

COMPOSITION OF WASTE

**McLeans Pit Landfill
SWAP Study
20 – 26 January 2007**

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1.0 EXECUTIVE SUMMARY

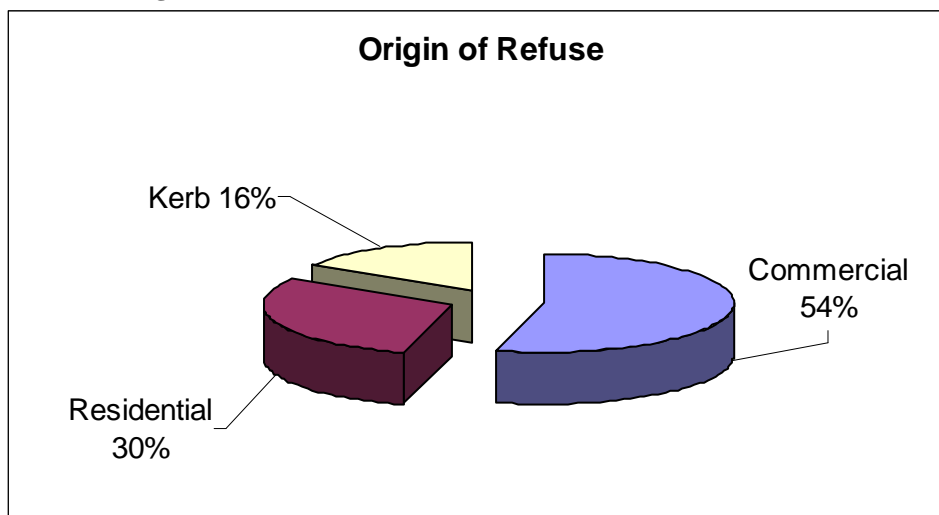
This report presents the results of the second waste analysis survey to be conducted at the McLeans Pit Landfill. The results were gained using the SWAP strategy developed by the Ministry for the Environment to standardize information gathered on waste streams and waste disposal throughout New Zealand. The strategy endeavours 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 three categories, residential, commercial, and kerbside collection. The values for the origin of materials are presented in Chart 1 below.

Chart 1: Origin of Refuse



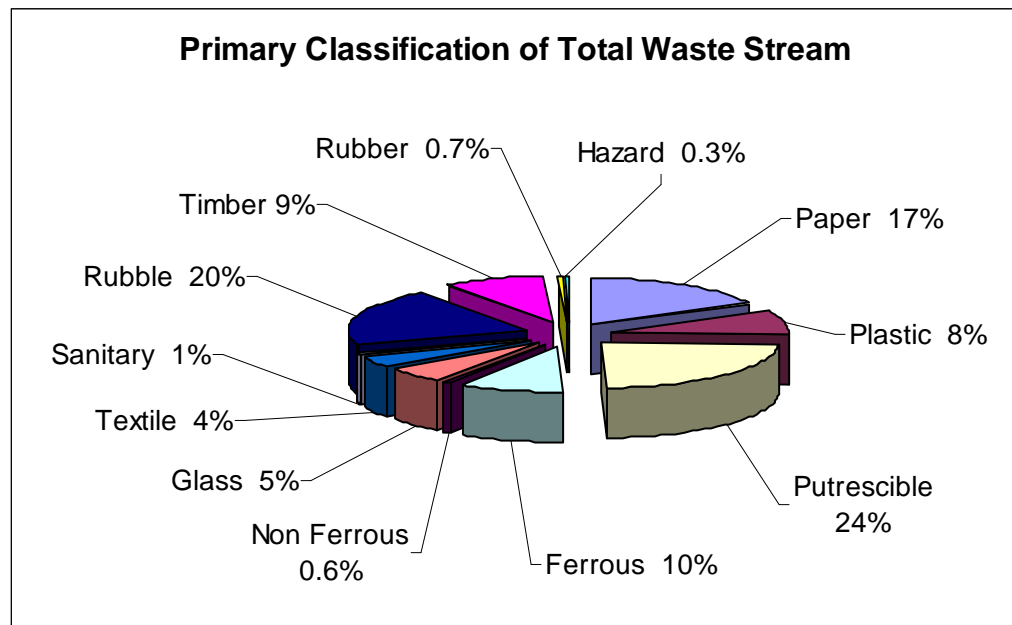
Transport values were recorded into five classes of vehicle: cars, utilities, trailers, compactor vehicles and trucks. A total of 586 vehicles accessed the landfill disposing of 777m³, equating to 163 tonne, of refuse during the survey period.

These values have been extrapolated into annual values, for reporting purposes only, of 40,000m³ (loose) and 8,500 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, which were 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 5.23kg 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 only the results from the analysis of kerb bags refuse were recorded.

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

The overall quantity of refuse increased by 12,700kg or 8.4%. This occurred mainly in the classifications of rubble and textiles, rubble increasing by 10,000kg and textile 2,800kg.

Glass and paper decreased significantly, glass by 1,900kg and paper 3,500kg.

An expected increase in putrescible waste did occur, up 2,500kg, however this increase did not occur in garden waste as expected for a seasonal variation but with kitchen wastes. Garden waste was up 169kg and kitchen waste up 2,300kg.

Baseline data from MfE is presented to allow comparison with other waste facilities throughout the country, however this database has not been updated since the McLeans 2005 survey, therefore the results of similar studies in Marlborough and Westport are included. Cardboard and newspaper are recycled on site capturing an estimated 15% of the paper waste stream. Timber wastes are often separated into an area where informal recovery is made for building material or firewood. Likewise most ferrous items are separated for recovery as scrap steel.

Garden putrescible wastes are separated and used as an intermediate cover material. There is potential for this material to be composted.

Hazardous waste is collected and either stored for collection by other parties or, in the case of paints, processed on site. LPG cylinders are decommissioned on site and components recycled.

One large quantity of hazardous material was recorded, being an estimated 300kg of asbestos pipe. This was stored in an isolated area to be recovered later for burial in the landfill.

Hazardous wastes do not appear to be a problem in the landfill.

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 McLeans Pit Landfill, Greymouth.

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 Untreated 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 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 McLeans Pit Landfill waste stream.

This was conducted during the period 7 – 13 August 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, which is the same period used for the 2005 survey. The McLeans Pit landfill operates 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 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 three 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.

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 five of the seven survey days.

The portable vehicle scales used were limited to single set axle set vehicles only.

3.3 Methodology

The survey was predetermined for, and carried out, over the week of 20th – 26th January 2007 on site at the McLeans Pit Landfill.

Survey forms capturing the required data were developed and used to ensure sufficient information was recorded on site.

A recording base was set up in the open front shed adjacent to the site office at the entry to the landfill. From there all vehicles could be observed as they entered the site and loads inspected, often with members of the team following vehicles to various discharge points to inspect and analyse loads. 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 around Greymouth 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

The origin of waste was recorded as one of three categories: Commercial, Residential or Kerb. These same categories were used in the 2005 survey.

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.

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.

