RPS

epa
Environmental Protection Agency
An Ghníomhaireacht um Chaomhnú Comhshaoil

Household Waste Characterisation Campaign

Final Report

November 2018

CLEAN TECHNOLOGY CENTRE CTC

Rialtas na hÉireann
Government of Ireland

Characterisation of Municipal Waste

Final Report

Document Control Sheet

Client:	EPA
Project Title:	Municipal Waste Characterisation
Document Title:	Household Waste Campaign - Final Report
Document No:	Rp0006

Text Pages:	39	Appendices:	10	Current Revision:	**F01**

Rev.	Status	Date	Author(s)		Reviewed By		Approved By	
F01	Approval	26nd Nov. 2018	CMcG / OG		CMcG		OG	

TABLE OF CONTENTS

APPENDICES

LIST OF FIGURES

LIST OF TABLES

LIST OF IMAGES

ACKNOWLEDGEMENTS

RPS thanks the following organisations for their time and assistance in the preparation of this report on the characterisation of household municipal waste:

- Central Statistics Office (CSO);
- Department of Communications, Climate Action and Environment (DCCAE);
- Environmental Protection Agency (EPA);
- Irish Waste Management Association (IWMA);
- National Waste Collection Permit Office (NWCPO);
- Regional Waste Management Offices and
- Repak.

RPS thanks its partners Clean Technology Centre, CIT (CTC).

Finally, RPS thanks the authorised waste collectors who collected samples and facilitated the conduct of surveys on their premises.

GLOSSARY OF TERMS

2-bin or 3-bin system refers to a source segregated collection system where mixed dry recyclables (MDR) and mixed residual wastes (MRW) are separately collected (2-bin system), or where dry recyclables (MDR), organics and mixed residual wastes (MRW) are separately collected (3-bin system).

Authorised waste collector means a waste collector who has a valid permit issued by the National Waste Collection Permit Office.

Brown Bin is a reference to an organic waste collection. Where garden waste is excluded, this bin may be termed a food waste collection.

Household waste is defined as waste produced within the curtilage of a building/residence or self-contained part of a building/premises used for the purposes of living accommodation. Household waste includes dry recyclables (e.g. glass, plastic, metals, paper and cardboard); organic waste (food and garden waste); residual (black-bin) waste and other wastes generated in the household such as bulky waste, portable batteries, waste electrical and electronic equipment and household hazardous wastes.

Kerbside collection is a common reference for the practice of collecting household or commercial waste directly from its source, often, though not necessarily, from the pavement or front door.

MDR means Mixed Dry Recyclables.

Mean means the mathematical average of all the items in a sample. The formula is $\bar{X} = \frac{1}{n}\sum_{i=1}^{n} X_i$

MRW means Mixed Residual Waste. It can include bulky items.

N/A means not applicable.

Non-recyclable material is material that is not widely recycled. The range of materials that are recycled will change over time as technology improves and market conditions alter.

Non-target material is material that is capable of being recycled but is not being targeted by the collector for separation and sale. This may be because they do not have a buyer (e.g. for composite beverage cartons like Tetrapak) or because the materials recycling facilities or reprocessor excludes it from their specification (e.g. textiles in the MDR bins which causes problems in the materials recovery facility).

NWCPO means National Waste Collection Permit Office operated by Offaly County Council.

Organic waste in this report means biodegradable food and liquids (packaged and not packaged), garden and landscaping waste. This stream is sub-divided in the report into:

- 'Organic waste (garden)' which comprises Biodegradable waste from garden & park and:

- 'Organic waste (non-garden)' which comprises edible kitchen & canteen waste: unused packaged and non-packaged food/liquids and inedible (post-consumer) kitchen & canteen waste like teabags and apple cores.

Packaging is defined in Directive 94/62/EC initially as: *'packaging' shall mean all products made of any materials of any nature to be used for the containment, protection, handling, delivery and presentation of goods, from raw materials to processed goods, from the producer to the user or the consumer. 'Non-returnable' items used for the same purposes shall also be considered to constitute packaging.*

Primary Waste Category - A high level waste category e.g. plastics or paper, metals etc.

Sample means portion of material selected from a larger quantity of material.

Secondary Waste Category is a more specific waste category within a Primary Waste Category, e.g. mixed flexible plastic, ferrous metal etc.

Target material is any material that the collector has identified as needing to be separated from other types of material by virtue of the fact that separation is required by the market. For the purposes of this study, 'target material' could include:

- The materials specified in the list of materials for co-mingled dry recyclables bin agreed by and listed on the national list www.recyclinglistireland.ie or:
- The organic materials like food or garden waste typically accepted into the biodegradable waste bin ('brown bin'), as listed in www.brownbin.ie. Some collections vary from the website list by primarily targeting food waste, to the exclusion of garden waste.

Waste is defined as any substance or object which the holder discards or intends or is required to discard, under the Waste Framework Directive (2008/98/EC).

Waste electrical and electronic equipment (WEEE) refers to electrical and electronic equipment which is waste within the meaning of Article 3(a) of the Waste Directive 2008/98/EC, including all components, subassemblies and consumables which are part of the product at the time of discarding.

Waste management means the collection, transport, recovery and disposal of waste, including the supervision of such operations and the after-care of disposal sites, and including actions taken as a dealer or broker.

EXECUTIVE SUMMARY

This report presents the composition of the national kerbside collected household waste[1] in Ireland in 2017-2018. The profile was generated from a physical analysis of waste as presented kerbside by householders. The report profiles the following waste streams:

- Mixed residual waste (MRW), which is the waste stream that should be used to dispose of wastes that cannot be recycled. The term MRW is used, regardless of whether the contents of that bin could have been recycled or not.
- Mixed dry recyclable (MDR) stream. The term "recyclable" is used to define wastes that are appropriate for recycling.
- Organic waste (OW) stream, meaning biodegradable food and liquids (packaged and not packaged), garden and landscaping waste.

The three streams above are combined to create a national profile. This profile excludes household waste collected at non kerbside locations, so Ireland's overall household recycling performance is not identified in this kerbside analysis alone.

Accurate and up to date information on the composition of waste is required for effective waste management planning, implementation and monitoring. A similar study was last conducted in Ireland in 2008, so this is an important update.

Table ES.1 - Kerbside Collected Household Waste Composition

Waste Categories	MRW	MDR	OW	2016 National Profile
Plastics	18.6%	19.5%	3.8%	17.2%
Papers	10.1%	34.3%	4.1%	15.3%
Organic waste (non-garden)	13.6%	2.3%	28.2%	12.5%
Cardboards	3.8%	24.9%	0.0%	8.5%
Fines (<20mm)	11.5%	1.9%	6.4%	8.6%
Organic waste (garden)	2.5%	0.1%	55.7%	7.6%
Textiles Excl. Nappies	10.3%	3.3%	0.5%	7.6%
Nappies	10.1%	0.3%	0.5%	6.7%
Metals	4.7%	4.6%	0.3%	4.2%
Unclassified Combustibles	5.6%	2.8%	0.2%	4.3%
Glass	3.2%	2.1%	0.1%	2.6%
Unclassified Incombustibles	2.3%	0.8%	0.2%	1.7%
Haz. Municipal Waste (Excl. WEEE & Tubes)	1.2%	0.6%	0.0%	0.9%
Composite beverage cartons	0.6%	1.7%	0.0%	0.8%
Wood	1.1%	0.5%	0.1%	0.8%
WEEE & Tubes	0.9%	0.4%	0.0%	0.7%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**

[1] Excludes waste delivered at bring banks, civic amenities or landfill.

Mixed Residual Waste

Results for Mixed Residual Waste collection are shown in **Figure ES.1**.

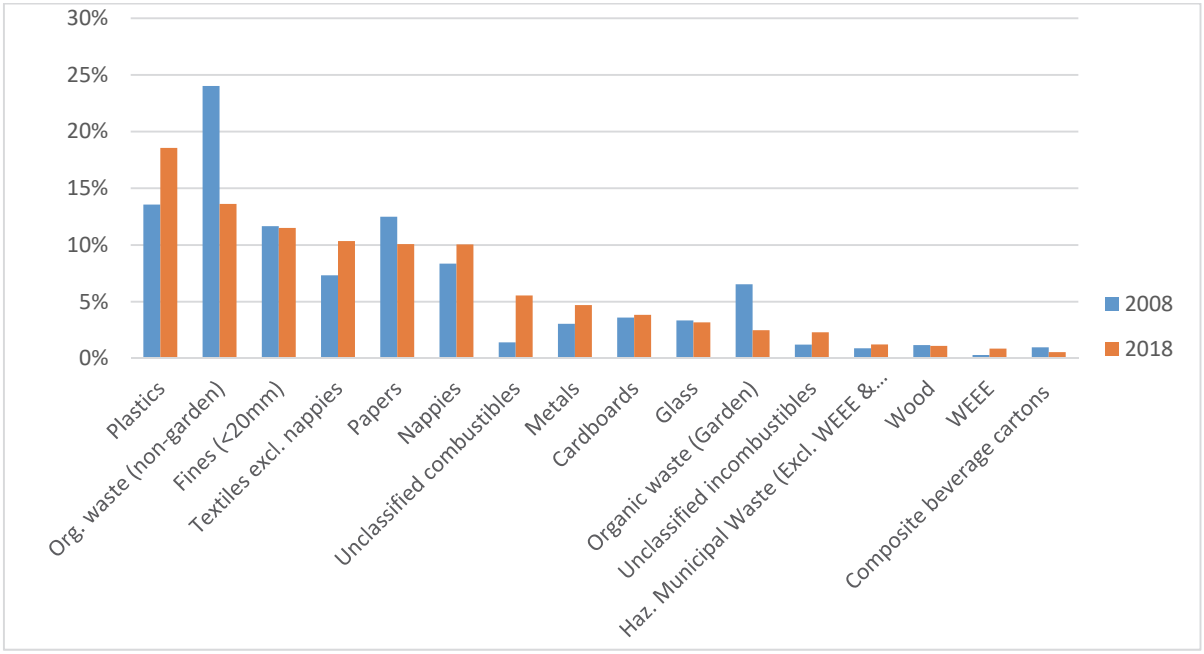


Figure ES 1 – Kerbside Collected MRW Composition - Change 2008-2018

Plastics has replaced organic waste as the most prominent waste category in mixed residual waste averaging 18.6% of the total composition. Plastics comprised supermarkets bags and films (packaging) at 6.9%, other plastic (non-packaging incl. bin bags) at 3.5%. PET, PE and PP packaging comprised 1.2%, 1.3% and 2% respectively.

