RPS

NWRWMG Residual Waste Project

Household Waste Compositional Analysis

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NORTH WEST REGION WASTE MANAGEMENT GROUP

NWRWMG RESIDUAL WASTE PROJECT

JANUARY 2010

HOUSEHOLD WASTE COMPOSITIONAL ANALYSIS

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1.0 INTRODUCTION

1.1 OVERVIEW

RPS Consulting Engineers were commissioned by the North West Region Waste Management Group (NWRWMG) in June 2009 to carry out a Household Waste Compositional Analysis on the kerbside collected residual waste from households in the NWRWMG.

The NWRWMG represents a voluntary grouping of seven local authorities in Northern Ireland. The membership of NWRWMG is comprised of a number of Constituent Councils which have formed this grouping expressly for strategic waste planning purposes. These Constituent Councils are currently as follows:

- Ballymoney Borough Council,
- Coleraine Borough Council,
- Derry City Borough Council,
- Limavady Borough Council,
- Magherafelt District Council,
- Moyle District Council and
- Strabane District Council.

1.2 REPORT CONTEXT

Waste characterisation or waste compositional/component analysis is a systematic approach to obtaining and analysing data from waste streams whereby the composition of waste according to the products and materials contained therein is obtained by manually sorting the waste. The analysis also provides an estimate of waste quantities generated.

As such no full waste compositional analysis project has been carried out in the NWRWMG previously however the Region was included in the Northern Ireland Environment Agency Study entitled a *"Review of Component Waste Analysis for Northern Ireland*" which was conducted by RPS and published in February 2008.

1.3 NWRWMG RESIDUAL WASTE INFRASTRUCTURE PROJECT

The NWRWMG is currently procuring waste infrastructure to treat municipal waste that has not been reused, recycled or composted. It is the intention to procure a private sector partner to design, build, operate, maintain and possibly finance facilities to treat residual or so called black bin waste and to provide associated services (including but not limited to the management, transport, sale and/or disposal of outputs from any such facilities). Other ancillary or associated infrastructure may also be required. These waste treatment facilities

are intended to facilitate the diversion of significant quantities of municipal solid waste from landfill to assist in meeting targets under the NILAS Scheme and other legal requirements, in accordance with the Waste Management Plan.

It is currently envisaged that the NWRWMG will have a requirement for:

(a) Mechanical Biological Treatment (MBT) facilities with a capacity of circa 140,000 tonnes of municipal waste per annum.

(b) Energy Recovery Facilities with sufficient capacity to treat the appropriate MBT outputs.

The NWRWMG identified the need to obtain information on the composition and characteristics of the residual waste collected in the NWRWMG in order to provide regional specific information to bidders during the procurement process and assist in informing decision making regarding specific technologies.

1.4 SCOPE

The composition of kerbside collected residual waste from representative sample areas throughout the NWRWMG has been investigated in this Study. The composition has been obtained by the physical hand sorting of the waste.

1.5 AIM OF THE STUDY

The main aim of the project was two-fold:

1. To determine the composition of residual kerbside collected waste in the NWRWMG; and
2. To assess the percentage of residual kerbside collected waste in the NWRWMG which is biodegradable i.e Biodegradable Municipal Waste (BMW).

1.6 REPORT CONTENT

This report content and structure is as follows:

- Section 2 summarises the methodology adopted for the analysis, including information on the collection and sorting of the waste and statistical analysis of the data.
- Section 3 presents the main results of the analysis including the compositions of kerbside collected household waste and also provides analyses of the biodegradable municipal waste percentage.
- Section 4 details our conclusions to the NWRWMG.

2.0 METHODOLOGY

2.1 OVERVIEW

This section of the report details the methodology employed to undertake the waste compositional analysis and therefore meet the objectives of the project. The project required waste to be collected and physically sorted from households in the NWRWMG. Figure 2.1 below sets out an overview of the project methodology.

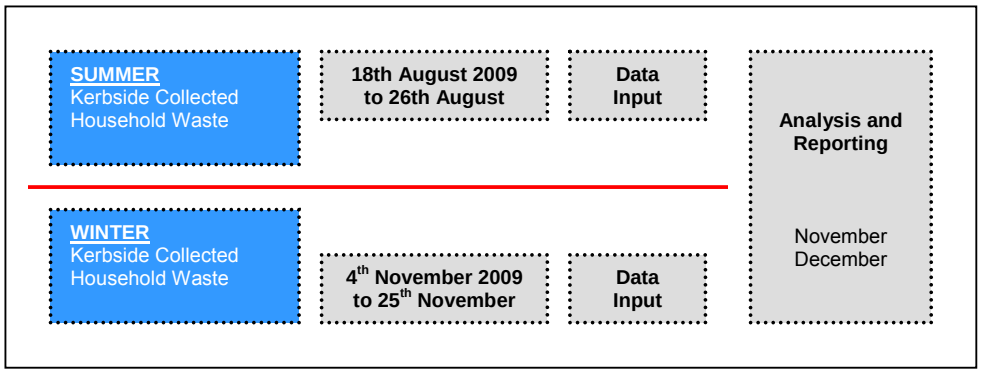

Figure 2.1 Methodology Overview

This section details the methodology employed to undertake this compositional analysis. In broad terms there were three key elements to the waste composition study:

- survey planning;
- survey execution; and
- data analysis.

As illustrated above this project was carried out in two elements:

- ***Element 1: Summer Residual Waste Compositional Analysis***
- ***Element 2: Winter Residual Waste Compositional Analysis Waste***

2.2 DEVELOPMENT OF A HOUSEHOLD PROFILE

The household profile for the NWRWMG was established using ACORN (A Classification of Residential Neighbourhoods) data.

2.2.1 ACORN (A Classification of Residential Neighbourhoods)

The classification of socio-economic variation chosen was "ACORN" (A Classification of Residential Neighbourhoods). ACORN combines geography with demographics and lifestyle information, places where people live with their underlying characteristics and behaviour, in order to create a tool for understanding the different types of people in different areas. By

analysing significant social factors and consumer behaviour, it provides an understanding of the different types of consumers throughout the region. It is an area profiling system which represents declining affluence and it groups the entire UK population into five categories as follows:

1. ACORN 1 - Wealthy Achievers
2. ACORN 2 - Urban Prosperity
3. ACORN 3 - Comfortably Off
4. ACORN 4 - Moderate Means
5. ACORN 5 - Hard Pressed

2.2.2 Sampling Design

A "grouped household-based" approach was employed for the collection and analysis of samples in accordance with best practice and European Commission guidance for analysis of waste. Samples were taken from thirty-five households, a representative number, for analysis.

