

# **COMPOSITION OF WASTE**

**Westport District Landfill  
SWAP Study  
25 – 31 July 2005**

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## 1.0 EXECUTIVE SUMMARY

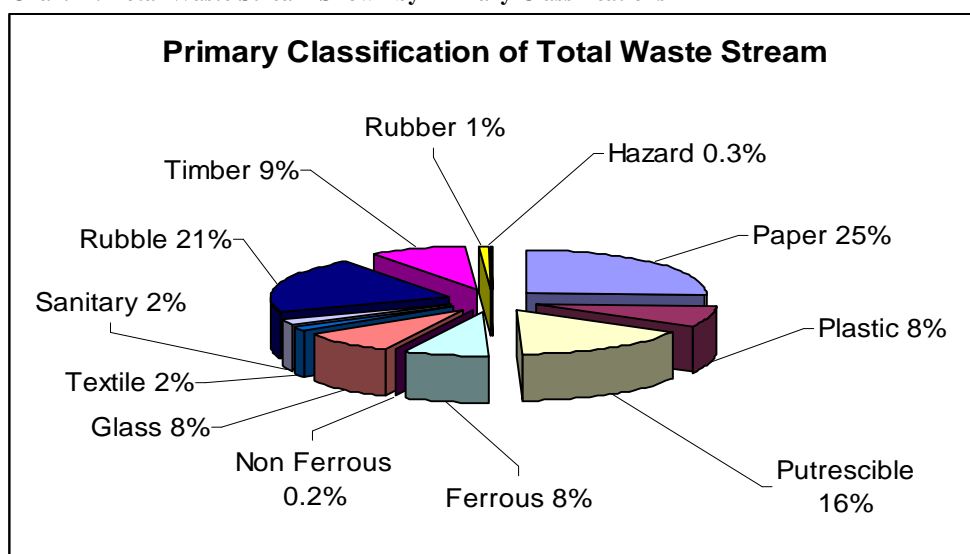
This report presents the results of an initial waste analysis survey conducted at the Westport landfill. The results, gained using the SWAP strategy, form an information base for future surveys as well as acting as a tool for the design and management of the waste stream.

The SWAP strategy was designed by the Ministry for the Environment to ensure that both consistent information is gathered at waste disposal facilities throughout New Zealand and that this information can be used as a tool for monitoring and for managing waste streams to landfill.

This survey was conducted over a seven day period in July 2005 which gives an indication of the waste stream influenced by winter seasonal factors. The survey determined the total waste stream into 12 primary classifications.

These values are shown in Chart I below.

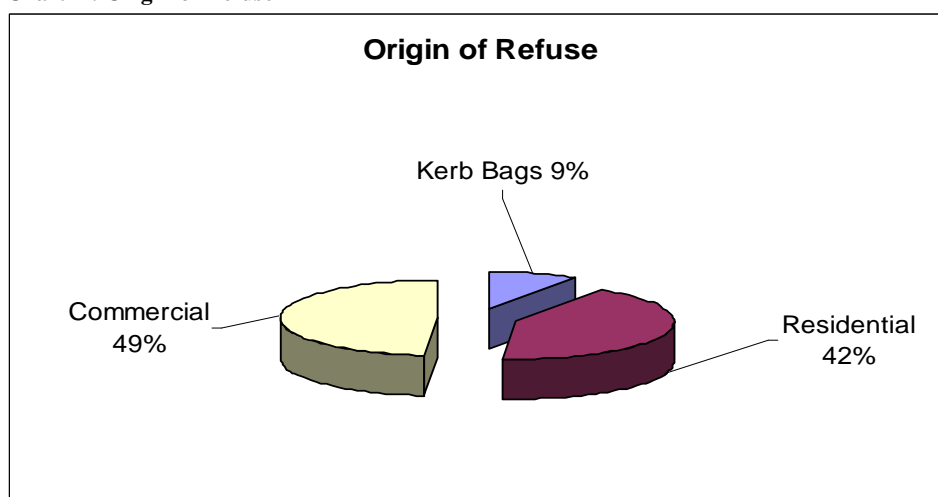
**Chart 1 : Total Waste Stream Shown by Primary Classifications**



With the need for a better understanding on many components of the waste stream secondary determinations were carried out on paper, plastics, putrescible, ferrous, glass, textiles, rubble and timber categories. Separate records were also kept on rubber, identifying tyres and other rubber products, and also on hazardous materials.

The information gathered also included the origin of all loads to the landfill. These values are presented in Chart 2.

**Chart 2 : Origin of Refuse**



A further influence on refuse disposal is the mode of transport to the site. Transport values were recorded into five classes of vehicles, cars, utility vehicles, trailers, compactor vehicles and trucks. For all vehicles arriving at the site the loads were analysed visually and the proportion of each classification assessed. As all results are reported in terms of weight, a number of loads were weighed by use of portable scales on site to assist with conversion from volume to weight calculations. To further help with these calculations, samples were taken from certain loads and unit rates established for particular types of material.

Approximately 70 kerbside bags were sampled and a full analysis made of the contents along with weighing a total of 140 bags to obtain a mean weight value per bag of 7.39kg.

423 vehicles used the landfill, disposing of 565m<sup>3</sup>, or approximately 135 tonne, of refuse during the survey period.

These values have, with caution, been extrapolated into annual quantities for reporting purposes only. These equate to 29,380m<sup>3</sup> (loose) and 7,050 tonne. The mean refuse density was calculated at 240kg/m<sup>3</sup> loose. A summary of values is given in Table 1

**Table 1 : Survey and Annual Values**

	<b>Survey Period</b>	<b>Annual Value</b>
Volume	565 m <sup>3</sup>	29,380 m <sup>3</sup>
Weight	135,629 kg	7,050 tonne
Density	240 kg/m <sup>3</sup>	

Hazardous waste consisted mainly of batteries and other small hazardous items in kerbside bags. Larger items in the general waste included paints, gas cylinders, oil, garden chemicals and automotive batteries. Hazardous waste accounts for only 0.3% of landfill waste stream, which is extremely low compared to other waste disposal facilities. Provision is made on site for the collection of waste oil, paints, automotive batteries, gas cylinders and a lock-up facility for other hazardous waste. Hazardous waste found during the survey was removed and placed in the appropriate storage area.

There is scope for reduction in many waste streams to the landfill and this is the reason this survey looked at secondary classifications of a number of the primary components.

Waste reduction should concentrate on the single large volume components of the waste stream, i.e. cardboard, paper and putrescible materials.

## 2.0 INTRODUCTION

This report presents the results of a waste analysis survey on the composition of the refuse stream recorded at the Westport landfill.

Such surveys, when undertaken over a period of time, can build up a reliable record on the quantity and type of material being disposed to landfill. The results can be used to assist with the constructive planning and management of the district's waste. They also may become a tool for measuring the changes to the waste stream and for gauging the effects of various strategies. The timing of this survey, 25<sup>th</sup> to 31<sup>st</sup> July 2005, should show any winter seasonal influence on the waste stream.

### 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, parties responsible for waste management have come under pressure to respond to waste issues. But to enable effective decisions to be made, consistent and reliable data is required.

Therefore, in response to the need 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 renamed 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 methods of classification, these being:-

Primary Classification  
Secondary Classification

The purpose of the two classification systems is to allow quick coverage of the full waste stream and also detailed analysis of any particular component or source of waste.

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 is used more for the analysis of a particular component in the waste stream, such as investigating a material for recycling.

This survey is based on primary classification analysis with additional analysis of selected items to meet objectives.

### 2.3 Objectives

The primary objective of this survey is to gauge by weight the primary classification of the waste stream.

Secondary objectives are to:-

- define paper into secondary classifications of newspaper, cardboard and other paper
- define plastics into seven categories of plastics
- define putrescibles as either kitchen or garden waste
- define ferrous waste into cans, whiteware and other type
- define glass by colours of clear, green and brown
- define textiles into clothing and other categories
- define rubble into ash, soil, concrete and stone, plaster board, and other rubble
- differentiate between treated and non-treated timber wastes

- differentiate between tyres and other rubber wastes and to take note of the number of tyres
- record the quantity and type of hazardous waste received

## **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 management and performance of the waste stream.

## **2.5 Previous Surveys**

There was no record found of previous waste analysis studies carried out on this waste stream.

## 3.0 SURVEY DESIGN and METHODOLOGY

### 3.1 Design Format

The survey format is based on the Solid Waste Analysis Protocol (MfE 2002).

In line with the protocol recommendations, supporting data is to be captured over a one week period.

The landfill operates for seven days a week.

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 classifications by volume or weight and converted to weight for reporting.

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 including station wagons and SUVs
- Utes and vans
- Trailers
- Compactor Vehicles
- Trucks

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

- |                 |   |
|-----------------|---|
| Residential     | This includes domestic household and property type wastes produced by residents.  |
| Commercial      | This includes wastes from commercial operations, building sites, shops factories, accommodation and commercial waste operators. |
| Kerb Collection | This covers domestic and commercial wastes collected through a kerbside bag system.   |

A minimum of 60 kerbside collected refuse bags are to be taken at random and analysed, with some bags taken from each load to the landfill.

The contents of refuse bags are to be sorted into the 12 primary classifications and weighed.

Similarly, a minimum of 120 bags are to be collected at random and weighed to determine an average weight for refuse bags.

Paper, plastics putrescibles, ferrous, glass, textile, rubble, timber and rubber categories are to be analysed into certain secondary classifications.

Supporting data is to be gained by weighing of selected vehicles by portable scales and also weighing of representative samples from loads of a single classification material.

### 3.2 Survey Limitations

Several factors occurred that served to limit the final results.

Density of material varied from exposure to rainfall and absorption of water. In the case of ash a mean value was derived using a damp consolidated sample.

