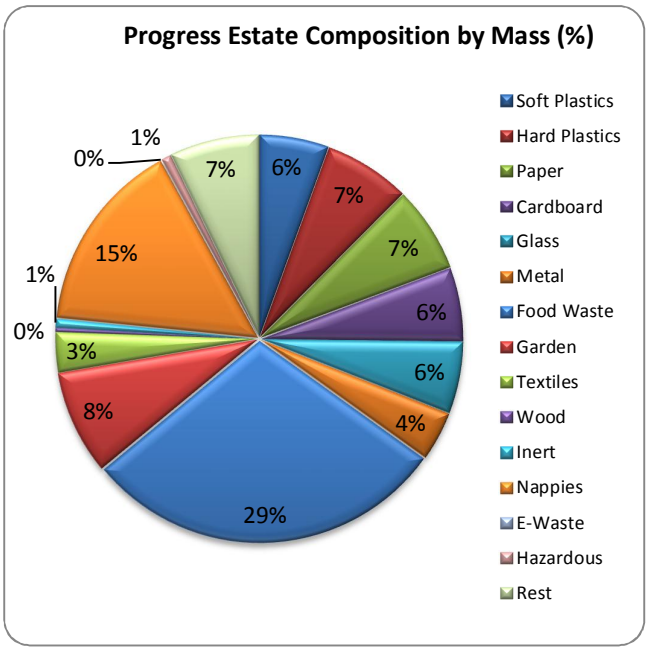


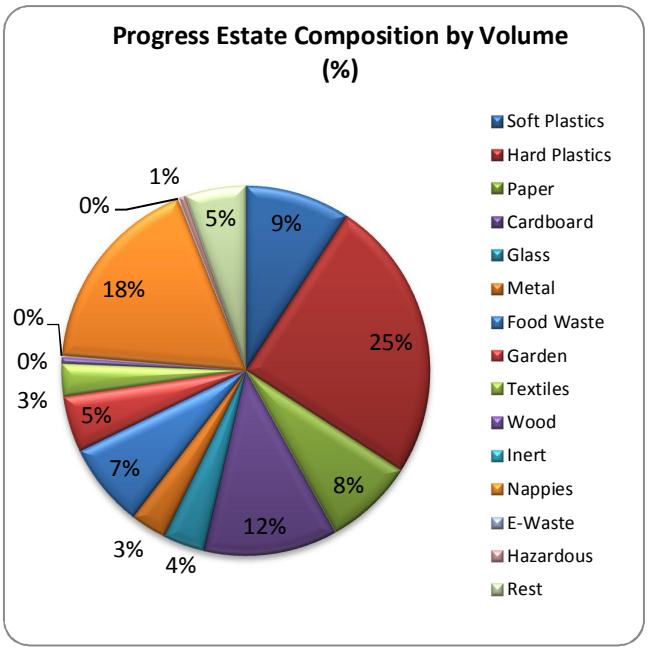


3.1.12 PROGRESS ESTATE (61 SAMPLES)

Waste Type	Mass (kg)	Percentage of total	Calculated Volume
Soft Plastics	18,50	5,53	0,119
Hard Plastics	23,05	6,90	0,320
Paper	23,00	6,88	0,101
Cardboard	19,64	5,88	0,151
Glass	19,25	5,76	0,047
Metal	13,21	3,95	0,041
Food Waste	97,30	29,11	0,095
Garden	27,90	8,35	0,063
Textiles	10,68	3,19	0,037
Wood	1,10	0,33	0,007
Inert	2,40	0,72	0,002
Nappies	51,50	15,41	0,227
E-Waste	0,25	0,07	0,002
Hazardous	2,60	0,78	0,007
Rest	23,90	7,15	0,069
Total	**334,28**	**100,00**	**1,287**

Table 3.12: Results for Progress Estate (61 samples)