2.2.3 Sample Areas Selected

Based on ACORN categories and the number of samples that were required to be carried out to achieve a representative sample for the region are set out in Table 2.1.

Table 2.1 Sampling Matrix by ACORN Category

	Sample Numbers by ACORN classification					
	Wealthy Achievers	**Urban Prosperity**	**Comfortably Off**	**Moderate Means**	**Hard Pressed**	**TOTAL**
Total Number of Samples	3	1	2	2	2	**10**
Total Number of Households	105	35	70	70	70	**350**

The sample size at each location was thirty-five households and these were collected in ten samples consisting of 350 households that were representative of the NWRWMG area. Considerations in achieving this representative sample were that the samples:

- Encompassed all five ACORN classifications;
- Located in urban and rural areas;
- Encompassed a number District Council areas; and
- Consisted in a mix of housing types, semi-detected, detached, with/without gardens.

The District Councils sampled were Derry City Council, Coleraine Borough Council and Limavady Borough Council.

2.3 SURVEY EXECUTION

The physical sorting was carried out at a licensed Waste Transfer Facility (WTF) and the collections were carried out by a waste carrier, registered under The Controlled Waste (Registration of Carriers and Seizure of Vehicles) Regulations (Northern Ireland) 1999.

Each collected waste sample (collection from a group of thirty-five households) was weighed at an independent facility and recorded prior to sorting at a designated area within the (WTF). Waste was then picked and sorted waste sorting operators and placed into dedicated waste stream containers. Once full, each container was weighed and the data entered on to standard proformas and then transferred to an Excel database. Validation checks were carried out at this stage.

2.4 DATA AND STATISTICAL ANALYSIS

2.4.1 Data Analysis

The "raw data" obtained from the compositional analysis was checked and validated again and then classified by ACORN category prior to statistical analysis.

2.4.2 Statistical Principles and Analysis

When conducting a waste survey, the objective is to predict a characteristic (e.g. the make-up of waste produced per household per collection in NWRWMG) of the whole population (in this case, all the households in NWRWMG) from our sample (the households studied during this survey). This is known as inferential statistics. We are therefore interested in two things;

- The inference; and
- A measure of its accuracy

The inference is simply a prediction about a specific parameter that is of interest to us (for example, the mean quantity produced per household per week in NWRWMG) while the accuracy of the measurement is usually expressed in terms of confidence intervals.

The results for the samples collected were scaled up in relation to ACORN for NWRWMG as a whole. The statistical scale up of the results was carried out as per the breakdown for each ACORN category, as is shown below in Figure 2.1 below.

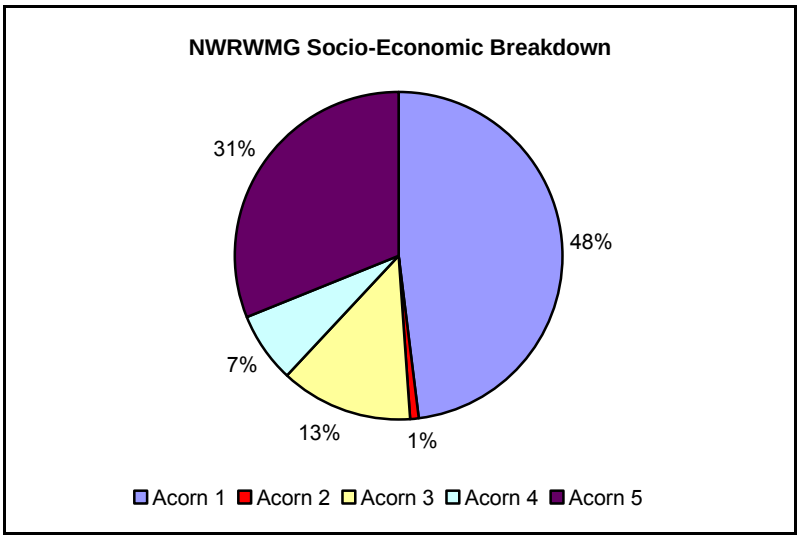

Figure 2.1 Socio-Economic Breakdown of the NWRWMG by ACORN data

A comprehensive statistical analysis was undertaken to produce the survey results including the following:

- Mean
- Median
- Standard deviation
- Variation coefficient
- Confidence coefficient
- Relative confidence interval (%)
- Confidence interval (kg)
- Composition

2.4.3 Confidence Intervals

The confidence interval is an expression of statistical accuracy. It provides the upper and lower limits of the "actual" population mean based on the sampled mean and variance of the observed sampled data. For example, sample mean for the waste category newspaper may be 5 % for a certain generator, with a confidence interval of +/- 1%. This implies that the true population mean for paper is between 4% and 6%.

2.4.4 Confidence Levels

The probability that a confidence interval will enclose the estimated parameter is called the confidence level and is usually expressed as a percentage. The confidence level measures the proportion of samples that produce a confidence interval containing the population parameter. A good confidence interval is one that is as narrow as possible and has a confidence level near 100%. (However, unless we sample every household in NWRWMG, we can never construct a 100% confidence interval). For example if the level of confidence is 95%, we are 95% certain that the true population mean is within the stated confidence

interval. Combining the terms confidence interval and level of confidence, we use the phrase "95% confidence interval". Applying this term to the previous example, we would be 95% certain that the true population mean would fall within the 4% to 6% range.

The narrower the interval, the more exact the estimated parameter is located, while the larger the confidence level, the more confidence we have that a particular interval encloses the estimated parameter. The confidence level gives a measure of the confidence one can place in the confidence limits constructed from the data contained in a sample. In that sense the width of an interval and its associated confidence level measure the accuracy of the confidence interval. Larger samples provide more information to use in forming the interval estimate. Therefore, for a given confidence level, the larger the sample the narrower will be the resulting confidence interval.

Finally, the level of confidence and the confidence interval have an inverse relationship. For example, for an 80% level of confidence, the confidence interval will be narrower than if the level of confidence were 95%.

The results were expressed on a 95% confidence level as recommended by best practice guidelines for EU waste characterisation studies. Extrapolation was carried out on the obtained sample results in relation to the five ACORN categories in NWRWMG.