Likewise the density of loads for green waste varied by effort made to pack or consolidate the material. These differences were minimised by weighing of loads.

The portable scales used were limited to single and dual axel vehicles only.

### 3.3 Methodology

The survey was predetermined for, and carried out, over the week of 25<sup>th</sup> to 31<sup>st</sup> July 2005 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 working area was established in an area adjacent to the tipping face and used for the duration of the survey. This was set up in line with Health and Safety requirements, and provided a safe working area away from the movement of machinery.

All sample analysis, weighing of samples and analysis classification work was carried out in this area. Weighing of vehicles was carried out on a level area adjacent to the site office.

Visual classification analysis was carried out at the tip face, if possible, as loads were being discharged. Two staff were involved on site while the landfill was open to the public.

A hazards assessment was carried out prior to the event and staff involved received safety training and were made aware of the likely hazards on site.

Checks on accuracy of evaluation were carried out during the survey by team members, individually assessing load components. These values were then discussed to ensure consistency of assessment and coverage of all classifications.

Loads were evaluated as soon as possible after being discharged so to avoid contamination or covering by other loads.

Volumes were recorded, as measured or assessed or from values given by drivers. Drivers were also requested information on the origin of the load.

Samples were removed for analysis.

As bags from kerbside collections were delivered on site, staff carried out analysis of the samples taken. They were sorted into primary and 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.

All site data was converted into weight basis to conform to the protocol and allow direct comparison with any future studies.

Hazardous materials were removed from the waste stream and placed in appropriate storage.

## 4.0 RESULTS

### 4.1 Origin of Refuse

For this survey the origin of the waste stream has been recorded into three categories, Commercial, Residential and Kerb Collection. This information was obtained from the drivers as vehicles accessed the landfill.

These categories allow a better understanding on the production of waste and, through further studies, will show trends and influences affecting each waste source.

Kerbside bags contain both residential and commercial wastes. No attempt was made to define the extent of the mix.

There are also some areas with undefined boundaries between residential and commercial sources, in particular with property maintenance. Where the material from a residential property is generated by a commercial activity then the material was classified as commercial.

The origin was not influenced by the mode of transport to the landfill. Transport is discussed in section 4.5.

Chart 3 : Waste Stream - Origin of Refuse

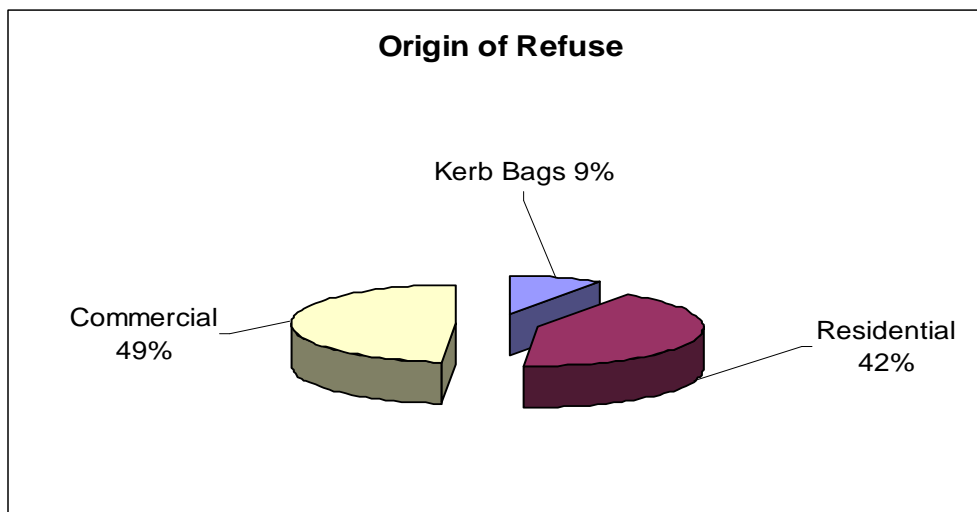


Table 2 : Origin of Refuse – Numerical Values

Origin	Weight kgs	Percentage
Commercial	65,798	48.51%
Residential	57,396	42.32%
Kerbside	12,435	9.17%
<b>Total</b>	<b>135,629</b>	<b>100.00</b>

### 4.2 Primary Classification of the Waste Stream

Primary Classification involves defining waste into twelve categories. For this survey the Primary Classification results are shown both for the total waste stream and also for each of the three origins of refuse.

The classification values are likely to vary greatly between the three origins of waste and the understanding of these values will assist with the targeting of waste recovery or waste minimization programmes.

### 4.2.1 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 3.

Chart 4 : Primary Classification Values of the Total Waste Stream

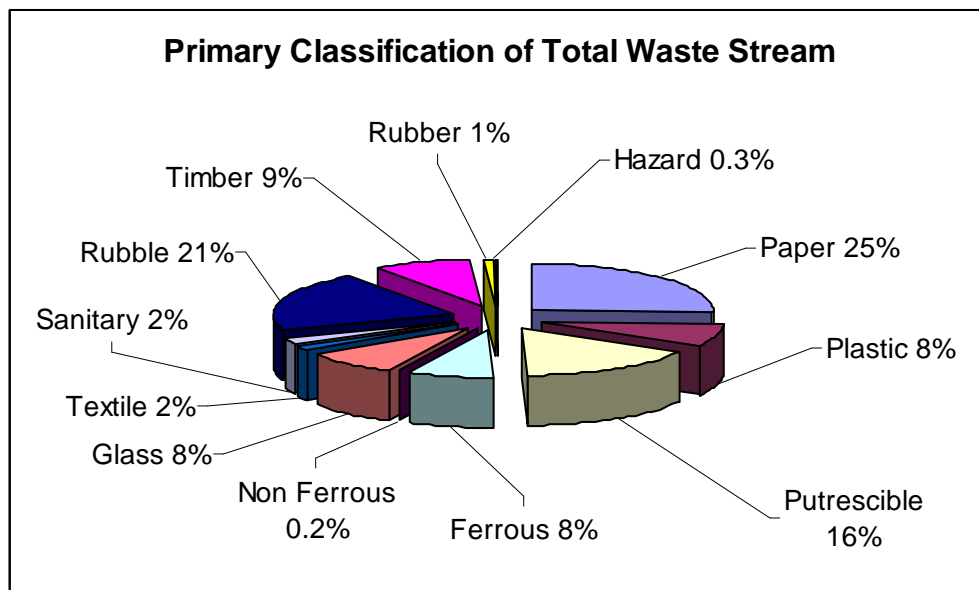


Table 3 : Total Waste Stream Analysis - Primary Classification Values

Classification	Total Kgs	% Total
Paper	34,607	25.5
Plastic	10,348	7.6
Putrescible	22,023	16.2
Ferrous	10,462	7.7
Non Ferrous	260	0.2
Glass	11,204	8.3
Textile	2,479	1.8
Sanitary	2,676	2.0
Rubble	28,451	21.0
Timber	11,635	8.6
Rubber	1,137	1.1
Hazardous	347	0.3
<b>Total</b>	<b>135,629</b>	<b>100.0</b>

### 4.2.2 Primary Classification of the Commercial Waste Stream

The commercial waste stream is defined as waste generated by industrial and commercial operations no matter where these operations are situated.

The primary classification values of commercial waste are shown in Chart 5 and Table 4.

Chart 5 : Primary Classification Values of Refuse from Commercial Origin

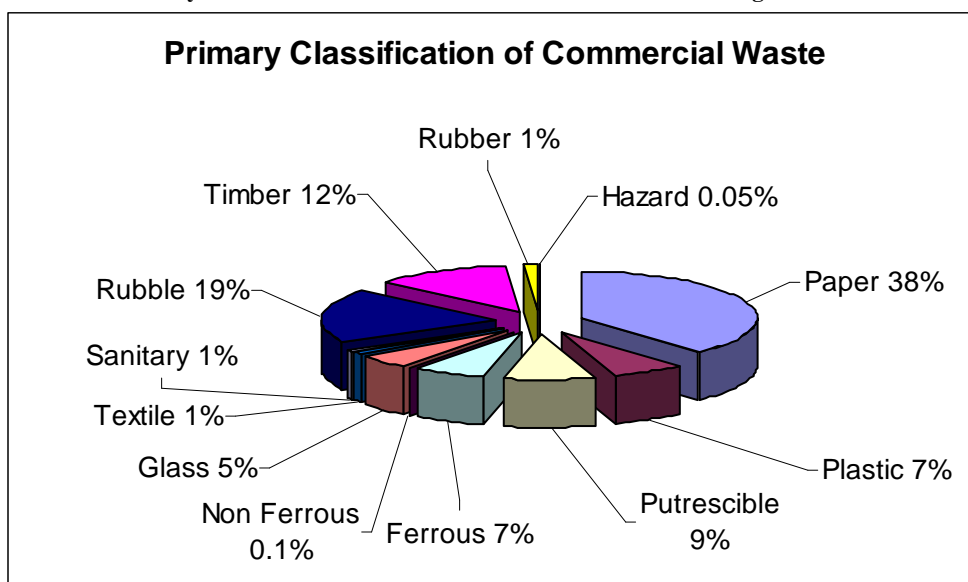


Table 4 : Commercial Waste Stream Primary Classification Values (by weight)

Classification	Total Kgs	% Commercial	% Total Waste
Paper	25,150	38.22	18.54
Plastic	4,510	6.85	3.33
Putrescible	5,651	8.59	4.17
Ferrous	4,291	6.52	3.16
Non Ferrous	53	0.08	0.04
Glass	3,146	4.78	2.32
Textile	830	1.26	0.61
Sanitary	520	0.79	0.38
Rubble	12,535	19.05	9.24
Timber	8,200	12.46	6.05
Rubber	879	1.34	0.65
Hazardous	33	0.05	0.02
<b>Total</b>	<b>65,798</b>	<b>100.00</b>	<b>48.51</b>

### 4.2.3 Primary Classifications of the Residential Waste Stream

The primary classifications for residential waste are presented in Chart 6 and Table 5 below. Whereas the chart depicts the classification as a percentage of the residential waste stream, Table 5 presents the values for each classification as both a percentage of the residential waste stream and also of the total waste stream.