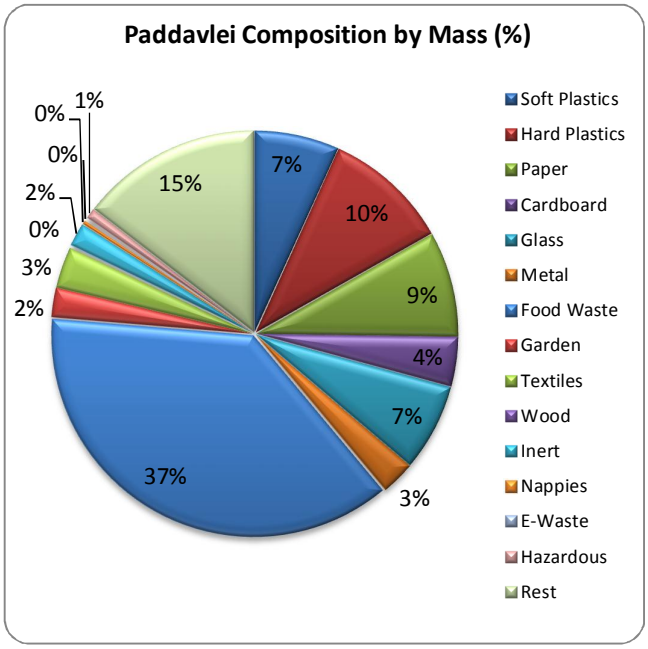


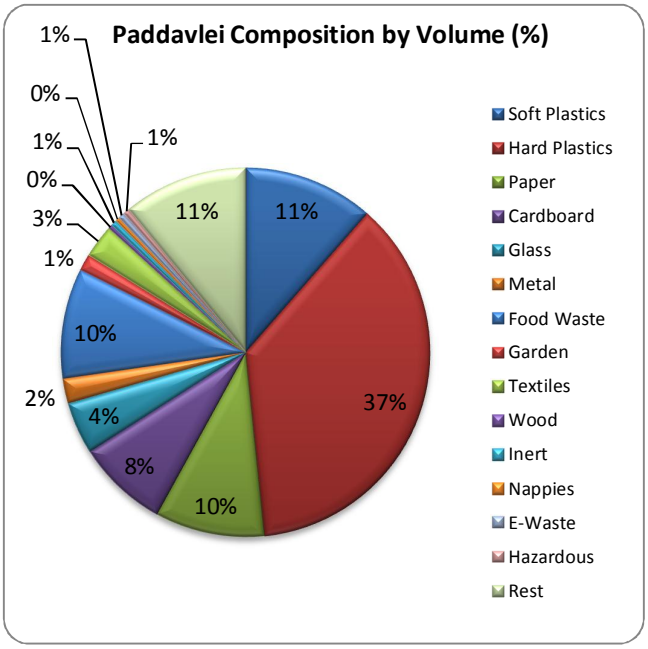


3.1.13 PADDAVLEI (29 SAMPLES)

Waste Type	Mass (kg)	Percentage of total	Calculated Volume
Soft Plastics	9.75	6.73	0.063
Hard Plastics	14.60	10.08	0.203
Paper	12.17	8.41	0.053
Cardboard	5.75	3.97	0.044
Glass	10.15	7.01	0.025
Metal	3.95	2.73	0.012
Food Waste	54.10	37.37	0.053
Garden	3.40	2.35	0.008
Textiles	4.80	3.32	0.016
Wood	0.30	0.21	0.002
Inert	2.70	1.87	0.003
Nappies	0.45	0.31	0.002
E-Waste	0.40	0.28	0.003
Hazardous	1.20	0.83	0.003
Rest	21.05	14.54	0.060
Total	**144.77**	**100.00**	**0.550**

Table 3.13: Results for Paddavlei (29 samples)

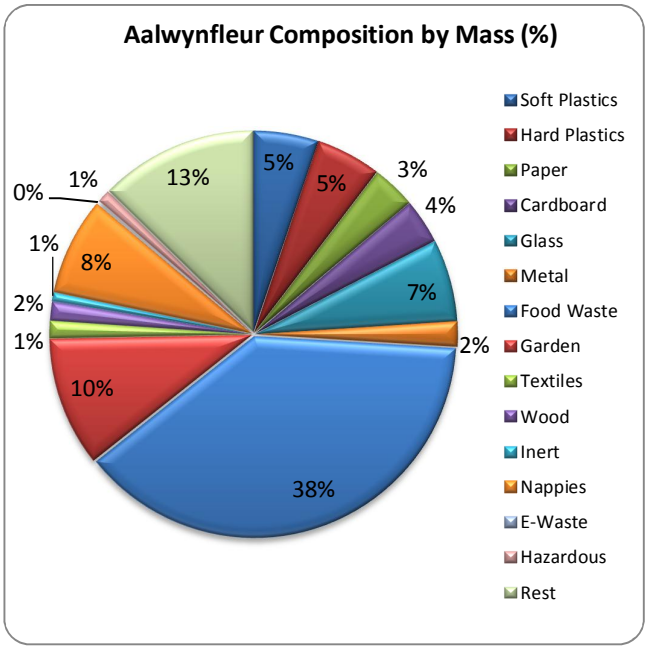


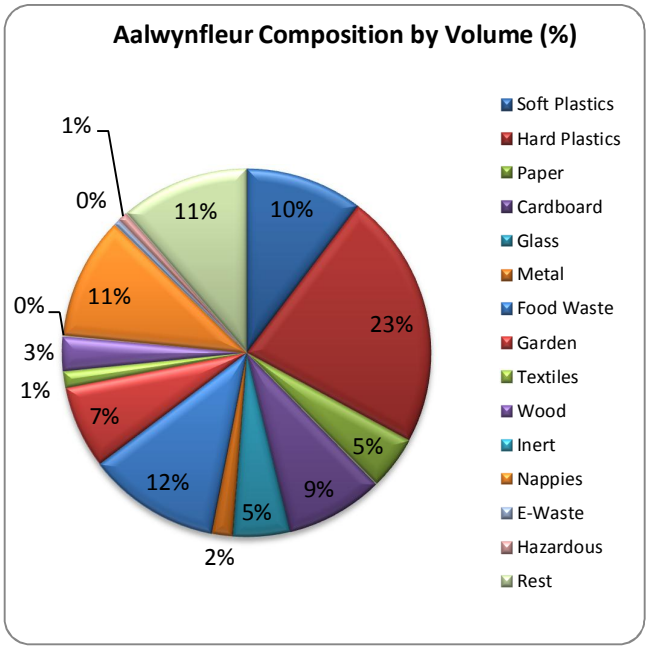


3.1.14 AALWYNFLEUR (41 SAMPLES)

Waste Type	Mass (kg)	Percentage of total	Calculated Volume
Soft Plastics	11.25	5.16	0.072
Hard Plastics	11.35	5.20	0.158
Paper	7.60	3.49	0.033
Cardboard	7.80	3.58	0.060
Glass	14.31	6.56	0.035
Metal	4.30	1.97	0.013
Food Waste	83.65	38.36	0.081
Garden	22.60	10.36	0.051
Textiles	3.00	1.38	0.010
Wood	3.30	1.51	0.021
Inert	1.55	0.71	0.001
Nappies	17.05	7.82	0.075
E-Waste	0.45	0.21	0.004
Hazardous	2.25	1.03	0.006
Rest	27.60	12.66	0.079
Total	**218.06**	**100.00**	**0.701**