3.0 COMPOMPOSITIONAL ANALYSIS RESULTS AND ANALYSIS

3.1 INTRODUCTION

The kerbside collected residual waste composition results for NWRWMG contained in this section are obtained from statistical analysis of the raw data from the physical hand sorting of the waste during the Study. As described in Section 2 the composition has been determined from selecting representative sample areas throughout the NWRWMG in accordance with ACORN data.

3.2 SUMMARY OF KERBSIDE COLLECTED HOUSEHOLD RESIDUAL WASTE COMPOSITION

As can be seen from Table 3.1 the following categories make up the majority of the residual waste stream in NWRWMG:

- Organic catering (34.19%)
- Plastic (14.57%)
  - Dense plastic (6.15%)
  - Plastic film (8.42%)
- Paper and Card (10.66%)
  - Paper (7.24%)
  - Cardboard (3.42%)
- Organic non catering (8.36%)

Table 3.1 Summary Composition of the Kerbside Collected Residual Waste

Summary Categories	Residual Waste
Paper	7.24%
Cardboard	3.42%
Dense Plastic	6.15%
Plastic Film	8.42%
Shoes and Textiles	3.65%
Glass	8.03%
Miscellaneous Combustibles	6.46%
Miscellaneous Non-Combustibles	1.83%
Ferrous Metal	1.31%
Non-Ferrous Metal	1.63%
Waste Electrical and Electronic Equipment	0.27%
Hazardous Household Waste	1.23%
Organic Non-Catering	8.36%
Organic Catering	34.19%
Fines (Less than 10 mm)	7.81%

Figure 3.1 illustrates the Table 3.1. As can be seen from Figure 3.1 Organic Catering (food waste), makes up the majority of the residual waste fraction disposed of in NWRWMG. The Study has shown that it is the largest single fraction of the household residual waste stream.

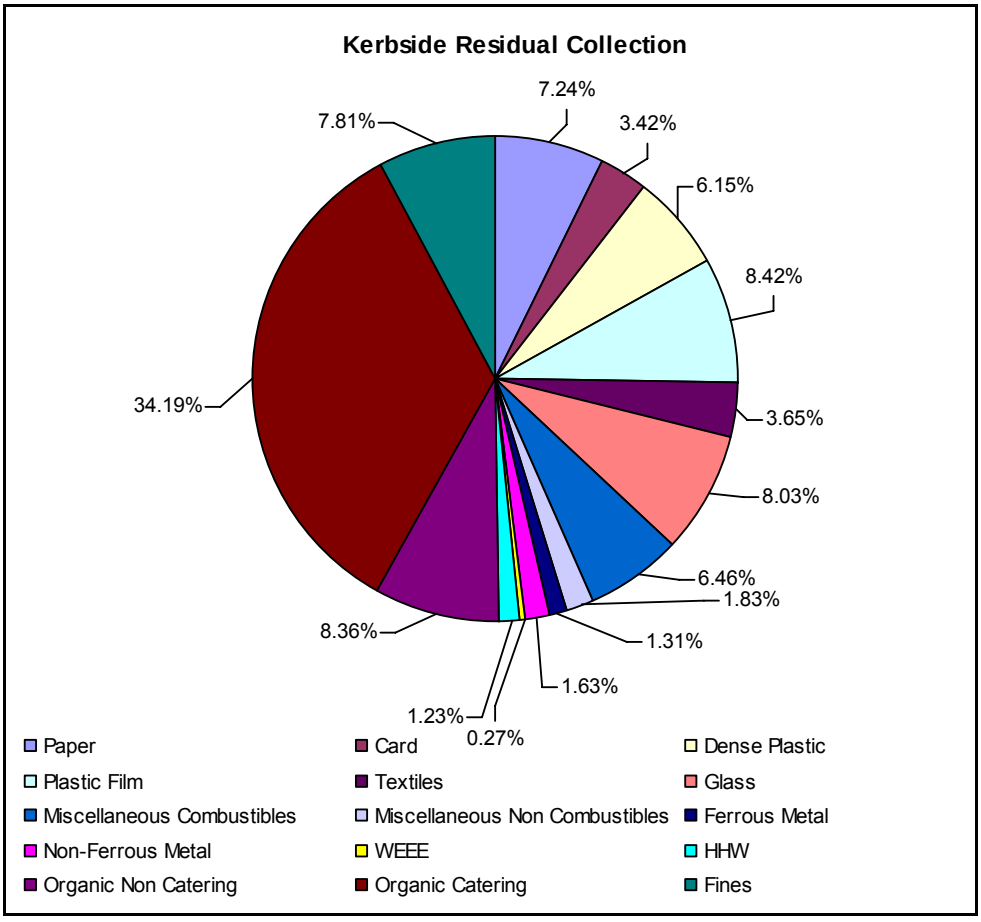

Figure 3.1 Summary Composition of Residual Waste in NWRWMG

The composition of the waste generated by the NWRWMG follows a similar trend to Northern Ireland Environment Agency Study 2008[1], however the percentage of organic catering, non organic catering, paper, fines and plastics differ in the two Studies. Table 3.2 provides a comparison of the compositions of the primary categories for the NWRWMG and NIEA 2008.

[1] DOE- Environment and Heritage Service review of municipal waste component analysis, RPS, 2008 http://www.ni-environment.gov.uk/waste_compositional_study_2007-08_full_report.pdf

Table 3.2 Summary Compositions of the Kerbside Collected Residual Waste from the NWRWMG Study and the Residual Waste Fraction from the NIEA Northern Ireland Wide Study (Review of Component Waste Analysis, 2008)

Summary Categories	Residual Waste NWRWMG 2009	Residual Waste NI Wide 2008
Paper	7.24%	9.1%
Cardboard	3.42%	4.3%
Dense Plastic	6.15%	8.3%
Plastic Film	8.42%	7.9%
Shoes and Textiles	3.65%	3.2%
Glass	8.03%	7.5%
Miscellaneous Combustibles	6.46%	8.1%
Miscellaneous Non-Combustibles	1.83%	4.0%
Ferrous Metal	1.31%	2.1%
Non-ferrous Metal	1.63%	1.1%
Waste Electrical and Electronic Equipment	0.27%	1.6%
Hazardous Household Waste	1.23%	0.4%
Organic Non-Catering	8.36%	2.7%
Organic Catering	34.19%	38.3%
Fines (Less than 10 mm)	7.81%	1.2%

3.3 DETAILED KERBSIDE COLLECTED HOUSEHOLD RESIDUAL WASTE COMPOSITION

Table 3.3 provides a more comprehensive breakdown of the waste composition. The highest percentage composition was:

- Home compostable kitchen waste (29.62%),
- Fines (7.81%),
- Disposable nappies (5.08%),
- Clear glass (4.94%)
- Other plastic films (4.79%)
- Non compostable home kitchen waste (4.58%)

The other secondary waste streams compose of less than 4% of the total waste composition.

