COMPOSITION OF WASTE

Westport Landfill
SWAP Study
8 – 14 January 2007

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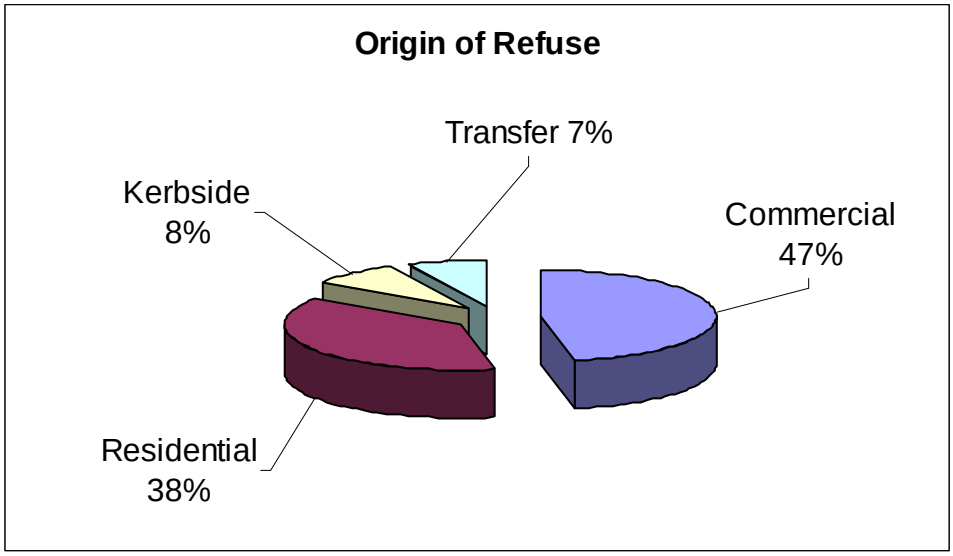
1.0 EXECUTIVE SUMMARY

This report presents the results of the second waste analysis survey to be conducted at the Westport Landfill. The results were gained using the SWAP strategy developed by the Ministry for the Environment to standardize information gathered on waste streams and waste disposal throughout New Zealand. The strategy endeavors to gather consistent and factual information that can be used as a tool for managing and monitoring waste streams and for reporting on a national scale.
Following strategy requirements this survey was conducted over a seven day period. January was chosen to obtain values showing summer seasonal influences.
There were two objectives for the survey. The first objective was to determine the Primary Classifications of the whole waste stream and the second was to determine Secondary Classifications on nominated primary categories. To assist with these objectives the survey recorded the origin of material and the mode of transport for all loads to the landfill.
Origin was recorded as one of four categories, residential, commercial, kerb and transfer. Transfer, not used in the first survey, identifies material originating from outer transfer stations.
The values for the origin of materials are presented in Chart 1 below.

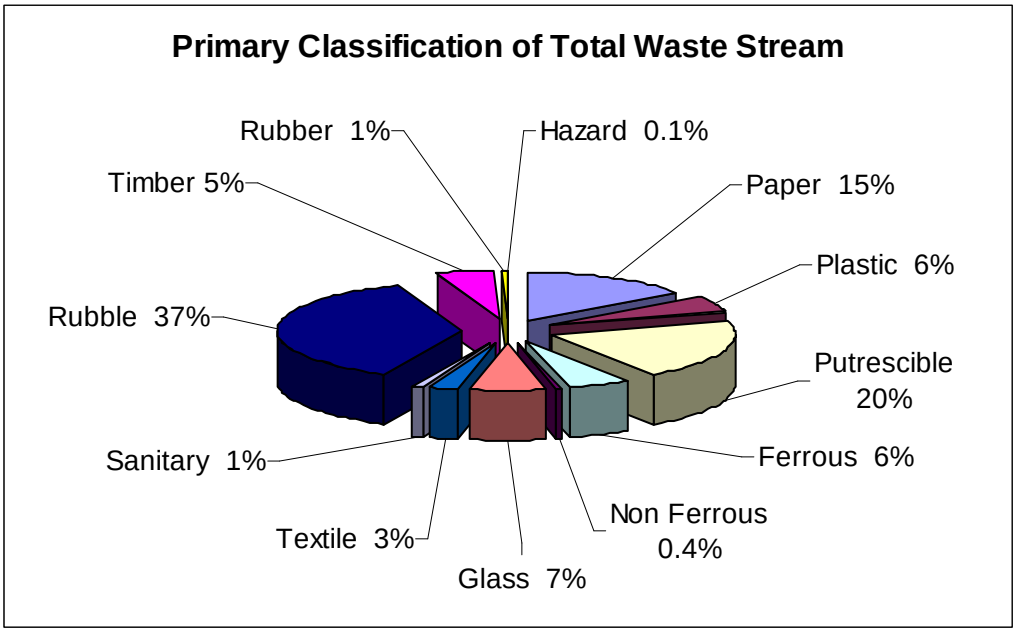
Chart 1: Origin of Refuse



Transport values were recorded into five classes of vehicle: cars, utilities, trailers, compactor vehicles and trucks. A total of 411 vehicles accessed the landfill disposing of 684m3, or 179 tonne, of refuse during the survey period.
These values have been extrapolated into annual values for reporting purposes only, and equate to 35,500m3 (loose) or 9,300 tonne.
To meet objectives the survey involved the visual assessment and recording of the breakdown of all loads into the primary classifications. These values were assessed either as a percentage of the volume of the load, and later converted to a weight value, or as an estimated weight of each component. A number of loads and components were weighed to confirm estimated values and conversion rates. Weighing of full loads also served to balance the weight of components after application of unit rates.
Further to this an analysis of the contents of kerb bags was carried out to determine the ratio and weight of primary and selected secondary components. These values were then applied to all loads of kerb and official bags.
A further number of bags were weighed and an average bag weight of 6.3kg established.

The results for the Primary Classification of the total waste stream are shown in Chart 2 below.

Chart 2: Primary Classifications of the Total Waste Stream



Secondary classifications were determined for paper, plastics, putrescible and timber wastes. The values for paper, putrescibles and timber were recorded for each load, however the values for plastics could not be visually determined and the only results from the analysis of kerb bags refuse were recorded.

As the results from this survey are directly comparable with the survey of July 2005 the report plots the results both by percentages and weight of primary classifications.

Values for rubble and putrescible waste increased significantly, rubble from 28,000 to 67,000kg and putrescible from 22,000 to 35,000kgs, increasing the overall disposal of refuse by 43,000kgs.

Rubble came mostly from excavations along with several loads of old concrete foundations and paving. Some smaller quantities originated from building activities. These activities may be seasonal but appeared more of a maintenance activity.

Putrescible waste increased in both secondary classifications, garden by 83%, a likely result of seasonal variation.

Baseline data from MfE is presented, however this has not been updated since the previous survey so results of recent studies in Marlborough are included.

Comments are made on classifications including Paper where over half the value is cardboard, which is received in a readily recyclable condition.

Hazardous waste encountered included paint, LPG cylinders, car batteries, dry cell batteries, acid and garden chemicals.

2.0 INTRODUCTION

This report presents the results of an analysis survey, conducted over a one-week period in January 2007, on the incoming refuse at the Westport Landfill.
Such surveys, when undertaken over a period of time, can build up a data base on the type and quantity of material being disposed of and will show trends in waste disposal. The results may be used as a tool for measuring the changes to waste disposal and for gauging the effects of various waste strategies.
The survey results can also be used to assist with the constructive planning and management of the district's waste.

2.1 Background

Traditionally, rubbish has been dumped and forgotten. However, growing awareness of environmental effects has increased the expectations of communities for enhanced standards of waste disposal. As a result waste managers have come under pressure to improve disposal practices. For effective decisions to be made, consistent and reliable data on waste streams is required.
Therefore, in response to the needs of operators and managers, and the need for information on a national basis, the Ministry for the Environment in 1992 released a strategy for measuring the components of the waste stream. This strategy was known as the "Waste Analysis Protocol" (WAP), which contained a methodology for categorising and collecting data on waste.
The strategy was revised in March 2002 and is now known as the "Solid Waste Analysis Protocol" (SWAP).
It is under the revised protocol that this survey has been conducted.

2.2 Waste Classification System

The SWAP protocol provides for two levels of classification, these being: -

Primary Classification
Secondary Classification

The purpose of the two classification levels is to allow primary or basic coverage of the waste stream and also to allow detailed analysis of any category where required.
Primary classification divides the waste into 12 categories, with secondary classification further dividing these categories into a total of 47 sub categories.
Secondary classification requires considerable time for analysis and tends to be used more for defining a particular component in the waste stream, such as investigating material for recycling.

2.3 Objectives

The main objective of this survey is to gauge by weight the primary classification of the waste stream during a period of 'summer' seasonal influence.

The secondary objectives are to gauge by weight the secondary classifications for: -

- Paper by Newspaper, Cardboard and Other categories.
- Plastic by the seven grades of recyclable plastic.

- Putrescible waste by Kitchen or Garden categories.
- Timber wastes by Treated and Non Treated categories.

2.4 The New Zealand Waste Strategy

Reducing New Zealand's waste has become the cornerstone of the Government's commitment to sustainable development.
The Ministry for the Environment released The New Zealand Waste Strategy in March 2002. This document outlines the Government's vision to minimize and manage waste resources as part of an overall goal to form a sustainable society. To achieve the waste reduction aim the New Zealand Waste Strategy has three core goals:

- Lowering the social cost and risks of waste.
- Reducing the damage to the environment from waste generation and disposal.
- Increasing economic benefit by more efficient use of materials.