Table 3.14: Results for Aalwynfleur (41 samples)

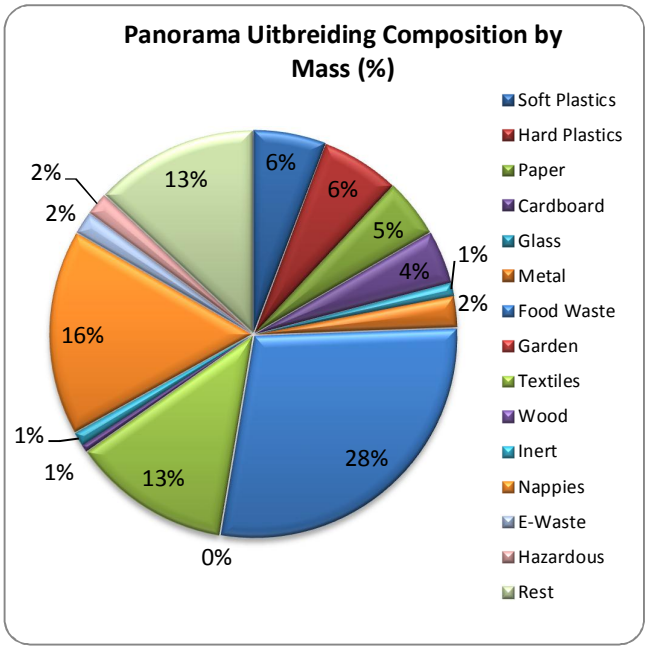


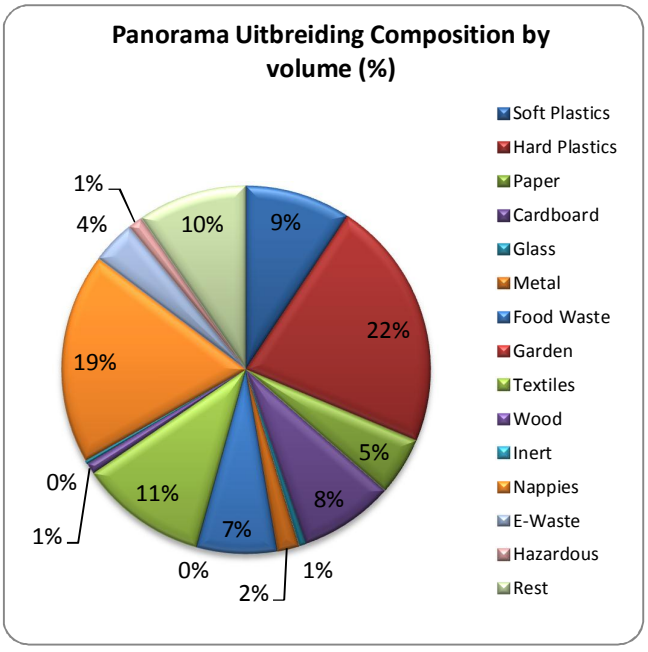


3.1.15 PANORAMA UITBREIDING (13 SAMPLES)

Waste Type	Mass (kg)	Percentage of total	Calculated Volume
Soft Plastics	4.60	5.75	0.029
Hard Plastics	5.00	6.25	0.069
Paper	3.75	4.68	0.016
Cardboard	3.40	4.25	0.026
Glass	0.85	1.06	0.002
Metal	1.95	2.44	0.006
Food Waste	22.60	28.23	0.022
Garden	0.00	0.00	0.000
Textiles	10.10	12.62	0.035
Wood	0.45	0.56	0.003
Inert	0.90	1.12	0.001
Nappies	13.10	16.36	0.058
E-Waste	1.45	1.81	0.012
Hazardous	1.45	1.81	0.004
Rest	10.45	13.05	0.030
Total	**80.05**	**100.00**	**0.314**

Table 3.15: Results for Panorama Uitbreiding (13 samples)