Table 3.3 Detailed Composition of the Kerbside Collected Residual Waste

Primary Categories	Secondary Categories	Mean	Lower Bound	Upper Bound
Paper	Newspapers	2.08%	0.70%	3.45%
	Magazines	1.22%	0.70%	1.73%
	Other Recyclable Paper	1.21%	0.00%	4.41%
	Paper Packaging	0.90%	0.38%	1.41%
	Non-Recyclable Paper	1.84%	0.81%	2.86%
Card	Liquid Cartons	1.12%	0.54%	1.70%
	Board Packaging	1.12%	0.52%	1.72%
	Card Packaging	1.01%	0.00%	2.40%
	Other Card	0.18%	0.00%	0.49%
Dense Plastic	Plastic Bottles	2.72%	1.82%	3.63%
	Dense Plastic Packaging	3.04%	2.16%	3.92%
	Other Dense Plastic	0.38%	0.00%	1.01%
Plastic Film	Other Plastic Film	4.79%	3.16%	6.43%
	Packaging Film	3.63%	3.45%	3.80%
Textiles	Textiles	2.57%	0.41%	4.73%
	Shoes	1.08%	0.00%	2.17%
Glass	Glass Bottles & Jars - Clear	4.94%	3.52%	6.36%
	Glass Bottles & Jars - Brown	1.62%	0.00%	5.25%
	Glass Bottles & Jars - Green	1.36%	0.18%	2.53%
	Other Glass	0.11%	0.00%	0.34%
Miscellaneous Combustibles	Treated Wood	0.36%	0.00%	2.16%
	Untreated Wood	0.31%	0.00%	0.97%
	Furniture	0.00%	0.00%	0.00%
	Disposable Nappies	5.08%	3.62%	6.54%
	Other Misc. Combustibles	0.48%	0.00%	1.04%
	Carpet and Underlay	0.23%	0.00%	0.75%
Miscellaneous Non Combustibles	Construction and Demolition	0.95%	0.22%	1.68%
	Other Misc. Non-combustibles	0.88%	0.40%	1.35%
Ferrous Metal	Food Cans	0.81%	0.01%	1.61%
	Beverage Cans	0.04%	0.00%	0.11%
	Other Ferrous Metal	0.46%	0.03%	0.88%
Non Ferrous Metal	Food Cans	0.48%	0.00%	1.18%
	Beverage Cans	0.46%	0.00%	1.12%
	Other Non Ferrous Metal	0.70%	0.51%	0.89%
Waste Electrical and Electronic Equipment	White Goods	0.00%	0.00%	0.00%
	Electronic Goods	0.20%	0.00%	0.46%
	TV's and Monitors	0.00%	0.00%	0.00%
	Other WEEE	0.07%	0.01%	0.12%
Hazardous Household Waste	Household Batteries	0.12%	0.00%	0.24%
	Car Batteries	0.00%	0.00%	0.00%
	Engine Oil	0.70%	0.15%	1.24%
	Asbestos	0.00%	0.00%	0.00%
	Other Potentially Hazardous	0.42%	0.05%	0.79%
	Identifiable Clinical Waste	0.00%	0.00%	0.00%
Organic (Non Catering)	Garden Waste	4.99%	2.68%	7.30%
	Soil	2.30%	0.77%	3.83%
	Other Organic	1.06%	0.35%	1.78%
Organic (Catering)	Home Compostable Kitchen Waste	29.62%	23.55%	35.68%
	Non-Home Comp Kitchen Waste	4.58%	2.45%	6.71%
Fines	Fines (Less than 10 mm)	7.81%	3.62%	12.00%

3.4 SEASONALITY

In order to allow for an element of seasonality and achieve results representative of the year as a whole, data was collected during the months of August and November. Table 3.4 shows the difference in the composition of the kerbside residual waste from the summer sample in August 2009 and winter sample in November 2009 for this Study.

Table 3.4 Summary of Summer and Winter Compositions of the Kerbside Collected Residual Waste

Primary Categories	Summer Sampling			Winter Sampling		
	Mean	Lower Bound	Upper Bound	Mean	Lower Bound	Upper Bound
Paper	5.63%	1.18%	10.08%	8.10%	3.22%	12.99%
Card	2.42%	0.00%	5.80%	4.09%	2.66%	5.52%
Dense Plastic	5.68%	2.08%	9.29%	6.55%	4.91%	8.20%
Plastic Film	6.27%	2.62%	9.92%	9.85%	8.65%	11.05%
Textiles	3.69%	0.00%	8.205	3.53%	1.49%	5.57%
Glass	8.84%	3.47%	14.21%	7.01%	1.60%	12.41%
Miscellaneous Combustibles	6.92%	1.78%	12.07%	6.37%	4.38%	8.36%
Miscellaneous Non-combustibles	2.50%	0.86%	4.15%	1.37%	0.48%	2.25%
Ferrous metal	1.74%	0.79%	2.70%	0.99%	0.06%	1.93%
Non-Ferrous Metal	1.08%	0.19%	1.97%	2.01%	1.44%	2.59%
Waste Electrical & Electronic Equipment	0.09%	0.00%	0.18%	0.38%	0.11%	0.64%
Hazardous Household Waste	0.35%	0.00%	0.72%	1.81%	0.56%	3.06%
Organic Non-Catering	9.78%	3.31%	16.25%	6.86%	3.72%	10.0%
Organic Catering	39.82%	20.18%	59.46%	30.78%	21.14%	40.41%
Fines (Less than 10 mm)	5.19%	2.40%	7.97%	10.30%	3.09%	17.51%

Trends in the disposal of kerbside collected residual waste can be related to the time of year. One obvious example is the production of garden waste (Organic non-catering waste) which should peak in the summer compared to the winter. This is also the case in this Study; the organic non-catering waste reduced by one third.

Table 3.5 provides a detailed composition of the secondary waste categories of the kerbside residual waste from the summer and winter.