Chart 6 : Primary Classification Values of Refuse from Residential Origin

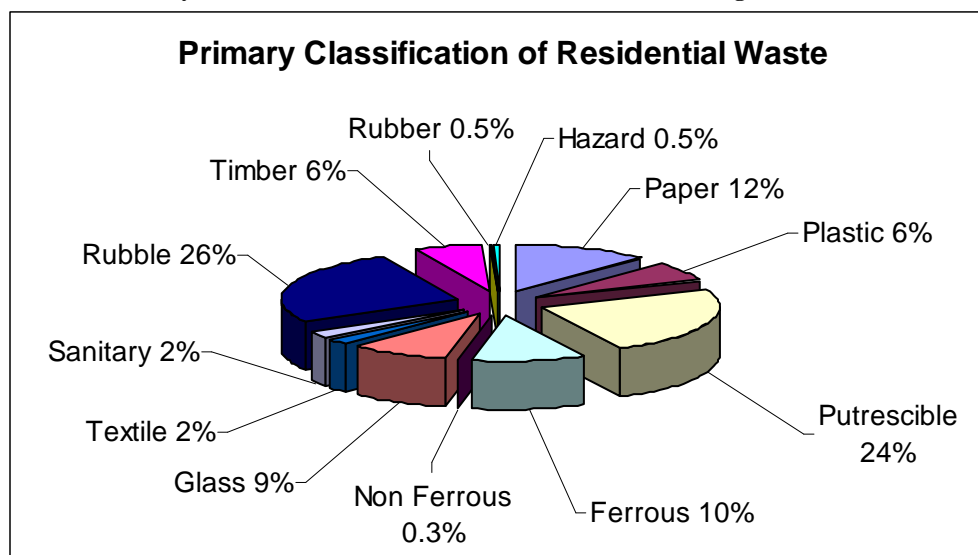


Table 5 : Residential Waste Stream Primary Classification Values (by weight)

Classification	Total Kgs	% Residential	% Total Waste
Paper	7158	12.47	5.28
Plastic	3722	6.48	2.74
Putrescible	13749	23.95	10.14
Ferrous	5745	10.01	4.24
Non Ferrous	155	0.27	0.11
Glass	5157	8.98	3.80
Textile	1370	2.39	1.01
Sanitary	1235	2.15	0.91
Rubble	15138	26.37	11.16
Timber	3435	5.98	2.53
Rubber	258	0.45	0.19
Hazardous	274	0.48	0.20
<b>Total</b>	<b>57396</b>	<b>100.00</b>	<b>42.32</b>

#### 4.2.4 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 in Westport and other smaller settlements in the district. It covers the material collected by one dedicated vehicle targeting specified refuse bags. 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 12,435 kg which equates to 9.17 % 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 refuse bags to give an acceptable confidence level on the major classification values.

The analysis of refuse bag contents was carried out using the SWAP primary and secondary classification procedure. The values gained from the sample bag analysis were extrapolated to give the full weight values for kerb refuse.

A summary of the classification values is given in Chart 7 and Table 6 below and a summary of individual samples is attached in Appendix 2.

Chart 7 : Primary Classification Values of Refuse from Kerb Collection

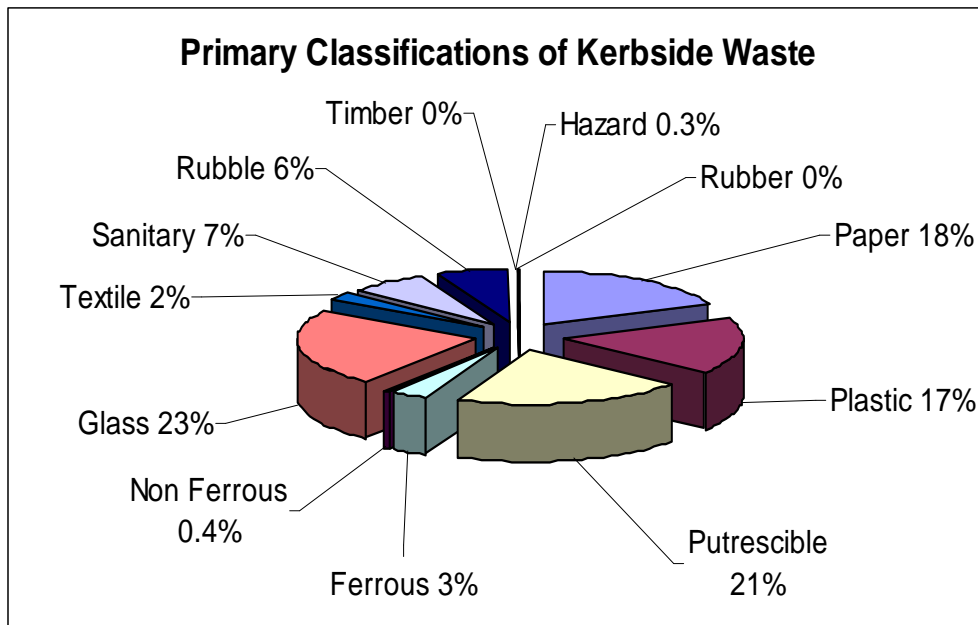


Table 6 : Primary Classification of Refuse from Kerb Collection

Classification	Sample Analysis kgs	% Kerbside	% Total Waste	Kerb Weight kgs
Paper	104.91	18.49	1.70	2,299
Plastic	96.48	17.02	1.56	2,116
Putrescible	120.10	21.09	1.93	2,623
Ferrous	19.60	3.43	0.31	426
Non Ferrous	2.35	0.42	0.04	52
Glass	132.60	23.33	2.14	2,901
Textile	12.80	2.24	0.21	279
Sanitary	42.20	7.41	0.68	921
Rubble	35.50	6.26	0.57	778
Timber	0.25	0.00	0.00	0
Rubber	0.00	0.00	0.00	0
Hazardous	1.80	0.32	0.03	40
<b>Total</b>	<b>568.59</b>	<b>100.00</b>	<b>9.17</b>	<b>12,435</b>

#### 4.2.5 Summary of Primary Classification Values of the 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)**

<b>Classification</b>	<b>Commercial</b>	<b>Residential</b>	<b>Kerb</b>	<b>Total</b>	<b>% Total</b>
Paper	25,150	7,158	2,299	34,607	25.5
Plastic	4,510	3,722	2,116	10,348	7.6
Putrescible	5,651	13,749	2,623	22,023	16.2
Ferrous	4,291	5,745	426	10,462	7.7
Non Ferrous	53	155	52	260	0.2
Glass	3,146	5,157	2,901	11,204	8.3
Textile	830	1,370	279	2,479	1.8
Sanitary	520	1,235	921	2,676	2.0
Rubble	12,535	15,138	778	28,451	21.0
Timber	8,200	3,435	0	11,635	8.6
Rubber	879	258	0	1,137	1.1
Hazardous	33	274	40	347	0.3
<b>Total</b>	<b>65,798</b>	<b>57,396</b>	<b>12,435</b>	<b>135,629</b>	<b>100.0</b>

### 4.3 Secondary Classification of the Waste Stream

Secondary classifications were carried out to gain a better understanding on the types of waste for selected primary classifications.

These were:-

- Paper into newspaper, cardboard and other categories
- Plastics into grades 1 to 7
- Putrescible into kitchen and garden origins
- Ferrous into cans, whiteware and other
- Glass into clear, green and brown
- Textile into clothing and other
- Rubble into ash, soil, concrete, plaster board, and other
- Timber into treated and untreated
- Rubber into tyres and other

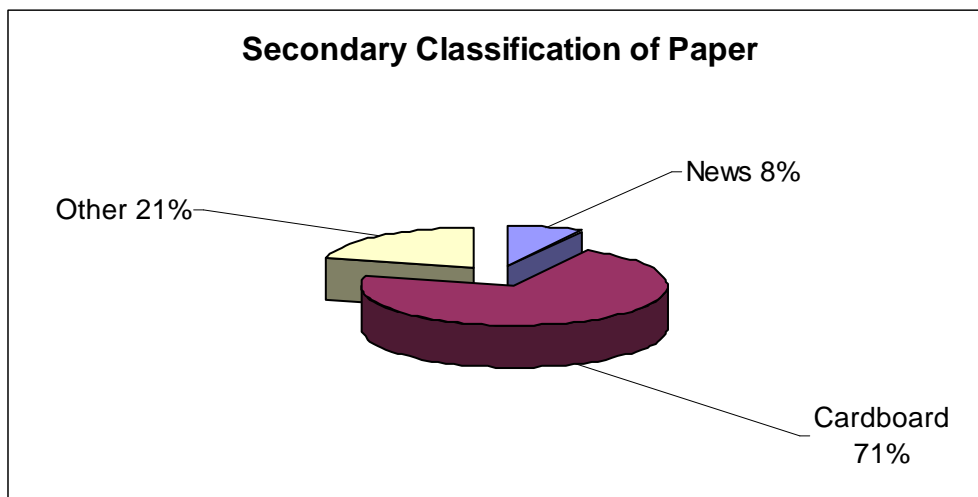
#### 4.3.1 Secondary Classification of Paper

Paper makes up 25.5% of the total waste stream.

The division into secondary classifications was easily carried out as the categories of paper were readily identified. Much of the paper, especially with commercial loads came in bulk quantities.

Chart 8 and Table 8 show the values of the secondary classifications.