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

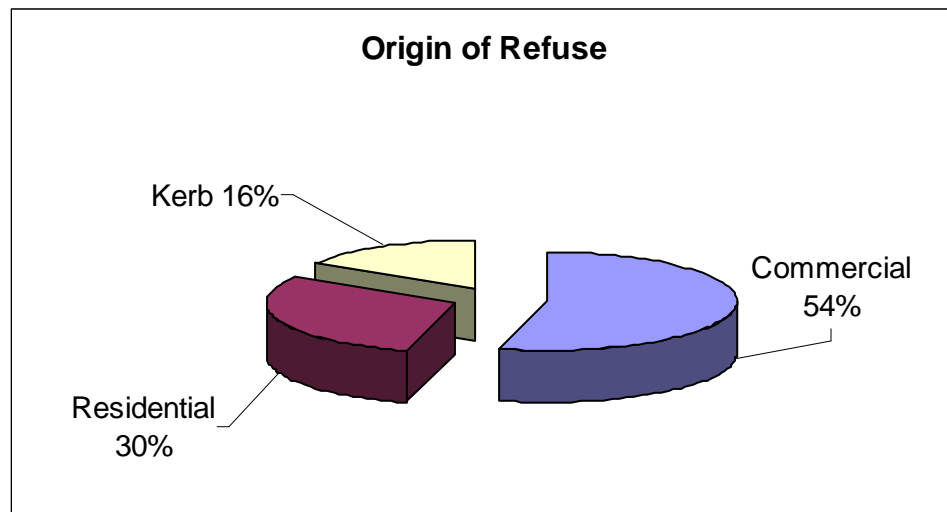


Table 1: Origin of Refuse – Numerical Values

Origin	Weight kgs	Percentage
Commercial	88,617	54.2 %
Residential	48,618	29.7 %
Kerbside	26,400	16.1 %
Total	163,635	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 three 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

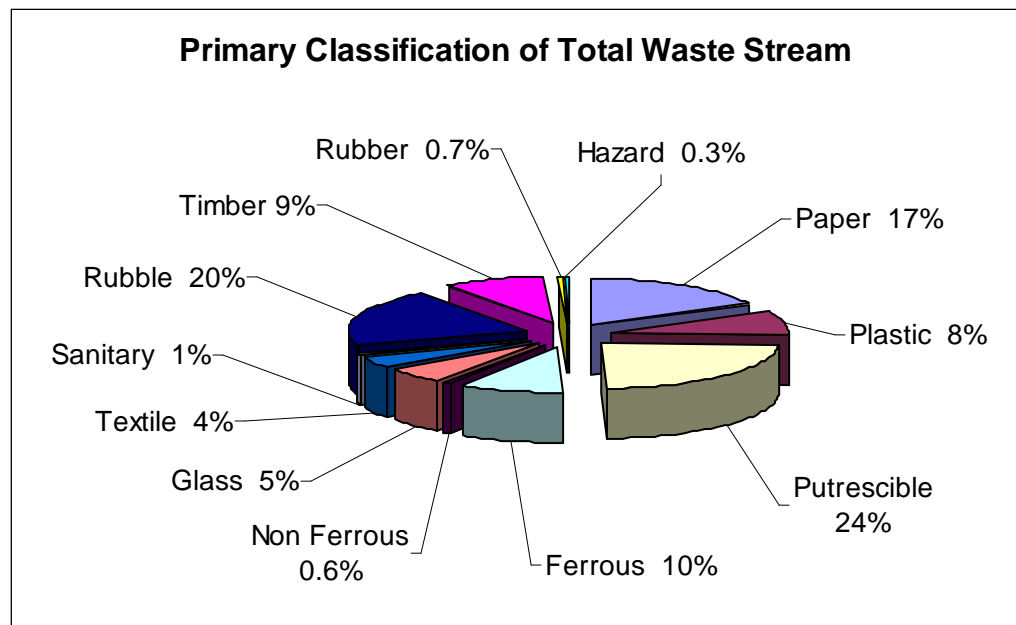


Table 2: Primary Classification Values of the Total Waste Stream

Classification	Total Kgs	% Total
Paper	28,478	17.4
Plastic	13,138	8.0
Putrescible	39,207	23.9
Ferrous	15,679	9.6
Non Ferrous	1,012	0.6
Glass	8,915	5.4
Textile	6,585	4.1
Sanitary	1,477	0.9
Rubble	32,966	20.2
Timber	14,685	8.9
Rubber	1,081	0.7
Hazardous	412	0.3
Total	163,635	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

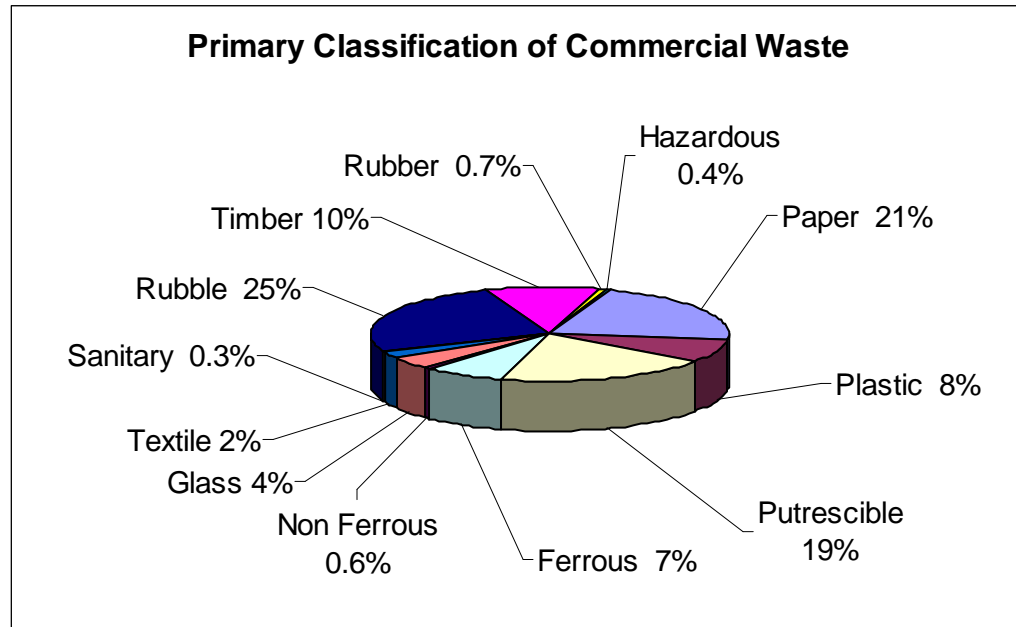


Table 3: Primary Classification Values of Commercial Waste

Classification	Total Kgs	% Commercial	% Total Waste
Paper	18,689	21.1	11.4
Plastic	7,485	8.5	4.6
Putrescible	17,090	19.3	10.4
Ferrous	6,382	7.2	3.9
Non Ferrous	565	0.6	0.3
Glass	3,582	4.0	2.2
Textile	2,143	2.4	1.3
Sanitary	256	0.3	0.2
Rubble	22,356	25.2	13.7
Timber	9,094	10.3	5.6
Rubber	654	0.7	0.4
Hazardous	321	0.4	0.2
Total	88,617	100	54.2

4.3.3 Primary Classifications of the Residential Waste Stream

Residential waste arrived at the landfill predominantly in small loads in cars, utes and trailers. A smaller quantity was delivered by truck or compactor vehicle.