The second largest waste category was **Organic waste (non-garden)** averaging 13.6%. The majority was unavoidable food waste[2] averaging 6.1%. Avoidable food waste was 4.6%, still in its packaging[3], with 2.7% possibly avoidable food waste[4], and 0.3% liquid fit for human consumption**. Organic waste (garden)** comprised 2.5%. Organic waste (non-garden) decreased and organic waste (garden) decreased significantly from 2008 to 2018.

Fines were one of the larger categories at 11.5% of the total composition. Fines are made of small particles <20mm that are difficult to determine the nature of (e.g. ash, soil, food fragment etc.).

Paper waste comprised 10.1% of the total composition, comprising the secondary waste categories: tissue papers (5.1%), paper packaging (1.8%), other papers (1.2%), newspapers (0.6%), magazines & glossy paper (0.6%) and office papers (0.6%).

[2] E.g. vegetable peelings, tea bags, meat carcasses
[3] E.g. partially used food that can't easily be separated from packaging, e.g. jar of honey, tub of hummus
[4] E.g. vegetables, fruit, cheese or sausages removed from packaging

Hazardous Waste (excl. WEEE) had a 0.3% increase from 0.9% in 2008 to 1.2% in 2018. **WEEE** also had a 0.6% increase, from 0.3% to 0.9% for the same period.

Materials placed incorrectly in the MRW Bin: up to 35.6% of the materials in the MRW bin could have been directed into mixed dry recyclable (14.6%) and organic collections (21.0%).

Packaging waste content increased 6.1% from 23.2% in 2008 to 29.3% in 2018.

Biodegradable waste decreased 12.3%, falling from 61.6% in 2008 to 49.3% in 2018. A large portion of this decrease is due to the decrease in organic (garden and non-garden) waste.

Mixed Dry Recyclables

Results for the mixed dry recyclables collection are shown in **Figure ES.2.**

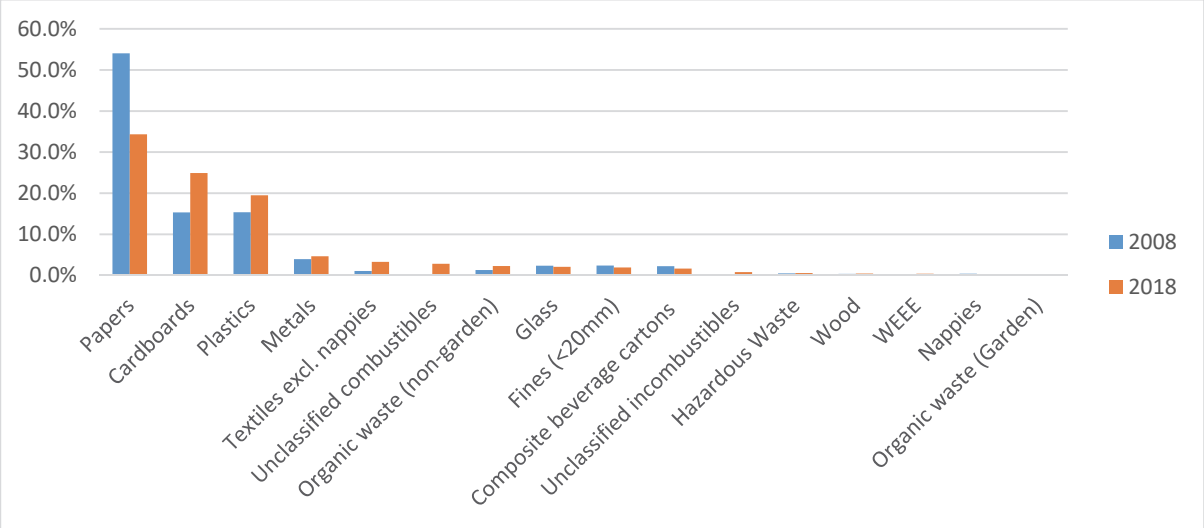


Figure ES 2 - Kerbside Collected MDR Composition - Change 2008-2018

The most prominent primary category was **papers** (34.3%) comprising newspapers (13.3%), magazines and glossy papers (7.0%), other papers (5.3%), tissue papers (1.9%), paper packaging (4.6%), and office papers (2.2%). The papers category showed a significant decrease from 54.0% of the waste in 2008 to 34.3% in 2018. This was largely driven by a decrease in newspapers from 30.6% in 2008 to 13.3% in 2018.

The second largest primary waste category was **cardboards** (24.9%), comprised flat card and corrugated cardboard (packaging) at 24.0%, and other cardboards (non-packaging) at 0.9%.

Plastics represent the third largest waste category recorded increasing 4.1% from 15.4% in 2008 to 19.5% in 2018. This was comprised mostly of PET, PE and PP packaging at 5.0%, 3.4% and 3.0% respectively. Other plastic (packaging) and supermarket bags and films amounted to 2.9% and 3.3% of the plastics recorded.

Metals (4.6%) included 2.3% ferrous packaging, 1.3% aluminium cans and 0.4% aluminium foil.

Composite beverage cartons (e.g. Tetrapak) amounted to 1.7% of the total waste composition.

Non targeted materials comprised 26.3% of the materials in the mixed dry recyclables collections.

Packaging waste comprised 54.9% of the MDR stream. The main packaging waste categories included papers and cardboard at 28.6%, plastics at 18%, metals at 4.1% and composite beverage cartons (e.g. Tetrapak) at 1.7%.

The MDR stream is estimated to comprise 66% **biodegradable materials** (mainly papers and cardboard).

Organic Waste

Results for organic waste are shown in **Figure ES.3.**

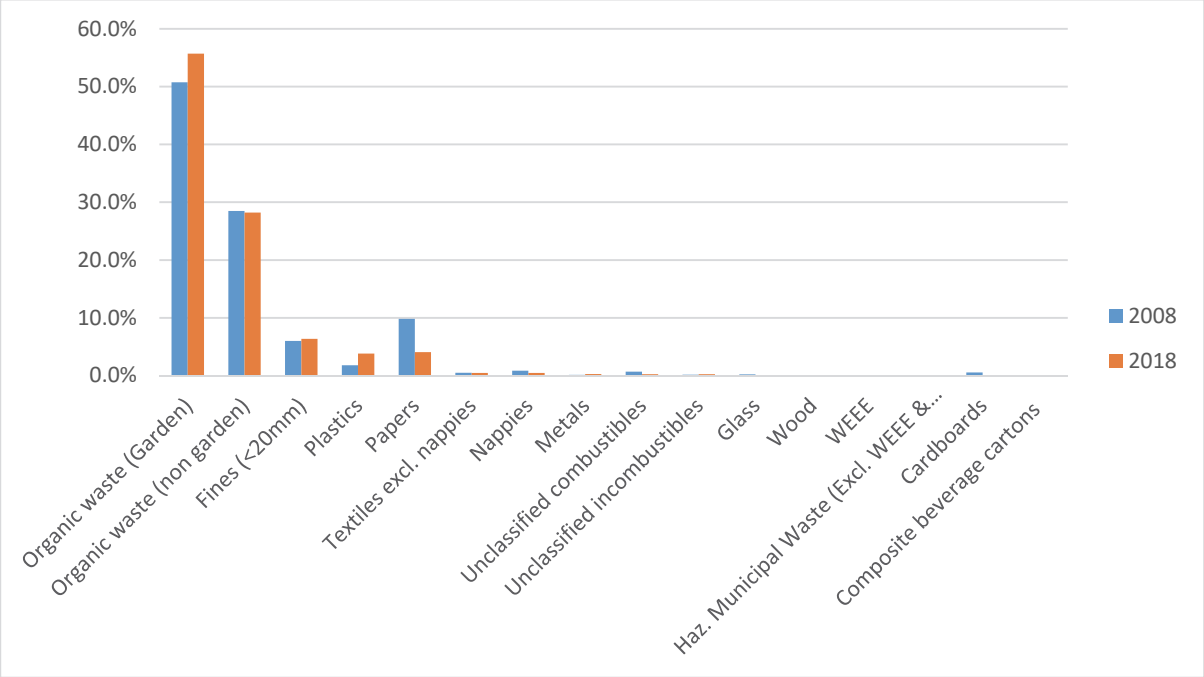


Figure ES 3 - Kerbside Collected Organic Waste Composition - Change 2008-2018

The most prominent primary category was **Organic waste (garden)** comprising 55.7% of the composition. This includes materials such as crass clippings, hedge trimmings, etc.

Organic waste (non-garden) was the second largest waste category and comprised 28.2% of organic waste collections. The majority of the food waste (22.1%) was ''unavoidable'' food waste, with 1.8% ''avoidable'' food waste and 3.1% ''possibly avoidable'' food waste.[5]

Fines (<20mm), were 6.4% of the composition, the third largest primary waste category.

Papers comprised 4.1%, mostly tissue (2.4%), recyclable and recoverable packaging (0.8%), Newspapers (0.3%) and unrecyclable paper (0.2%).

Non Target materials comprised 14.1% of the materials in the organic waste collections.

Packaging within this waste stream comprised 4.9% and included plastics at 3.4%, papers and cardboard at 1.0%, metals at 0.3% and glass at 0.1%.