Through the Ministry for the Environment waste programmes and guidelines, national targets will be set for regions to achieve. Target areas include organic wastes, special wastes, construction and demolition wastes, hazardous wastes including contaminated sites and organochlorines, trade wastes and lastly, waste disposal.
The results from SWAP studies are one tool that can be used to measure both the performance of a region and the government's achievement towards a sustainable society. On a local level the results assist Council with planning and management of the waste stream and disposal options.

2.5 Previous Surveys

One previous waste analysis survey has been completed on the Westport Landfill waste stream. This was conducted during the period 11 – 17 January 2005

The findings of the survey in 2005 are compared with the current results in section 5 of this report.

3.0 SURVEY DESIGN and METHODOLOGY

3.1 Design Format

The survey format is based on the Solid Waste Analysis Protocol (MfE 2002).
Consistent with the protocol recommendations, supporting data is to be captured over a one-week period. The Westport landfill operates for seven days a week - this is the same capture period used on the earlier survey.
With an expected low number of vehicle movements at the landfill, the survey is to include a visual analysis of all loads arriving. These loads are to be defined into the 12 primary and nominated secondary classifications by volume or weight and presented as weight values for reporting.
Secondary classifications are required for paper, plastics, putrescible and timber wastes.
The survey is also to capture supporting data on the type of transport to the site. As all types of vehicles are permitted on site the following categories are to be used:-

Cars	which includes station wagons and SUVs
Utility Vehicles	which includes utes and vans
Trailers	
Compactor Vehicles	
Trucks	

The origin of refuse is to be recorded as one of four categories: -

Residential	Domestic household and property type wastes produced by residents.
Commercial	Includes wastes from commercial and industrial operations, building sites, shops, factories, accommodation, and residential properties produced by commercial operators.
Kerb	Domestic and commercial wastes collected through a kerbside bag and kerbside recycling system.
Transfer	Waste originating from remote official collection points or transfer stations. It may consist of residential and commercial items.

A minimum of 60 kerbside collected refuse bags are to be taken at random and analysed, with sampling spread through the whole collection.
The contents of refuse bags are to be sorted into the 12 primary and nominated secondary classifications and weighed.
To define the average weight of kerbside bags a minimum of 120 bags are to be collected at random and weighed.
Supporting data is to be gained by weighing of selected vehicles on site by use of portable scales. Where possible the weighing of a measured volume of representative samples is to be carried out from loads of a single classification material.

3.2 Survey Limitations

Several factors occurred that served to limit the final results. These included: -

Variation in density of load due to wet conditions. Rain occurred on six of the seven survey days.

The portable vehicle scales used were limited to single set axel set vehicles only. Rain limited the full use of the scales.

3.3 Methodology

The survey was predetermined for, and carried out, over the week of 8th – 14th January 2007 on site at the Westport Landfill.
Survey forms capturing the required data were developed and used to ensure sufficient information was recorded on site.
A main working area was established at the recycling shed at the entry to the landfill. A further area was established adjacent to the tipping face and used for the analysis of bags and other refuse items. These were set up in line with Health and Safety requirements, and provided a safe working area away from the movement of machinery.
Visual classification analysis was also carried out at the tip face, if possible, as loads were being discharged.
Three staff were involved on site for the full survey period, which allowed continual recording of all incoming loads along with ability to carry out all weighing and analysis activities.
A 'hazards assessment' was carried out prior to the event and staff were instructed on safety and made aware of the likely hazards on site.
Team members carried out checks on accuracy of evaluation during the survey. These values were discussed to ensure consistency of assessment and coverage of all classifications.
Loads were evaluated on entry to the landfill and where more detail was required then analysis was carried out during discharge, or soon after being discharged.
Samples were removed for analysis.
As bags from kerbside collections in Westport were delivered on site, staff carried out analysis of the samples taken. The contents were sorted into primary and then secondary classifications. The bags were selected at random from each load.
Certain vehicles, representative of vehicle type and load, were weighed on portable scales. Other loads were sampled and samples weighed to determine unit values for particular materials.
Staff duties were rotated.
All site data was converted into weight format to conform to the protocol and allow direct comparison with earlier studies.

4.0 RESULTS

4.1 Results

The results are presented in a format similar to the previous survey to allow direct comparison. These are compared in section 5.
The results are shown by Origin of Refuse, Classification of the Waste Stream, both Primary and selected Secondary classifications, and lastly by Mode of Transport.

4.2 Origin of Refuse

A new category called Transfer was included under Origin for this survey. Transfer accounts for material originating at remote transfer stations and may be a mix of both residential and commercial wastes.
The other categories of Commercial, Residential and Kerb are as used in the earlier survey.
Kerb bags contain both residential and commercial wastes. No attempt was made to define the extent of the mix, however the number of commercial bags recovered was, according to the collectors, a small proportion of the total. Commercial origin covered all material generated by industrial and commercial activities. This included material from residential properties that was generated by a commercial operator such as grounds maintenance or building alterations.
Residential waste was waste generated by residents from daily living and property maintenance.
The origin was not influenced by the mode of transport to the landfill. Transport is discussed in section 4.6.

Chart 3: Waste Stream - Origin of Refuse

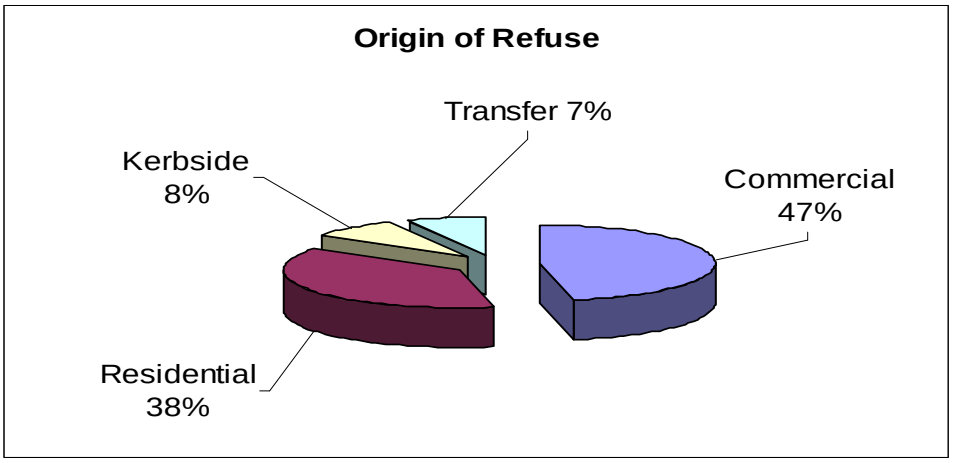


Table 1: Origin of Refuse – Numerical Values

Origin	Weight kgs	Percentage
Commercial	83,941	46.9 %
Residential	67,308	37.6 %
Kerbside	14,935	8.3 %
Transfer	12,825	7.2 %
Total	**179,009**	**100.00**

4.3 Primary Classification of the Waste Stream

Primary Classification involves defining the waste stream by weight into twelve categories. To give a better understanding of refuse production the Primary Classification results are shown for the total waste stream and also for each of the four categories of origin.

4.3.1 Primary Classification of the Total Waste Stream

A Summary of the Primary Classifications of the total waste stream, for the period of the survey, is shown below in Chart 4 and Table 2.

Chart 4: Primary Classification Values of the Total Waste Stream

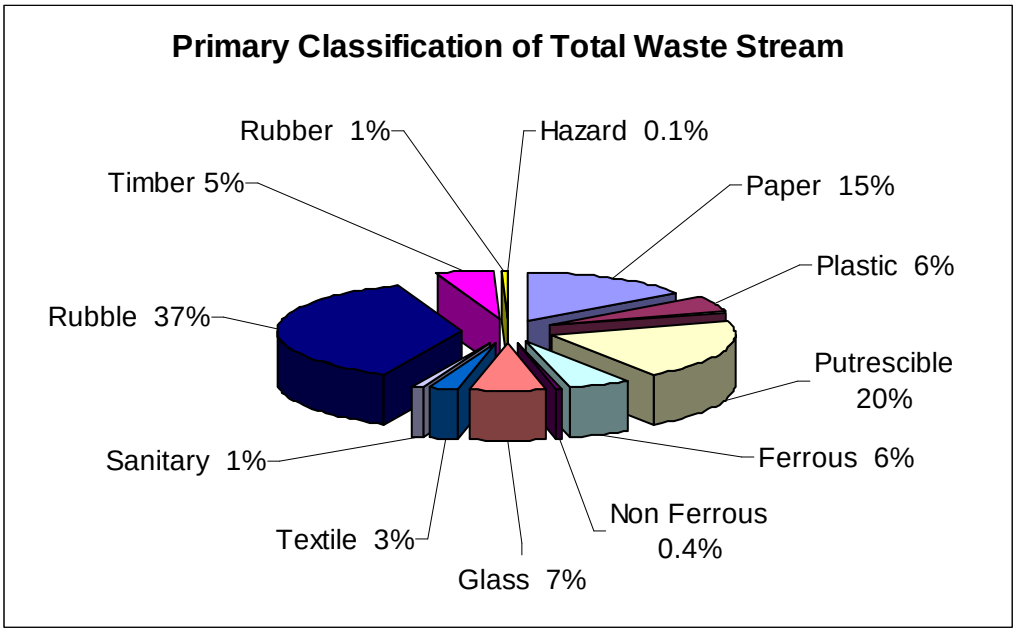


Table 2: Primary Classification Values of the Total Waste Stream

Classification	Total Kgs	% Total
Paper	26,769	15.0
Plastic	10,267	5.8
Putrescible	35,411	19.8
Ferrous	10,201	5.7
Non Ferrous	763	0.4
Glass	11,851	6.6
Textile	4,635	2.6
Sanitary	2,130	1.2
Rubble	66,978	37.4
Timber	8,831	4.9
Rubber	1,083	0.6
Hazardous	90	0.1
Total	**179,009**	**100.0**

4.3.2 Primary Classification of the Commercial Waste Stream

The Commercial Waste Stream is defined as waste generated by commercial and industrial operations no matter where these operations are situated.
The primary classification values of this waste are shown in Chart 5 and Table 3 below. Table 3 shows the estimated weight for each classification, the values as a percentage of the Commercial Waste stream and also as a percentage of the Total Waste stream.