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

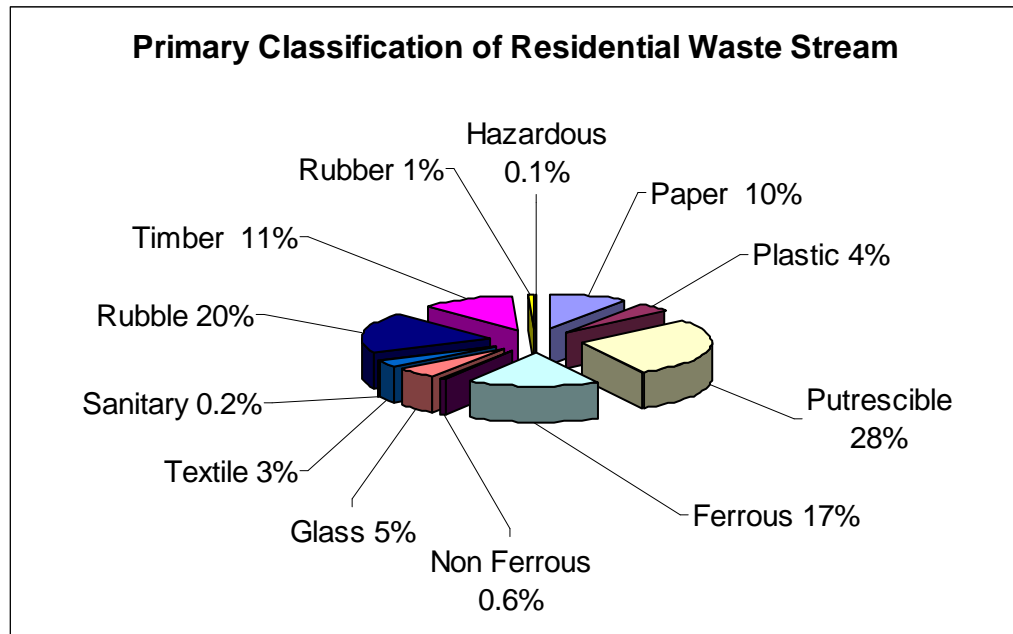


Table 4: Primary Classification Values of Residential Waste

Classification	Total Kgs	% Residential	% Total Waste
Paper	4774	9.8	2.9
Plastic	2036	4.2	1.2
Putrescible	13695	28.1	8.4
Ferrous	8056	16.6	4.9
Non Ferrous	289	0.6	0.2
Glass	2614	5.4	1.6
Textile	1486	3.1	0.9
Sanitary	112	0.2	0.1
Rubble	9633	19.8	5.9
Timber	5485	11.3	3.4
Rubber	374	0.8	0.2
Hazardous	64	0.1	0
Total	48618	100	29.7

4.3.4 Primary Classification of the Kerb Collection Waste Stream

The kerbside collection is carried out each weekday by contractors and covers both residential and commercial properties around Greymouth and surrounding small settlements in the district. The material is collected in a large compactor vehicle. This same vehicle also picked up the contents from official wheelie bins. The results do not include bags delivered with other

waste streams such as commercial skips or residential loads. Kerbside refuse during the survey period weighed 26,400 kg which equates to 16.1 % 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

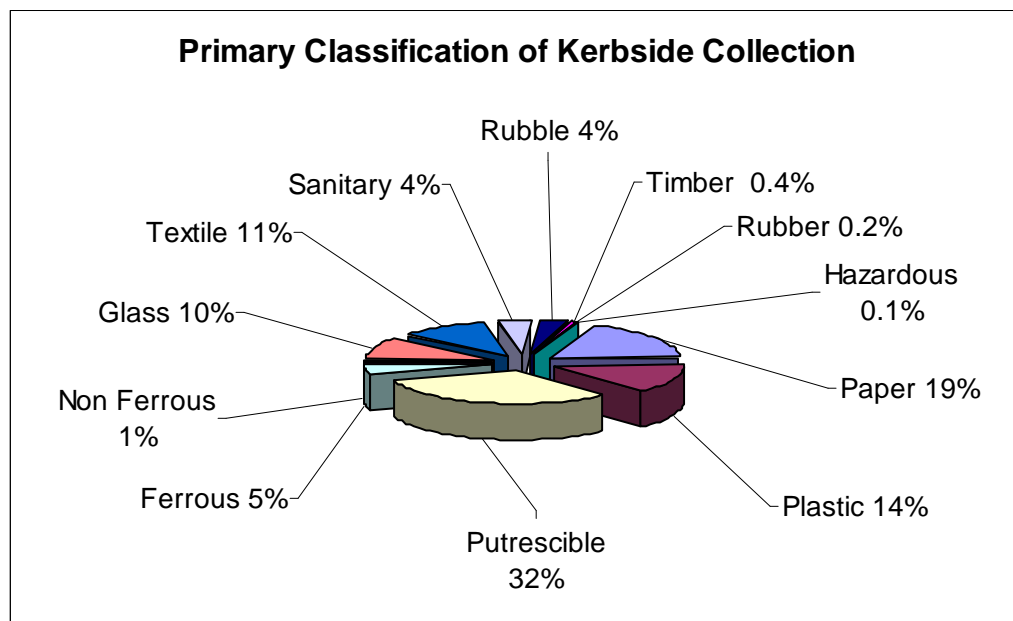


Table 5: Primary Classification of Kerb Collection Waste

Classification	Total Kgs	% Kerb	% Total Waste
Paper	5,015	19.0	3.0
Plastic	3,617	13.7	2.2
Putrescible	8,422	31.9	5.1
Ferrous	1,241	4.7	0.8
Non Ferrous	158	0.6	0.1
Glass	2,719	10.3	1.7
Textile	2,956	11.2	1.8
Sanitary	1,109	4.2	0.7
Rubble	977	3.7	0.6
Timber	106	0.4	0.06
Rubber	53	0.2	0.03
Hazardous	27	0.1	0.02
Total	26,400	100	16.1

4.3.5 Summary of Primary Classification Values of the Total Waste Stream

Table 6 presents a summary of the classification values by origin and as a total of the waste stream.

Table 6: Summary of Primary Classification Values of the Waste Stream (By weight kgs)

Classification	Commercial	Residential	Kerb	Total	% Total
Paper	18,689	4,774	5,015	28,478	17.4
Plastic	7,485	2,036	3,617	13,138	8.0
Putrescible	17,090	13,695	8,422	39,207	23.9
Ferrous	6,382	8,056	1,241	15,679	9.6
Non Ferrous	565	289	158	1,012	0.6
Glass	3,582	2,614	2,719	8,915	5.4
Textile	2,143	1,486	2,956	6,585	4.1
Sanitary	256	112	1,109	1,477	0.9
Rubble	22,356	9,633	977	32,966	20.2
Timber	9,094	5,485	106	14,685	8.9
Rubber	654	374	53	1,081	0.7
Hazardous	321	64	27	412	0.3
Total	88,617	48,618	26,400	163,635	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
- Untreated

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

4.4.2 Secondary Classification of Paper

Paper makes up 17.0% of the total waste stream. This was boosted by two large loads of news print originating from a printing office.

Analysis for secondary classifications of paper was carried out over the full survey.

The analysis for paper, except kerb bags, was by visual assessment of loads. Kerb bags values were obtained from the bag analysis study.

The values determined are shown in Chart 8 and Table 7 below. This information is further broken down by including origin of loads and is shown in Table 8.

