Conducting Waste Characterisation Studies within Six Municipalities of the Western Cape: An Overview of Practical Experiences

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ABSTRACT

Most municipalities within the Western Cape do not have waste information systems and infrastructure in place to accurately measure waste disposed or diverted from landfills within their municipal boundaries. The collection and analysis of accurate and reliable waste data is a key requirement to inform the development of Integrated Waste Management Plans (IWMP). It assists municipalities to set baselines from where short, medium and long term integrated waste management targets can be set and helps the municipality to design and implement a more efficient and effective integrated waste management system. The Department in collaboration with Stellenbosch Municipality conducted waste characterisation studies within the Central Karoo District municipalities i.e. Beaufort West, Laingsburg and Prince Albert. The Department also conducted waste characterisation studies in Kannaland, Swellendam and Cederberg municipalities. The process was cost effective and provided current, accurate and reliable data for the municipalities.

KEY WORDS
Waste Characterisation, Waste Streams, Integrated Waste Management Plans, Platform scales, Extended Public Works Programme.

1. INTRODUCTION

The Department has assisted certain municipalities with the review and development of their second generation IWMPs. The assistance provided to municipalities included conducting waste characterisation studies. The first waste characterisation studies were conducted in the Beaufort West, Laingsburg and Prince Albert municipalities after the department was approached by the Department of Environmental Affairs (DEA), for assistance. The studies in the Central Karoo were conducted in collaboration with the Stellenbosch Municipality. During these studies the Department obtained the necessary expertise, training and purchased its own equipment (electronic scales, buckets, protective clothing and disinfectant/cleaning chemicals) to conduct waste characterisation studies within the remaining three municipalities. Subsequent studies were also conducted in Kannaland, Swellendam and Cederberg municipalities.

The aim of doing the studies was to:

- Obtain up to date information on the quantity of each waste stream generated and an estimation of possible waste diversion from waste management disposal facilities.
- Use the information in the development and review of their 2nd generation municipal IWMPs.
- Enable municipalities to use the information for forward planning w.r.t the design and implementation of efficient and effective collection, waste minimisation (recovery, reuse, recycling) and transportation services for the various solid waste streams.

2. METHODOLOGY

2.1 Planning

It was important to have prior engagements with the relevant municipal officials to organise, plan and obtain critical information to conduct the waste characterisation training and studies. Ideally about three to four dedicated staff within the municipality is needed to ensure all logistical arrangements were in place, to collect, transport and store the sample bags and to provide information regarding different residential (number of households) and business areas. The officials must be contactable via their emails and cell phones during the duration of the characterisation study to improve the logistics and obtain the necessary support from the municipality. It is of utmost importance that everyone involved in the studies are dedicated and motivated to ensure a successful result. The Municipality recruited twenty Expended Public Work Programme (EPWP) workers who needed to be trained one or two weeks prior to the study taking place. During this training final planning and preparations were finalised and we were able to identify and resolve any outstanding issues that would have had a detrimental impact on the study that was to be conducted.

2.2 Sample size

The sample size was based on the United Nations Environmental Programme (UNEP) methodology which aims at achieving 80 to 90 % confidence levels with a sample size averaging 500 bags. The sampling was spread across the municipality and is concentrated in those towns and residential areas with the highest number of households. A typical sampling plan (Table 1) is then drawn up using information obtained from municipal zoning maps (Figure 1), waste collection programmes and knowing the number of households in the municipality.