Chart 5: Primary Classification Values of Commercial Waste

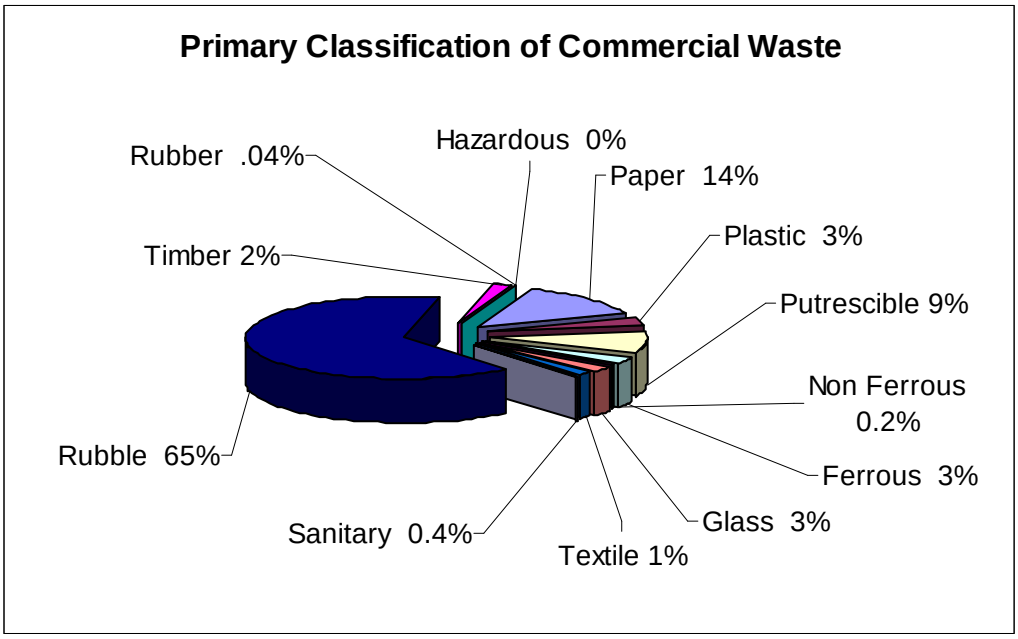


Table 3: Primary Classification Values of Commercial Waste

Classification	Total Kgs	% Commercial	% Total Waste
Paper	11,545	13.8	6.4
Plastic	2,356	2.8	1.3
Putrescible	7,441	8.9	4.2
Ferrous	2,703	3.2	1.5
Non Ferrous	150	0.2	0.1
Glass	2,325	2.8	1.3
Textile	1,121	1.3	0.6
Sanitary	364	0.4	0.2
Rubble	54,353	64.8	30.4
Timber	1,551	1.8	0.9
Rubber	32	0.04	0
Hazardous	0	0	0
Total	**83,941**	**100.0**	**46.9**

4.3.3 Primary Classifications of the Residential Waste Stream

Residential waste comes from three main sources: material delivered by residents, material brought directly by truck or skip bin and material collected from wheelie bin collection services, usually in compactor vehicles.
The primary classifications for residential waste are presented in Chart 6 and Table 4 below.
Whereas Chart 6 depicts the classification as a percentage of the residential waste stream only, Table 4 gives further information showing the actual weight value for each classification along with the percentage of both the residential waste stream and the total waste stream.

Chart 6: Primary Classification Values of Residential Waste

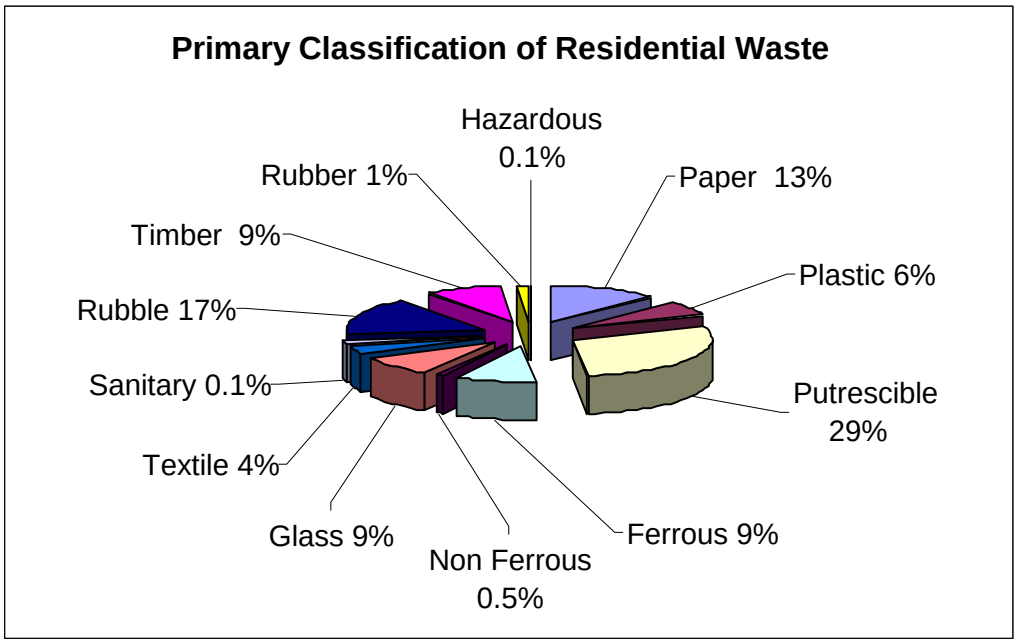


Table 4: Primary Classification Values of Residential Waste

Classification	Total Kgs	% Residential	% Total Waste
Paper	8,613	12.8	4.8
Plastic	4,264	6.3	2.4
Putrescible	19,704	29.3	11.0
Ferrous	6,353	9.4	3.5
Non Ferrous	313	0.5	0.2
Glass	6,225	9.3	3.5
Textile	2,510	3.7	1.4
Sanitary	941	1.4	0.5
Rubble	11,455	17.0	6.4
Timber	6,072	9.0	3.4
Rubber	768	1.2	0.4
Hazardous	90	0.1	0.1
Total	**67,308**	**100.0**	**37.6**

4.3.4 Primary Classification of the Kerb Collection Waste Stream

The kerbside collection is carried out on weekdays by contractors and covers both residential and commercial properties around Westport and other smaller settlements in the district. It covers material collected by two vehicles targeting official refuse bags and specified recycling material. It does not cover bags included in other waste streams such as commercial skips or bins from transfer stations. Kerbside refuse during the survey period weighed 14,935 kg which equates to 8.3 % of the total waste stream.
Where visual classification is quickly carried out on open refuse, refuse bags pose a problem, especially bags from residential origin, as the contents can vary greatly both in type and quantity.
The design of the survey took this issue into account and allowed the analysis of contents from sufficient bags to give an acceptable confidence level for the major classification values.
The analysis of bag contents was carried out using the SWAP primary and secondary classification procedure. The values gained were then applied to all loads containing refuse bags.
A summary of the classification values is given in Chart 7 and Table 5 below.

Chart 7: Primary Classification Values of Kerb Collection Waste

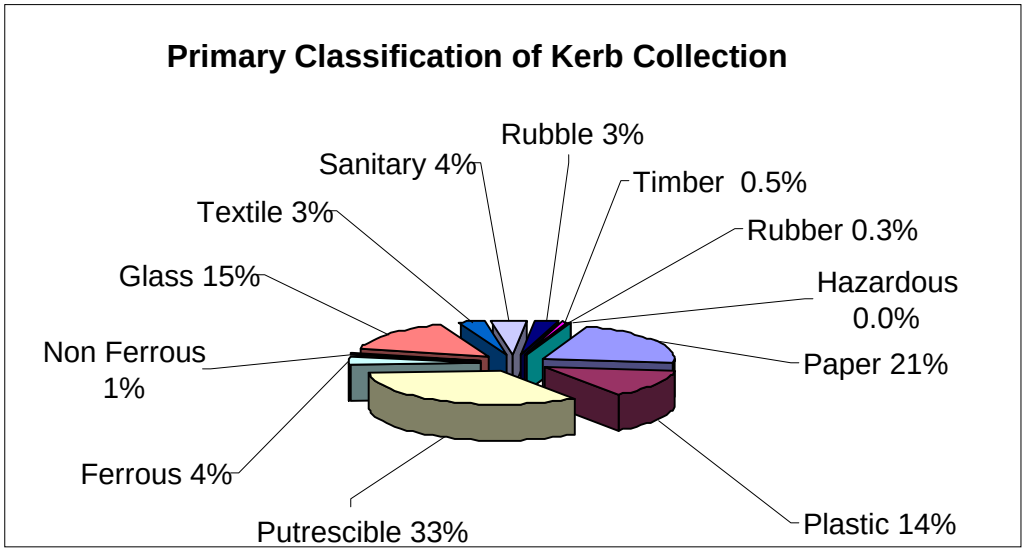


Table 5: Primary Classification of Kerb Collection Waste

Classification	Total Kgs	% Kerb	% Total Waste
Paper	3,138	21.0	1.7
Plastic	2,086	14.0	1.2
Putrescible	4,942	33.0	2.8
Ferrous	596	4.0	0.3
Non Ferrous	210	1.4	0.1
Glass	2,282	15.3	1.3
Textile	492	3.3	0.3
Sanitary	612	4.1	0.3
Rubble	460	3.1	0.3
Timber	68	0.5	0.0
Rubber	49	0.3	0.0
Hazardous	0	0.0	0.0
Total	**14,935**	**100.0**	**8.3**

4.3.5 Primary Classification of the Transfer Waste Stream.

Refuse is collected in skips at transfer stations within the district and transported to the landfill for disposal. The material is from both residential and commercial sources and no attempt was made to define the mix.
During the survey several additional truck loads of waste from the Reefton transfer station were delivered to the landfill. These loads were from an overflow of material that occurred during the Christmas period and the quantities have been included in the results.