Chart 8: Secondary Classification Values of Paper

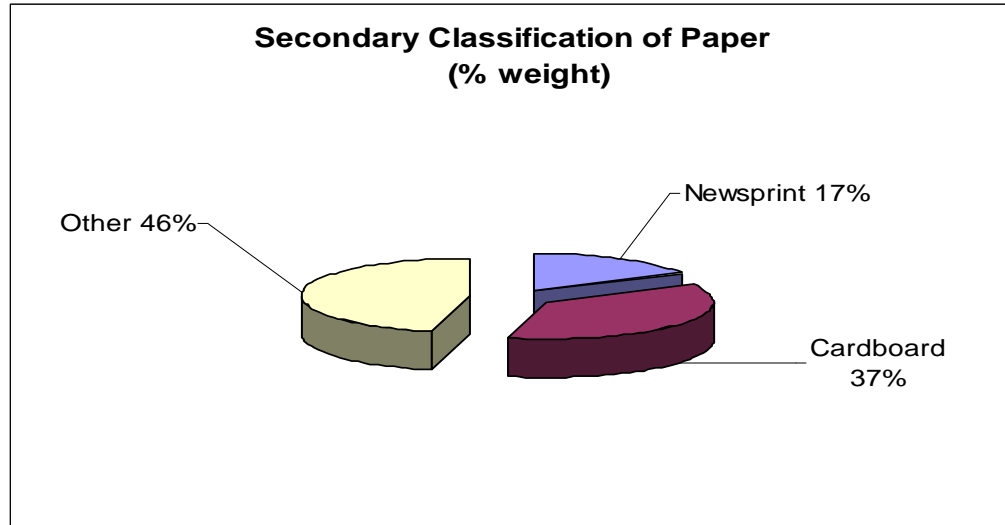


Table 7: Secondary Classification Values of Paper

Classification	Total Kgs	% Paper Wastes	% Total Wastes
Newspaper	4,941	17.3	3.0
Cardboard	10,361	36.4	6.3
Other	13,176	46.3	8.1
Totals	28,478	100.0	17.4

Table 8: Secondary Classification of Paper by Origin

Classification	Total Kgs	% Paper Wastes	% Total Wastes
Commercial News	3,133	11.0	1.9
Commercial Card	7,370	25.9	4.5
Commercial Other	8,186	28.7	5.0
Residential News	304	1.1	0.2
Residential Card	2,278	8.0	1.4
Residential Other	2,192	7.7	1.4
Kerb News	1,504	5.3	0.9
Kerb Card	713	2.5	0.4
Kerb Other	2,798	9.8	1.7
Total	28,478	100.0	17.4

4.4.3 Secondary Classification of Plastics

Plastics make up 8% of the total waste stream.

The SWAP secondary classifications for plastic are based on industrial identification codes for the recycling of plastic. These are generally 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 super market bags
- Grade 4 Bread bags, 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 9 and Table 9 below.

Chart 9: Secondary Classification Values of Kerbside Plastics

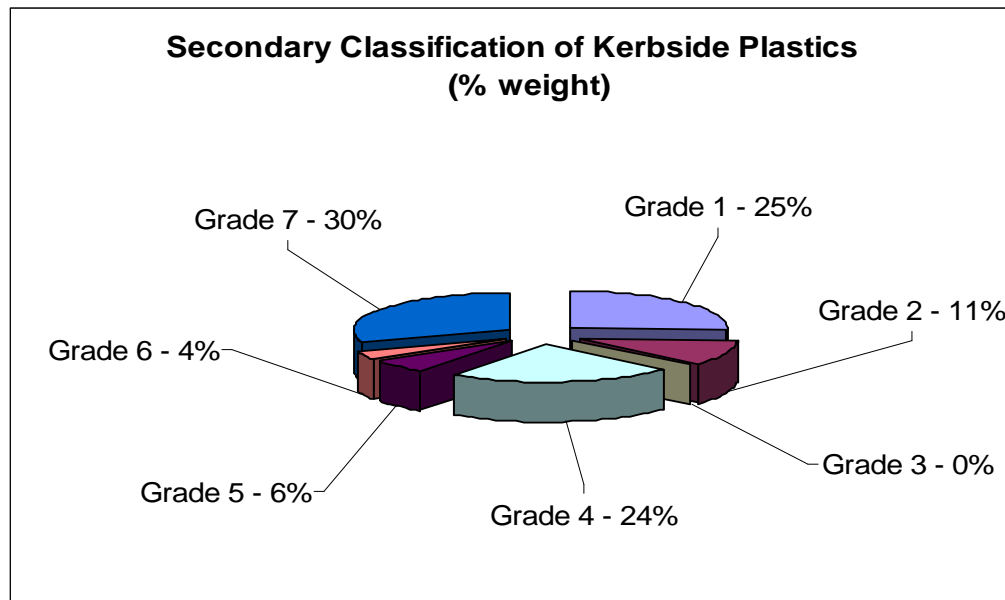


Table 9: Secondary Classification of Kerbside Plastics

Classification	Sample Kgs	Estimate for Kerb Plastics	% Kerb Plastics
Grade 1	11.9	911	25.2
Grade 2	15.3	405	11.2
Grade 3	0	0	0
Grade 4	11.1	850	23.5
Grade 5	2.9	221	6.1
Grade 6	1.7	130	3.6
Grade 7	14.4	1100	30.4
Total	47.3	3617	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 help determine quantities both kerb bags and compactor truckloads were sampled and values for each putrescible component determined. All other loads were assessed visually.

The results are shown in Chart 10 and Tables 10 and 11 below.

Chart 10: Secondary Classification Values of Putrescible Waste

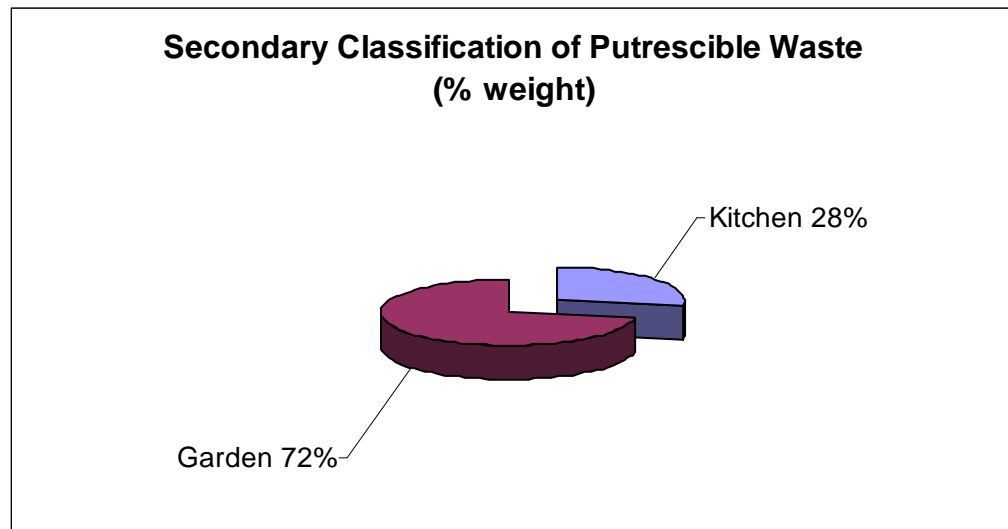


Table 10: Secondary Classification of Putrescible Waste

Classification	Total Kgs	% Putrescible Wastes	% Total Wastes
Kitchen	11,038	28.2	6.7
Garden	28,169	71.8	17.2
Total	39,207	100.0	23.9

Table 11: Secondary Classification of Putrescible Waste by Origin

Origin	Total Kgs	% Putrescible wastes	% Total wastes
Commercial Kitchen	3,808	9.7	2.3
Commercial Garden	13,282	33.9	8.1
Residential Kitchen	788	2.0	0.5
Residential Garden	12,907	32.9	7.9
Kerb Kitchen	6,442	16.4	3.9
Kerb Garden	1,980	5.1	1.2
Total	39,207	100.0	23.9

4.4.5 Secondary Classification of Timber Wastes

Secondary classification of timber wastes involved the identification of all timber products into treated and untreated 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 11 and Tables 12 and 13 below.