The organic waste stream is estimated to comprise 91.8% **biodegradable materials**.

[5] It must be noted that it is sometimes difficult to differentiate between avoidable and unavoidable food waste due to the advanced decomposition of some food materials.

National Profile

National waste composition profile results are shown in **Figures ES.4.**

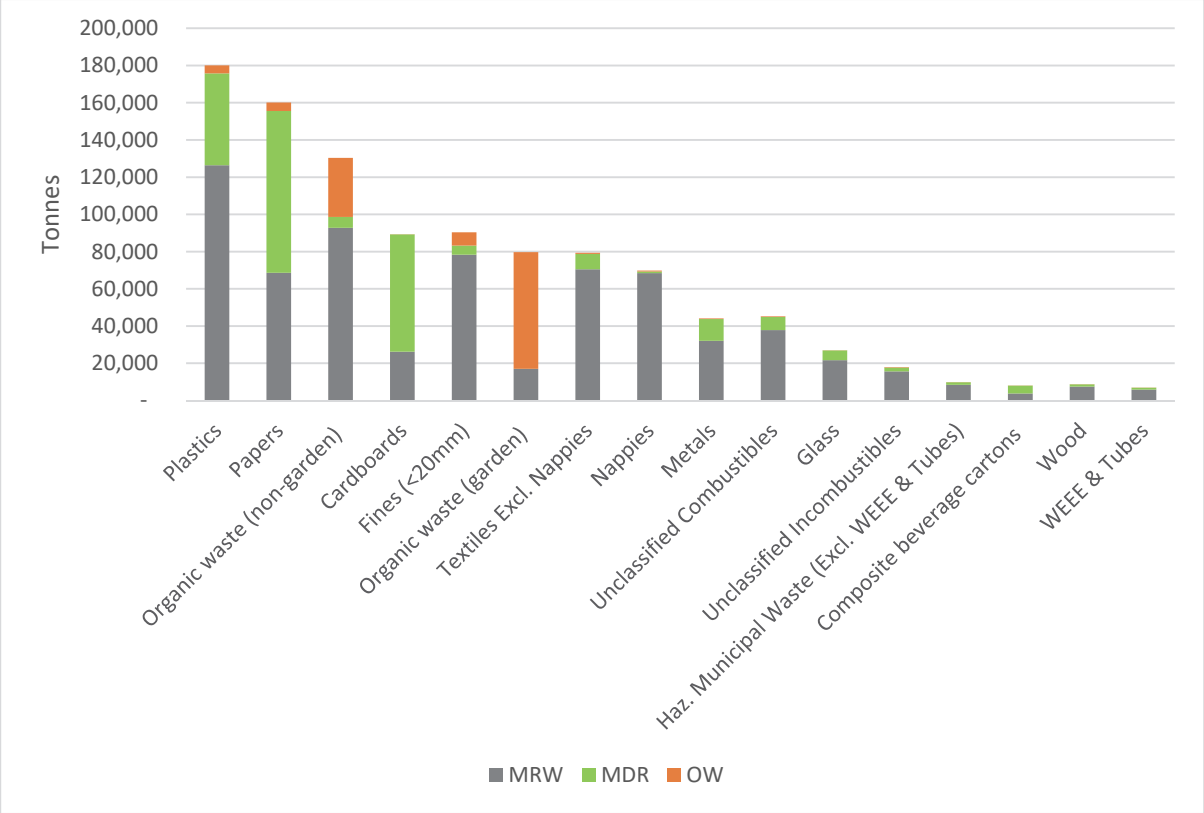


Figure ES 4 - National Profile for Kerbside Collected Household Waste

The most prominent category was **plastics** averaging 17.2% of the total composition. Of this plastic waste, 70% remains in the MRW collection.

The second largest waste category was **paper waste** with 15.3% of the total composition. 54% is captured in the MDR collection and 43% remain in the MRW collection.

Organic waste (non-garden) averages 12.5%. With 71% of organic wastes (non-garden) remaining in the MRW collection and 24% collected in the organic waste (e.g. brown bin) collection. It must be noted that 4% is also present as non-targeted material in the MDR collection.

Organic waste (garden) comprised 7.6%, mainly collected in the organic waste (e.g. brown bin) collection (79%) and the remainder in the MRW collection.

Cardboard waste comprised 8.5% of the total composition, mainly collected in the MDR collection (71%) with the remainder in the MRW collection (29%).

Textiles waste (excl. nappies) averaged 7.6%, mainly collected in the MRW collection (89%) with the remainder in the MDR collection (11%).

Metal waste averaged 4.2%, mainly collected in the MRW collection (73%) with the remainder in the MDR collection (27%).

Glass waste averaged 2.6% of the materials, mainly collected in the MRW collection (80%) with the remainder in the MDR collection (19%).

Composite beverage cartons averaged 0.8%, captured mainly in the MDR collection (53%) and MRW collection (47%).

Hazardous Waste (aerosols, paints, medicines and drugs) comprised 0.9% of the waste composition with an additional 0.7% comprising **WEEE**. These streams are mainly captured in the MRW collection (85%).

The kerbside household waste stream is estimated to comprise 57.9% **biodegradable materials**.

Packaging accounted for 32.9% of the household kerbside waste. **Figure ES.5** shows that the mixed dry recyclable collection is successful in capturing cardboard packaging, but further progress is needed for the other packaging streams (plastics, papers and metals).

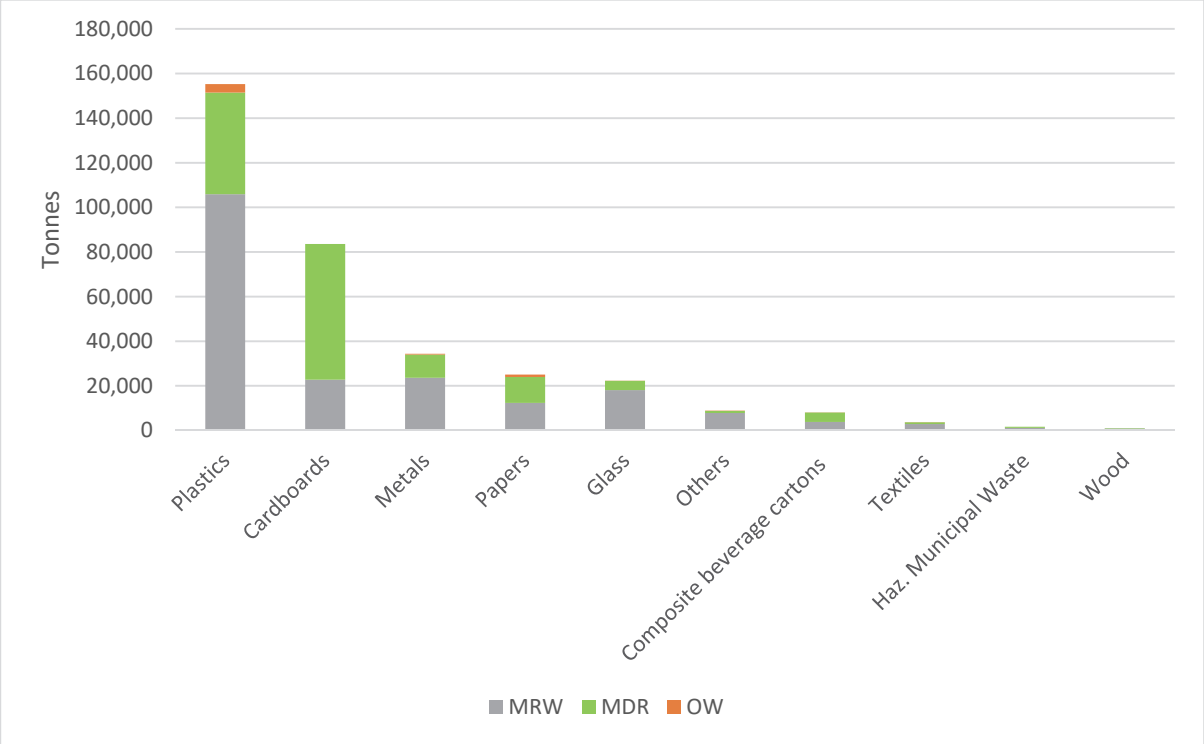


Figure ES 5 - National Profile for Kerbside Household Packaging Waste by Main Material Stream

1 INTRODUCTION

The objective of this project[6] is to undertake characterisation on the different fractions of household (Task 1) and non-household (Task 2) municipal waste, to develop a model (Task 4) that can be applied to national figures and to quantify the level of contamination in packaging waste (Task 3).

The Final Report is the final deliverable of Task 1 household waste characterisation. The Final Report:

- Describes the household waste sampling methodology and sampling procedure,
- Presents the samples, their analysis and composition,
- Quantify the level of contamination in packaging household waste, and
- Recommends methodology for the application of findings.

The fieldwork element was based on the methodology developed in 2015[7] (referred hereafter as the 2015 methodology) and updated sampling plans issued to the EPA in February 2017 and September 2017.

The fieldwork element comprised a physical waste compositional analysis of the following kerbside collected streams:

- Mixed Residual Waste (hereafter referred to as MRW),
- Mixed Dry Recyclables(hereafter referred to as MDR), and
- Organic Waste (hereafter referred to as OW).

The three streams above are combined to create a national profile using 2016 kerbside collected household waste data. This profile excludes household waste collected at non kerbside locations (e.g. bring banks, civic amenity sites etc.), so Ireland's overall household recycling performance is not identified in this kerbside analysis alone.

The fieldwork was completed between April 2017 and March 2018. This period is denoted as '2018' throughout this report.

The data is presented at the primary category level[8] and full detailed data sets results with all secondary waste categories[9] in percentages of the materials surveyed are included in **Appendices G, H and I**.

A national kerbside household waste composition profile is generated with full details of secondary categories in **Appendix J**.