A summary of the classification values is given in Chart 8 and Table 6 below.

Chart 8 : Primary Classification Values of Transfer Waste

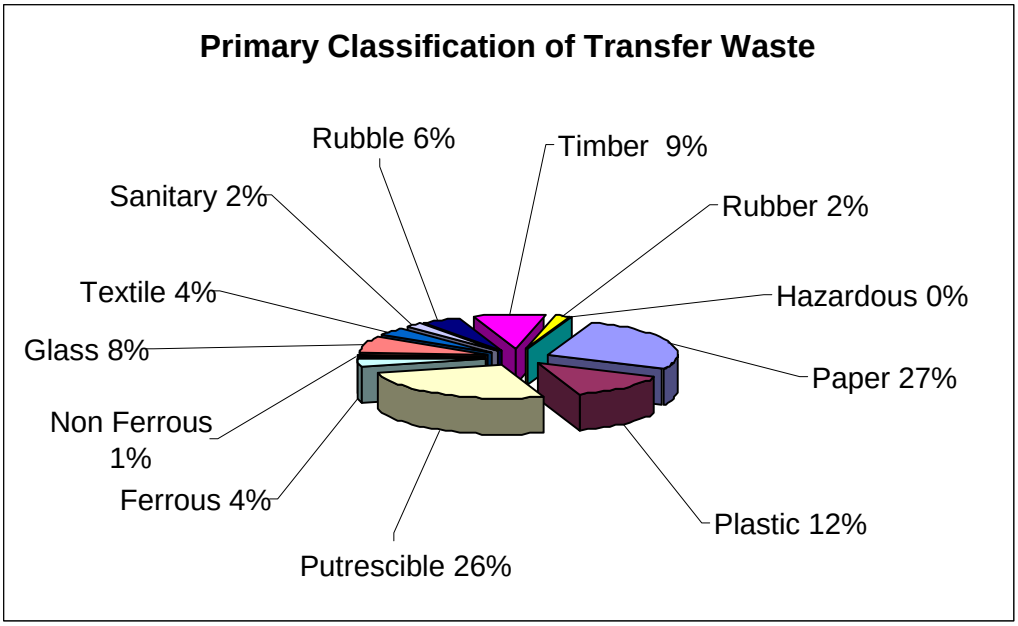


Table 6 : Primary Classification of Transfer Waste

Classification	Total Kgs	% Residential	% Total Waste
Paper	3,473	27.1	1.9
Plastic	1,561	12.2	0.9
Putrescible	3,324	25.9	1.9
Ferrous	549	4.3	0.3
Non Ferrous	90	0.7	0.1
Glass	1,019	7.9	0.6
Textile	512	4.0	0.3
Sanitary	213	1.7	0.1
Rubble	710	5.5	0.4
Timber	1,140	8.9	0.6
Rubber	234	1.8	0.1
Hazardous	0	0.0	0.0
Total	**12,825**	**100.0**	**7.2**

4.3.6 Summary of Primary Classification Values of the Total Waste Stream

Table 7 presents a summary of the classification values by origin and as a total of the waste stream.

Table 7: Summary of Primary Classification Values of the Waste Stream (By weight kgs)

Classification	Commercial	Residential	Kerb	Transfer	Total	% Total
Paper	11,545	8,613	3,138	3,473	26,769	15.0
Plastic	2,356	4,264	2,086	1,561	10,267	5.8
Putrescible	7,441	19,704	4,942	3,324	35,411	19.8
Ferrous	2,703	6,353	596	549	10,201	5.7
Non Ferrous	150	313	210	90	763	0.4
Glass	2,325	6,225	2,282	1,019	11,851	6.6
Textile	1,121	2,510	492	512	4,635	2.6
Sanitary	364	941	612	213	2,130	1.2
Rubble	54,353	11,455	460	710	66,978	37.4
Timber	1,551	6,072	68	1,140	8,831	4.9
Rubber	32	768	49	234	1,083	0.6
Hazardous	0	90	0	0	90	0.1
Total	**83,941**	**67,308**	**14,935**	**12,825**	**179,009**	**100.0**

4.4 Secondary Classification of the Waste Stream

Secondary Classification involves defining a primary classification into sub classifications or categories.
The SWAP strategy nominates a total of 47 secondary classifications, however the protocol is not restricted to these and others can be used where appropriate.

4.4.1 Secondary Classification of Selected Items in the Waste Stream

Secondary classifications were sought on four primary items: paper, plastics, putrescible and timber. These were defined into the following:-

Paper: -	Newsprint
	Cardboard
	Other
Plastics: -	Grades 1 - 7
Putrescible: -	Kitchen
	Garden
Timber: -	Treated
	Non-treated

The secondary classification for plastics was only achievable for kerb bag material as there are problems with identifying grades of plastic by visual analysis.

4.4.2 Secondary Classification of Paper

Paper makes up 15.0% of the total waste stream.
The breakdown for all categories, except kerb bags, was by visual assessment of loads.
Kerb bags values were obtained from the bag analysis study.

Visual analysis for secondary classification of paper was carried out over the full survey. The values determined are shown in Chart 9 and Table 8 below. This information is further broken down by including origin of loads and is shown in Table 9.

Chart 9: Secondary Classification Values of Paper

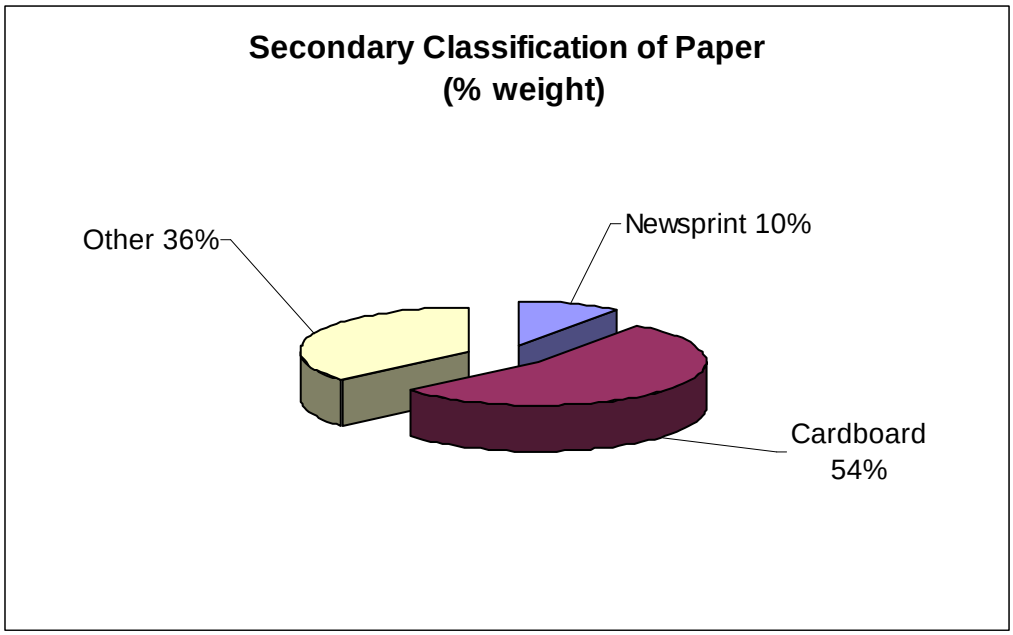


Table 8: Secondary Classification Values of Paper

Classification	Total Kgs	% Paper Wastes	% Total Wastes
Newspaper	2702.6	10.1	1.5
Cardboard	14359.2	53.6	8.0
Other	9707.2	36.3	5.5
Totals	**26769**	**100.0**	**15.0**

Table 9: Secondary Classification of Paper by Origin

Classification	Total Kgs	% Paper Wastes	% Total Wastes
Commercial News	535	2.0	0.3
Commercial Card	8462	31.6	4.7
Commercial Other	2548	9.5	1.4
Residential News	846	3.2	0.5
Residential Card	4059	15.2	2.3
Residential Other	3708	13.9	2.1
Kerb News	901	3.4	0.5
Kerb Card	460	1.7	0.3
Kerb Other	1777	6.6	1.0
Transfer News	420	1.6	0.2
Transfer Card	1378	5.1	0.8
Transfer Other	1675	6.3	0.9
Total	**26,769**	**100.0**	**15.0**

4.4.3 Secondary Classification of Plastics

Plastic makes up 12.2% of the total waste stream.