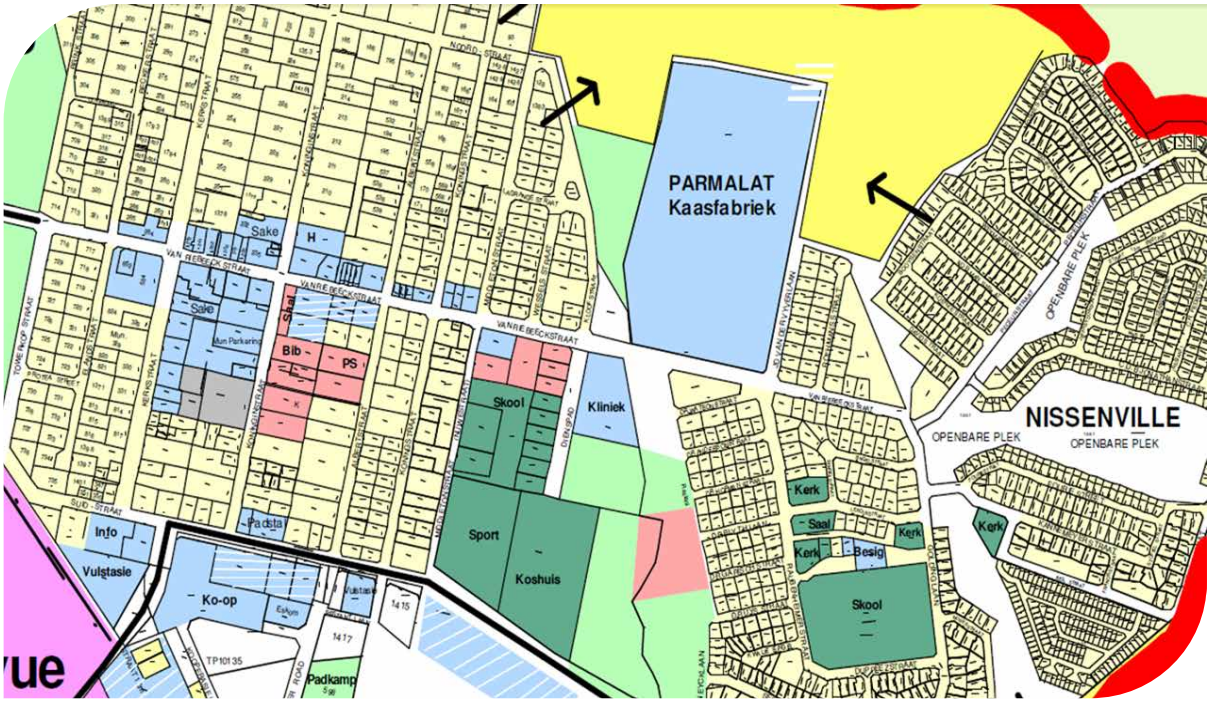


Figure 1: Municipal Zoning Maps

Table 1: Sampling plan of Cederberg Municipality

Town	Monday	Tuesday	Wednesday	Thursday	Friday
	Area(sample size)	Area(sample size)	Area(sample size)	Area(sample size)	Area(sample size)
Citrusdal	Riverview(20)	Dorp (50)	Orangeville(10),Heuwelsig (8),Hopland(20)		
Lambertsbaai	Dorp (90)		Nuwelad(5), Witkamp(35),Kompong(5), Erwe(10), Hopland(15)		
Clanwilliam		Dorp (19), Nuwe Hopland (13)	Ou Hopland(10), Sederville (24)	Kayelitsha (40)	
Graafwater			Dorp(8), Nuwe Hopland(15), Ou Hopland(5), De Eike(10)		
Elandsbaai		Lambertsbaaikamp (5), Hopland(10), Seebreezepark (8), v/d Westhuizenkamp (5)			
Algeria(60)					60
Total	110	110	110	110	60

2.3 Method

The empty vessel (basin) used for the characterisation was first tared on the electronic scale. The full black bag was then weighed and the mass was recorded. The bag was placed on the table, opened and the waste was then separated into 10 waste streams within each individual 20l basin. The waste streams characterised in the study was soft plastics, hard plastics or plastic bottles, paper, cardboard, metals, food and greens, fabric, glass, nappies and other. Each separate waste stream was weighed and the volume estimated based on the fullness of the vessel (basin). The supervisor used a spreadsheet to record the data during the studies.