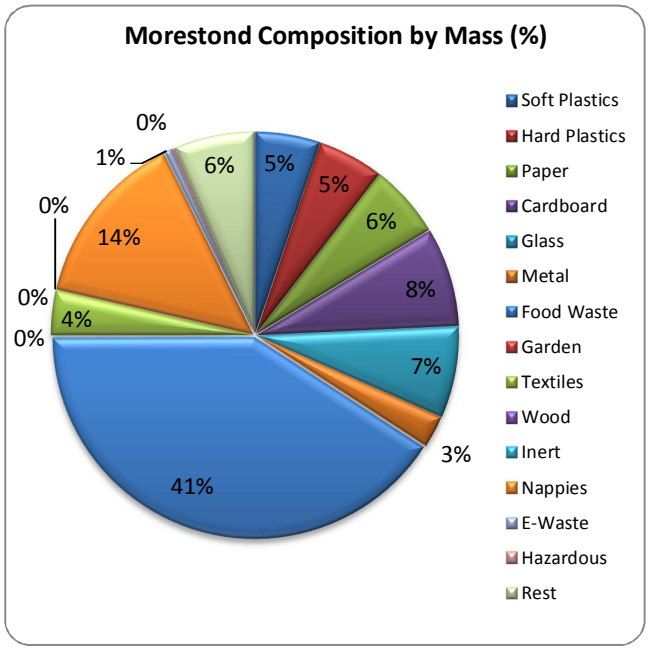


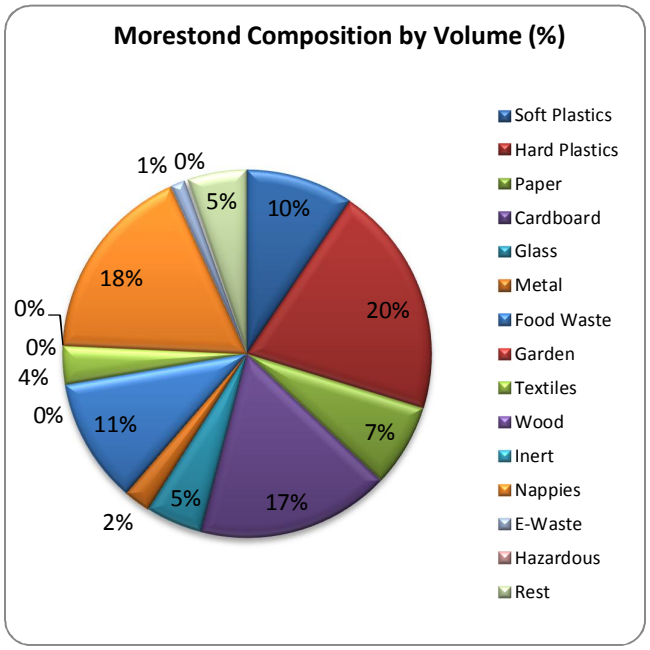


3.1.16 MORESTOND (17 SAMPLES)

Waste Type	Mass (kg)	Percentage of total	Calculated Volume
Soft Plastics	5.55	5.18	0.036
Hard Plastics	5.65	5.27	0.078
Paper	6.35	5.93	0.028
Cardboard	8.45	7.88	0.065
Glass	7.85	7.32	0.019
Metal	2.77	2.58	0.009
Food Waste	43.70	40.78	0.042
Garden	0.05	0.05	0.000
Textiles	3.80	3.55	0.013
Wood	0.00	0.00	0.000
Inert	0.05	0.05	0.000
Nappies	15.10	14.09	0.067
E-Waste	0.65	0.61	0.005
Hazardous	0.30	0.28	0.001
Rest	6.90	6.44	0.020
Total	**107.17**	**100.00**	**0.383**

Table 3.16: Results for Morestond (17 samples)

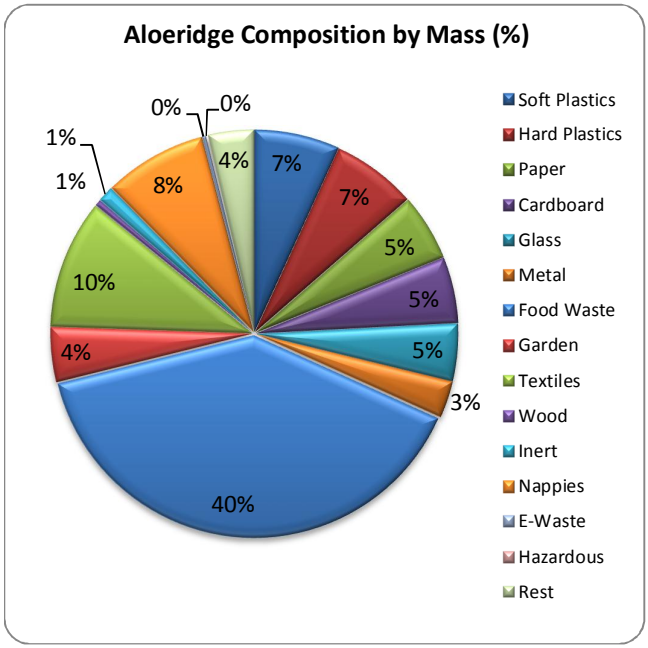


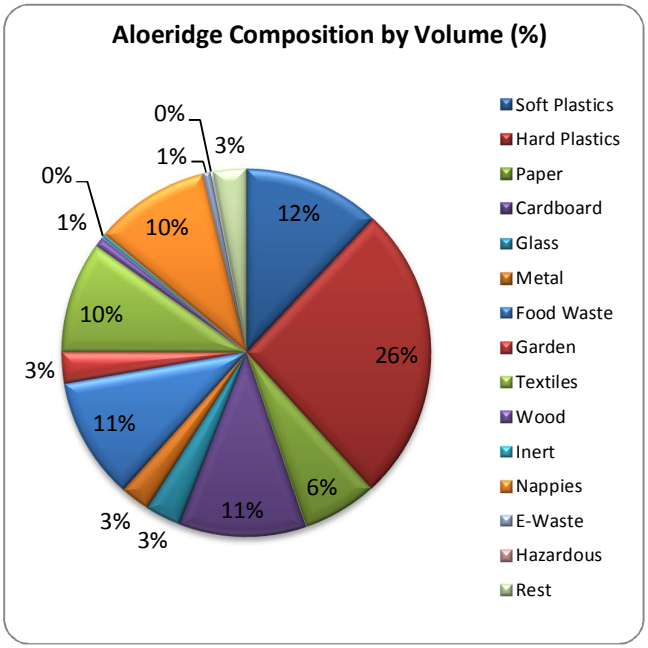


3.1.17 ALOERIDGE (30 SAMPLES)

Waste Type	Mass (kg)	Percentage of total	Calculated Volume
Soft Plastics	10.95	6.79	0.070
Hard Plastics	10.93	6.78	0.152
Paper	8.60	5.33	0.038
Cardboard	8.50	5.27	0.065
Glass	7.40	4.59	0.018
Metal	4.79	2.97	0.015
Food Waste	63.60	39.43	0.062
Garden	7.05	4.37	0.016
Textiles	16.61	10.30	0.057
Wood	0.85	0.53	0.005
Inert	2.05	1.27	0.002
Nappies	13.30	8.25	0.059
E-Waste	0.50	0.31	0.004
Hazardous	0.25	0.16	0.001
Rest	5.90	3.66	0.017
Total	**161.28**	**100.00**	**0.580**