The SWAP secondary classifications for plastic are based on industrial identification codes for the recycling of plastic. These are shown on products as the numbers 1 to 7 inside a triangular recycling logo.

The grades are: -

1.	PET	polyethylene terephthalate
2	HDPE	High-density polyethylene
3	PVC	Poly vinyl chloride
4	LDPE	Low density Polyethylene
5	PP	Polypropylene
6	PS	Polystyrene – expanded styrene
7	Other	All other plastics

Common items found include:-

Grade 1	soft drink bottles and food containers
Grade 2	commodity containers and water pipe
Grade 4	tubes and irrigation pipe

Secondary analysis was limited to kerb bags as identification cannot be carried out by quick visual analysis.
No large quantities of one grade of plastic were noted.

The values determined are shown in Chart 10 and Table 10 below.

Chart 10: Secondary Classification Values of Kerbside Plastics

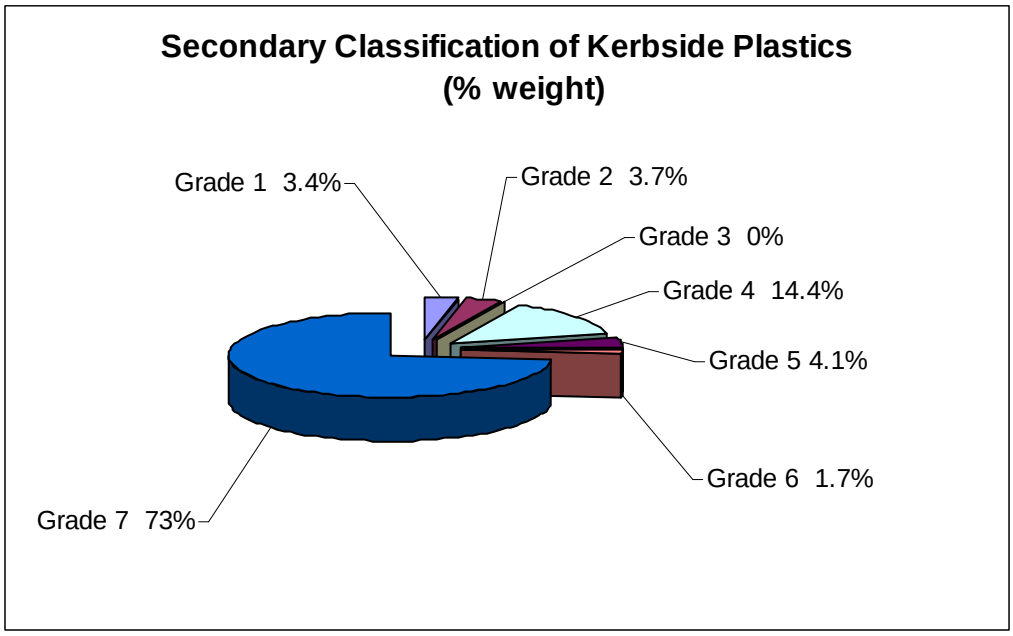


Table 10: Secondary Classification of Kerbside Plastic

Classification	Sample Kgs	Estimate for Kerb Plastics	% Kerb Plastics
Grade 1	1.4	70.9	3.4
Grade 2	1.5	77.2	3.7
Grade 3	0	0	0
Grade 4	5.8	294.1	14.1
Grade 5	1.7	85.5	4.1
Grade 6	0.7	35.5	1.7
Grade 7	30	1,522.8	73.0
Total	**41.1**	**2,086**	**100**

4.4.4 Secondary Classification of Putrescible Wastes

Putrescible Wastes were recorded as either Kitchen or Garden wastes.
Kitchen wastes included all food scraps, food preparation waste, offal, and shellfish waste.
Garden wastes included all vegetation wastes other than food scraps.
To define quantities both kerb bags and compactor truckloads were sampled and values for each putrescible component determined. Transfer vehicles were assessed as to the total putrescible volume with allowance made for material contained in bags etc. All other loads were assessed visually.
The results are shown in Chart 11 and Tables 11 and 12 below.

Chart 11: Secondary Classification Values of Putrescible Waste

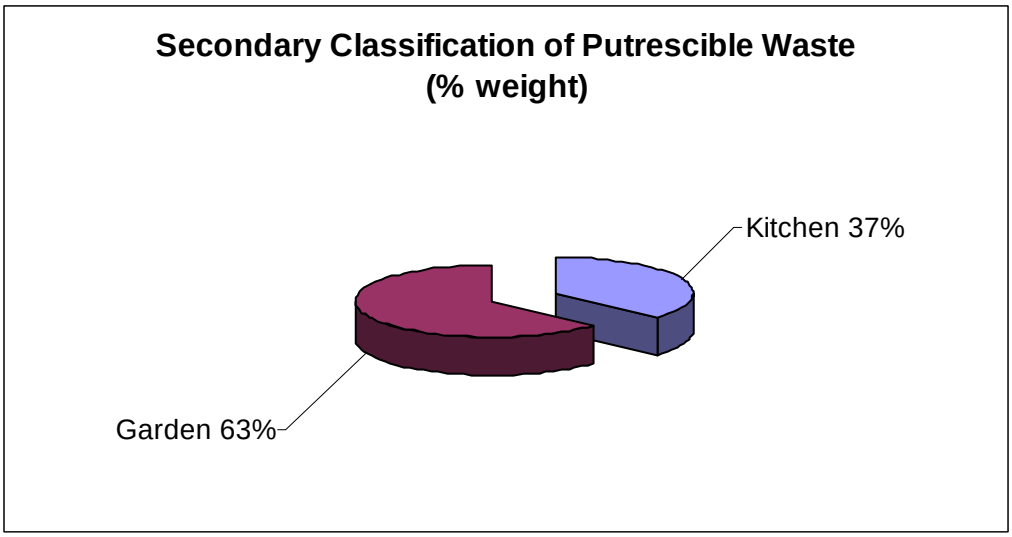


Table 11: Secondary Classification of Putrescible Waste

Classification	Total Kgs	% Putrescible Wastes	% Total Wastes
Kitchen	12,981.55	36.7	**7.3**
Garden	22,429.45	63.3	**12.5**
Total	**35,411**	**100**	**19.8**

Table 12: Secondary Classification of Putrescible Waste by Origin

Origin	Total Kgs	% Putrescible wastes	% Total wastes
Commercial Kitchen	2822.6	8.0	1.6
Commercial Garden	4618.5	13.0	2.6
Residential Kitchen	4869	9.4	1.9
Residential Garden	14835	4.5	0.9
Kerb Kitchen	3335	13.7	2.7
Kerb Garden	1607	41.9	8.3
Transfer Kitchen	1955	5.5	1.1
Transfer Garden	1369	3.9	0.8
Total	**35411.1**	**100**	**19.8**

4.4.5 Secondary Classification of Timber Wastes

Secondary classification of timber wastes involved the identification of all timber products into treated and non-treated categories. These classifications are outside the standard SWAP classifications and are considered more relevant to end use issues.

Treated timber waste comes in many forms, from fencing to offcuts and from sawdust to manufactured boards.
As origin has a huge influence on timber waste values, the results are shown by 'Origin' and 'Secondary' Classification.
The results are shown in Chart 12 and Tables 13 and 14 below.

Chart 12: Secondary Classification Values of Timber Wastes

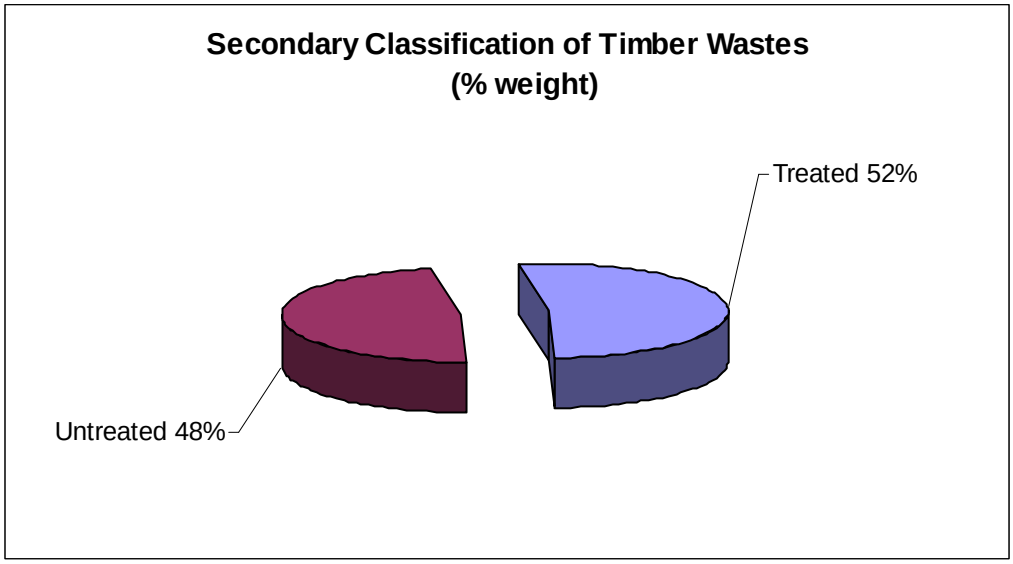


Table 13: Secondary Classification of Timber Wastes

Classification	Total Kgs	% Timber Wastes	% Total Wastes
Treated	4613.25	**52.2**	2.6
Untreated	4217.75	**47.8**	2.3
Total	8831.0	**100**	4.9

Table 14: Secondary Classification of Timber Wastes by Origin

Origin	Total Kgs	% Timber wastes	% Total wastes
Commercial treated	964.5	10.9	0.5
Commercial untreated	586.8	6.6	0.3
Residential Treated	3073.75	34.8	1.7
Residential Untreated	2998.15	34.0	1.7
Kerb Treated	23	0.3	0.0
Kerb Untreated	45.2	0.5	0.0
Transfer Treated	552	6.3	0.3
Transfer Untreated	587.6	6.7	0.3
Total	8831.0	100	4.9

4.5 Kerb Collection Bag Analysis

The mixture of refuse in kerb bags cannot be visually assessed and therefore the contents of a number of bags were analysed. This work was carried out using the SWAP Primary Classification procedure with Secondary classifications being recorded on paper, plastic, putrescible, and timber classifications.
A summary of the results is attached in Appendix 2.