[6] EPA, 2016. Request for Tender SPCP-2016-49 Municipal waste characterization.
[7] RPS, 2015. Review of the methodologies used for the characterisation of household municipal waste.
[8] Primary Waste Category - A high level waste category e.g. organics, metals etc.
[9] Secondary Waste Category is a more specific waste category within a Primary Waste Category, e.g. mixed flexible plastic, ferrous metal etc.

2 MIXED RESIDUAL WASTE

This section presents:

- Background information on authorised waste collectors (AWCs) and number of samples collected per AWC.
- MRW waste composition results and their analysis.

2.1 BACKGROUND INFORMATION

Table 2.1 presents background information on mixed residual waste collections for the AWCs who collaborated in the campaign. These AWCs comprised 47% of households provided with kerbside waste collection in 2015.

Table 2.1 - AWCs Background Information

AWC	Frequency of Collection	Charges	Type of Container	Collection Systems
AWC1	Fortnightly	Pay by Weight	Bins & bags	2& 3 bin
AWC2	Fortnightly	Pay by Weight	Bins	3 bin
AWC3	Fortnightly	Flat fee	Bins & bags	3 bin
AWC4	Fortnightly	Pay by Weight	Bins	4 bin
AWC5	Fortnightly	Flat up to weight limits then Pay by Weight	Bins	2, 3& 4 bin
AWC6	Fortnightly	Pay by Weight and Flat fee mixed options	Bins	2 & 3 bin
AWC7	Fortnightly	Flat up to weight limits then Pay by Weight	Bins	2 & 3 bin
AWC8	Fortnightly	Pay by Weight	Bins	4 bin

2.2 SAMPLING PROGRAMME

In total, 32 household mixed residual waste samples, from 8 AWCs, were surveyed. **Table 2.2** indicates the stratum from which the samples were collected.

Table 2.2 - Number of Samples

Level of Urbanisation	Collection System	AWC 1	AWC 2	AWC 3	AWC 4	AWC 5	AWC 6	AWC 7	AWC 8	Total
Cities (and their suburbs)	1-bin	0	0	0	0	0	0	0	0	**0**
	2-bin	0	2*	0	0	1*	0	0	0	**3**
	3-bin	5	2	0	0	2	0	0	0	**9**
	1, 2 & 3-bin w/Glass	0	0	0	0	0	0	0	1	**1**
Rural and mixed rural/urban areas	1-bin	0	0	0	0	0	0	0	0	**0**
	2-bin	1	0	1	0	0	2	2	0	**6**
	3-bin	3	0	3	2	0	2	1*	0	**11**
	1, 2 & 3-bin w/Glass	0	0	0	1	0	0	0	1	**2**
Total		**9**	**4**	**4**	**3**	**3**	**4**	**3**	**2**	**32**

*** Apartments**

2.3 RESULTS

Table 2.3 shows the composition of kerbside collected household mixed residual waste. Detailed results are presented in **Appendix G**.

Table 2.3 - Composition of Kerbside Collected Household MRW[10]

Waste Categories	Mean	Min	Max	Lower Limit	Upper Limit
Organic waste (garden)	2.5%	0.2%	13.5%	1.6%	3.4%
Organic waste (non-garden)	13.6%	2.4%	33.7%	11.3%	16.0%
Papers	10.1%	4.7%	17.1%	9.3%	10.8%
Cardboards	3.8%	0.6%	9.9%	3.3%	4.4%
Composite beverage cartons	0.6%	0.0%	2.5%	0.4%	0.7%
Textiles Excl. Nappies	10.3%	2.9%	24.1%	9.0%	11.7%
Nappies	10.1%	0.0%	30.5%	8.4%	11.7%
Plastics	18.6%	8.8%	25.8%	17.4%	19.8%
Glass	3.2%	0.6%	10.8%	2.5%	3.8%
Metals	4.7%	1.7%	9.1%	4.2%	5.2%
Wood	1.1%	0.0%	5.6%	0.7%	1.5%
Haz. Municipal Waste (Excl. WEEE & Tubes)	1.2%	0.0%	9.0%	0.7%	1.8%
WEEE & Tubes	0.9%	0.0%	4.0%	0.6%	1.2%
Unclassified Combustibles	5.6%	0.1%	19.1%	4.3%	6.8%
Unclassified Incombustibles	2.3%	0.0%	13.4%	1.6%	3.0%
Fines (<20mm)	11.5%	0.0%	23.8%	9.5%	13.6%
Total	**100.0%**	**n/a**	**n/a**	**n/a**	**n/a**

[10] To compare waste categories, a confidence level of 90% has been used consistently used in this report.

Figure 2.1 depicts the composition of kerbside collected household mixed residual waste presented in Table 2.3.

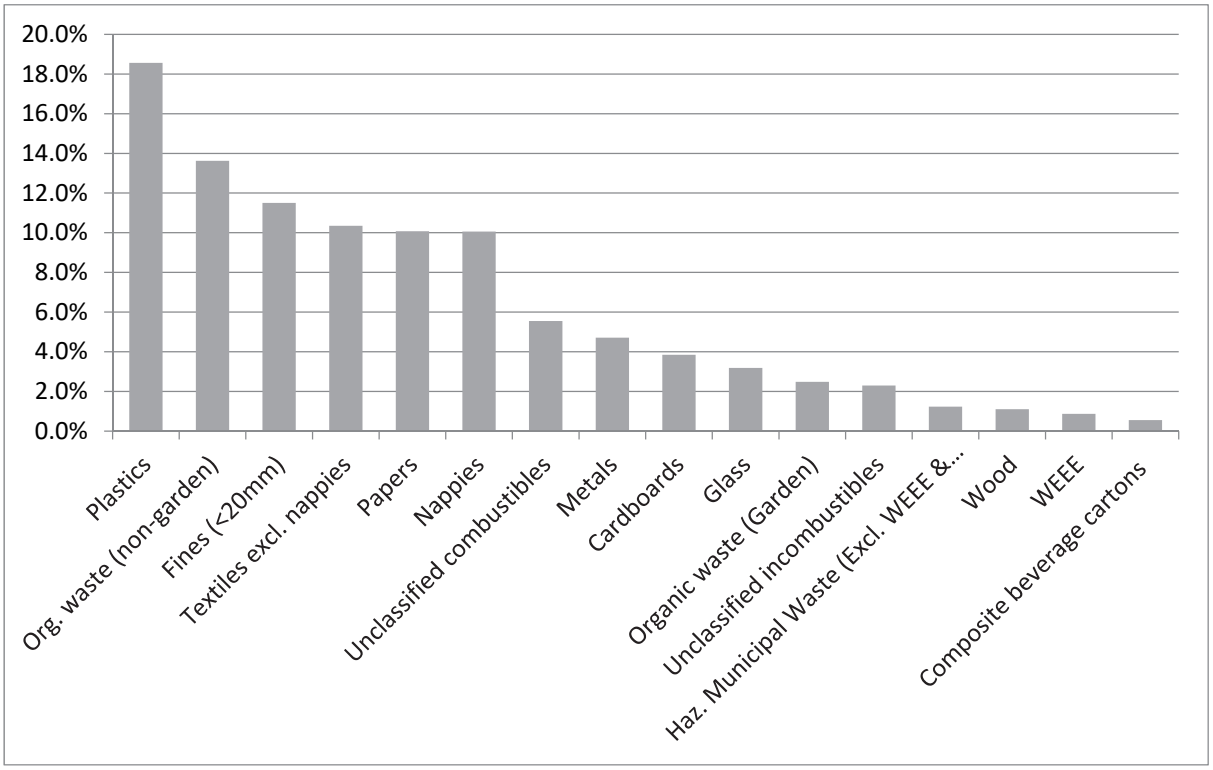


Figure 2.1 - Composition of Kerbside Collected Household MRW

The most prominent category was **plastics** averaging 18.6% of the total composition. Plastics comprised supermarkets bags and films (packaging) at 6.9%, other plastic (non-packaging incl. bin bags) at 3.5%. PET, PE and PP packaging comprised 1.2%, 1.3% and 2% respectively.

The second largest waste category was **Organic waste (non-garden)** averaging 13.6%. The majority was unavoidable food waste[11] averaging 6.1%. Avoidable food waste was 4.6%, still in its packaging[12], with 2.7% possibly avoidable food waste[13], and 0.3% liquid fit for human consumption**.** **Organic waste (garden)** comprised 2.5%.

Paper waste comprised 10.1% of the total composition, comprising the secondary waste categories: tissue papers (5.1%), paper packaging (1.8%), other papers (1.2%), newspapers (0.6%), magazines & glossy paper (0.6%) and office papers (0.6%).

Cardboard waste comprised 3.8% of the total composition, comprising the secondary waste categories: Flat Card and Corrugated Cardboard (Packaging) (3.3%) and other cardboards (Non-packaging) (0.5%).

[11] E.g. vegetable peelings, tea bags, meat carcasses
[12] E.g. partially used food that can't easily be separated from packaging, e.g. jar of honey, tub of hummus
[13] E.g. vegetables, fruit, cheese or sausages removed from packaging

Textiles waste averaged 20.4%, comprising: nappies (10.1%), clothes (5.9%) and textiles (non-packaging) (3.1%) and healthcare textiles (1%).

Fines (small particles <20mm that are difficult to determine the nature of) was one of the larger categories at 11.5% of the total composition.

Metal waste averaged 4.7% of the materials including aluminium foil (1.6%), aluminium cans (1.6%), other metal waste (1.2%) and ferrous metal packaging (1%).

Glass waste averaged 3.2% of the materials, with 2.7% of this being glass packaging.

Wood averaged 1.1% with 0.6% being treated/composite wood and the remainder natural wood.

Hazardous Waste (aerosols, paints, medicines and drugs,) comprised 1.2% of the waste composition with an additional 0.9% comprising **WEEE** and 0.1% comprising of **batteries**.

Composite beverage cartons averaged 0.6%.