Chart 11: Secondary Classification Values of Timber Wastes

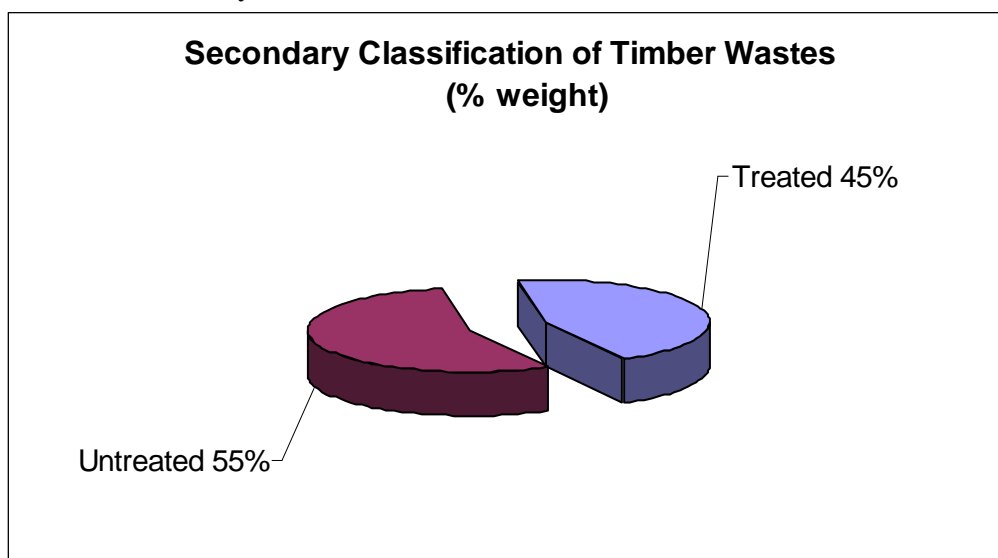


Table 12: Secondary Classification of Timber Wastes

Classification	Total Kgs	% Timber Wastes	% Total Wastes
Treated	6,615	45	4.0
Untreated	8,070	55	4.9
Total	14,685	100	8.9

Table 13: Secondary Classification of Timber Wastes by Origin

Origin	Total Kgs	% Timber wastes	% Total wastes
Commercial treated	3,767	25.6	2.3
Commercial untreated	5,327	36.3	3.2
Residential Treated	2,795	19.0	1.7
Residential Untreated	2,690	18.3	1.6
Kerb Treated	53	0.4	0.03
Kerb Untreated	53	0.4	0.03
Total	14,685	100.0	8.9

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 that analysis of a minimum of 60 refuse bags is needed to give a 95% confidence level on a precision of plus or minus 15% for classifications of 20% or greater. This means that by analysing the contents of 60 or more bags we should have a reasonable average value for the main components of this waste stream.

A total of 65 bags were analysed and these contained 394 kg of refuse.

4.5.2 Average Bag Weight and Refuse Density

Along with the 65 bags analysed for primary classification a further 222 bags were weighed and an average weight calculated from the total.

This mean value equated to 5.2 kg.

Table 14: Average Bag Weight (kgs)

Sample No	No of Bags	Weight kg	Average kg
1	222	1,108	4.99
2	65	394	6.06
Total	287	1,502	5.23

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
- 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 less than 2m³ capacity. The largest trailer volume recorded was 5m³. Vehicles towing trailers were not recorded unless they also carried refuse.

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, with the maximum volume being 20m³.

A total of 586 vehicles transported refuse to the landfill during the survey.

Detail on the weight of refuse and individual vehicle numbers is given in Chart 12 and Table 15 below.

Vehicle counts were up significantly on the previous survey from 451 to 586, a 30% increase in vehicle movements. In particular utility vehicle whose numbers increased by 61%.

Chart 12: Refuse by Transport Category

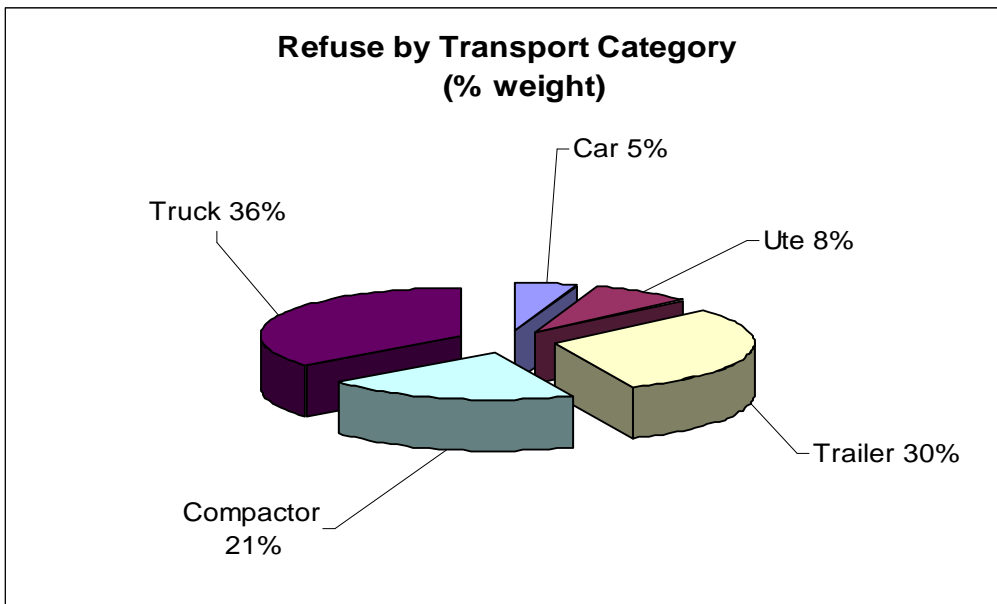


Table 15: Refuse by Transport Category

Category	No of Vehicles	Weight kgs	% Total Weight
Car	163	8,004	4.9
Ute	150	13,599	8.3
Trailer	195	49,586	30.3
Compactor	10	33,950	20.7
Truck	68	58,496	35.8
Total	586	163,635	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 13 and Table 16 below.