**Chart 8 : Secondary Classification Values for Paper Waste**



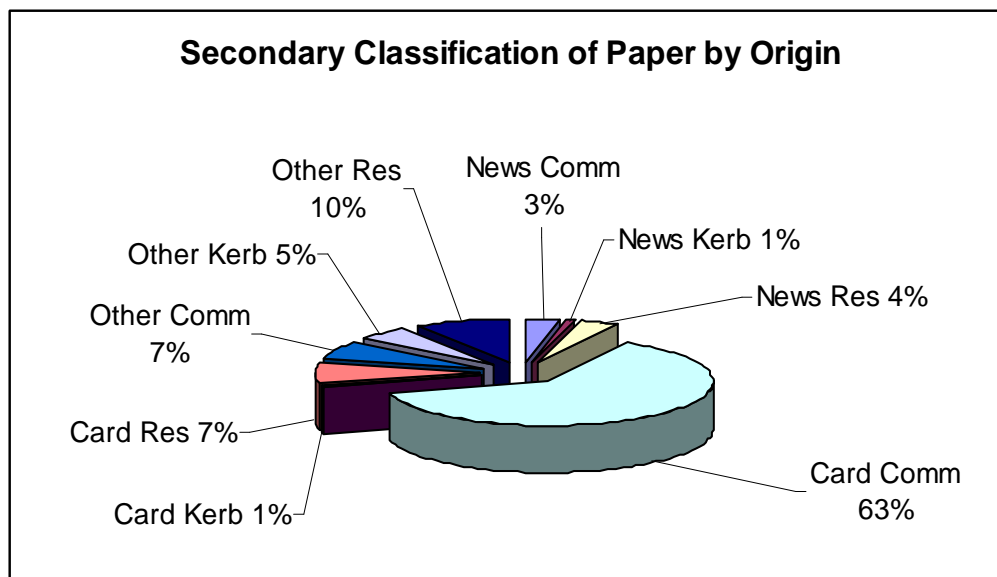
**Table 8 : Secondary Classification Values for Paper Waste**

Category	Weight Kgs	% of Category
Newspaper	2788	8.06
Cardboard	24478	70.73
Other	7341	21.21
Total	34,607	100.00

Further analysis of the secondary classification by the origin of material shows clearly where the greater proportion of material is originating from.

Chart 9 and Table 9 below show the secondary classifications for the three origin categories.

**Chart 9 : Secondary Classification Values for Paper by Origin of Waste**



**Table 9 : Secondary Classification Values for Paper by Origin of Waste**

Category and Origin	Weight kgs	% of Category
Newspaper - Commercial	1,114	3.22
Newspaper - Kerb	372	1.07
Newspaper - Residential	1,302	3.76
Cardboard - Commercial	21,655	62.57
Cardboard - Kerb	258	0.75
Cardboard - Residential	2,565	7.41
Other - Commercial	2,381	6.88
Other - Kerb	1,669	4.82
Other - Residential	3,291	9.51
Total	34,607	100.00

### 4.3.2 Secondary Classification of Plastics

Plastics were classified into the 7 categories used for recycling purposes.

These 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

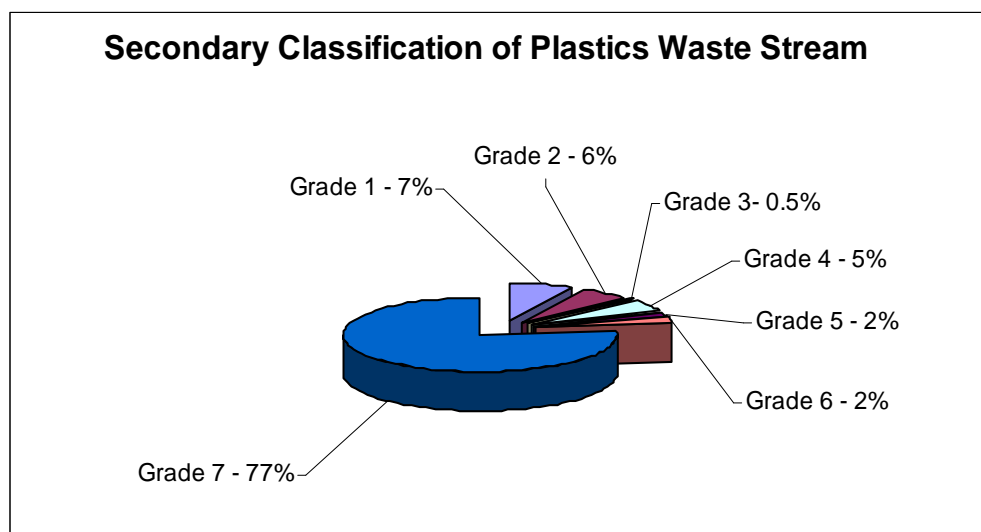
There was great difficulty identifying grades of plastics especially as items often have no identifying marks. Consequently most of the plastic was graded as Type 7.

One exception is the plastic packaging used for household items. With the analysis of kerbside bags all plastics were separated into grades and recorded.

Chart 10 and Table 10 below show the secondary classifications for the full waste stream.

These values have also been further divided in Table 11 to show the secondary classifications of plastics by the origin of the waste.

**Chart 10 : Secondary Classification Values for Plastic Waste**



**Table 10 : Secondary Classification Values for Plastic Waste**

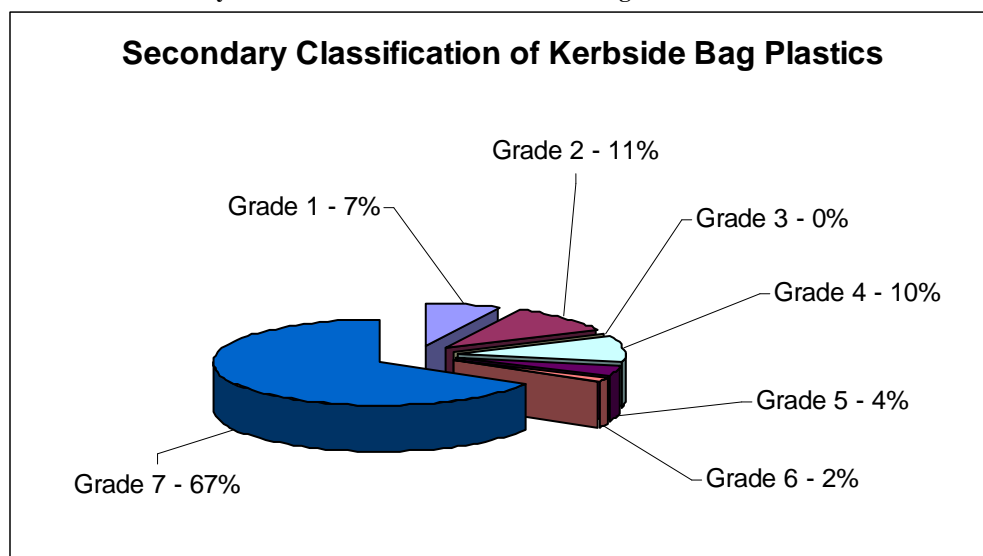
Grade of Plastics	Weight kgs	% of Plastics waste stream
1	764	7.38
2	609	5.89
3	56	0.54
4	554	5.35
5	206	1.99
6	222	2.15
7	7937	76.70
<b>Total</b>	<b>10348</b>	<b>100.00</b>

**Table 11 : Secondary Classification Values for Plastic Wastes by Origin (By Weight Kgs)**

Grade	1	2	3	4	5	6	7	Total
<b>Commercial</b>	134	134	0	120	46	121	3955	<b>4510</b>
<b>Kerb</b>	154	228	0	208	83	32	1411	<b>2116</b>
<b>Residential</b>	476	247	56	226	77	69	2571	<b>3722</b>
<b>Totals</b>	<b>764</b>	<b>609</b>	<b>56</b>	<b>554</b>	<b>206</b>	<b>222</b>	<b>7937</b>	<b>10348</b>

As only the Kerbside bag analysis gave a representative analysis of the secondary classifications these values are shown below in Chart 11 and Table 12.

**Chart 11 : Secondary Classification Values for Kerbside Bag Plastics**



**Table 12 : Secondary Classification Values for Kerbside Bag Plastics**

Grade of Plastics	Weight kgs	% of Plastics waste stream
1	154	7.28
2	228	10.78
3	0	0.00
4	208	9.83
5	83	3.92
6	32	1.51
7	1411	66.68
<b>Total</b>	<b>2116</b>	<b>100.00</b>

### 4.3.3 Secondary Classification of Putrescible Material

All loads containing putrescible wastes were recorded by secondary classifications of either kitchen or garden origin.

The results are shown in Charts 12 & 13 and Table 13 below.