2.4 Venue and set up

When the characterisation was conducted outside it was important to provide shelter against the wind and rain to ensure that the equipment and the people working in the teams were protected from the elements. The dedicated area, approximately 100 to 200m^2 should be covered in order to accommodate 4 teams of 6 people each including a supervisor. Each team was issued with an electronic platform scale, 10 vessels (basins) and 2 tables/trestles of about 3 metres length and 1.5 metres wide which preferably should be covered with Damp Proof Course (DPC) material (Photo 1) to ensure protection of the trestles. An indoor venue can also be used, however a few additional requirements are needed i.e. sufficient ventilation and extra care should be taken to ensure the venue is kept clean and to ensure that cockroaches, weevils and other pests are extinguished by means of effective insecticides. There should be ablution facilities with antimicrobial hand wash and hand towels together with dishwashing liquid to wash the basins, tables and floors after use (Photo 2).


Photo 1: DPC on trestles


Photo 2: Cleaning of vessels/basins

2.5 Equipment

Four platform scales were used during the waste characterisation studies. The scales were levelled and calibrated beforehand. It is important that the scales to be portable as they need to be transported and moved continuously. During the waste characterisation study in Swellendam the scales were protected from the wind by being placed in cubicles constructed from wooden ply sheets (Photo 3) which were re-used after the study.


Photo 3: Scale – wind protection

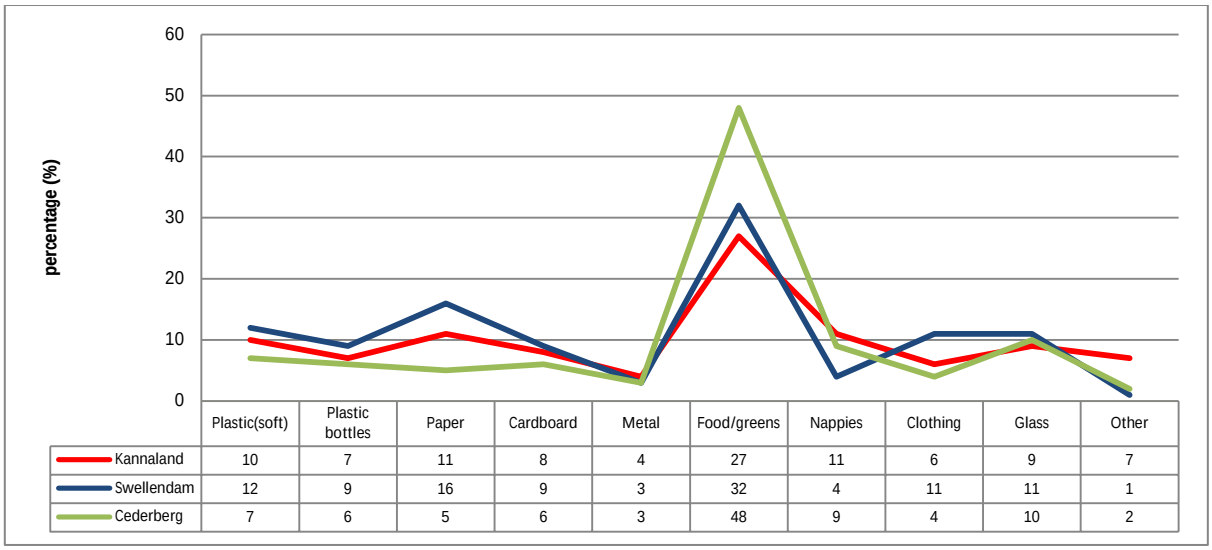
2.6 Storage area

It is important that the sampled black bags are stored in an secured or fenced area as illustrated below in Photo 4, to prevent the bags from being damaged or vandalised by animals or people gaining unauthorised access to the storage area.