2.4 DISCUSSION

2.4.1 Materials Placed Incorrectly in the MRW Bin

The analysis allowed us to determine waste types incorrectly placed in the MRW bin. This includes items that could be collected in other kerbside services, (e.g. PET packaging in MDR collection).

Up to 35.6% of the materials in the MRW bin could have been directed into mixed dry recyclable [14](14.6%) and organic collections[15] (21.0%).

Materials that could potentially be **targeted by MDR collections** include: Papers and cardboards (7.9%), Plastics (4.5%), Metals (1.7%), Composite beverage cartons (e.g. Tetrapak) (0.6%).

Materials that could be **targeted by organic waste collections** include food waste at 13.4%, garden waste at 2.7% and tissue papers at 5.1%.

[14] Recyclable and Recoverable Paper Packaging, Newspapers, Magazines & glossy paper, Office papers, Other papers, Flat Card and Corrugated Cardboard (Packaging), Other cardboards (Non-packaging), Composite beverage cartons (e.g. Tetrapak), PET packaging, PE packaging, PP Packaging, Ferrous metal packaging, Aluminium cans.

[15] Food waste, biodegradable waste from garden & park, tissue papers.

2.4.2 Packaging Waste

An estimated 29.3% was **packaging.**[16] The main packaging materials comprised: packaging plastics (15.6%), packaging papers and cardboard (5.2%), packaging metals (3.3%), packaging glass (2.7%). Figure 3.2 shows the detailed packaging waste categories.

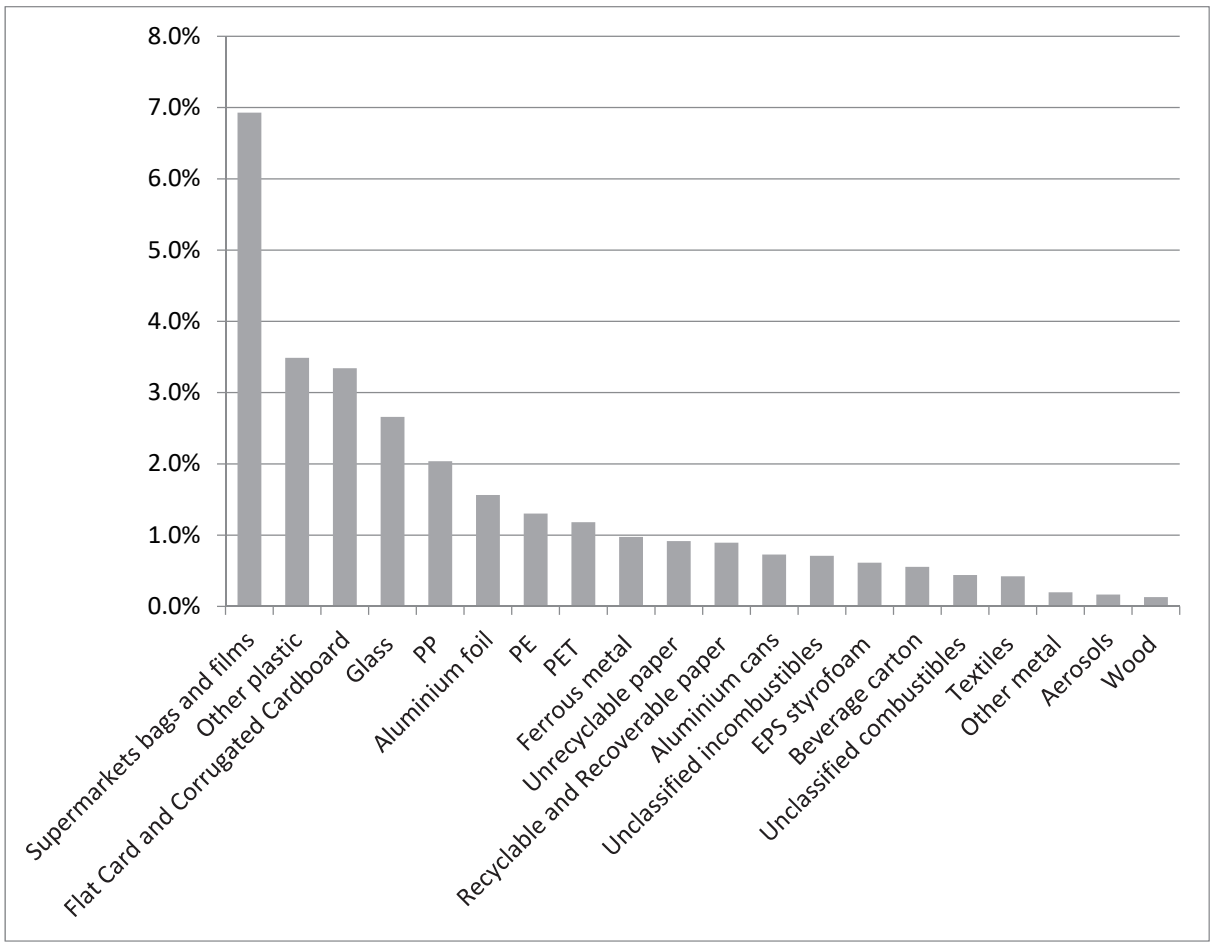


Figure 2.2 - Packaging in Kerbside Collected Household MRW

2.4.3 Biodegradable Waste

An estimated 49.3% of the MRW bin was biodegradable[17].

[16] Paper Packaging, Flat Card and Corrugated Cardboard (Packaging), Composite beverage cartons (e.g. Tetrapak), Textiles Packaging, PET packaging, PE packaging, PP Packaging, EPS Styrofoam Packaging, Supermarkets bags and films (packaging), Other plastic (packaging), Glass packaging, Ferrous metal packaging, Aluminium cans, Aluminium foil, Other metal packaging, Wood packaging, Aerosols, Unclassified combustibles packaging, Unclassified incombustibles packaging,

[17] Each waste type is assigned as 100% BMW, 50% BMW or 0% BMW. Food waste, garden waste, papers and cardboard are 100% BMW. Textiles (including nappies), and timber, unclassified combustibles and fines are 50% BMW. Other categories such as glass, plastics and metals are 0% BMW. (EPA, 2011, Protocol For The Evaluation Of Biodegradable Municipal Waste Sent To Landfill).

2.4.4 Main Changes 2008-2018

A comparison of results for 2008[18] and 2018 shows that:

- Plastic has replaced organic waste as the primary waste category in mixed residual waste.
- Plastic waste increased from 13.6% to 18.6%.
- Organic waste (non-garden) decreased from 24.0% to 13.6% and organic waste (garden) decreased from 6.5% to 2.5%.
- Textiles (excluding nappies) increased from 7.3% to 10.3%.
- Nappies increased from 8.4% to 10.1%.
- Papers had a 2.4% decrease, falling from 12.5% to 10.1%.
- There was a 0.2% increase in the quantity of cardboards to 3.8%.
- Metal waste increased 1.7%, from 3.1% to 4.7%.
- Glass fell by 0.2% to 3.2%.
- Composite beverage cartons decreased 0.4%, from 1% to 0.6%.
- Unclassified Combustibles increased 4.1%, from 1.4% to 5.6%.
- Unclassified Incombustibles increased 1.2%, being 2.3% of the waste.
- Hazardous Waste had a 0.3% increase from 0.9% in 2008 to 1.2%.
- WEEE had a 0.6% increase, from 0.3% to 0.9%.
- Fines (<20mm) proportion barely changed falling from 11.7% to 11.5%. Solid fuel ash was very apparent in samples from Galway.

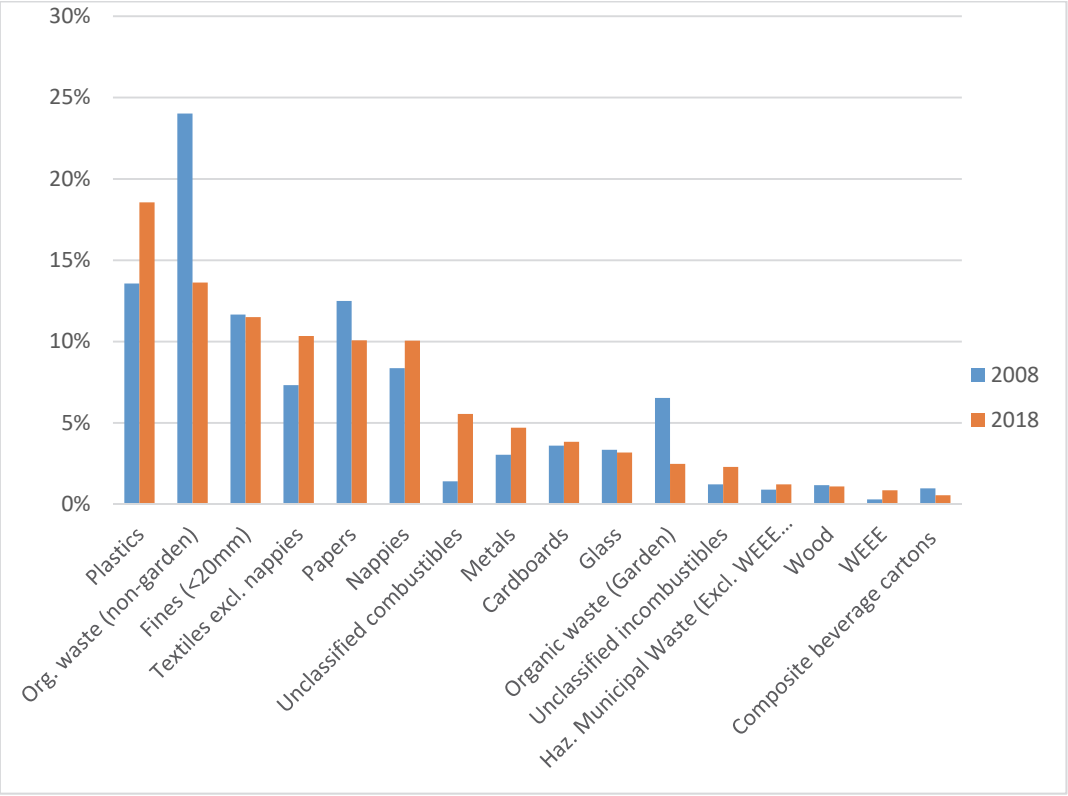


Figure 2.3 – Kerbside Collected Household MRW Composition - Change 2008-2018

[18] RPS, 2009. Municipal Waste Characterisation Surveys 2008.