As can be seen from the Table 3.5 there are variations in the waste composition from both surveys, particularly in relation to Organic Catering waste, fines and plastic films. In relation to the seasonal variations of these waste categories a number of assumptions can be made:

Table 3.5 Detailed Seasonality Composition

Primary Categories	Secondary Categories	Summer	Winter
Paper	Newspapers	2.27%	1.87%
	Magazines	1.32%	1.28%
	Other Recyclable Paper	0.54%	1.50%
	Paper Packaging	0.86%	0.92%
	Non-Recyclable Paper	0.64%	2.54%
Card	Liquid Cartons	0.88%	1.27%
	Board Packaging	0.61%	1.41%
	Card Packaging	0.55%	1.39%
	Other Card	0.38%	0.02%
Dense Plastic	Plastic Bottles	2.60%	2.90%
	Dense Plastic Packaging	2.35%	3.54%
	Other Dense Plastic	0.73%	0.12%
Plastic Film	Other Plastic Film	3.54%	5.59%
	Packaging Film	2.72%	4.26%
Textiles	Textiles	3.02%	2.12%
	Shoes	0.67%	1.42%
Glass	Glass Bottles & Jars - Clear	5.98%	4.02%
	Glass Bottles & Jars - Brown	1.34%	1.61%
	Glass Bottles & Jars - Green	1.22%	1.37%
	Other Glass	0.29%	0.00%
Miscellaneous Combustibles	Treated Wood	0.64%	0.10%
	Untreated Wood	0.52%	0.10%
	Furniture	0.00%	0.00%
	Disposable Nappies	5.03%	5.44%
	Other Misc. Combustibles	0.67%	0.32%
	Carpet and Underlay	0.06%	0.40%
Miscellaneous Non Combustibles	Construction and Demolition	2.44%	0.00%
	Other Misc. Non-combustibles	0.06%	1.37%
Ferrous Metal	Food Cans	0.79%	0.76%
	Beverage Cans	0.00%	0.08%
	Other Ferrous Metal	0.95%	0.15%
Non Ferrous Metal	Food Cans	0.65%	0.34%
	Beverage Cans	0.18%	0.63%
	Other Non Ferrous Metal	0.25%	1.04%
Waste Electrical and Electronic Equipment	White Goods	0.00%	0.00%
	Electronic Goods	0.00%	0.31%
	TV's and Monitors	0.00%	0.00%
	Other WEEE	0.09%	0.07%
Hazardous Household Waste	Household Batteries	0.35%	0.00%
	Car Batteries	0.00%	0.00%
	Engine Oil	0.00%	1.13%
	Asbestos	0.00%	0.00%
	Other Potentially Hazardous	0.00%	0.67%
	Identifiable Clinical Waste	0.00%	0.00%
Organic (Non Catering)	Garden Waste	5.11%	4.09%
	Soil	4.67%	0.99%
	Other Organic	0.00%	1.77%
Organic (Catering)	Home Compostable Kitchen Waste	39.00%	23.54%
	Non-Home Comp Kitchen Waste	0.82%	7.23%
Fines	Fines (Less than 10 mm)	5.19%	10.30%

3.4.1 Organic Catering Waste

- Home compostable kitchen waste comprising of materials such as fruit and vegetable peelings, tea bags, and liquids decrease from 39.00% in summer to 23.54% in the winter sample. Other UK local authority compositional studies have found similar trends suggesting that summer is the time when consumption of fresh fruit and vegetables is at its highest. This reduction in the home compostable kitchen waste was also found in the NIEA study, however the percentage composition was significantly less with 16.53% in summer to 9.87% in the winter.
- Non-compostable kitchen waste comprising of materials such as meat, processed food, bread, egg shells, chocolate, biscuits, and cheese increased from 0.82% in summer to 7.23% in winter. Other waste compositional analysis studies carried out in the UK[2] and Northern Ireland found similar trends suggesting that more food waste is thrown away in the autumn/winter months than in spring/summer. The percentage composition of the non-compostable kitchen waste is significantly lower than the NIEA findings of (16.53% in spring to 9.87% in autumn).

3.4.2 Fines

- The Fines category usually comprises a mixture of organic sources such as soil particles and dusty particles arisings from construction and demolition waste like cement dust, < 10mm diameter particles and cinder and ashes for example. There was a large variation in the fines generated between the summer and winter. The majority of the winter fines were recorded as ashes from fires.
- The summer sampling appears to give a more accurate composition as the lower bound (LB) and upper bound (UB) composition confidence levels are much narrower than those generated by the winter samples.
- As well as the variation in the fine composition in the two seasons, the fines composition was higher than would normally be expected. Fines accounted for 7.81% of the composition which is a lot higher than the NIEA Study (1.16%) and other surveys namely: Bedfordshire County Council[3] (1% to 5%), Greater London Authorities[4] (1%), Parfitt[5] (2002) (3%) and Merseyside[6] and Wiltshire[7] (≈ 2%).

3.4.3 Plastic Film and Other Plastic

- Plastic films includes plastic bags and refuse bags and packaging film such as crisp packets, sweet wrappers, bread bags, potato bags, and food wrapping film. The summer sample composed of less plastic film (3.54%) than the winter sample (5.59%). A similar trend was also highlighted in the packaging film. The total plastic film constituents 8.42%

[2] Analysis of the Composition of Waste Arising in Essex, 2004
[3] Bedfordshire County Council Waste Compositional Analysis , resource futures ,2008
[4] Greater London Authority Waste composition scoping report, 2004
[5] Analysis of household waste composition and factors driving waste increases, Parfitt, 2002
[6] Household waste compositional analysis final report, SWAP, 2006
[7] Residual Waste compositional analysis, Wiltshire Waste Partnership, 2007

(1.9kg /household/collection) of the waste generated. This high composition was also found in a study in Bedford and NIEA, however Greater London Authorities (5%), Merseryside (5.04%), and Essex (4.1%) had low compositions of plastic films.

3.5 COMPOSITION BREAKDOWN BY SOCIO-ECONOMIC GROUPS

As detailed in Section 2 ACORN data was been obtained for the purposes of the Study.

3.5.1 ACORN 1 – Wealthy Achievers

These are some of the most affluent householders. They are described as wealthy executives, affluent greys (mature couples) and flourishing families. They live in wealthy, high status suburban, rural and semi-rural areas. The houses tend to be large and detached with four or more bedrooms. Forty eight percent of the NWRWMG area is classified as wealthy achievers. Generally affluent greys are the best recyclers as they have the lifestyle to do so.