Chart 13: Refuse by Transport and Origin

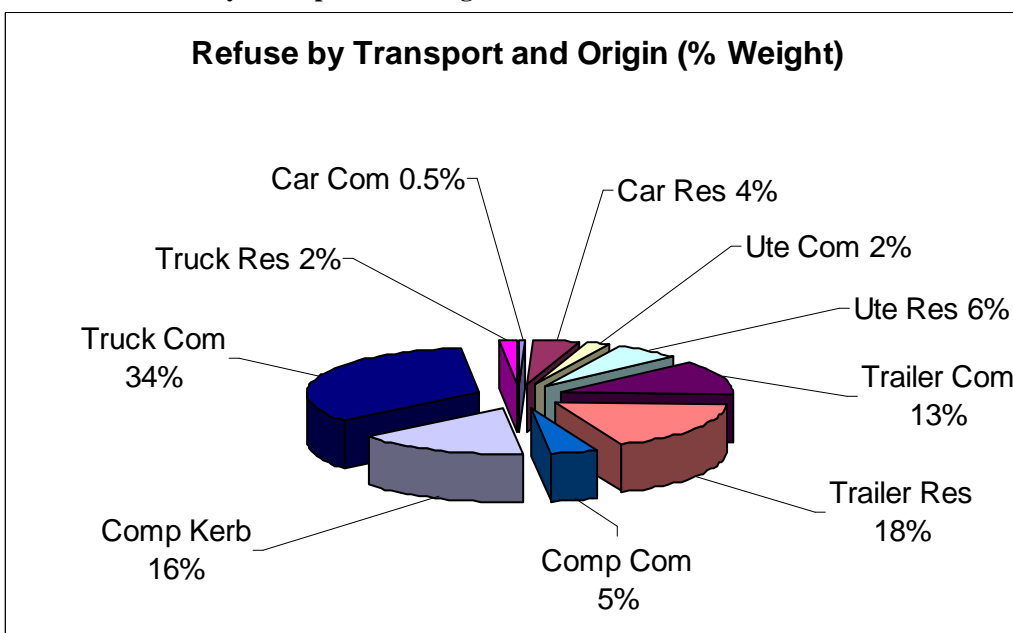


Table 16: Weight of Refuse by Transport Category and Origin of Source

	Commercial	Residential	Kerb	Total
Car	860	7,144	0	8,004
Utility	3,823	9,776	0	13,599
Trailer	20,664	28,922	0	49,586
Compactor	7,550	0	26,400	33,950
Truck	55,720	2,776	0	58,496
Total	88,617	48,618	26,400	163,635

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 17: Estimated Annual Volume and Weight Values

	Survey Period	Estimated Annual Value
Volume (loose)	777 m3	40,000 m3
Weight kgs	163,635 kgs	8,500 tonne

4.7.2 Density of Loose Refuse

A value was determined from the summary survey data. This value is shown in Table 18. It has been calculated on the basis of loose volume.

Table 18: Average Density of Loose Refuse

Total weight kgs	163,635
Total volume m3	777
Average Density	210 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 2005 study and have been plotted on the following charts to show where changes are occurring.

The results are presented by showing categories both as a percentage of the waste stream and by weight, as these formats can present quite different views. To improve reading of the results two charts have been drawn for each presentation, one showing the high value categories and the other the lower value categories.

Charts 14 and 15 below present trends expressed as a percentage of the waste stream whereas Charts 16 and 17 expresses trends based on true weight.

In analysing trends consideration should be made of both the percentage and weight charts. Full primary values for the 2005 and this survey are shown in Table 19.