Combining some component primary and secondary categories into gives information about the major materials incorrectly placed in the MRW bin, biodegradable and packaging waste.

Materials incorrectly placed in the MRW bin decreased from 54.3% to 35.6%.

Biodegradable waste decreased 12.3%, falling from 61.6% in 2008 to 49.3% in 2018. A large portion of this decrease is due to the decrease in organic (garden and non-garden) waste.

Packaging waste increased 6.1% from 23.2% in 2008 to 29.3% in 2018. The main changes were as follows:

- Plastic packaging increased from 11.1% in 2008 to 15.6% in 2018. While PET, PE and PP packaging quantities decreased slightly (-0.8%), this 3.5% increase arises from an increase in the proportion of other plastic packaging (3.2%), supermarket bags and films (packaging) (1.7%) and EPS Styrofoam packaging (0.4%)
- Metal packaging increased to 3.5%.
- Paper and cardboard packaging decreased slightly by 0.3% from 5.5% in 2008 to 5.2% in 2018.

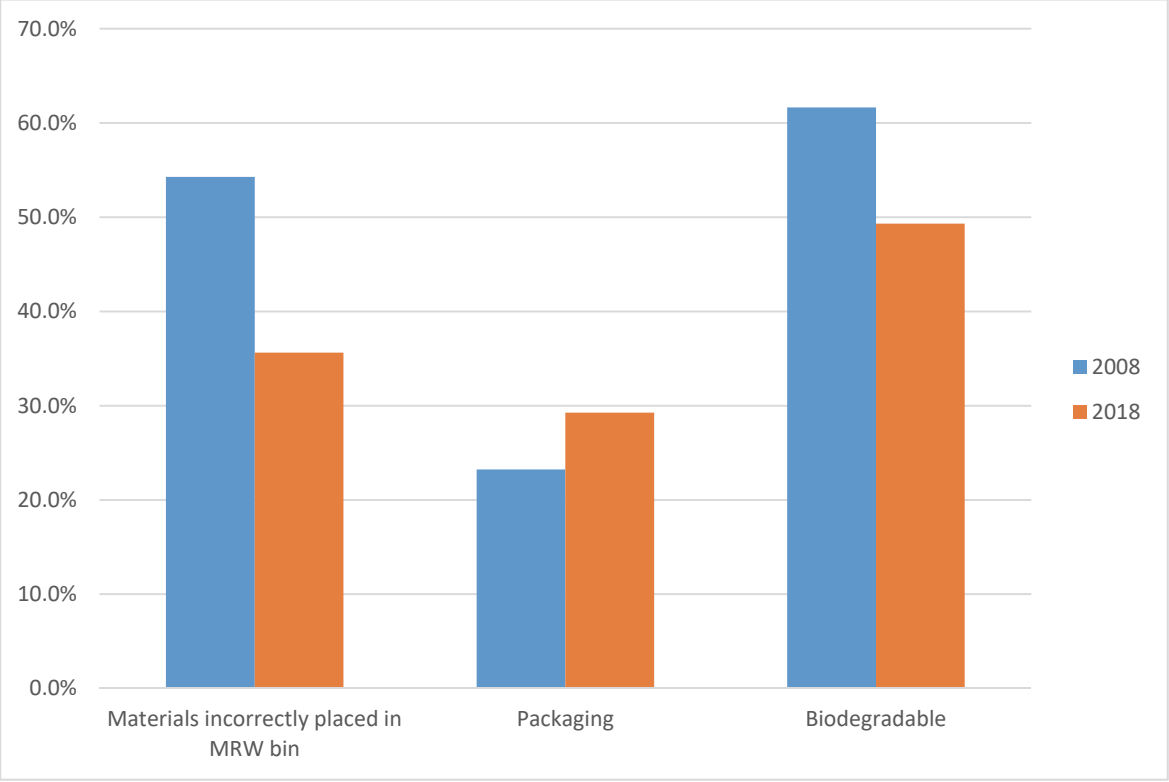


Figure 2.4 – Kerbside Collected Household MRW Target, Packaging & Biodegradable Waste Content Change 2008-2018

Image 2.1 – Fines (Solid Fuel Ash) Visible in MRW Sample from Galway

Image 2.2 - Fines

Image 2.3 - Glass packaging

3 MIXED DRY RECYCLABLES

3.1 BACKGROUND INFORMATION

Table 3.1 presents background information on MDR collections for the AWCs who collaborated in the campaign.

Table 3.1 - AWCs Background Information

Indicator	AWC1	AWC2	AWC3	AWC4	AWC8
Frequency of collection	Fortnightly	Fortnightly	Fortnightly	Fortnightly	Fortnightly
Charges	Pay by Weight	Free	Flat fee	Pay by Weight	Pay by Weight
Type of container	Bins	Bins	Bins	Bins	Bins
Targeted materials	- Paper - Newspapers & Magazines - Cardboard (clean & dry) - Phonebooks & Catalogues - Cereal boxes	- Newspapers / General paper - Magazines - Cardboard Packaging	- Light Cardboard Packaging - Newspapers, Magazines - Paper, Junk Mail, Books, Envelopes, pamphlets	- Paper (newspaper, envelopes, etc.) - Cardboard - Cartons	Cardboard, , Boxes (Flat), Letters and Brochures, Egg Boxes Toilet and Newspapers, Kitchen Roll
	- Plastic bottles - Plastic containers - Acceptable plastic types in green bin: All Plastic Bottles including mineral milk and detergent bottles	- Plastic Bottles (Mineral/Milk/Juice) - Clear, Clean plastic film	- Plastic Bottles	- Plastic containers (with appropriate symbols)	Butter, Yoghurt, & Salad Tubs, Plastic, Cleaning, Bottles, Plastic Drink, Bottles, Fruit &, Veg Trays, Plastic Milk, Cartons, Soap or, Shampoo, Bottles
	- Steel food cans - Aluminium drink cans	- Washed Food (Steel/Tin) Cans - Drink (Aluminium) Cans	- Drinks Cans - Food / Biscuit Tins	- Food & Drinks containers - Tin cans	Soup Cans , Pet Food Cans , Drink Cans , Food Cans
	- Tetrapak (juice & milk cartons)	- Washed Tetrapak Milk & Juice Cartons	- Tetrapak Cartons		Tetra Pak, Juice or Milk Cartons,

3.2 SAMPLING PROGRAMME

In total, 12 household MDR samples were surveyed from 5 AWCs. **Table 3.2** shows from which stratum the samples were collected from.

Table 3.2 - Number of Samples

Stratum Level of Urbanisation	Stratum Collection System	AWC1	AWC2	AWC3	AWC6	AWC8	Total
Rural and mixed rural/urban areas	1-bin	-	-	-	-	-	-
	2-bin	-	-	1	1	-	**2**
	3-bin	1	2	1	-	-	**4**
	1, 2& 3-bin w/Glass	-	-	-	-	1	**1**
Cities (and their suburbs)	1-bin	-	-	-	-	-	-
	2-bin	-	1*	-	-	-	**1**
	3-bin	1	2	-	-	-	**3**
	1, 2& 3-bin w/Glass	-	-	-	-	1	**1**
Totals		**2**	**5**	**2**	**1**	**2**	**12**

*** Apartments**

3.3 RESULTS

Table 3.3 and **Figure 3.1** show the composition of MDR collections for the waste characterisation campaign. Detailed results are presented in **Appendix H**.

Table 3.3 - Composition of Kerbside Collected Household MDR

Primary Waste Categories	Mean	Min	Max	Lower Limit	Upper Limit
Papers	34.3%	17.7%	49.0%	30.6%	38.0%
Cardboards	24.9%	19.6%	33.2%	22.7%	27.1%
Plastics	19.5%	13.9%	24.8%	18.0%	20.9%
Metals	4.6%	2.0%	11.0%	3.5%	5.7%
Textiles Excl. Nappies	3.3%	0.9%	11.5%	1.9%	4.7%
Unclassified Combustibles	2.8%	0.2%	7.4%	1.6%	4.0%
Organic waste (non-garden)	2.3%	0.0%	10.6%	0.8%	3.8%
Glass	2.1%	0.5%	4.1%	1.5%	2.6%
Fines (<20mm)	1.9%	0.5%	6.1%	1.2%	2.7%
Composite beverage cartons	1.7%	0.9%	2.9%	1.4%	2.0%
Unclassified Incombustibles	0.8%	0.0%	5.1%	0.2%	1.4%
Haz. Municipal Waste (Excl. WEEE & Tubes)	0.6%	0.1%	1.1%	0.4%	0.7%
Wood	0.5%	0.0%	2.8%	0.1%	0.8%
WEEE & Tubes	0.4%	0.0%	2.1%	0.1%	0.7%
Nappies	0.3%	0.0%	1.2%	0.2%	0.5%
Organic waste (garden)	0.1%	0.0%	0.5%	0.0%	0.1%
Total	**100.0%**	**n/a**	**n/a**	**n/a**	**n/a**