Photo 4: Storage area within a municipal yard

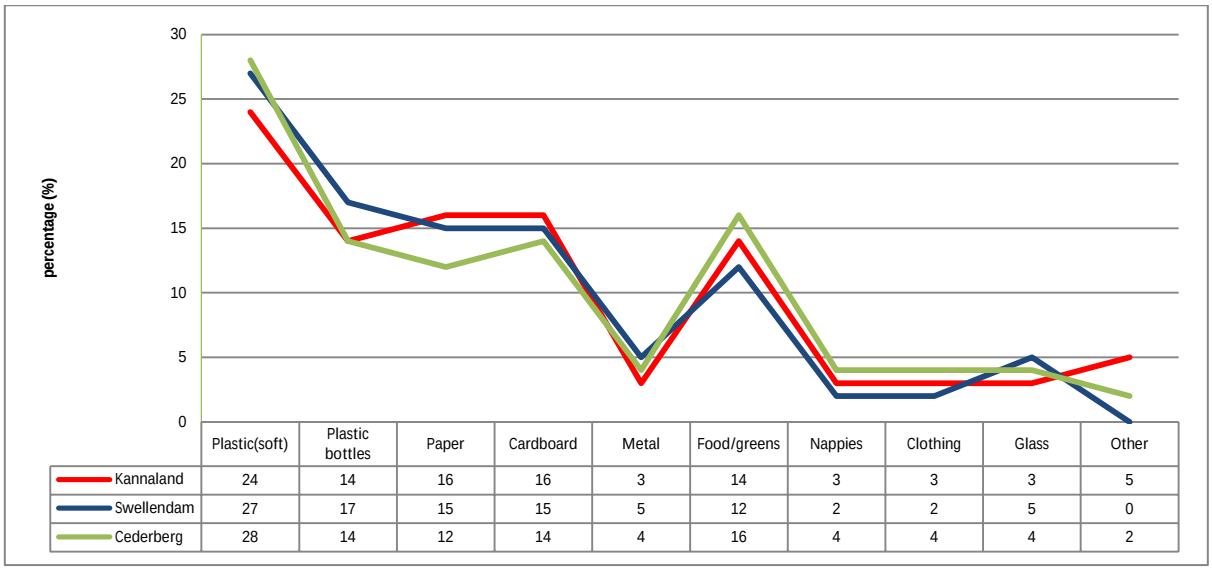
3. RESULTS

The Department in conjunction with the municipalities conducted waste characterisation studies in Kannaland, Swellendam and Cederberg using similar methodologies and applying the lesson's learn from the studies conducted with the Central Karoo municipalities. The results from the studies conducted in Kannaland, Swellendam and Cederberg is depicted in Graphs 1 and 2 below. These results are based on the waste characterisation performed on the approximately 500 black bags sampled from households within each municipality. Graph 3 on page 6 depicts the waste characterisation comparison between Beaufort West and Laingsburg Municipalities.



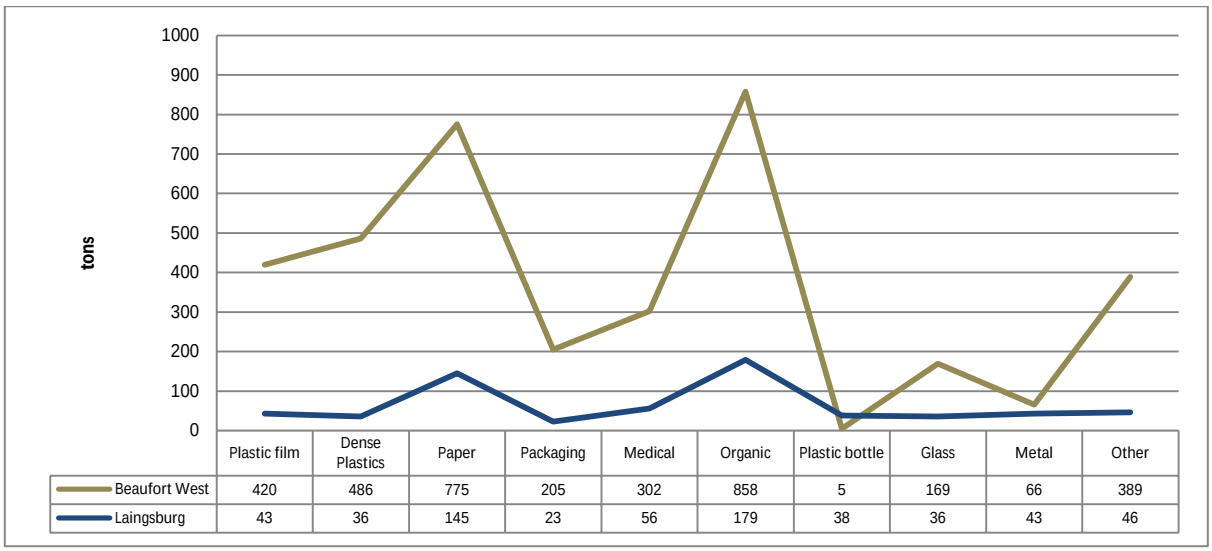
	Plastic(soft)	Plastic bottles	Paper	Cardboard	Metal	Food/greens	Nappies	Clothing	Glass	Other
Kannaland	10	7	11	8	4	27	11	6	9	7
Swellendam	12	9	16	9	3	32	4	11	11	1
Cederberg	7	6	5	6	3	48	9	4	10	2