Table 3.17: Results for Aloeridge (30 samples)

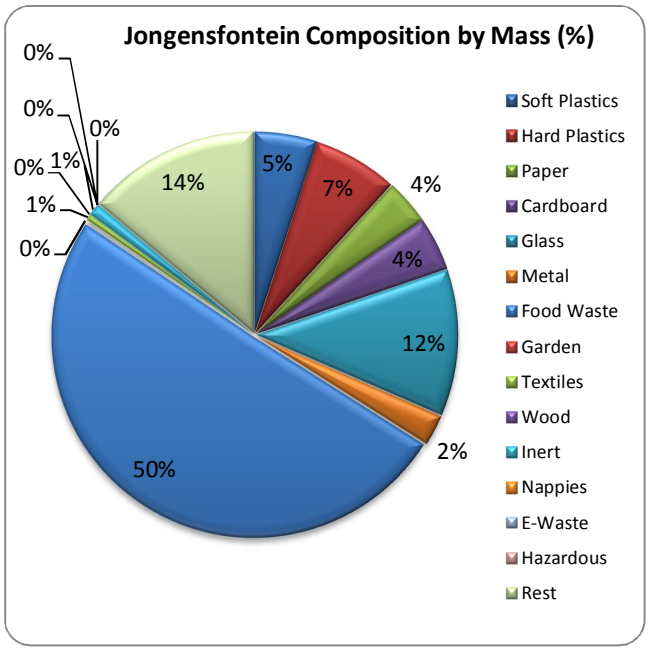


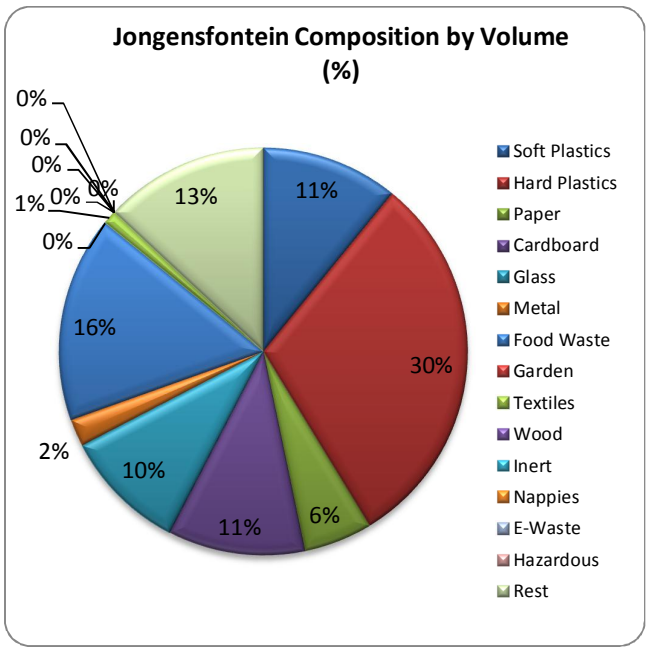


3.1.18 JONGENSFOTEIN (8 SAMPLES)

Waste Type	Mass (kg)	Percentage of total	Calculated Volume
Soft Plastics	1.50	4.98	0.010
Hard Plastics	2.05	6.80	0.028
Paper	1.10	3.65	0.005
Cardboard	1.30	4.31	0.010
Glass	3.55	11.77	0.009
Metal	0.75	2.49	0.002
Food Waste	15.20	50.41	0.015
Garden	0.05	0.17	0.000
Textiles	0.15	0.50	0.001
Wood	0.00	0.00	0.000
Inert	0.30	1.00	0.000
Nappies	0.00	0.00	0.000
E-Waste	0.00	0.00	0.000
Hazardous	0.00	0.00	0.000
Rest	4.20	13.93	0.012
Total	**30.15**	**100.00**	**0.092**

Table 3.18: Results for Jongensfontein (8 samples)