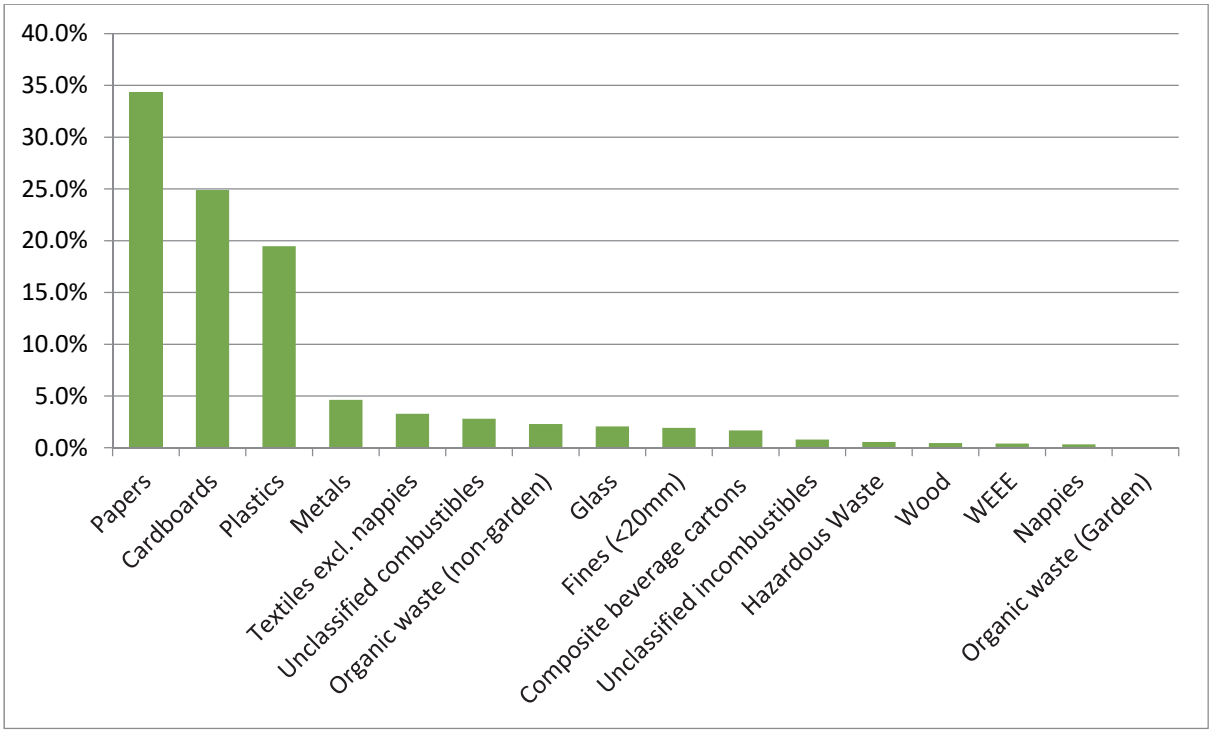


Figure 3.1 - Composition of Kerbside Collected Household MDR

The most prominent primary category was **papers** (34.3%) comprising newspapers (13.3%), magazines and glossy papers (7.0%), other papers (5.3%), tissue papers (1.9%), paper packaging (4.6%), and office papers (2.2%).

The second largest primary waste category was **cardboards** (24.9%), which comprised flat card and corrugated cardboard (packaging) at 24.0%, and other cardboards (non-packaging) at 0.9%.

Plastics comprised 19.5% of the total waste composition, making it the third largest primary waste category. This was comprised mostly of PET, PE and PP packaging at 5.0%, 3.4% and 3.0% respectively. Other plastic (packaging) and supermarket bags and films amounted to 2.9% and 3.3% of the plastics recorded.

For other streams:

- **Metals** (4.6%) included 2.3% ferrous packaging, 1.3% aluminium cans and 0.4% aluminium foil.
- **Textiles** comprised 3.3% and **nappies** 0.3% of the waste.
- **Fines (<20mm)**, small particles whose nature is difficult to determine, comprised 1.9% of the composition.
- **Composite beverage cartons (e.g. Tetrapak**) amounted to 1.7% of the total waste composition.
- **Glass** comprised 2.1%, with 1.4% being glass packaging and 0.7% non-packaging glass.
- **Hazardous Waste** (Aerosols, Paints, Medicines and Drugs, Batteries) comprised 0.6% of the materials and 0.4% comprised WEEE.

3.4 DISCUSSION

3.4.1 Non Target Materials

Non targeted materials comprised 26.3% of the materials in the mixed dry recyclables collections.

The analysis allowed us to determine the degree of non-target 'contamination' - meaning waste types incorrectly placed in the MDR bin. Non-target includes items which have been placed in the wrong stream - e.g. organic waste in an MDR collection - and other wastes that cannot be recycled in kerbside services - e.g. glass or WEEE.

The non-target materials included plastics (films, EPS, etc.) at 8.1%, textiles and nappies at 3.6%, organic waste at 2.3%, unclassified combustibles (e.g. composite packaging other than composite beverage cartons (e.g. Tetrapak)) at 2.8%, tissue and unrecyclable papers at 2.6%, fines (<20mm) at 1.9%, glass at 2.0%, metals at 1.1%, hazardous waste at 0.7%, WEEE at 0.4%, unclassified incombustibles at 0.8% and wood at 0.5%.

Even materials present at low rates can have significant effects: nappies, for example, were present at 0.3%, but represent a disproportionately large potential for contamination. Glass (2.0%) similarly has been shown to have a negative effect on recycling for the paper content of the MDR stream.

3.4.2 Packaging Waste

Packaging waste comprised 54.9% of the MDR stream. The main packaging waste categories include papers and cardboard at 28.6%, plastics at 18%, metals at 4.1% and composite beverage cartons (e.g. Tetrapak) at 1.7%. **Figure 3.2** shows the detailed packaging waste categories.

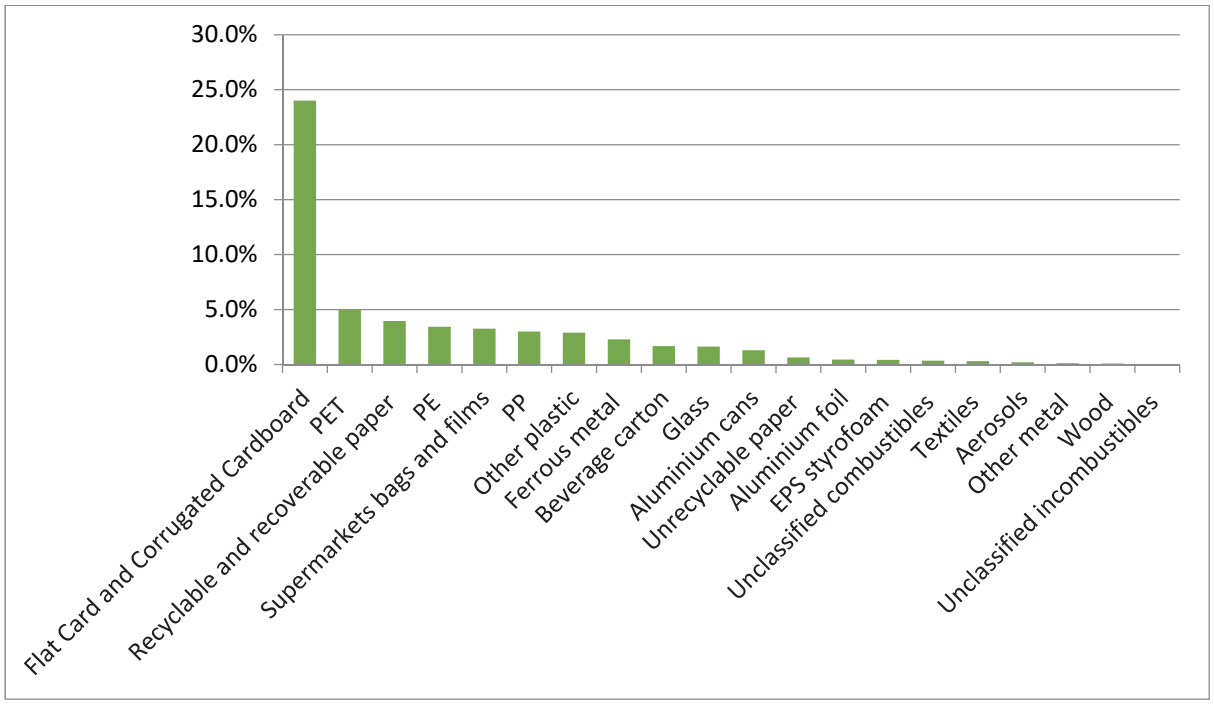


Figure 3.2 - Packaging in Kerbside Collected Household MDR

3.4.3 Biodegradable Waste

The MDR stream is estimated to comprise 66% biodegradable materials (mainly papers and cardboard).

Image 3.1 - Newspapers

Image 3.2 - PET packaging

3.4.4 Main Changes 2008-2018

The papers category showed a significant decrease from 54.0% of the waste in 2008 to 34.3% in 2018. This was largely driven by a decrease in newspapers from 30.6% in 2008 to 13.3% in 2018.

Cardboard increased 15.3% in 2008 to 24.9% in 2018, making it the second largest waste category.