3.5.2 ACORN 2 – Urban Prosperity

This category is divided into three broad groups: prosperous professionals, educated urbanities and aspiring singles. Only 1% of the NWRWMG area is classified under this category. These are well educated and mostly prosperous people. This category also includes some well educated but less affluent individuals such as graduates in their first jobs. Typically, Acorn 2 category people are generally not good at recycling, do not dispose of a lot of waste as they eat out a lot and keep small and low maintenance gardens.

3.5.3 ACORN 3 – Comfortably Off

This category contains much of “middle-of-the-road” residents consisting of prudent pensioners, settled suburbia, secure families and those starting out. Most people in this category have few major financial worries and are comfortably off. Approximately 13% of households in the NWRWMG area are classified under this category. Generally the retired couples and pensioners produce the least amount of waste and are good at participating in recycling schemes. The other two categories, settled suburbia and secure families generally encompasses households with children or families. These categories produce a lot of waste.

3.5.4 ACORN 4 – Modest Means

This category consists much of what used to be the industrial heartlands consisting of post-industrial families and blue-collar roots. Most housing is terraced, with two or three bedrooms, and largely owner occupied. It includes many former council houses, bought by their tenants in the 1980s. Approximately 7% of the NWRWMG area is classified as Modest Means. Modest Means households are often seen to dispose of the greatest amounts of waste.

3.5.5 ACORN 5 – Hard Pressed

Approximately 31% of the NWRWMG is classified under ACORN as Hard Pressed. This category consists of struggling families, burdened singles and high-rise hardship. Levels of qualifications are low and those in work are likely to be employed in unskilled occupations. There are a large number of single adult households, including many single pensioners and lone parents. These are the least affluent households and often generalised to be the worst recyclers.

The composition of the primary categories for the ACORN categories are provided in Table 3.6.

Table 3.6 Summary Compositions by ACORN Category

Primary Categories	Wealthy Achievers	Urban Prosperity	Comfortably Off	Moderate Means	Hard Pressed
Paper	6.6%	15.3%	5.2%	7.1%	8.9%
Cardboard	2.9%	6.8%	4.2%	5.9%	3.3%
Dense Plastic	5.45%	7.04%	8.00%	7.00%	6.22%
Plastic Film	8.94%	11.39%	9.23%	8.81%	7.14%
Shoes and Textiles	2.98%	3.06%	5.11%	7.32%	3.25%
Glass	8.8%	16.5%	9.1%	6.5%	6.6%
Miscellaneous Combustibles	7.5%	8.5%	8.2%	6.6%	4.1%
Miscellaneous Non-Combustibles	2.4%	0.6%	2.5%	1.7%	0.7%
Ferrous Metal	1.0%	0.0%	2.0%	1.0%	1.6%
Non-Ferrous Metal	1.2%	2.2%	1.9%	2.4%	2.0%
Waste Electrical & Electronic Equipment	0.5%	0.5%	0.0%	0.1%	0.1%
Hazardous Household Waste	2.0%	0.0%	0.0%	0.6%	0.7%
Organic Non-Catering	8.1%	2.3%	8.1%	2.5%	10.3%
Organic Catering	34.3%	24.5%	30.9%	40.1%	34.4%
Fines (Less than 10 mm)	7.4%	1.4%	5.7%	2.5%	10.7%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Table 3.7 provides a detailed breakdown of the secondary categories for each ACORN category.

In general the Urban Prosperity generates the most potentially recyclable waste i.e. paper, card, glass and non ferrous metal. The composition of these residential households was indicative of the demographical and lifestyle classification by ACORN. The Urban Prosperity households had the highest percentage of the potentially recyclable waste, but also generated less organic waste which could have been due to purchasing convenience food.

Hard Pressed households are generally the worst recyclers however this doesn't seem to the cases in this survey, as they have some of the lowest cardboard, dense plastic, textiles and

glass compositions. These households recorded a very high percentage composition of fines which were mainly contributed by fire ashes.

The Moderate Means samples disposed of the highest amount of organic catering waste (40.1%), followed by the Hard Pressed and Wealthy Achievers. This follows the general trend found in other UK studies, with the poorest and wealthy categories generating the most organic catering waste.

Table 3.7 Detailed Compositions by ACORN Category

Primary Categories	Wealthy Achievers	Urban Prosperity	Comfortably Off	Moderate Means	Hard Pressed
Newspapers	1.04%	3.33%	1.49%	1.85%	3.92%
Magazines	0.73%	1.34%	1.22%	1.07%	1.99%
Other Recyclable Paper	1.94%	7.14%	0.38%	0.70%	0.41%
Paper Packaging	0.71%	0.00%	0.97%	1.06%	1.14%
Non-Recyclable Paper	2.21%	3.45%	1.10%	2.39%	1.41%
Liquid Cartons	0.69%	0.49%	1.53%	1.57%	1.52%
Board Packaging	1.17%	2.11%	1.74%	1.30%	0.70%
Card Packaging	0.86%	3.38%	0.57%	2.69%	0.98%
Other Card	0.15%	0.80%	0.37%	0.31%	0.09%
Plastic Bottles	1.83%	2.64%	3.55%	2.44%	3.80%
Dense Plastic Packaging	3.46%	4.39%	3.38%	3.32%	2.16%
Other Dense Plastic	0.16%	0.00%	1.07%	1.24%	0.25%
Other Plastic Film	5.28%	7.75%	5.35%	5.34%	3.62%
Packaging Film	3.66%	3.64%	3.87%	3.47%	3.52%
Textiles	1.85%	3.06%	2.55%	6.78%	2.72%
Shoes	1.13%	0.00%	2.56%	0.54%	0.53%
Glass Bottles & Jars - Clear	4.83%	7.46%	5.08%	4.05%	5.19%
Glass Bottles & Jars - Brown	2.17%	8.55%	1.33%	0.94%	0.88%
Glass Bottles & Jars - Green	1.62%	0.00%	2.65%	1.51%	0.40%
Other Glass	0.14%	0.51%	0.04%	0.00%	0.12%
Treated Wood	0.11%	3.85%	1.79%	0.48%	0.00%
Untreated Wood	0.21%	0.00%	1.43%	0.32%	0.00%
Furniture	0.00%	0.00%	0.00%	0.00%	0.00%
Disposable Nappies	6.43%	3.29%	4.97%	4.24%	3.31%
Other Misc. Combustibles	0.72%	1.34%	0.00%	0.49%	0.29%
Carpet and Underlay	0.00%	0.00%	0.00%	1.04%	0.51%
Construction and Demolition	1.10%	0.00%	1.75%	0.79%	0.46%
Other Misc. Non-combustibles	1.35%	0.56%	0.73%	0.94%	0.21%
Food Cans	0.61%	0.00%	1.95%	0.99%	0.60%
Beverage Cans	0.00%	0.00%	0.00%	0.00%	0.13%
Other Ferrous Metal	0.39%	0.00%	0.00%	0.00%	0.87%
Food Cans	0.13%	0.00%	0.00%	1.33%	1.02%
Beverage Cans	0.39%	1.29%	1.33%	0.09%	0.26%
Other Non Ferrous Metal	0.69%	0.90%	0.52%	0.95%	0.73%
White Goods	0.00%	0.00%	0.00%	0.00%	0.00%
Electronic Goods	0.40%	0.50%	0.00%	0.12%	0.00%
TV's and Monitors	0.00%	0.00%	0.00%	0.00%	0.00%
Other WEEE	0.06%	0.00%	0.00%	0.00%	0.12%
Household Batteries	0.24%	0.00%	0.00%	0.00%	0.00%