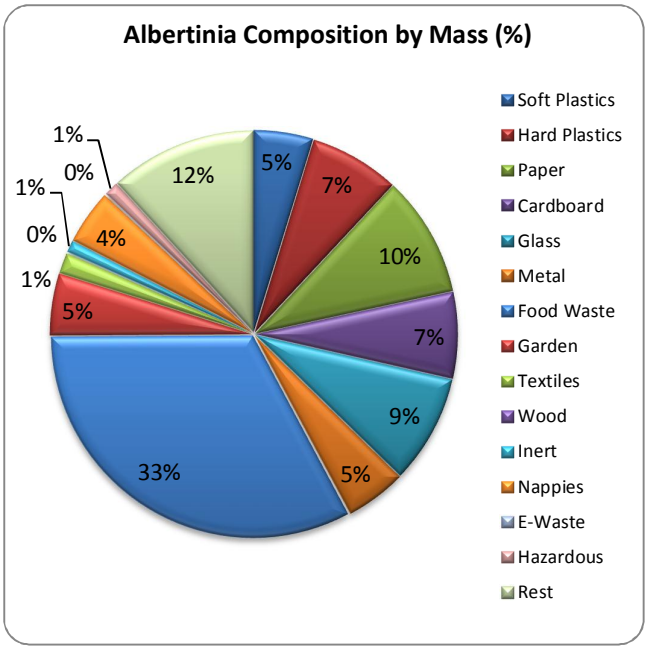


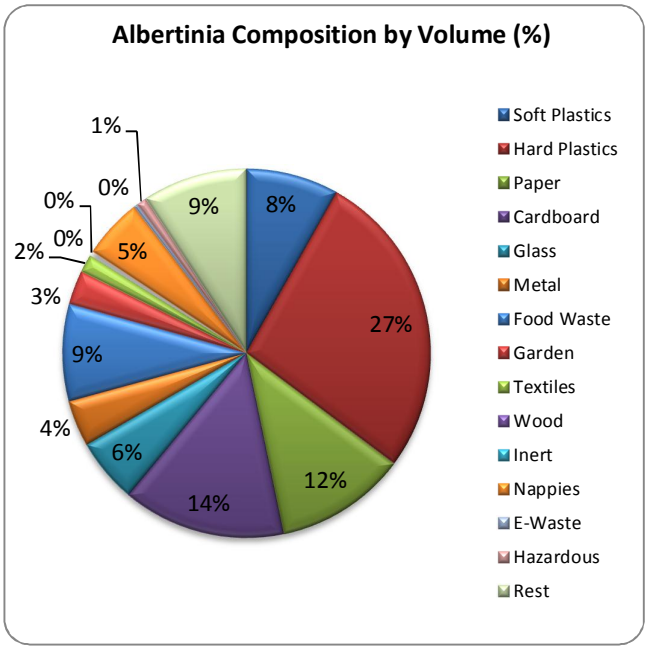


3.1.19 ALBERTINIA (36 SAMPLES)

Waste Type	Mass (kg)	Percentage of total	Calculated Volume
Soft Plastics	7.20	4.72	0.046
Hard Plastics	11.02	7.23	0.153
Paper	14.75	9.67	0.065
Cardboard	10.55	6.92	0.081
Glass	13.35	8.76	0.032
Metal	7.45	4.89	0.023
Food Waste	49.90	32.73	0.048
Garden	7.50	4.92	0.017
Textiles	2.51	1.65	0.009
Wood	0.20	0.13	0.001
Inert	1.45	0.95	0.001
Nappies	6.70	4.39	0.030
E-Waste	0.20	0.13	0.002
Hazardous	1.75	1.15	0.005
Rest	17.95	11.77	0.052
Total	**152.48**	**100.00**	**0.565**

Table 3.19: Results for Albertinia (36 samples)