**Chart 12 : Secondary Classification Values for Putrescible Waste**

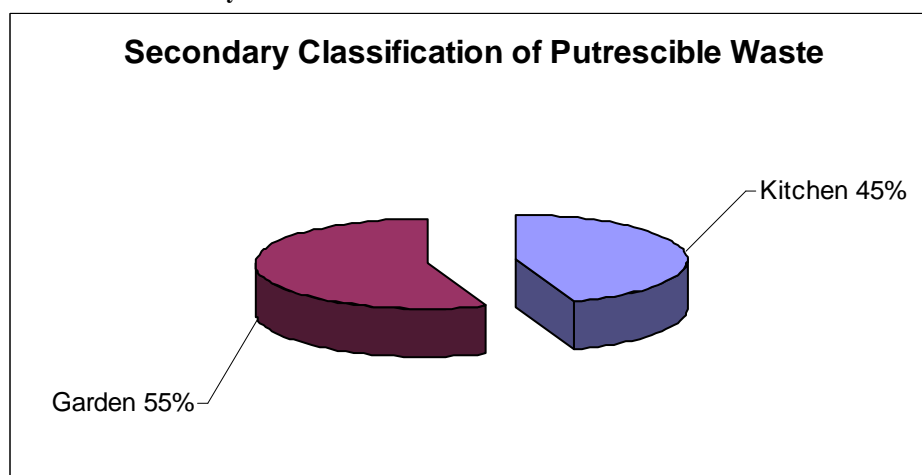


Chart 13 : Secondary Classification Values for Putrescible Waste by Origin

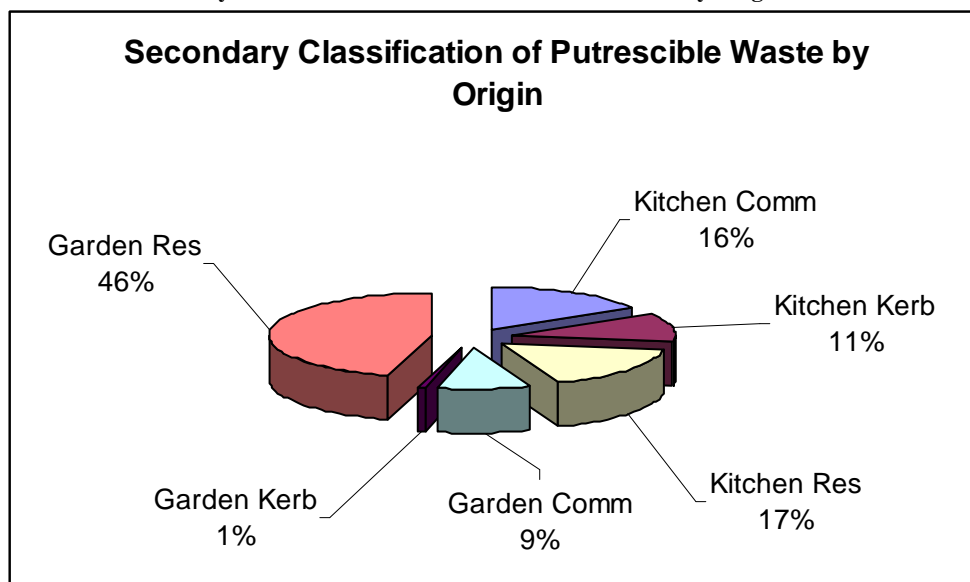


Table 13 : Secondary Classification Values for Putrescible Waste by Origin

	Kitchen		Garden		Totals	
	Kg	%	Kg	%	kg	%
Commercial	3,630	16.48	2,021	9.18	<b>5,651</b>	<b>25.66</b>
Kerb	2,467	11.20	156	0.71	<b>2,623</b>	<b>11.91</b>
Residential	3,719	16.89	10,030	45.54	<b>13,749</b>	<b>62.43</b>
<b>Totals</b>	<b>9,816</b>	<b>44.57</b>	<b>12,207</b>	<b>55.43</b>	<b>22,023</b>	<b>100.00</b>

### 4.3.4 Secondary Classification of Ferrous Waste

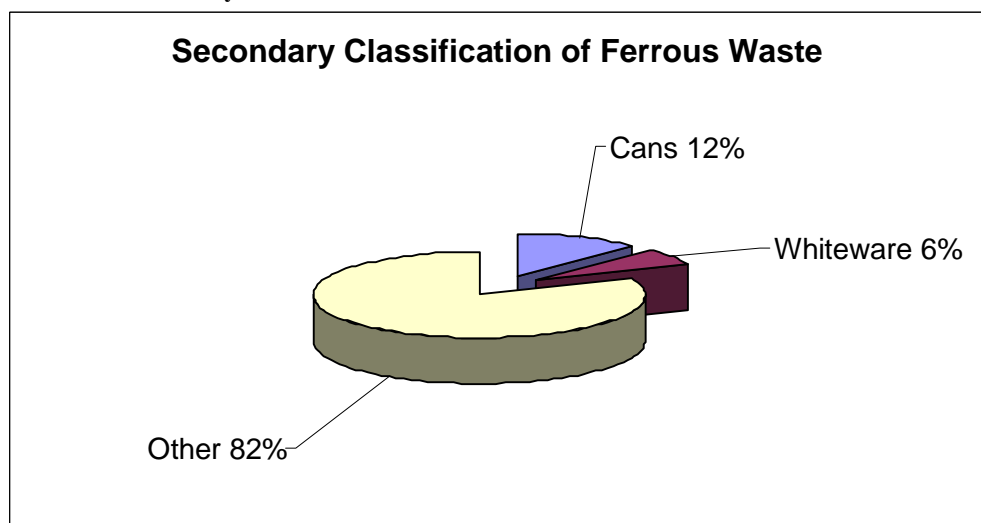
Three categories of ferrous materials were recorded.

These were :-

- Cans
- Whiteware
- Other

The values recorded are shown in Chart 14 and Table 14.

Chart 14 : Secondary Classification Values for Ferrous Waste



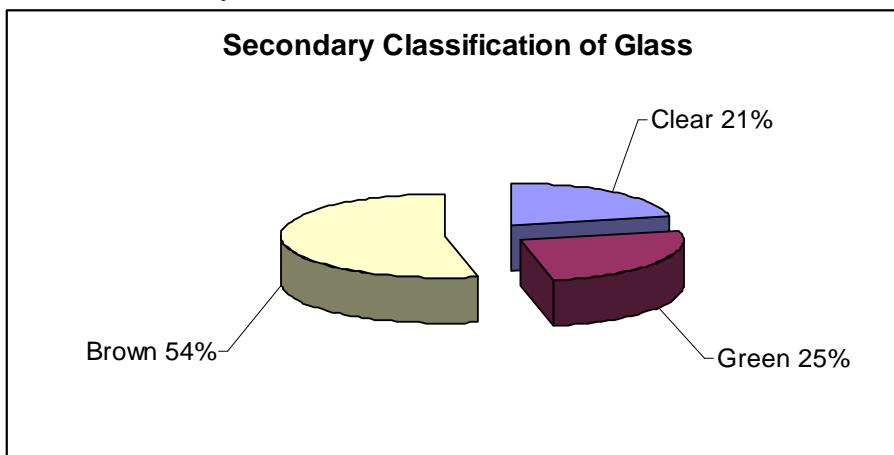
**Table 14 : Secondary Classification Values for Ferrous Waste**

	<b>Weight Kg</b>	<b>% of Ferrous Waste</b>
Cans	1283	12.26
Whiteware	649	6.20
Other	8530	81.53
<b>Total</b>	<b>10462</b>	<b>100.00</b>

### 4.3.5 Secondary Classification of Glass

All loads of glass were assessed by weight and colour. The results are shown in Chart 15 and Table 15 below.

**Chart 15 : Secondary Classification Values for Glass Waste**



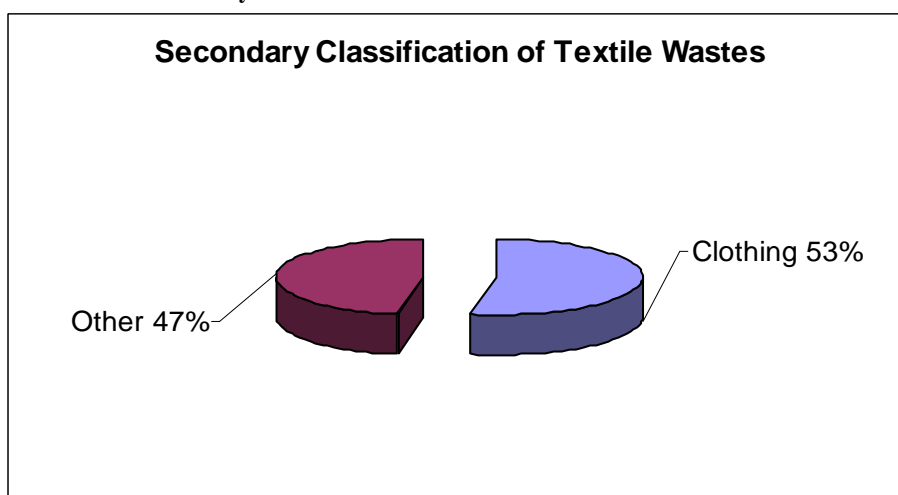
**Table 15 : Secondary Classification Values for Glass Waste**

	<b>Weight kgs</b>	<b>% of Glass Waste</b>
Clear	2,405	21.47
Green	2,810	25.08
Brown	5,989	53.45
<b>Total</b>	<b>11,204</b>	<b>100.00</b>

### 4.3.6 Secondary Classification of Textiles

Textiles were divided into two secondary classifications, clothing and other. The greater quantity of other textiles consisted of carpets and furnishings.