Graph 1: waste stream analysis per municipality (% tons in sample)



	Plastic(soft)	Plastic bottles	Paper	Cardboard	Metal	Food/greens	Nappies	Clothing	Glass	Other
Kannaland	24	14	16	16	3	14	3	3	3	5
Swellendam	27	17	15	15	5	12	2	2	5	0
Cederberg	28	14	12	14	4	16	4	4	4	2

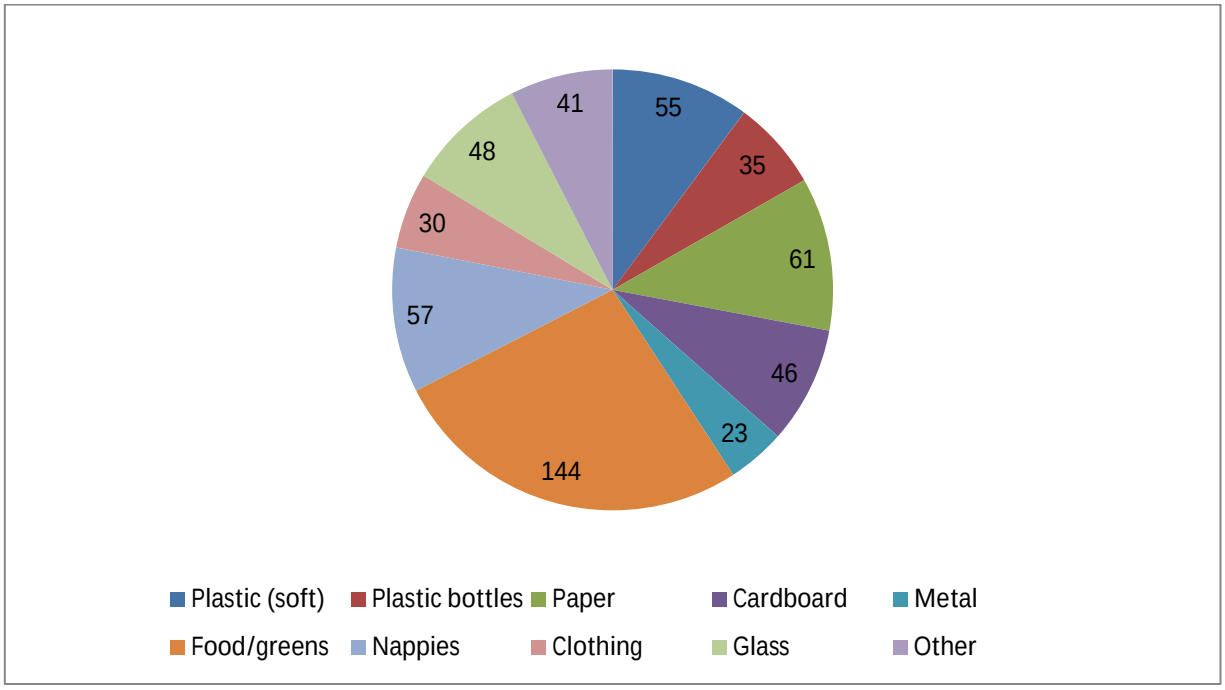
Graph 2: waste stream analysis per municipality (% volume in sample)