4.5.1 Kerb Collection Accuracy of Analysis

Investigation for previous SWAP surveys have indicated a minimum of 60 refuse bags require analysis to give a 95% confidence level on a precision of plus or minus 15% for classifications of 20% or greater.
A total of 47 bags were analysed and these contained 303.6 kg of refuse. This lesser than desirable quantity was brought about by unavailability of bags and the weather.

4.5.2 Average Bag Weight and Refuse Density

Along with the 47 bags analysed for primary classification a further 120 bags were weighed and an average weight calculated from the total.
This mean value equated to 6.3 kg.

Table 15: Average Bag Weight (kgs)

Sample No	No of Bags	Weight kg	Average kg
1	47	303.6	6.46
2	120	751	6.26
Total	**147**	**1054.6**	**6.3**

4.6 Transport

Transport accounts for the type of vehicles used in the delivery of refuse to the landfill. It does not determine the type or origin of refuse.

4.6.1 Transport of Refuse

As the site is open to both the public and commercial operators and in line with the previous survey the following categories of vehicles were used:-

Cars
Utility vehicles includes utes and vans
Trailers
Compactor Vehicles
Trucks

The category for Cars includes station wagons and SUVs. Utility vehicles include utes and vans. Trailers come in a range of sizes although the majority were of 1 to 2m3 capacity. Vehicles towing trailers were not recorded unless they also carried refuse. Trailers were recorded up to 12m3 capacity.
Compactor vehicles are identified as their loads are not directly comparable with “loose” loads, and adjustment was made for their volume in final volume values.
Trucks also came in a range of sizes.
A total of 411 vehicles transported refuse to the landfill during the survey.
Detail on the weight of refuse and individual vehicle numbers is given in Chart 13 and Table 16 below.
Vehicle counts were up significantly on the previous survey from 294 to 411, a 40% increase in vehicle movements.

Chart 13: Refuse by Transport Category

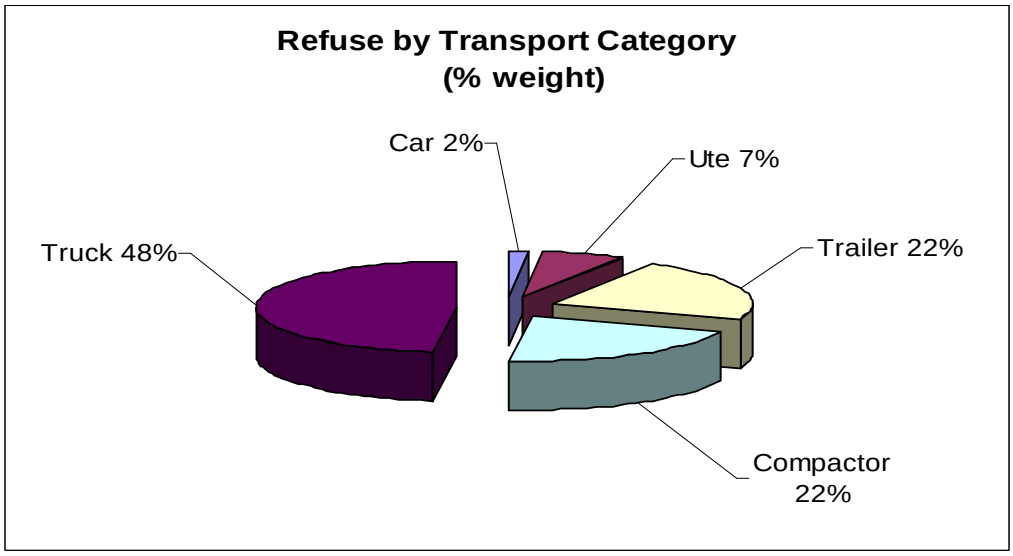


Table 16: Refuse by Transport Category

Category	No of Vehicles	Weight kgs	% Total Weight
Car	107	2807	1.6
Ute	81	12039	6.7
Trailer	142	39825	22.2
Compactor	18	38430	21.5
Truck	63	85908	48.0
Total	411	179009	100.0

The Transport Category, when combined with Origin information, gives a wider view on how refuse is managed for collection and transport.
Values are given in Chart 14 and Table 17 below.

Chart 14: Refuse by Transport and Origin

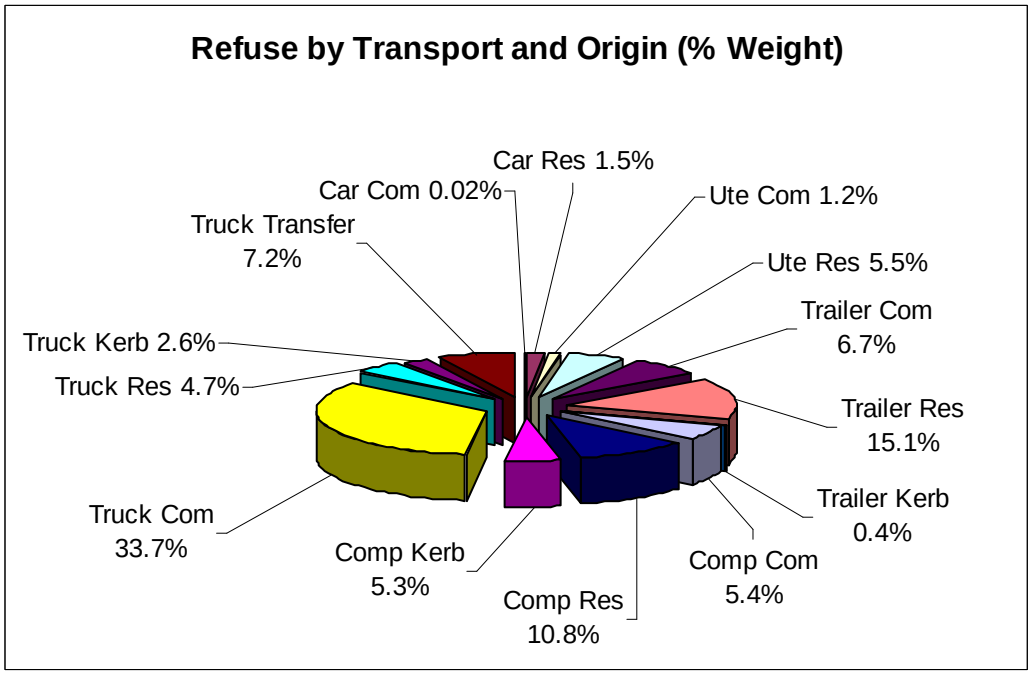


Table 17: Refuse by Transport Category and Origin of Source

	Commercial	Residential	Kerb	Transfer	Total
Car	40	2767	0	0	2807
Utility	2187	9852	0	0	12039
Trailer	11961	26944	770	0	39825
Compactor	9630	19265	9535	0	38430
Truck	60273	8330	4630	12825	85908
Total	83941	67308	14935	12825	179009

4.7 Refuse Volume and Weights

4.7.1 Annual Volume and Weight of Refuse

Refuse data was recorded by volume or weight and converted to weight for presentation of results. The values obtained are accurate only for the survey period and extrapolation of results from these values may not be reliable. However as refuse quantities are often expressed in annual values, the results from the survey have been extrapolated to this format. No adjustments or correction factors have been applied so these values should be used for indicative purposes only.

Table 18: Estimated Annual Volume and Weight Values

	Survey Period	Estimated Annual Value
Volume (loose)	684 m3	35,500 m3
Weight kgs	179,009 kgs	9300 tonne

4.7.2 Density of Loose Refuse

A value was determined from the summary survey data. This value is shown in Table 19. It has been calculated on the basis of loose volume.

Table 19: Average Density of Loose Refuse

Total weight kgs	179009
Total volume m3	684
Average Density	**262 kg/m3**

4.8 Conversion Factors

All classifications were assessed either as a percentage of the load volume or as a weight in kilograms.
Percentage values were later converted to weight values using one of four methods.

1. Using conversion factors gained from earlier studies
2. Using a sample weight and applying to full load
3. Use of portable scales to weigh full load
4 Using results of bag analysis

The conversion values used are shown in Appendix 1.

5.0 Discussion

5.1 Trends of Waste Classifications

The results of this study are directly comparable with the previous study and have been plotted on the following charts to show where changes are occurring. These results are presented over two charts in each category for ease of clarity.
Charts 15 and 16 show trends expressed as a percentage of the survey waste stream whereas Charts 17 and 18 expresses trends based on true weight.
In analysing trends consideration should be made of both the percentage and weight charts.