**Chart 16 : Secondary Classification Values for Textile Waste**



**Table 16 : Secondary Classification Values for Textile Waste**

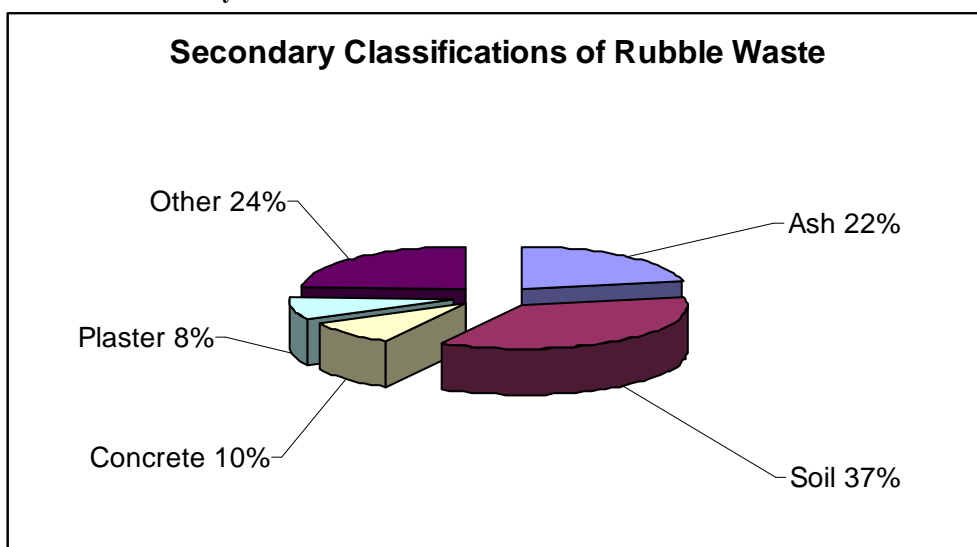
	<b>Weight Kg</b>	<b>% of Textile Waste</b>
Clothing	1308	52.76
Other	1171	47.24
<b>Total</b>	<b>2479</b>	<b>100.00</b>

### 4.3.7 Secondary Classification of Rubble Wastes

Rubble was requested in four secondary classifications, soil, concrete including rock, plaster board and other. A fifth classification of ash was added during the survey when it was found that this was a common material requiring disposal.

Chart 17 and Table 17 show the values for the secondary classifications for rubble.

**Chart 17 : Secondary Classification Values for Rubble Waste**



**Table 17 : Secondary Classification Values for Rubble Waste**

	<b>Weight kgs</b>	<b>% of Rubble Waste</b>
Ash	6125	21.53
Soil	10,394	36.53
Concrete	2710	9.53
Plaster board	2310	8.12
Other	6912	24.29
<b>Total</b>	<b>28451</b>	<b>100.00</b>

### 4.3.8 Secondary Classification of Timber Wastes

Timber wastes were assessed as being either treated or untreated material. The results are shown in Chart 18 and Table 18 below.

Chart 18 : Secondary Classification Values for Timber Waste

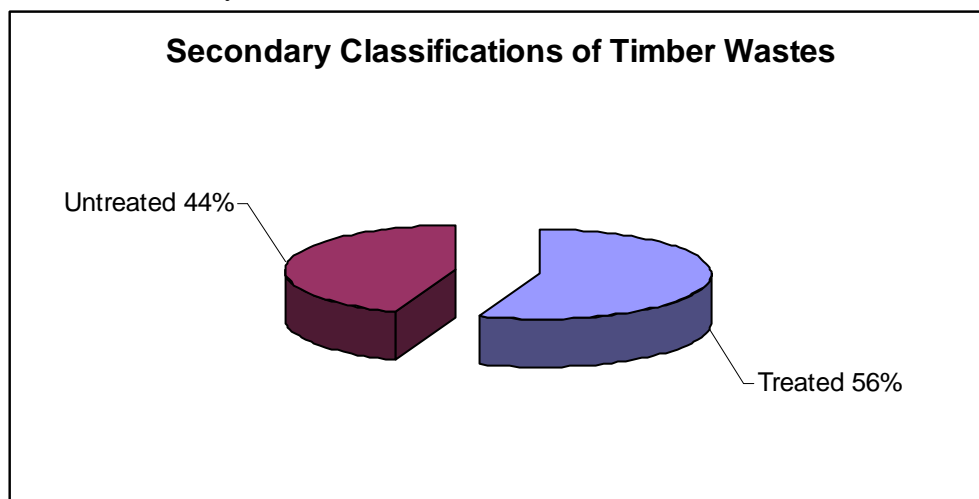


Table 18 : Secondary Classification Values for Timber Waste

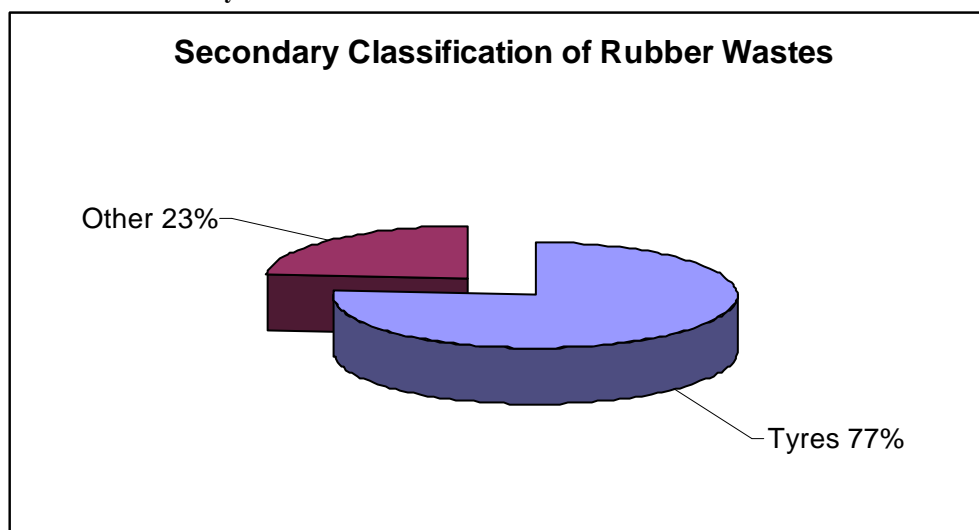
	Weight kgs	% of Timber Waste
Treated	6482	55.71
Untreated	5153	44.29
<b>Total</b>	<b>11635</b>	<b>100.00</b>

### 4.3.9 Secondary Classification of Rubber Wastes

Secondary classification of rubber wastes involved the identification of rubber tyres in the waste stream. The remaining rubber was classified as other rubber and consisted mainly of rubber carpet underlay and rubber conveyor belts.

A total of 80 tyres were recorded during the survey. 62 of these arrived in one skip, which according to the driver was approximately four months collection from one commercial outlet. It is not known how many other commercial operators dispose of tyres in bulk. It is likely the value for tyres and rubber is not representative of an average week’s refuse disposal.

Chart 19 : Secondary Classification Values for Rubber Waste



**Table 19 : Secondary Classification Values for Rubber Waste**

	<b>Weight kgs</b>	<b>% of rubber Waste</b>
Tyres	870	76.52
Other	267	23.48
<b>Total</b>	<b>1,137</b>	<b>100.00</b>

#### 4.4 Kerb Collection Bag Analysis

##### 4.4.1 Kerb Collection Accuracy of Analysis

SWAP surveys conducted elsewhere 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 paper, plastics and putrescibles. This survey analysed a total of 77 bags containing 568kg of refuse.

##### 4.4.2 Kerb Bag Weight, Volume and Density

Along with the 77 bags analysed for primary classification a further 78 bags were weighed and an average weight calculated from the total. This equated to a mean value of 7.39kg.

**Table 20 : Average Bag Weight (kgs)**

<b>Sample No</b>	<b>No of Bags</b>	<b>Weight kg</b>	<b>Average kg</b>
1	77	568.59	
2	78	577.40	
<b>Total</b>	<b>155</b>	<b>1,145.99</b>	<b>7.39</b>

Bag volume was gauged by two methods.

Firstly a number of bags were measured in an uncompacted state by placing contents into a 200 litre drum and recording the number of bags to fill a series of 10 drums.

The second method related to counting the number of bags in a truck load. It was considered by the survey team and verified by the truck weights that loads were not being compacted to full potential. This method also required the operator counting the bag numbers and these were given only as an approximate figure.

Bag volume averaged at 50 litres per bag.

Density calculated from average bag weight equates to 148kg per m<sup>3</sup>.

Density calculated from truck weight and volume equated to 145kg per m<sup>3</sup>.

**Table 21 : Bag Density**

<b>Density</b>	<b>Kg/m<sup>3</sup></b>
Bag measure	148
Truck measure	145

#### 4.5 Transport

##### 4.5.1 Vehicle Counts

A total of 294 vehicles transported refuse to the landfill during the survey.

##### 4.5.2 Transport of Refuse

As the site is open to both the public and commercial operators the number of categories of vehicles was kept to five which accommodated the normal type of vehicles encountered.

These categories being:-

- Cars
- Utes or utility vehicles
- Trailers
- Compactor Vehicles
- Trucks

The category for cars includes vehicles such as station wagons and SUVs. Generally these have only small loads.

Utes included vans, often the loads are comparable to trailers.

Trailers were generally small with loads around one cubic metre however there were a number of extended trailers carrying large volumes of low density commercial waste, mainly packaging.

Compactor vehicle can usually achieve a two to one compression ratio and their loads are not directly comparable with other 'loose' refuse. Compactor vehicles include the kerbside bag collection vehicle. These vehicles were weighed so the true value of the load was known.

The five categories of transport service both the residential and commercial sectors.

Chart 20 and Table 22 show the values for the survey period.