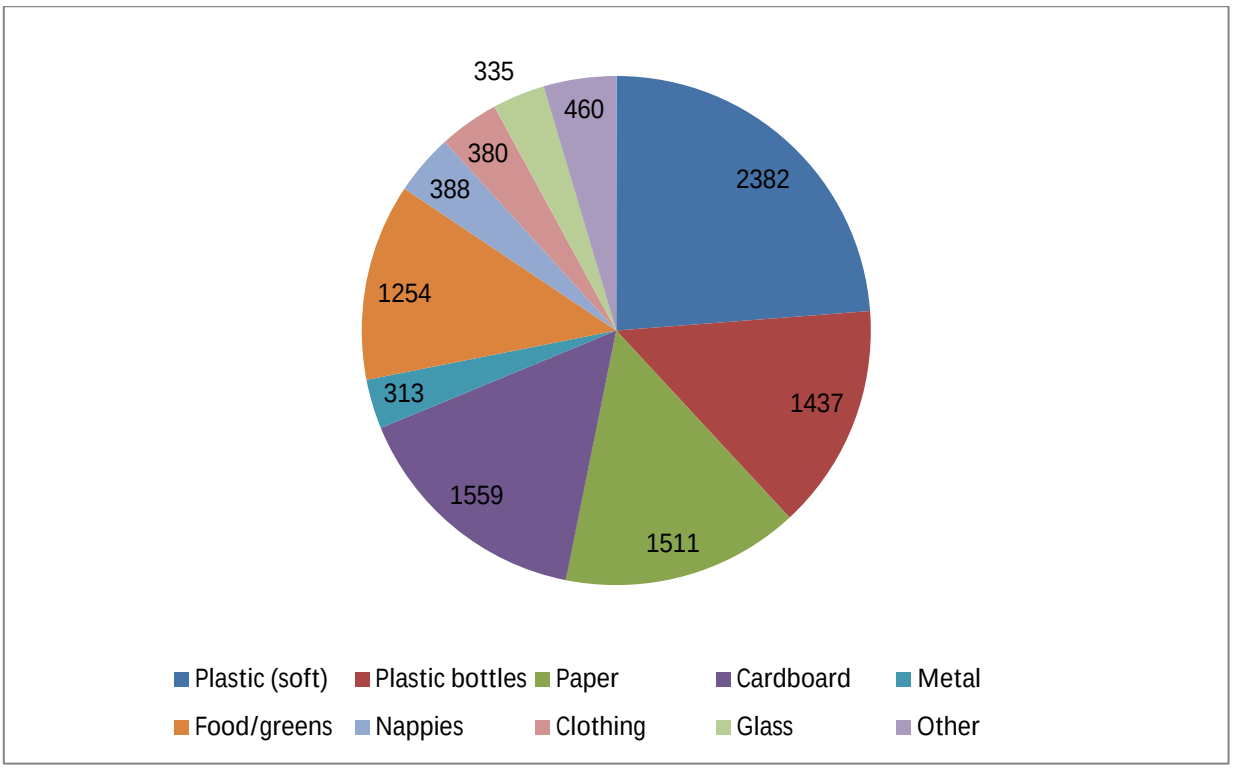
	Plastic film	Dense Plastics	Paper	Packaging	Medical	Organic	Plastic bottle	Glass	Metal	Other
Beaufort West	420	486	775	205	302	858	5	169	66	389
Laingsburg	43	36	145	23	56	179	38	36	43	46

Graph 3: waste stream analysis per municipality (tons in sample)

Annual waste generation figures for each waste stream can then be calculated from the data generated from the sample which was characterised. This is depicted in Graphs 4 and 5 below which are the annual waste tonnage and volume figures in Kannaland Municipality.