Chart 15: Classification Trend by Percentage - High Values

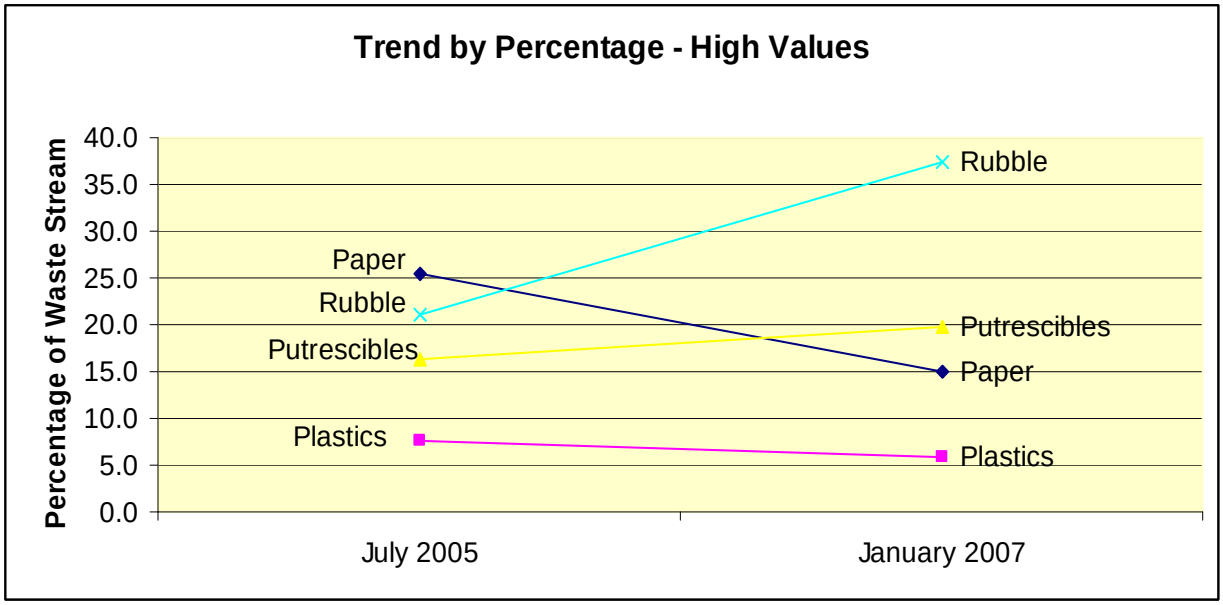


Chart 16: Classification Trend by Percentage - Low Values

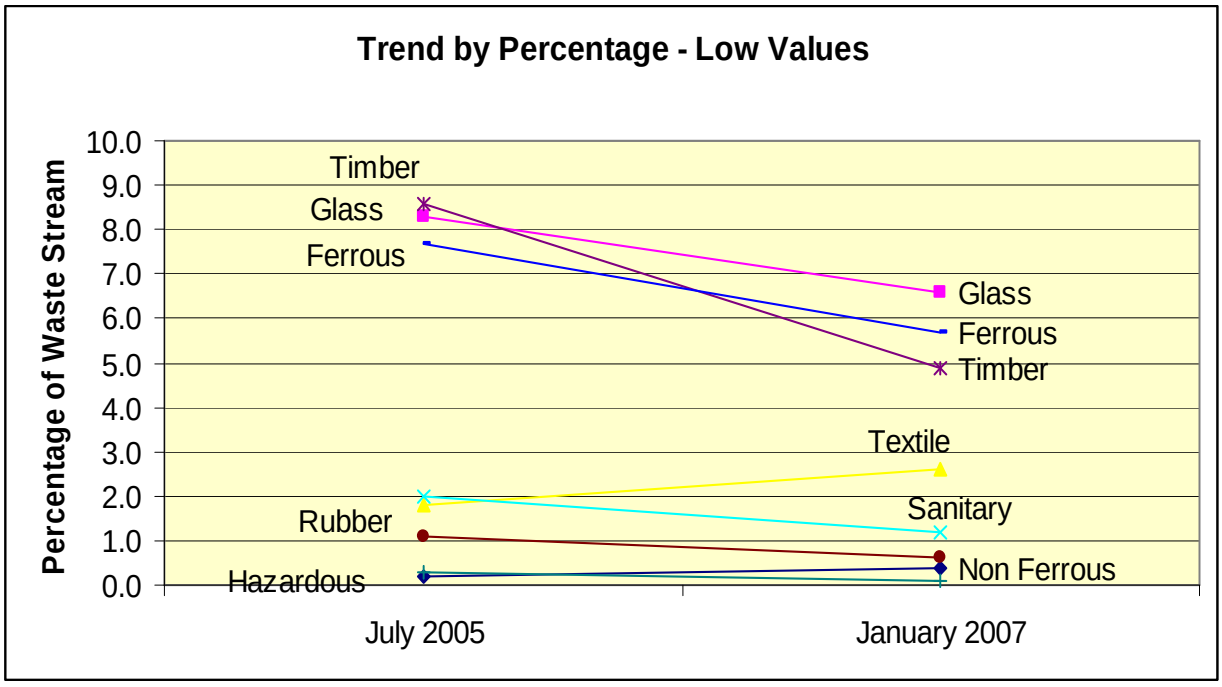


Chart 17: Classification Trend by Weight – High Values

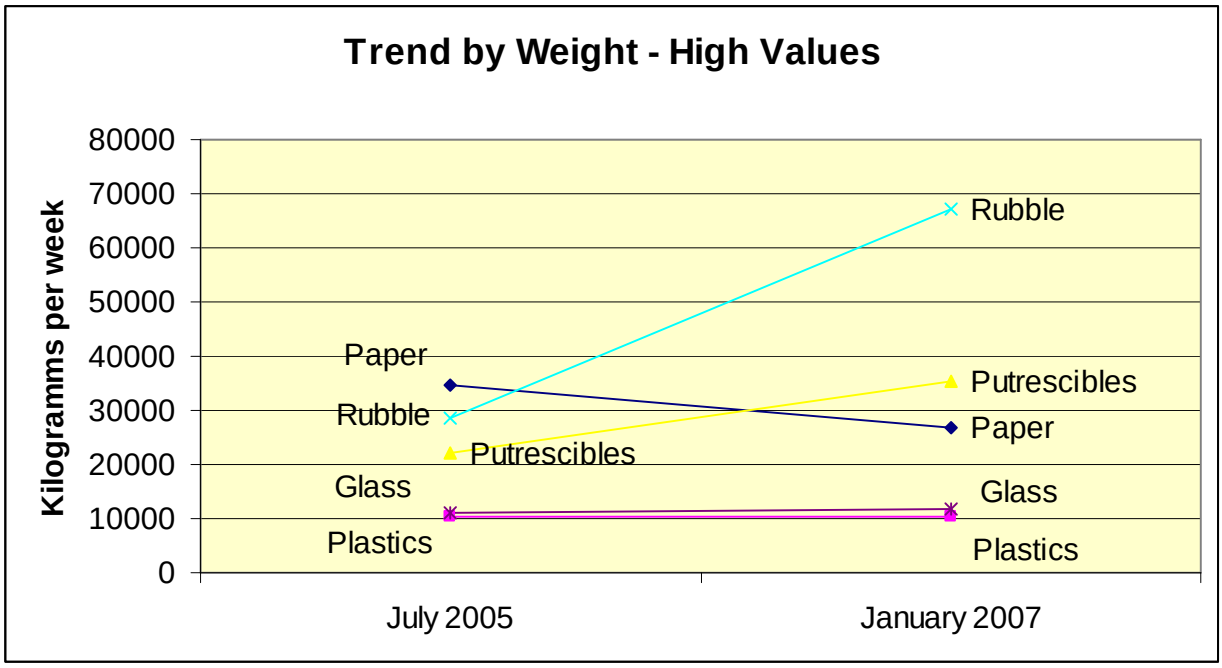
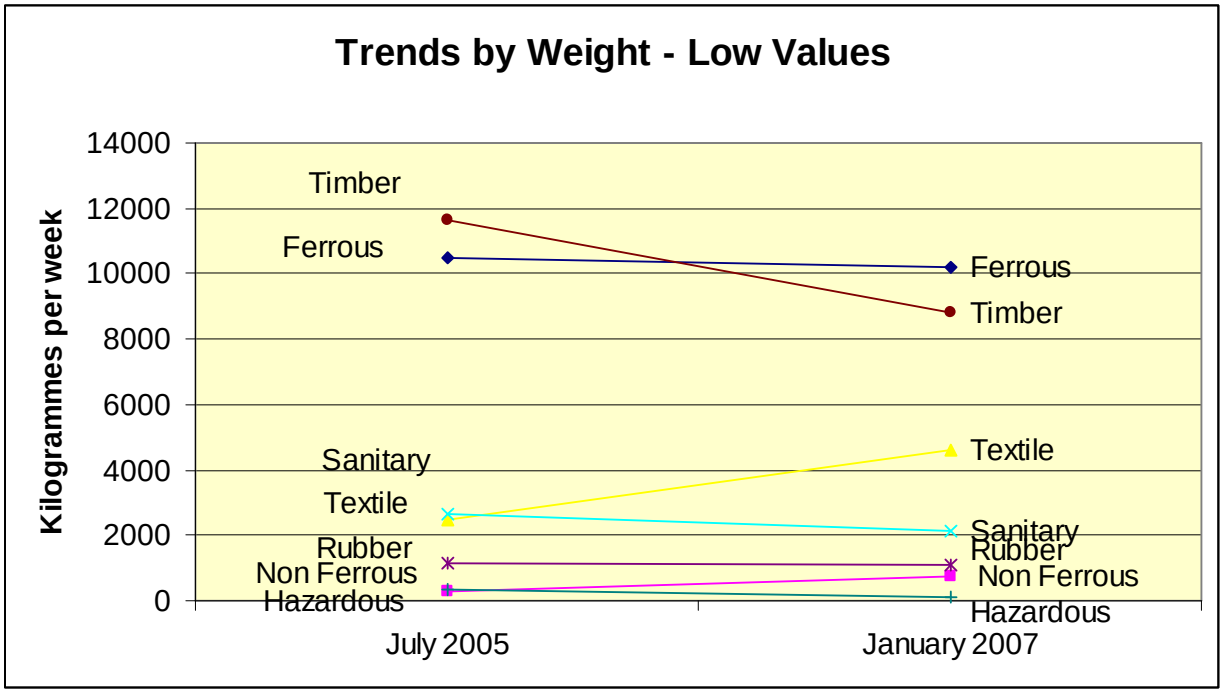