Chart 14: Classification Trend by Percentage - High Values

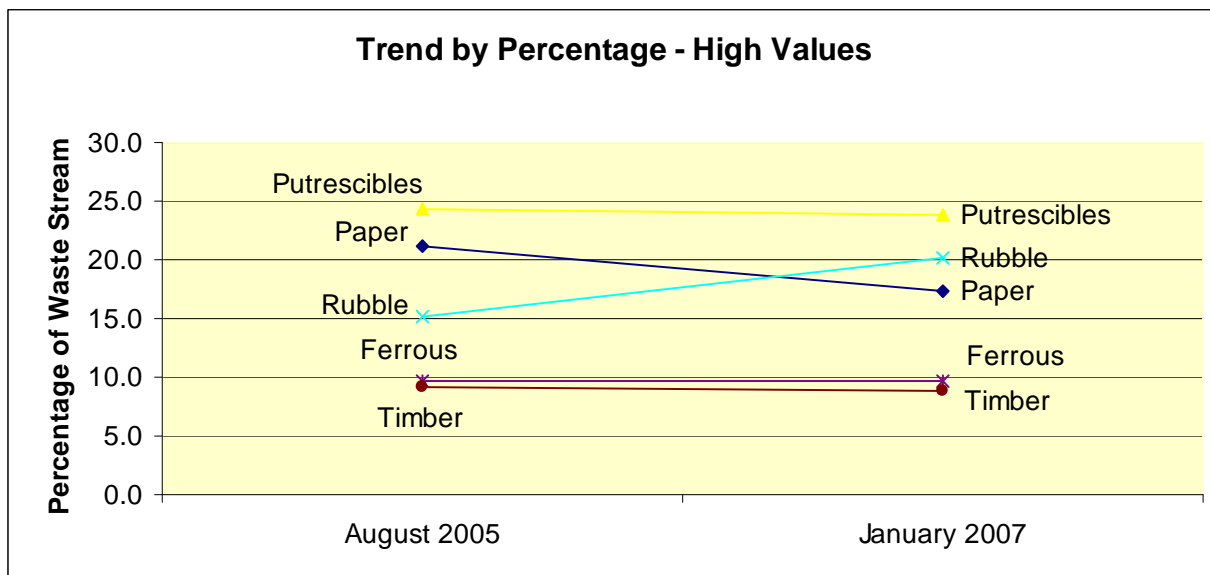


Chart 15: Classification Trend by Percentage - Low Values

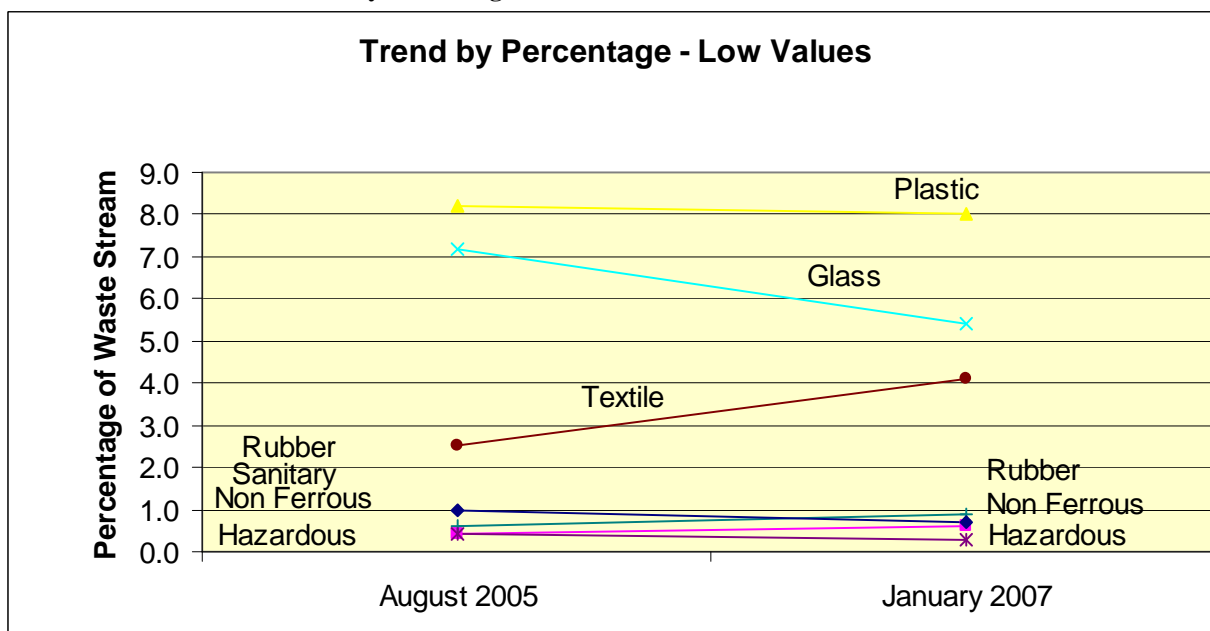


Chart 16: Classification Trend by Weight – High Values

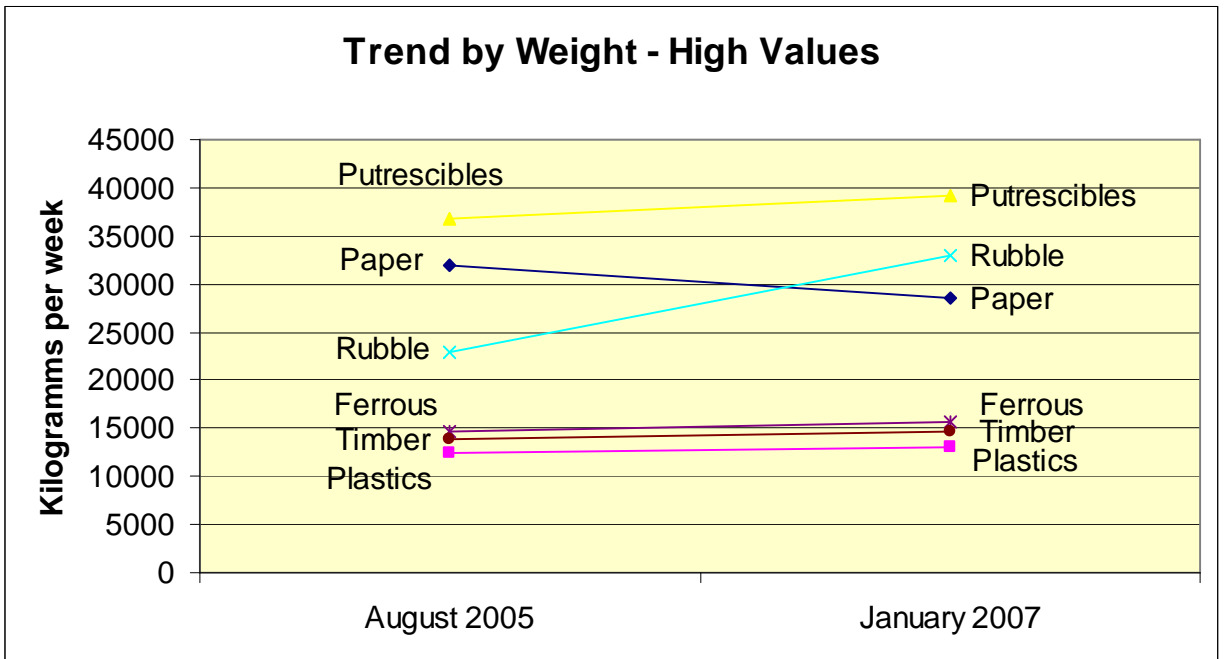


Chart 17: Classification Trend by Weight – Low Values

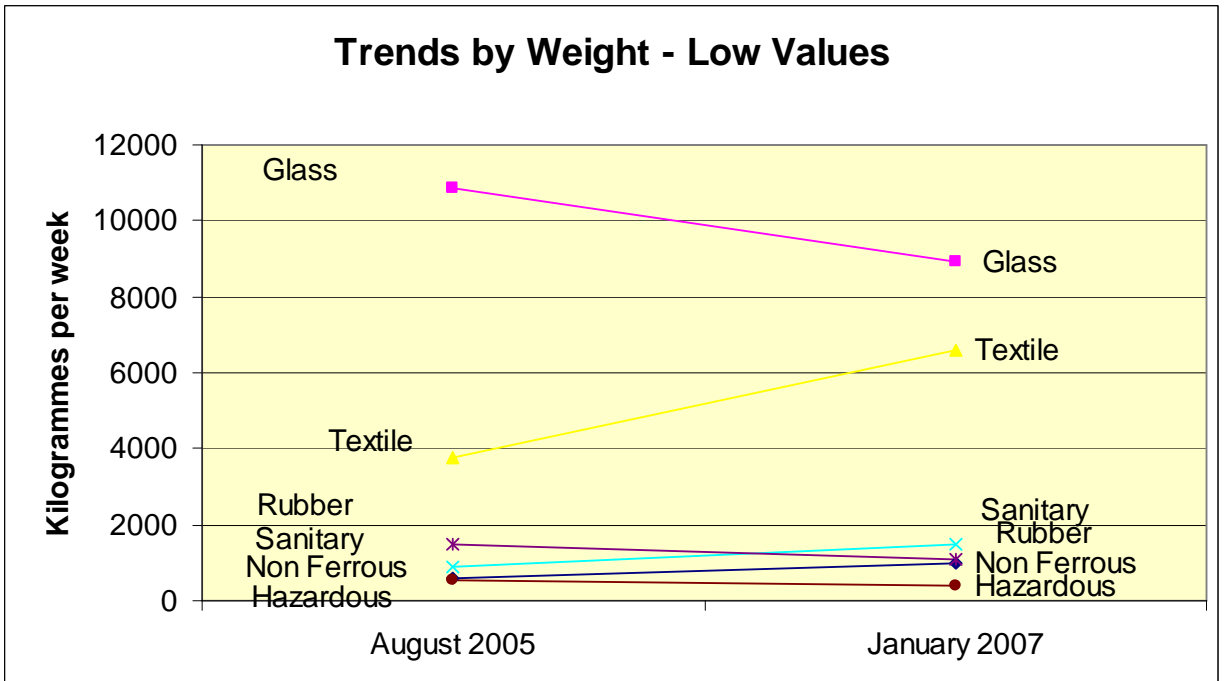


Table 19: Comparison of 2005 /2007 Primary Classification Values

Classification	2005 kgs	2007 kgs	2005%Total	2007% Total
Paper	32,034	28,478	21.2	17.4
Plastic	12,413	13,138	8.2	8.0
Putrescible	36,735	39,207	24.3	23.9
Ferrous	14,682	15,679	9.7	9.6
Non Ferrous	603	1,012	0.4	0.6
Glass	10,849	8,915	7.2	5.4
Textile	3,784	6,585	2.5	4.1
Sanitary	892	1,477	0.6	0.9
Rubble	23,002	32,966	15.2	20.2
Timber	13,893	14,685	9.2	8.9
Rubber	1,470	1,081	1.0	0.7
Hazardous	536	412	0.4	0.3
Total	150,893	163,635	100.0	100.0

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 their latest information is presented along with results from the last two studies at both the Marlborough Regional Landfill and the Westport Landfill as well as the two studies at the McLeans Pit Landfill in Table 20 below.