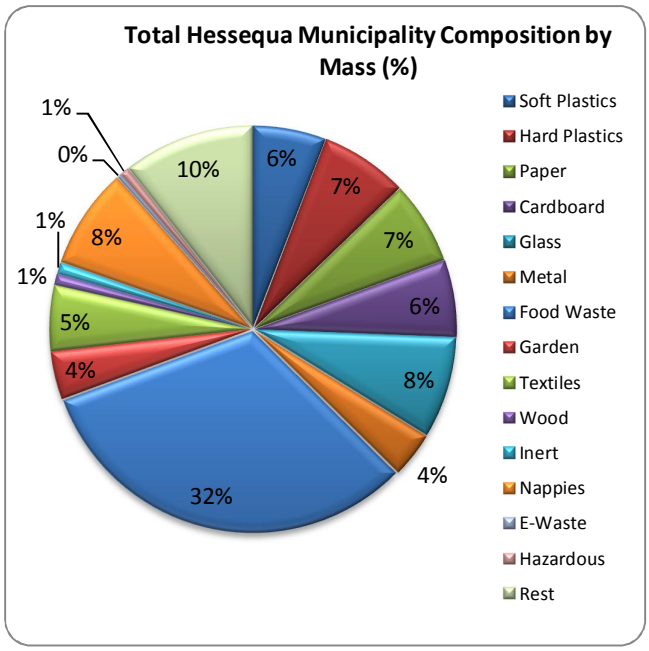


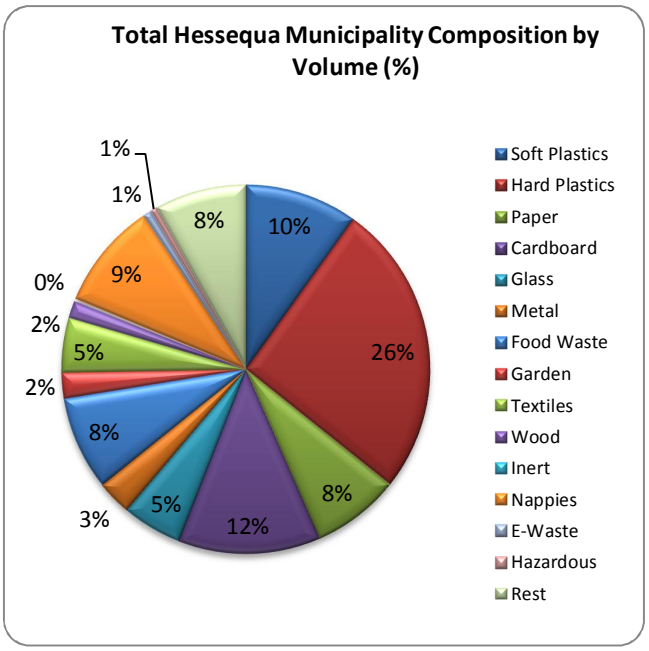


3.1.20 TOTAL HESSEQUA MUNICIPALITY (530 SAMPLES)

Waste Type	Mass (kg)	Percentage of total	Calculated Volume
Soft Plastics	150,05	5,82	0,962
Hard Plastics	180,57	7,01	2,508
Paper	171,37	6,65	0,752
Cardboard	157,55	6,12	1,212
Glass	209,66	8,14	0,510
Metal	94,22	3,66	0,294
Food Waste	824,60	32,01	0,801
Garden	98,80	3,84	0,222
Textiles	135,55	5,26	0,464
Wood	22,75	0,88	0,146
Inert	24,15	0,94	0,023
Nappies	207,55	8,06	0,914
E-Waste	8,50	0,33	0,071
Hazardous	19,00	0,74	0,055
Rest	271,75	10,55	0,781
Total	**2576,07**	**100,00**	**9,715**

Table 3.20: Results for Total Hessequa Municipality (530 samples)





4. CONCLUSIONS

Of the 530 bags that were sampled a total mass of 2 576.07 kg (2.57 tons) of waste was recorded, with a compacted volume of 9.715 m^3.

Food Waste was the most prominent component by mass (32%) of the waste types that were sampled, however only makes up 8% of the total waste by volume. Hard Plastics was the most prominent component by volume (26%) of the waste types that were sampled.

38% of the waste types that were sampled by mass were recyclable materials: Glass (8%), Hard Plastics (7%), Paper (7%), Soft Plastics (6%), Cardboard (6%) and Metal (4%). However, by volume, 63% of the waste types that were sampled were recyclable materials: Hard Plastics (26%), Cardboard (12%), Soft Plastics (10%), Paper (7%), Glass (5%) and Metal (3%).

Garden waste constituted 4% of the total waste sampled by mass and 2% by volume.

E-waste constituted a mere 0.33% of the total waste sampled by mass and 0.75% by volume. E-waste is however classified as hazardous waste and contains recyclable materials that can be recovered. The remaining hazardous components of the E-waste should be disposed of at an appropriate facility.

Hazardous Waste constituted a mere 0.74% of the total waste sampled by mass and 0.55% by volume. Although minimal, hazardous waste is not permitted to be disposed with household general waste.

The remaining 26% of the waste types by mass and 24% by volume was Nappies, Textiles, Wood, Inert and Rest. These waste types cannot be recycled and there is no or limited (unaffordable) alternative waste technologies available in South Africa. Therefore this is considered the portion that will be necessary to dispose of at a landfill site.

The results obtained from the different sub areas within Hessequa Municipality illustrated different trends in waste generation. These trends will be significant in identifying and prioritising the type of waste minimisation initiatives to be implemented in the various sub-areas. E.g. Home composting initiatives should be implemented in the sub areas where Garden Waste was the prominent component of the waste sampled.

It was generally considered that the participation rate in the two-bag recycling system was prominent in the higher income areas. However the study indicated that the majority (by volume) of the waste generated in the higher income areas are recyclable materials.

The prediction of uniformity and consistency of waste type occurrence is complex due to the heterogeneous nature and variability of waste. Therefore it is not likely to determine accurate projections of the likelihood of the occurrence of particular waste types in a waste stream.

5. ASSUMPTIONS

Currently, there is no record of waste tonnages that is being disposed of at landfill in Hessequa Municipality. Therefore, the number of households and the percentage of access to refuse removal specified in the Socio-Economic Profile 2015 document compiled by Western Cape Provincial Treasury was used to draft the waste generation assumptions. Based on the figures calculated from the results of the waste characterisation study, the following assumptions can be made:

- The average household generates 2.62 refuse bags per week.
- The average mass per refuse bag can be assumed to be 4.86 kg.
- The Socio-Economic Profile 2015 document compiled by Western Cape Provincial Treasury indicates the total number of households to be 17 278 and access to refuse removal services being at 78.7%. Therefore, the estimation of households used to determine the sample size can be considered moderately accurate at 76.9% (13 304 households).

Based on the above, it can be assumed that approximately 677.6 tons of waste is collected and disposed of at landfill in Hessequa Municipality on a monthly basis. However, it should be noted that waste generation is affected by seasonal variation, and this figure increasing during the months of the festive holiday season is probable.

When applying the results of the characterisation study to the assumed monthly average of 677.6 tons, the following tonnages per waste type being landfilled can be assumed:

Waste Type	Mass (Tons)	Percentage of total Mass (%)	Calculated Volume (m^3)
Soft Plastics	39,43	5,82	252,76
Hard Plastics	47,49	7,01	659,58
Paper	45,06	6,65	197,63
Cardboard	41,47	6,12	319,00
Glass	55,16	8,14	134,21
Metal	24,80	3,66	77,50
Food Waste	216,89	32,01	210,78
Garden	26,02	3,84	58,47
Textiles	35,63	5,26	122,02
Wood	5,96	0,88	38,21
Inert	6,36	0,94	6,00
Nappies	54,61	8,06	240,57
E-Waste	2,23	0,33	18,58
Hazardous	5,01	0,74	14,39
Rest	71,48	10,55	205,40
Total	**677,60**	**100**	**2555,10**

Table 5.1: Assumed tonnages per waste type per month

When referring to Table 5.1 above, the recyclable portion (soft plastic, hard plastic, paper, cardboard, glass and metal) comprises of 38% of the total waste going to landfill on a monthly basis. This amounts to a total

of approximately 253.41 tons and 1640.68 m³ of recyclable materials that could potentially be diverted from landfill.