Chart 18: Classification Trend by Weight – Low Values



5. 2 Baseline data

The Ministry for the Environment maintains a database on results from WAP and SWAP studies completed at a number of sites throughout New Zealand and in particular four indicator sites, Silverstream Landfill Lower Hutt, Green Island Landfill Dunedin, Matamata Transfer Station Matamata and Kaikoura Landfill Kaikoura. The information database on the MfE website has not been updated since September 2004, however this information is presented along with results from the last two studies at the Marlborough Regional Landfill and the two Westport studies in Table 20 below.

Table 20: Baseline Data – By Percentage of Waste Stream

	NZ mean	Hutt	Kaikoura	Marlb	Marlb	Westport	Westport
	2004	Dec 2004	Sept 2004	Jan 2005	Sept 2006	July 2005	Jan 2007
Paper	11.5	11.0	9.0	11.5	10.3	25.5	15.0
Plastic	7.6	7.6	12.8	11.1	10.0	7.6	5.8
Putrescible	22.0	21.2	24.9	26.0	23.0	16.2	19.8
Ferrous	6.0	8.0	3.5	1.6	5.0	7.7	5.7
Non ferrous	0.9	1.1	2.6	0.1	0.2	0.2	0.4
Glass	2.8	2.3	1.5	3.7	3.5	8.3	6.6
Textiles	5.6	9.0	2.7	0.7	1.7	1.8	2.6
Sanitary	1.8	0.8	3.3	0.2	1.4	2.0	1.2
Rubble	19.1	16.4	22.3	37.6	24.7	21.0	37.4
Timber	11.7	15.5	14.6	7.4	19.0	8.6	4.9
Rubber	1.8	1.6	2.5	0.2	0.8	0.8	0.6
Hazardous	9.2	5.5	0.3	0.03	0.2	0.3	0.1

5.3 Paper

Paper makes up 15% of the current waste stream with over half of the quantity being cardboard. Much of this material is of commercial origin and arrives in large single material loads.
Other paper makes up 36 % of the paper wastes and consists of items such as glossy magazines and paper, building papers, office and contaminated paper.
Paper has decreased by weight and percentage since the July 2005 survey.
Newspaper is being recycled. Recycled material values are included in the survey results.

5.4 Plastics

The classification of plastics is very difficult by visual analysis. The secondary classification was carried out on kerb bag plastics only.
The trend for plastic has remained static both as a percentage and weight of material measured.
Current recycling activities appear to have had effect on the plastics waste stream with noticeably lower values of grade 1 and 2 plastics found in the refuse bags since the previous survey.

5.5 Putrescible Material

Values and quantities of putrescible material have risen. Secondary analysis shows both kitchen and garden wastes increasing, garden by 83% and this increase is a likely effect of seasonal variation.
Offal from local abattoir activities was included in Kitchen wastes.

5.6 Hazardous Wastes

The level of hazardous waste detected remains low. This survey recorded 90kg of hazardous materials, which consisted mainly of paints, LPG cylinders, car batteries, small dry cell batteries and a bottle of laboratory acid. The items found were referred to site staff.

6.0 ACKNOWLEDGEMENTS

I would like to thank the following:

Jamie and Chloe who willingly assisted with all field work.

The Westreef staff at the Westport Landfill, who prepared a work area, willingly assisted with moving material and allowed disruption of activities to permit completion of load analysis.

7.0 REFERENCES

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8.0 APPENDIX

8.1 : Appendix 1: Standard Conversion Factors

Basic values for converting volume to weight shown as kg/m3 updated September 2006

Item		Low	General	High	Notes
Paper	loose		100		
	compactor loads		200		
	flattened cardboard		380		
Plastics	loose		100		
	compactor loads		200		
	polystyrene		105		
	vineyard irrigation	90 coils	120 lengths		
Putrescible	general loose	160	250	400+	
	garden weeds / soil		400		
	offal		580		600 skins/ offal
	offal, paunch		1000		
	paunch dry		380		
	garlic		425		
	olives		1100		
	mussels		610		
	mussels inc shell		800		
	kina		310		450 wet
	compactor truck		300 loose		600 compacted vol
	fish / salmon		800		
Ferrous	loose		250		wire, roofing, appliances
	heavy gauge		500		machinery, pipes, beams
	timber yard strapping	180			
Non ferrous			100		
Glass	bottles		420		250 for skip loads
	batts		60 dry	120 damp	
Textile	rags, clothes		120		
	carpet	150	180	240	
Sanitary	council		800		
Rubble	mussel shells		800		
	ash		600 coal	1000 wet	
	soil	850	1000	1260	
	gravel		1600		
	concrete, broken		1200		
	gib board		680		
	builders loose		400		
	fullers earth		1150	1200	winery diatomaceous earth
Timber	builders skips		250		
	transfer bins		400		where packed
	transfer bins loose		300		
	particle board	300	517	700	
	sawdust, dry	220	300	400	450 wet
	shavings dry	90	153	167	
	timber yard offcuts	125	186	500 solid	
	timber battens		120		
Rubber	general loose		200		
	tyres cut up		600		when stacked inside each other
	tyres whole		150	loose	
	tyres each	car 8	ute 10	SUV 14	
	tyres truck each		22		
	underlay		180		
	furniture / mattress		180		

Hazardous			as weighed		
Bags	commercial cleaners		120		
	hospital bags		36	100	
	road side / town		150		
Vehicles					
top loader	Envirowaste		210		
compactor			250 loose		500 compacted

8.2 : Appendix 2: Kerb Bag Analysis (weight in kgs)

Date		9/1/07	9/1/07	10/1/07	11/1/07	Total	%	%
No of Bags		6	16	17	8	**41**	**Secondary**	**Primary**
Paper	News	1.6	6.1	6.8	2.1	16.6	5.5	
	Cardboard	0.3	3.2	4.7	0.3	8.5	2.8	
	Other	5.6	15.9	6	5.3	32.8	10.8	
Total paper						**57.9**		**19.1 %**
Plastics	1	0.1	0.2	0.6	0.5	1.4	0.5	
	2	0.05	0.2	0.7	.05	1.5	0.5	
	3	0	0	0	0	0	0	
	4	0.8	1.0	2.8	1.2	5.8	1.9	
	5	0.4	0.2	0.6	0.5	1.7	0.6	
	6	0.2	0.1	0.3	0.2	0.7	0.2	
	7	5.5	8.4	11.3	4.8	30.0	9.9	
Total Plastics						**41.1**		**13.5 %**
Putrescible	Kitchen	12.0	30.3	36.7	4.7	83.7	27.6	
	Garden	7.2	13.1	7.3	0	27.6	9.1	
Total Putrescible						**111.3**		**36.6 %**
Ferrous	Cans	1.0	0	1.3	0	2.3	0.8	
	Whiteware	0	0	0	0	0	0	
	Other	0	1.7	2.0	2.1	5.8	1.9	
Total Ferrous						**8.1**		**2.7 %**
Non Ferrous		0.3	1.5	0.2	0	2.0	0.7	
Total Non Fer						**2.0**		**0.7 %**
Glass	Clear	1.7	1.2	4.4	4.6	11.9	3.9	
	Green	1.0	0.5	2.0	0	3.5	1.2	
	Brown	4.0	4.3	10.0	12.6	30.9	10.2	
Total Glass						**46.3**		**15.3 %**
Textiles	Clothes	2.1	0	1.4	1.7	5.2	1.7	
	Other	0	5.6	0	0	5.6	1.8	
Total Textiles						**10.8**		**3.5 %**
Sanitary	Naps	1.3	6.7	4.1	1.3	13.4	4.4	
Total Sanitary						**13.4**		**4.4 %**
Rubble	Ash	1.0	9.7	4.1	16.5	31.3	5.5	
	Soil	0	0	0	0	0	0	
	Concrete	0	0	0	0	0	0	
	Plaster	0	0	0	0	0	0	
	Other	1.6	0.3	4.5	3.7	10.1	3.3	
Total Rubble						**10.1**		**3.3 %**
Timber	Treated	0	0.5	0	0	0.5	0.2	
	Untreated	0	0	1.0	0	1.0	0.3	
Total Timber						**1.5**		**0.5 %**
Rubber	Tyres	0	0	0	0	0	0	
	Other	0	0	1.1	0	1.1	0.4	
Total Rubber						**1.1**		**0.4 %**
Hazardous		0	0	0	0	0	0	
Total Hazardous						**0**		**0 %**