Table 3.7 Detailed Compositions by ACORN category (cont…)

Primary Categories	Wealthy Achievers	Urban Prosperity	Comfortably Off	Moderate Means	Hard Pressed
Car Batteries	0.00%	0.00%	0.00%	0.00%	0.00%
Engine Oil	1.08%	0.00%	0.00%	0.00%	0.57%
Asbestos	0.00%	0.00%	0.00%	0.00%	0.00%
Other Potentially Hazardous	0.72%	0.00%	0.00%	0.55%	0.14%
Identifiable Clinical Waste	0.00%	0.00%	0.00%	0.00%	0.00%
Garden Waste	4.21%	2.31%	4.05%	2.12%	7.30%
Soil	2.41%	0.00%	3.18%	0.38%	2.25%
Other Organic	1.50%	0.00%	0.92%	0.00%	0.73%
Home Compostable Kitchen Waste	28.63%	23.22%	28.64%	38.37%	29.74%
Non-Home Comp Kitchen Waste	5.63%	1.30%	2.25%	1.74%	4.69%
Fines (Less than 10 mm)	7.38%	1.37%	5.67%	2.48%	10.73%

3.6 BIODEGRADABLE MUNICIPAL WASTE PERCENTAGE OF KERBSIDE COLLECTED RESIDUAL WASTE

This section provides an analysis of the biodegradable fraction of waste by using a combination of WasteDataFlow operational data, and statistical analysis from the physical hand sorting.

3.6.1 Biodegradable municipal waste (BMW)

The biodegradable fraction of the waste collected is of particular importance when considered in the context of the Landfill Directive targets for the reduction in the biodegradable waste to landfill implemented through the Northern Ireland Landfill Allowance Scheme (NILAS). NILAS makes detailed provisions for the allocation and monitoring of landfill allowances allocated to District Councils.

The schedule to the NILAS Regulations details the amount of BMW in certain types of waste and these have been applied for the purposes of this study. The Regulations defines components consisting of biogenic carbon to be a 100% biodegradable component, fraction with no carbon or solely fossil carbon to be 0% and those with a mixture to be 50%. For example, the Schedule defines paper, card, putrescible waste and vegetable oil as being 100% biodegradable. Footwear, furniture and textiles are regarded as being 50% biodegradable in the regulations.

Table 3.8 details the amount of BMW content expressed as a percentage by weight.

Table 3.8 Percentage BMW Content of Various Waste Categories

Type of Waste	Amount of BMW (% by weight)
Paper, Card, Putrescible[8] Waste and Vegetable Oil	100%
Footwear, Furniture and Textiles	50%
Batteries, Electrical and electronic equipment, End-of-life vehicles, Fluorescent tubes, Glass, Inert construction and demolition waste, Metal, Mineral oil, Plastic and Soil	0%

Table 3.9 below sets out the calculation of the biodegradable fraction of kerbside collected residual waste. Each of the different fractions of kerbside collected waste are set out below.

[8] Putrescible waste means any animal or vegetable waste (including wood which is capable of undergoing anaerobic or aerobic decomposition, but do not include any of these other types of wastes: Batteries, Electrical and Electronic Equipment, End-of-Life Vehicles, Florescent Tubes, Glass, Inert Construction and Demolition Waste, Metal, Mineral Oil, Plastic and Soil.

Table 3.9 BMW Percentage Calculation for Kerbside Collected Household Residual Waste

Waste Categories	% by weight	% Biodegradability	% Biodegradable Content	WDF 06/07	Tonnage Biodegradable
Newspapers	2.08%	Paper (100%)	2.08%	1,647.18	1,647.18
Magazines	1.22%		1.22%	965.56	965.56
Other Recyclable Paper	1.21%		1.21%	960.38	960.38
Paper Packaging	0.90%		0.90%	710.50	710.50
Non-Recyclable Paper	1.84%		1.84%	1,457.02	1,457.02
Liquid Cartons	1.12%	Card (100%)	1.12%	888.02	888.02
Board Packaging	1.12%		1.12%	886.01	886.01
Card Packaging	1.01%		1.01%	798.53	798.53
Other Card	0.18%		0.18%	138.94	138.94
Plastic Bottles	2.72%	Dense Plastic (0%)	0.0%	2,159.86	0.00
Dense Plastic Packaging	3.04%		0.0%	2.414.08	0.00
Other Dense Plastic	0.38%		0.0%	304.98	0.00
Other Plastic Film	4.79%	Plastic Film (0%)	0.0%	3803.89	0.00
Packaging Film	3.63%		0.0%	2,878.93	0.00
Textiles	2.57%	Textiles (50%)	1.29%	2,040.12	1,020.06
Shoes	1.08%		0.54%	857.87	428.93
Glass Bottles & Jars - Clear	4.94%	Glass (0%)	0.0%	3921.12	0.00
Glass Bottles & Jars - Brown	1.62%		0.0%	1284.98	0.00
Glass Bottles & Jars - Green	1.36%		0.0%	1075.16	0.00
Other Glass	0.11%		0.0%	91.10	0.00
Treated Wood	0.36%	Miscellaneous Combustibles (Some categories are 100%, some are 0% and disposable nappies 50%[9])	0.36%	283.04	283.04
Untreated Wood	0.31%		0.31%	246.90	246.90
Furniture	0.00%		0.0%	0.00	0.00
Disposable Nappies	5.08%		2.54%	4030.10	2,015.05
Other Misc. Combustibles	0.48%		0.0%	380.89	0.00
Carpet and Underlay	0.23%		0.0%	184.81	0.00
Construction and Demolition	0.95%	Miscellaneous Non-Combustibles (0%)	0.0%	754.86	0.00
Other Misc. Non-combustibles	0.88%		0.0%	694.41	0.00

[9] Furthermore the Regulations do not state the percentage biodegradability of Disposable Nappies, due to the make up of these, 50% biodegradability has been agreed previously with Northern Ireland Environment Agency.