There are currently informal waste pickers removing the recyclable materials from the Steynskloof landfill site as it is received. However, a large portion of the recyclable material will be of a poor quality as it is contaminated by organic waste.

It is assumed that approximately 216.89 tons (210.78 m³) of food waste and 26.02 tons (58.47 m³) of garden waste is being landfilled on a monthly basis. This is a portion that can be significantly reduced should home composting initiatives be implemented.

It is alarming to note that approximately 2.23 tons of E-waste (recyclable and hazardous components) and 5.01 tons of Hazardous Waste is assumed to be disposed of on a monthly basis.

The remaining waste types (Textiles, Wood, Inert, Nappies and Rest) amounts to approximately 174.04 tons (612.2 m³) and is considered the portion that has no alternative than landfill.

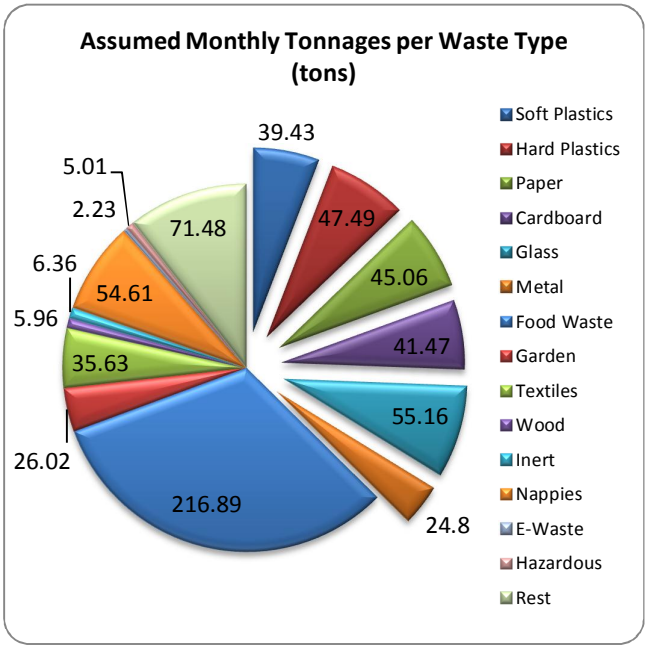


Figure 5.2: Pie Chart indicating assumed portion of recyclable materials in tons

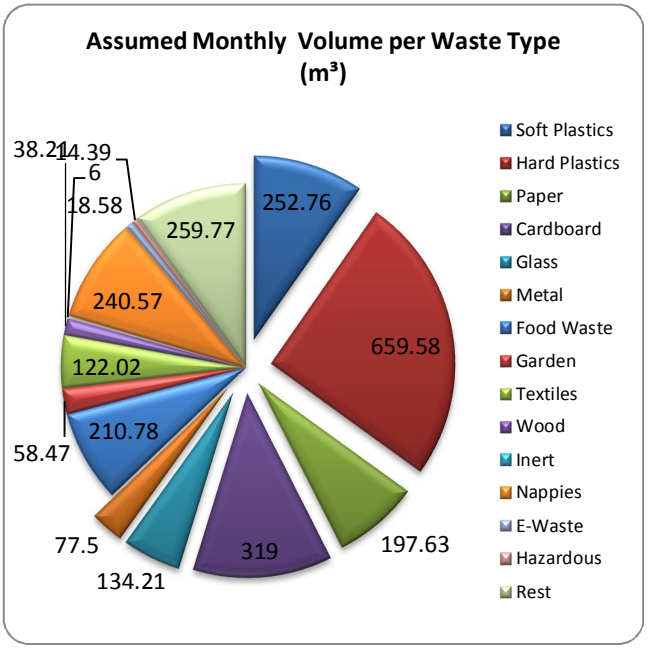


Figure 5.3: Pie chart indicating assumed portion of recyclable materials in m³

6. CHALLENGES

6.1 DATA CAPTURING

The capturing of data from the raw data sheets to an electronic format (spreadsheets) was time consuming and may have resulted in possible human error. The data sheets were scrutinised on a number of occasions in order to ensure that human error was eliminated.

6.2 INSUFFICIENT SAMPLING PLAN

The lack of a sufficient sampling plan resulted in a shortage of a representative sample. A sample size of 550 was determined in order to ensure a representative sample, however, only a total of 530 samples were collected. The sample size of 530 was deemed to be sufficient in order to represent an indication of waste generation trends.

The lack of a sufficient sampling plan also resulted in time constraints as the samples that were to be sorted on the specified days were only collected on the morning of that day. This resulted in extensive time periods where no sorting or work could be conducted until such time that the samples were dropped off. This resulted in the study being extended for an additional two days.

6.3 LACK OF SUPERVISION

The lack of supervision of the Youth Jobs in Waste participants resulted in longer lunch breaks and absenteeism causing the characterisation study to proceed for longer than anticipated.

7. RECOMMENDATIONS

7.1 As indicated in the results of the study, a large portion of recyclable material is being disposed of at landfill. It is therefore recommended that recycling initiatives (formal) be significantly intensified in Hessequa Municipality.

7.2 This report should be used as a guideline to prioritise waste minimisation initiatives per sub area. E.g. Composting initiatives should be implemented in areas where garden and food waste generation is prominent.

7.3 Waste generation is affected by seasonal variation and therefore it would be recommended that waste characterisation studies be conducted at three month intervals. However, due to personnel and financial constraints, it is acceptable to carry out a minimum of two surveys six months apart.

7.4 Categorise the waste into a bigger variety of waste types i.e. break up waste types more specifically e.g. Categorise plastics into different polymer groups.