Table 20: Baseline Data – By Percentage of Waste Stream

	NZ mean	Hutt	Kaikoura	Marlb	Marlb	Westport	Westport	McLeans	McLeans
	2004	Dec 2004	Sept 2004	Jan 2005	Sept 2006	July 2005	Jan 2007	August 2005	January 2007
Paper	11.5	11.0	9.0	11.5	10.3	25.5	15.0	21.2	17.4
Plastic	7.6	7.6	12.8	11.1	10.0	7.6	5.8	8.2	8.0
Putrescible	22.0	21.2	24.9	26.0	23.0	16.2	19.8	24.3	23.9
Ferrous	6.0	8.0	3.5	1.6	5.0	7.7	5.7	9.7	9.6
Non ferrous	0.9	1.1	2.6	0.1	0.2	0.2	0.4	0.4	0.6
Glass	2.8	2.3	1.5	3.7	3.5	8.3	6.6	7.2	5.4
Textiles	5.6	9.0	2.7	0.7	1.7	1.8	2.6	2.5	4.1
Sanitary	1.8	0.8	3.3	0.2	1.4	2.0	1.2	0.6	0.9
Rubble	19.1	16.4	22.3	37.6	24.7	21.0	37.4	15.2	20.2
Timber	11.7	15.5	14.6	7.4	19.0	8.6	4.9	9.2	8.9
Rubber	1.8	1.6	2.5	0.2	0.8	0.8	0.6	1.0	0.7
Hazardous	9.2	5.5	0.3	0.03	0.2	0.3	0.1	0.4	0.3

5.3 Paper

Some paper and cardboard is recovered on site and quantities depend greatly on the public using collection bins provided by a private contractor. When activities permitted, the site attendant recovered cardboard and paper from the transfer pit before refuse was carted to the landfill. A total of 10.3 tonne of cardboard was recorded of which an estimated 15% is recovered. 70% of the cardboard is from commercial operations with the larger quantities being discharged directly to the landfill. No loads, which consisted of cardboard only, were recorded.

The weather has an impact on recovery of paper and cardboard as wet material is not acceptable for recycling.

The contractor servicing the bins indicated he removed cardboard from commercial premises in the district but was not willing to indicate quantities.

Paper has decreased by weight and percentage since the August 2005 survey.

Recycled quantities are included in the total results.

5.4 Plastics

The classification of plastics is very difficult for all loads 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.

There is no current recycling of plastics.

5.5 Putrescible Material

Putrescible material by weight has increased since the 2005 survey and this would be expected as a seasonal change however all the change is in kitchen waste as values for garden waste have remained static.

Putrescible still makes up the largest component of the waste stream at 23.9% by weight.

5.6 Hazardous Wastes

Hazardous waste is managed on site by West Road's staff. It appears their actions minimise the quantity of this material being disposed in the landfill. During the survey only one large load of hazardous waste was recorded, this being an estimated 300kg of asbestos pipe which was placed in an isolated area until such time it can be buried in a specified area of the landfill. The most common hazardous waste was paint and oil which was generally identified by the public on arrival at the landfill. This along with several containers of similar items recovered from the transfer pit were removed by site staff for processing or, with oil, bulked in a purpose built tank.

Other hazardous material encountered included LPG cylinders, pesticides and automotive batteries. Hazardous waste in refuse bags consisted mainly of small dry cell batteries and solvents. Pesticides are stored on site along with other hazardous materials.

LPG cylinders are decommissioned on site. The metal components are retained for recycling.

5.7 Recycling

Ferrous or steel items are separated for recovery and by volume have the greatest impact on the waste to landfill. Apart from paper wastes no other serious recycling occurs. There is potential for composting operations.

6.0 ACKNOWLEDGEMENTS

I would like to thank the following:

Jamie and Chloe who willingly assisted with all field work.

The West Roads staff at McLeans Pit Landfill, who allowed interruption of their work and willingly assisted with the intention of the survey.

7.0 REFERENCES

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Ministry for the Environment, November 1992, *The New Zealand Waste Analysis Protocol*. Ministry for the Environment: Wellington.

Ministry for the Environment, March 2002, *The New Zealand Waste Strategy*. Ministry for the Environment: Wellington.

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		
	diatomaceous earth		1150	1200	Winery filter medium
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		Cut & stacked in 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 & NS		210		
compactor			250 loose		500 compacted

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

Date		23/1/07	24/1/07	25/1/07	26/1/07	Total	% of total waste	
No of Bags		15	10	30	10	65	Secondary	Primary
Paper	News	3.5	4.7	12.7	1.6	22.5	5.7%	
	Cardboard	2.0	1.6	5.6	1.4	10.6	2.7%	
	Other	9.9	6.5	18.0	7.3	41.7	10.6%	
Total paper						74.8		19.0 %
Plastics	1	2.4	2.7	4.7	2.2	13.6	3.5%	
	2	2.1	0.6	1.9	0.7	6.0	1.5%	
	3	0	0	0	0	0	0%	
	4	4.3	2.1	2.2	2.7	12.7	3.2%	
	5	0.7	0.4	1.1	0.7	3.3	0.8%	
	6	0.6	0.1	0.1	0.9	1.9	0.5%	
	7	2.9	3.5	5.2	2.8	16.4	4.2%	
Total Plastics						53.9		13.7 %
Putrescible	Kitchen	21.5	22.2	34.3	18.2		24.4%	
	Garden	14	3.5	6.0	6.0		7.5%	
Total Putrescible						125.7		31.9%
Ferrous	Cans	2.3	4.5	5.7	5.4	17.9	4.5%	
	Whiteware	0	0	0	0	0	0%	
	Other	0	0.6	0	0.2	0.8	0.2%	
Total Ferrous						18.7		4.7%
Non Ferrous		0.4	0.6	0.7	0.6	2.3	0.6%	
Total Non Fer						2.3		0.6%
Glass	Clear	2.7	1.6	4.8	3.4	12.5	3.2%	
	Green	2.5	4.3	3.3	1.0	11.1	2.8%	
	Brown	5.5	2.0	4.0	5.3	16.8	4.3%	
Total Glass						40.4		10.3%
Textiles	Clothes	17.8	12.4	13.1	0	43.3	11.0%	
	Other				1.0	1	0.2%	
Total Textiles						44.3		11.2%
Sanitary	Naps	0.6	5.1	10.3	0	16.0	4.1%	
	Other			0.5		0.5	0.1%	
Total Sanitary								4.2%
Rubble	Ash	0	0	0	0	0	0%	
	Soil	0	0	0	0	0	0%	
	Concrete	0	0	0	0	0	0%	
	Plaster	0	0	0	0	0	0%	
	Other	6.0	0.3	6.2	2.1	14.6	3.7%	
Total Rubble						14.6		3.7%
Timber	Treated	0	0.2	0.1	1.2	1.5	0.4%	
	Untreated	0	0	0	0		0%	
Total Timber						1.5		0.4%
Rubber	Tyres	0	0	0	0	0	0%	
	Other	0.5	0	0.1	0.1	0.7	0.2%	
Total Rubber						0.7		0.2%
Hazardous		0	0.1	0.5	0	0.6	0.1%	
Total Hazardous						0.6		0.1%