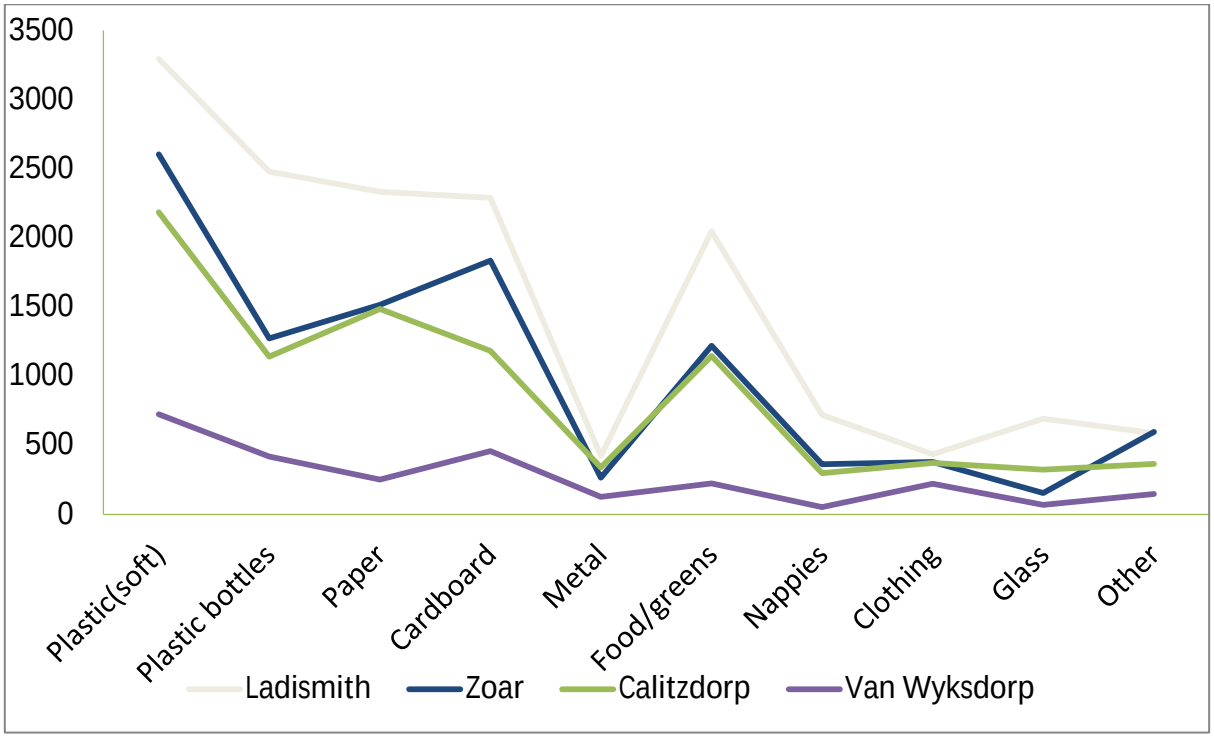


Graph 4: Kannaland Municipality - Annual waste generation composition (tons)



Graph 5: Kannaland Municipality - Annual waste generation (m^3)

Within a particular municipality waste characterisation data can also be generated per town as is illustrated below in Graph 6, which depicts the different waste streams generated in each of the towns in Kannaland Municipality. Similar results can be generated in terms of volume.