Chart 20 : Refuse Weight by Transport Category

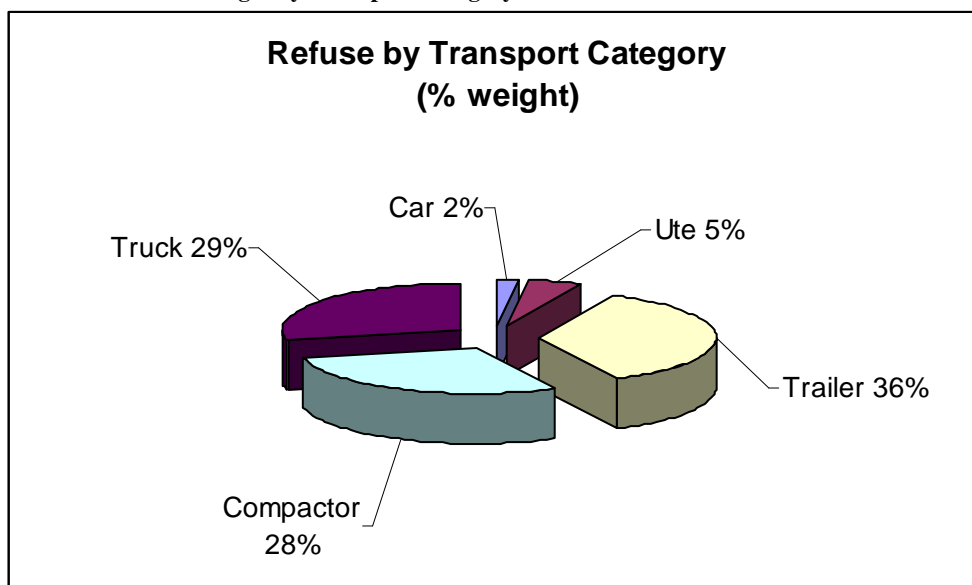


Table 22 : Refuse Weight by Transport Category

Category	No of Vehicles	Weight kgs	% total weight
Car	54	2,754	2.03
Ute	48	6,633	4.89
Trailer	116	48,817	35.99
Compactor	26	38,072	28.07
Truck	50	39,353	29.02
Total	294	135,629	100.00

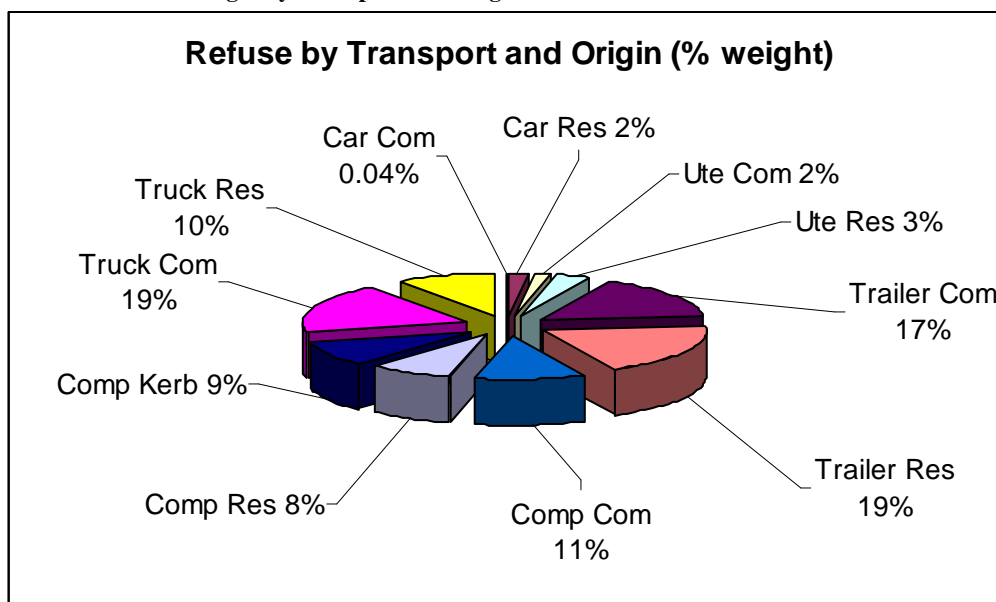
The transport category, when combined with origin information, gives a wider view on how refuse is managed for collection and transport.

Values are given in Table 23 and Chart 21 below. The weight for each division is also expressed as a percentage of the total waste stream.

**Table 23 : Refuse Weight by Transport Category and Origin of Source**

	<b>Commercial</b>	<b>Residential</b>	<b>Kerb</b>	<b>Total</b>
<b>Car</b>	58kg 0.04%	2,696kg 1.99%	0 0	2,754kg 2.03%
<b>Ute</b>	2,328kg 1.72%	4,305kg 3.17%	0 0	6,633kg 4.89%
<b>Trailer</b>	22,626kg 16.68%	26,191kg 19.31%	0 0	48,817kg 35.99%
<b>Compactor</b>	14,521kg 10.71%	11,116kg 8.20%	12,435kg 9.17%	38,072kg 28.07%
<b>Truck</b>	26,265kg 19.37%	13,088kg 9.65%	0 0	39,353kg 29.02%
<b>Total</b>	65,798kg 48.51%	57,396kg 42.32%	12,435kg 9.17%	135,629kg 100.00%

**Chart 21 : Refuse Weight by Transport and Origin**



## 4.6 Refuse Volume and Weights

### 4.6.1 Annual Volume and Weight of Refuse

Refuse data was recorded by volume 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, such as seasonal influences, have been applied so these values should be used for indicative purposes only.

**Table 24 : Estimated Annual Volume and Weight Values**

	<b>Survey Period</b>	<b>Estimated Annual Value</b>
Volume (loose)	565 m3	29,380 m3
Weight kgs	135,629 kgs	7,050 tonne

## 4.6.2 Density of Loose Refuse

A value was determined from the summary survey data. This value is shown in Table 25. It has been calculated on the basis of loose volume.

**Table 25 : Average Density of Loose Refuse During Survey Period**

Total weight kgs	135,629
Total volume m3	565
<b>Average Density</b>	<b>240 kg/m3</b>

## 4.7 Conversion Factors

All loads were generally assessed visually by percentage volume into the 12 primary and required secondary classifications. These values were later converted to weight values using one of four methods.

1. Using conversion factors gained from sampling or earlier surveys the weight of loads was assessed from the volume of each classification.
2. Selected loads were weighed on site by means of portable scales with the final weight for each classification being adjusted to match the total weight of the load.
3. One classification type loads were assessed by a sample weight from the load, for example ash, sawdust and green waste.
4. Bag samples were analysed and each classification weighed.

Conversion factors used are shown in Appendix 1.

## 4.8 Baseline data

The Ministry for the Environment maintains a data base on results from WAP and SWAP studies completed at a number of sites throughout New Zealand. This information is available on their website. Table 26 presents relative data from this site along with the results from a Marlborough SWAP survey earlier this year.

**Table 26 : Baseline Data – By Percentage of Waste Stream**

	<b>NZ mean</b>	<b>Hutt</b>	<b>Kaikoura</b>	<b>Marlborough</b>	<b>Westport</b>
	2004	Dec 2004	Sept 2004	Jan 2005	July 2005
Paper	11.5	11.0	9.0	11.5	25.5
Plastic	7.6	7.6	12.8	11.1	7.6
Putrescible	22.0	21.2	24.9	26.0	16.2
Ferrous	6.0	8.0	3.5	1.6	7.7
Non ferrous	0.9	1.1	2.6	0.1	0.2
Glass	2.8	2.3	1.5	3.7	8.3
Textiles	5.6	9.0	2.7	0.7	1.8
Sanitary	1.8	0.8	3.3	0.2	2.0
Rubble	19.1	16.4	22.3	37.6	21.0
Timber	11.7	15.5	14.6	7.4	8.6
Rubber	1.8	1.6	2.5	0.2	0.8
Hazardous	9.2	5.5	0.3	0.03	0.3

## 5.0 DISCUSSION

The following comments are made from observations by members of the survey team in an effort to offer constructive advice on improvements to the waste stream management and in particular towards waste reduction to landfill by recycling and recovery.

### 5.1 Paper Wastes

Paper wastes at 25% of all wastes form a major component of the waste stream. Of this quantity over 70% was assessed as cardboard generally being delivered in bulk by commercial operators. Whereas some cardboard recycling occurs at the supermarkets it was found that the staff sent the excess material onto the landfill.

Most paper is readily recycled and there are generally long term contracts available for paper wastes. This is one material that should be targeted if a waste reduction programme is initiated.

Likely recoverable rates, if a drop off system is operated, should be in order of 80% of the current cardboard and newspaper waste stream and 20% of other paper. A collection recovery programme targeted at commercial operations should increase the cardboard to at least 95% and increase the other paper recovery value substantially.

### 5.2 Plastics

A breakdown of plastics into the 7 grades of plastic was requested for this survey. This is a very difficult task as most plastics articles have no identification and without some form of testing a result was not fully achievable. In analysis of loads where known plastics were encountered, such as PVC and polystyrene, these were recorded in the appropriate category and all unknown plastics were classified as Grade 7.

It was only with the full analysis of refuse bag waste that a true picture on mix of grades was achievable as most commodity bottles and some other plastics, as found in household refuse, are marked with a recycling logo containing the grade of plastic. This waste covers less than 2% of the total waste stream and values cannot be extrapolated to the general waste stream.

There was no one large source of plastic observed during the survey. Likely target areas would be the commodity bottles of type 1, 2 and 4 plastics which could amount to a 25% recovery rate for these grades with a drop off type recovery programme.

Surveys on waste streams at other landfills have found around 60% of plastics are recyclable although not always recoverable.

Other opportunities for better plastics disposal may occur in the future with technology available to convert plastics into fuels. Trials are currently being carried out in New Zealand.

### 5.3 Putrescible Material

Putrescible material accounted for 22 tonne or 16% of the total waste stream for this survey.

The primary classification was further divided into material that was of kitchen, that is food orientated type wastes, or garden, that is vegetation orientated type wastes.

Garden waste was stockpiled separately and is easily managed this way as most of this material came as single classification loads or was in such quantity that it was easily separated from other wastes.

During the survey there were access problems with the stockpile area but this is considered only a minor maintenance problem for the site contractor. Consequently more green waste was discharged at the tip face than would be expected. No values were kept on the quantities to each area, however at least 95% capture of green waste should be achievable.

Options of garden waste management include composting or mulching with disposal by sales or by use as a surface restoration material for finished landfill areas.

Kitchen wastes can also be composted but usually requires a closed process that excludes vermin and birds. Contractors at Kaikoura Landfill have developed a cheap tunnel method of composting these wastes which may be of interest should disposal other than landfill be considered.