Table 3.9 BMW Percentage Calculation for Kerbside Collected Household Residual Waste (Cont…)

Waste Categories	% by weight	% Biodegradability	% Biodegradable Content	WDF 06/07	Tonnage Biodegradable
Ferrous Food Cans	0.81%	Ferrous Metal (0%)	0.0%	641.34	0.00
Ferrous Beverage Cans	0.04%		0.0%	33.27	0.00
Other Ferrous Metal	0.46%		0.0%	361.8	0.00
Non Ferrous food cans	0.48%	Non Ferrous Metal (0%)	0.0%	376.98	0.00
Non ferrous beverage Cans	0.46%		0.0%	364.47	0.00
Other Non Ferrous Metal	0.70%		0.0%	554.84	0.00
White Goods	0.00%	WEEE (0%)	0.0%	0.0	0.00
Electronic Goods	0.20%		0.0%	161.28	0.00
TV's and Monitors	0.00%		0.0%	0.0	0.00
Other WEEE	0.07%		0.0%	51.79	0.00
Household Batteries	0.12%	HHW (0%)	0.0%	92.27	0.00
Car Batteries	0.00%		0.0%	0.0	0.00
Engine Oil	0.70%		0.0%	551.72	0.00
Asbestos	0.00%		0.0%	0.0	0.00
Other potentially Hazardous	0.42%		0.0%	335.22	0.00
Identifiable Clinical Waste	0.00%		0.0%	0.0	0.00
Garden Waste	4.99%	Organic Non Catering (Some categories are 100%, some are 0%)	4.99%	3,961.16	3,961.16
Soil	2.30%		0.0%	1824.36	0.00
Other Organic	1.06%		1.06%	843.84	843.84
Home Compostable Kitchen Waste	29.62%	Organic Catering (100%)	29.62%	23,495.97	23,495.97
Non-Home Comp Kitchen Waste	4.58%		4.58%	3,632.42	3,632.42
Fines (Less than 10 mm)	7.81%	Fines (50%)[10]	3.90%	6,195.16	3097.58
			59.53%	79,337.00	47,477.09

Therefore, the BMW fraction of Kerbside Collected Residual Waste is derived at 60%

[10] The Regulations does not specifically state the percentage biodegradability of Fines. However the fines smaller than 10mm encountered in physical sorting of the waste were generally derived from a mixture of organic sources, miscellaneous combustibles and miscellaneous non-combustibles and therefore have been classified as having 50% biodegradability.

4.0 CONCLUSIONS AND RECOMMENDATIONS

4.1 OVERVIEW

This study has determined the composition of the kerbside collected residual waste and reviewed the percentage of Biodegradable Municipal Waste (BMW) in the NWRMWG. The survey uses data obtained from the physical hand-sorting of the residual waste from a total of 350 households in the NWRWMG to achieve these results. The households encompassed the five Acorn categories and the results were statistically scaled up in accordance with the ACORN breakdown for the NWRWMG. Sampling was conducted during the Summer (August 2009) and Winter (November 2009) in order to assess the seasonality of the waste composition.

4.2 COMPOSITION OF MUNICIPAL WASTE IN NWRWMG

Table 4.1 below details the composition of the municipal waste in NRWMG

Table 4.1 Municipal Waste Composition for NRWMG

Summary Categories	Residual Waste
Paper	7.24%
Cardboard	3.42%
Dense plastic	6.15%
Plastic film	8.42%
Shoes and Textiles	3.65%
Glass	8.03%
Miscellaneous Combustibles	6.46%
Miscellaneous Non-Combustibles	1.83%
Ferrous Metal	1.31%
Non-Ferrous Metal	1.63%
Waste Electrical and Electronic Equipment	0.27%
Household Hazardous Waste	1.23%
Organic Non-Catering	8.36%
Organic Catering	34.19%
Fines (Less than 10 mm)	7.81%

4.3 WASTE COMPOSITION

The study involved detailed waste compositional analysis and conclusions in relation to the residual waste steam are summarised below.

4.3.1 Organic Waste is the Predominant Material

Organic catering waste is the predominant material (34%) in the residual waste stream, followed by Plastic (14.57%, consisting of Dense Plastic and Plastic Film), Paper and Card (10.66%) and organic non-catering (8%). Currently there are approximately 30,408 households with brown bin (organic collection) provision in the NWRWMG which amounts to approximately 24% distribution across the Region. The further distribution of brown bins throughout the local authority areas in the NWRWMG would assist in capturing this organic material.

4.3.2 Large seasonal Variations

There is a seasonal variation between a number of categories, namely organic catering waste and fines. For example, there was a reduction in home compostable kitchen waste in the winter which is a general trend that is to be expected and have been exhibited in other UK studies. Furthermore the composition of fines increased from summer to winter, and this has been mainly attributed to the presence of fire ashes.

4.3.3 Biodegradable Municipal Waste Fraction

The BMW fraction of the kerbside collected residual waste is derived at 60%.

4.3.4 Notable Comparisons to the Northern Wide Study

A number of differences have been noted in the compositional data when compared with the results of the Northern Ireland wide waste characterisation study in 2007, these include:

- a decrease in paper from 9.1% to 7.24%; a
- a decrease in the organic catering fraction of the waste from 38.3% to 34.19%;
- an increase in the non catering organic waste from 2.7% to 8.36%; and
- fines were increased from 1.2% to 7.81%. .

4.4 NEXT STEPS AND RECOMMENDATIONS

4.4.1 Future Work

Comparison of waste composition and seasonality in this study has highlighted the potential variability and therefore it is recommended that seasonal studies be repeated on a more regular basis to gain more information on these potential trends and anomalies. Additional analyses in the summer/winter would be extremely valuable to enhance the reliability of the data collected and to allow reliable conclusions regarding seasonality to be made. The "grouped household-based" approach employed for this study is advantageous if further seasonal studies were to be considered as representative samples have been devised in each waste management group and the approach allows repeatability with relative ease.