Graph 6: Kannaland municipality - waste stream analysis per town (m^3)

4. DISCUSSION

The waste characterisation results for Kannaland, Swellendam and Cederberg Municipalities show similar trends for the different waste streams in mass and in volume. Plastics (hard and soft), paper, cardboard and food/greens make up the greatest portion of the waste generated according to volume. The volume estimates must also be viewed as uncompacted since the waste was sampled directly from the households. Conversely food/greens, paper and nappies make up the biggest portion of the waste generated according to mass. The figure for mass is however elevated by the moisture content of the paper. During the study conducted in Swellendam we experienced a bit of rain which would have elevated the moisture content and therefore the mass for each waste stream particularly paper and cardboard. The comparison between Laingsburg and Beaufort West Municipalities shows that paper and organic materials make up the biggest portion of the waste recovered, however since Beaufort West has a bigger population the quantities will be bigger in Beaufort West than in Laingsburg.

Annual waste generation figures (mass and volume) for the municipality can be calculated by first calculating the average mass and volume of the 500 bags. The total number of bags generated within the municipality can be obtained by counting the number of bags generated from each household. The total mass and volume generated is then calculated by multiplying the average mass and volume for one bag by the total number of bags generated in a municipality. The percentage mass and volume contribution of each waste stream to the total mass and volume of the 500 bags can be used to calculate the mass and volume of each waste stream for the municipality as a whole.

The waste characterisation data can also help to identify prioritise towns or areas where higher amounts of waste is generated and also to prioritise certain problematic waste streams that could have negative impacts on the environment and health of the communities. During the study pharmaceuticals where found within the household waste. This was common for all the municipalities where studies were conducted. The management of pharmaceutical waste should be a high priority within the municipalities to prevent it from ending up on the landfill sites where it will impact on both environment and human health.

During the waste characterisation study conducted in Cederberg Municipality, 500 bags were collected and sorted into 10 different waste streams. Six of the waste streams were repacked into black bags (211) and collected by a recycler working in the municipality. The other 4 waste streams were packed into other black bags (127) and transported to the local landfill site. The initial totals of 500 black bags were thus reduced to a total of 338 black bags. Based on the reduced total is it calculated that 62,4% of waste was recovered. The study can inform the viability for the for the establishment of cooperatives between communities, private sector and the municipalities to recover and recycle waste. The recovered waste materials were however contaminated since it was recovered post collection and thus could prove to be unattractive to recyclers.

5. CONCLUSIONS

In order for a successful waste characterisation study to take place there must be a good working relationship, with clearly defined roles and responsibilities, between provincial government, municipal officials and the EPWP workers. Given the nature of the work 3 days proved to be the optimal period within which the study could be performed. A key aspect to the success of the study is the sampling procedure which needs to be representative of the entire municipality. The studies were done as a once off, however in order to take into account seasonal fluctuations additional studies would need to be performed.

The EPWP programme is a good mechanism of incorporating unemployed people from the communities to assist with the study and potential involvement in cooperatives should it be established. The study is an excellent opportunity to create short term employment but also to create awareness in middle and higher income groups. The result from the waste characterisation studies, conducted in each municipality, clearly shows the huge potential that exists for the recovery of recyclables. Having young people involved in the programmed further enhances youth development where the knowledge and skills obtained can be used in future waste related jobs or characterisation studies.

This information has been included in their second generation IWMPs to inform decisions around the implementation of source separation programmes, buy-back programmes, waste treatment technologies, job creation and awareness raising programmes.

ACKNOWLEDGEMENTS

Senior Managers, DEADP
Saliem Haider, Stellenbosch Municipality
Vuyokazi Ruiters, Beaufort West Municipality
Gwynne Pekeur, Laingsburg Municipalities
Hendrik Barnard, Kannaland Municipality
Nardus Badenhorst, Bartho Burger, Louis Mralasi, Swellendam Municipality
Nick Hector, Cederberg Municipality
Barbara Brown, Department of Environmental Affairs
EPWP workers and other municipal workers
Stellenbosch post graduate students.

REFERENCES

United Nations Environment Programme, developing integrated solid waste management plan, training manual Volume 1: Waste Characterization and Quantification with Projections for Future
Tables / Graphs / Illustrations