## 5.4 Ferrous Material

All ferrous materials are recyclable. An effort is made to stockpile these separately for recovery however it is considered the management of the stockpile area could be improved both to assist with the recovery of the steel and for the safety of the public and workstaff.

Much steel is still lost in the landfill and efforts such as a skip bin for steel items at the tip face would allow recovery of a great quantity of this material.

From observation of ferrous recovery areas at other waste facilities the management of automotive bodies and other types of steel are best kept well separated. Car bodies need to be prepared to the standard required by the steel processor and stockpiled to minimize interference and risk of injury. Such an area is best managed in a compound accessed only by authorized personnel.

Greater returns can be made by separation of certain grades of steel and advice should be sought from the scrap metal merchant purchasing the ferrous scrap.

## 5.5 Non Ferrous

Non ferrous materials are generally readily recycled, however there was no organized recycling of this material on site and apart from any informal efforts most of this material would be buried. Some refuse collection centres provide bins for the collection of this type of material which can yield a relatively high return for the effort required to manage the collection.

Many refuse centres allow aluminium can collection crates to operate on site where a school or charity benefit from the sale of cans. It would be possible for one of these to operate on site without interfering with other operations.

The analysis of refuse bag rubbish revealed very few alloy cans which could indicate aluminium can collection centres operate elsewhere in the district.

## 5.6 Glass

For the survey glass was recorded by colour. Most of the glass was bottles estimated at 96% of the waste stream with one large quantity of window glass from a repair shop.

The future of glass recycling is not good owing to the oversupply of glass products from overseas markets and the lack of opportunities or ventures requiring glass as a raw material.

Glass, being inert, is probably best left in the landfill until a suitable alternative becomes viable.

## 5.7 Textiles

Several trailer loads of used clothing were received from a welfare group during the survey. Staff disposing of the material indicated this was a regular weekly or fortnightly occurrence. With bulk waste streams like this other opportunities may be available if the material could be dispatched to a processing plant to make rags or be shredded for wadding.

Other textiles in larger quantities were carpets and furnishings with fabric covers.

Textiles are a problem if they become wet. In most cases the material observed was wet when brought to the site.

Some textiles may be suitable for adding to compost. It has been observed that items, such as natural fibre carpet, can be disposed in this way.

## 5.8 Sanitary

Sanitary wastes were mainly disposable nappies which were found in the analysis of refuse bags. No industrial sanitary wastes were observed during the survey.

## 5.9 Rubble

Nearly 50% of the rubble wastes are kept out of the tip area with provision on site to stockpile soil and hardfill elsewhere.

Plaster board at other waste facilities is recovered both for the recovery of gypsum or for inclusion in compost mixes as a source of lime. There is opportunity to do the same at this landfill.

### **5.10 Timber**

Timber wastes were recorded as either treated or untreated wastes.

Untreated timber wastes in other areas are a sought after source of fuel for boilers or drying plants or, on a smaller scale, a source of firewood for members of the community. This is one material that could be separately stockpiled for recycling rather than being disposed to landfill. Treated timber wastes are more difficult to recycle as they have the potential to cause environmental damage. It is essential that treated timber wastes are not burnt as the process releases chemicals directly to the environment. The only known opportunity for recycling treated timber wastes is for reuse of the material.

### **5.11 Rubber**

Tyres make up the major portion of rubber wastes. There is currently no profitable process to recycle tyre casings and, in whole form, they are a problem in a landfill. As currently done, all whole tyres should be removed from the waste stream and cut into smaller pieces before landfilling.

Likely recycling of old casings includes use on farms to hold down silage covers and for use in earth retaining walls.

Tyres can be used as a fuel source, however the technology is not available at present in New Zealand.

### **5.12 Hazardous Wastes**

Hazardous waste covers a variety of materials most of which are not suitable or permitted for disposal into landfill. Treated timber has not been classified in this survey as hazardous waste.

Very low levels of hazardous wastes were recorded in the waste stream and some effort is made by the site contractor to remove this material.

As such, paints, gas cylinders, oil, automotive batteries and garden chemicals, when located, were removed and placed in separate storage. It was positive to see that all gas cylinders were stored in open conditions, which lessens any risk associated with fire.

Neither the contractor nor the site is prepared fully to manage the hazardous waste stream and consequently, a number of items were recovered from the tip face by the survey team. It is likely hazwaste at other times may be buried unnoticed.

Many waste sites around the country have a drop off area for such wastes where staff, who have some form of training, can identify and manage the waste pending suitable disposal.

Further consideration should be made towards more lockable storage as the single lockup was found to contain acids and cyanides stored side by side. These items reacting together can have fatal consequences and must be kept in separate storage.

It is therefore recommended that consideration be given to providing further lockable storage, a larger public accessible waste oil collection facility and that staff receive some formal training on identification and management of this waste stream.

## **6.0 ACKNOWLEDGEMENTS**

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I would like to thank the following:

The landfill staff of West Reef who willingly assisted with survey activities and allowed disruption of activities at the tip face to permit completion of load analysis.

Mike Mackie, who willingly assisted with all field work including the analysis of bags.

## 7.0 REFERENCES

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## 8.0 APPENDIX

### 8.1 : Appendix 1: Conversion factors for volume to weight calculations

Classification	Standard kg/m <sup>3</sup>	Range kg/m <sup>3</sup>
Paper	200	100 loose, 200 compactor, cardboard boxes flattened 380
Plastic	200	100 – 370, 17.5 polystyrene, 410 nets
Putrescible	250	610 mussels, 310 kina 300 compactor, 400 greenwaste, 580 offal, 425 garlic, 1100 olives
Ferrous	500	250 appliances, 500 mixed / heavy Individual fridges 45 – 80kg Stove standard type 55kg Microwave 20 -35kg Car shell 700kg ave.size
Non Ferrous	100	loose
Glass	420	400 - 420 bottles
Textile	130	Carpet 250, clothing 120
Sanitary	300	
Rubble	1000	800 shells, 1200 concrete, 1600 gravel, gib 680, builders loose 400, fullers earth 1150, ash 750,
Timber	350 - 450	215 – 492 sawdust, 517 particle board, 450 wet shavings, 250 builders loose, 400 transfer bins packed, 180 battens,
Rubber	200	Car tyre 8 ute 10 truck 20+ (kg each)
Hazardous	-	Weighed individually
Compactor trucks	500	or 250 x loose volume
Top loader	210	Envirowaste

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

Date		25/7/05	26/7/05	27/7/05	28&29/05	Total	%	%
No of Bags		12	28	5	32	77	Secondary	Primary
Paper	News	2.1	7.6	0	7.18	16.88	2.97 %	
	Cardboard	1.4	4.6	0	5.68	11.68	2.05 %	
	Other	5.6	22.8	6.8	41.15	76.35	13.43 %	
<b>Total paper</b>						<b>104.91</b>		<b>18.5 %</b>
Plastics	1	3.3	0.6	0.35	2.70	6.95	1.22 %	
	2	5.4	0.8	0.3	4.0	10.5	1.85 %	
	3	0	0	0	0	0	0 %	
	4	4.6	0.8	0.45	3.70	9.55	1.68 %	
	5	0.6	1.6	0	1.4	3.6	0.63 %	
	6	0.08	0.4	0.15	1.0	1.63	0.29 %	
	7	4.2	27.6	6.45	26.0	64.25	11.30 %	
<b>Total Plastics</b>						<b>96.48</b>		<b>17.0 %</b>
Putrescible	Kitchen	15.0	49.1	9.3	39.5	112.9	19.86 %	
	Garden	5.4	0	0.2	1.6	7.2	1.27 %	
<b>Total Putrescible</b>						<b>120.1</b>		<b>21.2 %</b>
Ferrous	Cans	2.4	3.6	1.3	12.3	19.6	3.45 %	
	Whiteware	0	0	0	0	0	0 %	
	Other	0	0	0	0	0	0 %	
<b>Total Ferrous</b>						<b>19.6</b>		<b>3.4 %</b>
Non Ferrous		0.8	0.7	0.35	0.50	2.35	0.41 %	
<b>Total Non Fer</b>						<b>2.35</b>		<b>0.4 %</b>
Glass	Clear	0.7	15.4	2.8	8.6	27.5	4.84 %	
	Green	13.9	5.2	0	16.5	35.6	6.26 %	
	Brown	22.4	14.2	2.2	30.7	69.5	12.22 %	
<b>Total Glass</b>						<b>132.6</b>		<b>23.3 %</b>
Textiles	Clothes	1.0	5.2	0.6	3.6	10.4	1.83 %	
	Other	0	0	0	2.4	2.4	0.42 %	
<b>Total Textiles</b>						<b>12.8</b>		<b>2.3 %</b>
Sanitary		0	18.1	2.7	21.4	42.2	7.42 %	
<b>Total Sanitary</b>						<b>42.2</b>		<b>7.4 %</b>
Rubble	Ash	1.0	9.7	4.1	16.5	31.3	5.50 %	
	Soil	0	0	0	0	0	0 %	
	Concrete	0	0	0	0	0	0 %	
	Plaster	0	0	0	0	0	0 %	
	Other	4.2	0	0	0	4.2	0.74 %	
<b>Total Rubble</b>						<b>35.5</b>		<b>6.2 %</b>
Timber	Treated	0	0	0.05	0	0.05	0.01 %	
	Untreated	0	0	0	0.2	0.2	0.04 %	
<b>Total Timber</b>						<b>0.25</b>		<b>0.05 %</b>
Rubber	Tyres	0	0	0	0	0	0 %	
	Other	0	0	0	0	0	0 %	
<b>Total Rubber</b>						<b>0</b>		<b>0 %</b>
Hazardous		0	0.7*	0	1.1*	1.8	0.3 %	
<b>Total Hazardous</b>						<b>1.8</b>		<b>0.3 %</b>

\* all hazardous waste consisted of small batteries