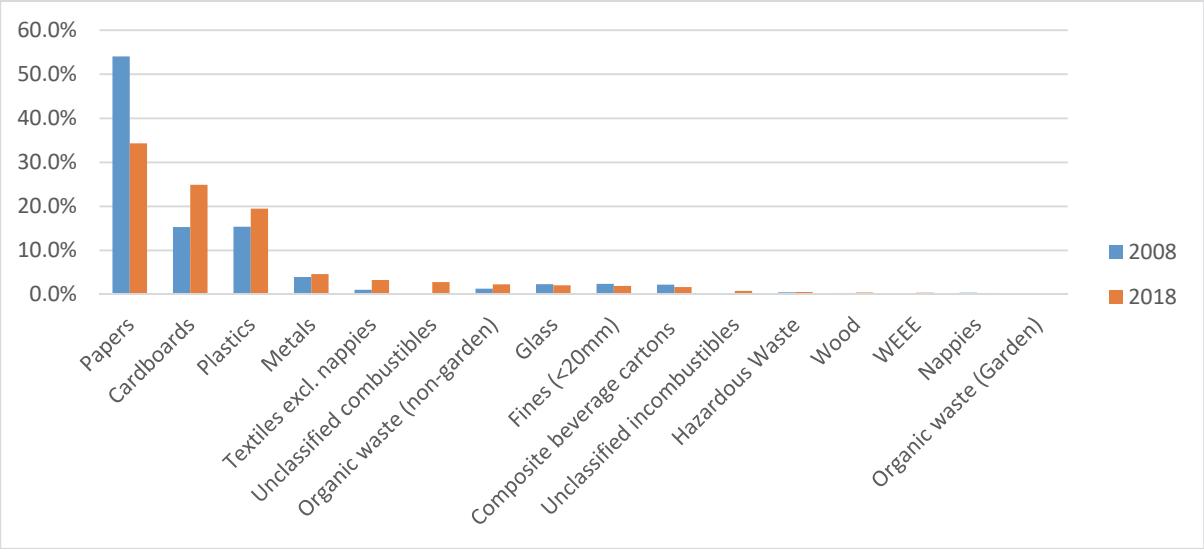


Figure 3.3 – Kerbside Collected Household MDR Composition - Change 2008-2018

Plastics represent the third largest waste category recorded increasing 4.1% from 15.4% in 2008 to 19.5% in 2018. Composites beverage cartons decreased from 2.2% to 1.7% in 2018.

Metals increased from 4.0% in 2008 to 4.6% of the waste composition.

Textiles excluding nappies, increased by 2.2% from 1.1% in 2008 to 3.3% in 2018.

Unclassified Combustibles increased from 0.2% in 2008 to 2.8% in 2018.

Unclassified Incombustibles increased by 0.6% to 0.8% in 2018.

Organic Waste (non-garden) increased from 1.3% in 2008 to 2.3% in 2018.

Fines (<20mm) fell by 0.5%, dropping from 2.4% in 2008 to 1.9% in 2018.

Glass decreased by 0.3% to 2.1%.

Hazardous waste increased 0.1% to 0.6%

WEEE increased 0.2% to 0.4%.

Non-target materials increased from 17.4% in 2008 to 26.7% in 2018.

Biodegradable waste proportions fell from 72.9% in 2008 to 66.0% in 2018. This was attributable, in part, to a large decrease in the quantity of newspapers.

The Packaging waste fraction of the composition increased from 41.3% in 2008 to 54.9% in 2018. The comparison shows that:

- Paper and cardboard packaging increased from 19% in 2008 to 29% in 2018, an increase of 10%. This was mainly driven by an increase of 8.9% for flat card and corrugated cardboard packaging.
- Plastics packaging increased from 14.1% in 2008 to 17.5% in 2018.
- Metal packaging increased from 3.6% to 4.1%, a change of 0.5%.

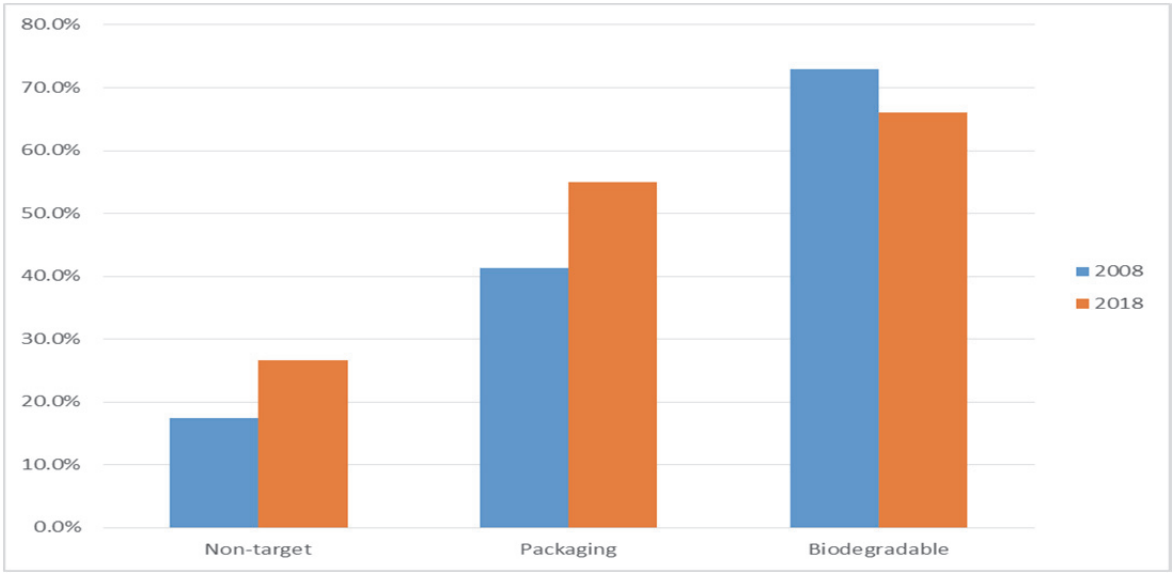


Figure 3.4 - Kerbside Collected Household MDR Non-Target, Packaging & Biodegradable Waste Content change 2008-2018

Image 3.3 - MDR Input Materials as Received

4 ORGANIC WASTE

4.1 BACKGROUND INFORMATION

Table 4.1 presents background information on organic waste collections for the AWCs who collaborated in the campaign.

Table 4.1 - AWCs Background Information

AWC	AWC1	AWC2	AWC3	AWC4	AWC 5
Frequency of collection	Fortnightly	Fortnightly	Fortnightly	Fortnightly	Fortnightly
Charges	Pay by Lift	Pay by Lift	Flat fee	Pay by Weight	Flat up to weight limits then PBW[19]
Type of container	140 litres Bins	140 litres Bins	140 litres Bins	25 litres Bins	240L and 24L Bins
Materials Accepted	- Kitchen Food Scraps - Fruits and Vegetables - Bread - Cakes & Biscuits - Eggs & Dairy - Out of Date food (No plastic packaging) - Cooked and Raw Foods - Tea leaves and Tea bags - Meat - Fish - Poultry & Bones	- Raw or cooked food - Meat, poultry & fish, incl. bones - Leftover food from your plate & dishes - Fruit & vegetables - Tea bags, coffee - Breads & cakes - Rice, pasta & cereals - Dairy products - Soups & sauces - Eggs, egg shells - Out of date food with packaging removed	- Cooked & raw foods - Dairy, fruit, vegetables, breads, etc. - Peelings and unwanted leftovers - Teabags, tea leaves, coffee grinds and coffee filters.	- Food & Garden waste "Anything that was once living, either plant or animal can be composted"	- Kitchen Food Scraps - Plate Scrapings, - Tea Bags, coffee grinds & paper filters - Soups and sauces - Eggs and dairy, out of date food - Breads, cakes, biscuits and cereals
	- Plant trimmings - Grass & Leaves - Flowers & plants	- Grass clippings and small twigs	- Grass cuttings, clippings, twigs, weeds, etc.		Garden waste in 240L bins
		- Food soiled paper napkins, paper towels & pizza boxes - Newspaper (when used for wrapping food waste) - Card egg boxes	- Napkins, paper plates, paper food wrapping and paper bags		Paper napkins and paper towels

[19] Pay-by-weight

We note that AWC4 collects materials in a 25L "*kitchen caddy*" primarily designed to collect food waste, to the partial exclusion of garden waste. Although these containers are not in widespread use in Ireland, they do have the impact of diverting garden waste away from the kerbside.

4.2 SAMPLING PROGRAMME

In total, 6 organic waste samples were surveyed from 5 AWCs. **Table 4.2** shows from which stratum the samples were collected from.

Table 4.2 - Number of Samples

Stratum Level of Urbanisation	Stratum Collection System	AWC1	AWC2	AWC3	AWC4	AWC5	Total
Rural and mixed rural/urban areas	1-bin	0	0	0	0	0	**0**
	2-bin	0	0	0	0	0	**0**
	3-bin	0	0	0	1	0	**1**
	1, 2& 3-bin with Glass	0	0	0	0	0	**0**
Cities (and their suburbs)	1-bin	0	0	0	0	0	**0**
	2-bin	0	0	0	0	0	**0**
	3-bin	2	1	1	0	1	**5**
	1, 2& 3-bin with Glass	0	0	0	0	0	**0**
Total		**2**	**1**	**1**	**1**	**1**	**6**

4.3 RESULTS

The following table and figure show the composition of organic waste collections for the waste characterisation campaign.

Table 4.3 - Composition of Kerbside Collected Household Organic Waste

Primary Category	Mean[20]	Min	Max	Lower Limit	Upper Limit
Organic Waste (Garden)	55.7%	0.1%	75.0%	33.8%	77.6%
Organic waste (non-garden)	28.2%	22.7%	92.0%	5.1%	12.8%
Fines (<20mm)	6.4%	0.0%	13.2%	3.1%	9.7%
Plastics	3.8%	1.6%	6.0%	2.8%	4.9%
Papers	4.1%	0.0%	12.9%	1.2%	7.0%
Textiles (excl. nappies)	0.5%	0.0%	1.1%	0.2%	0.7%
Nappies	0.5%	0.0%	1.7%	0.1%	0.9%
Unclassified Incomb.	0.2%	0.0%	0.9%	0.0%	0.4%
Metals	0.3%	0.0%	0.6%	0.1%	0.4%
Unclassified Comb.	0.2%	0.0%	0.6%	0.1%	0.4%
Wood	0.1%	0.0%	0.2%	0.0%	0.1%
Glass	0.1%	0.0%	0.2%	0.0%	0.1%
Haz. Mun. Waste	0.0%	0.0%	0.1%	0.0%	0.0%
Cardboards	0.0%	0.0%	0.0%	0.0%	0.0%
Total	**100%**	**n/a**	**n/a**	**n/a**	**n/a**

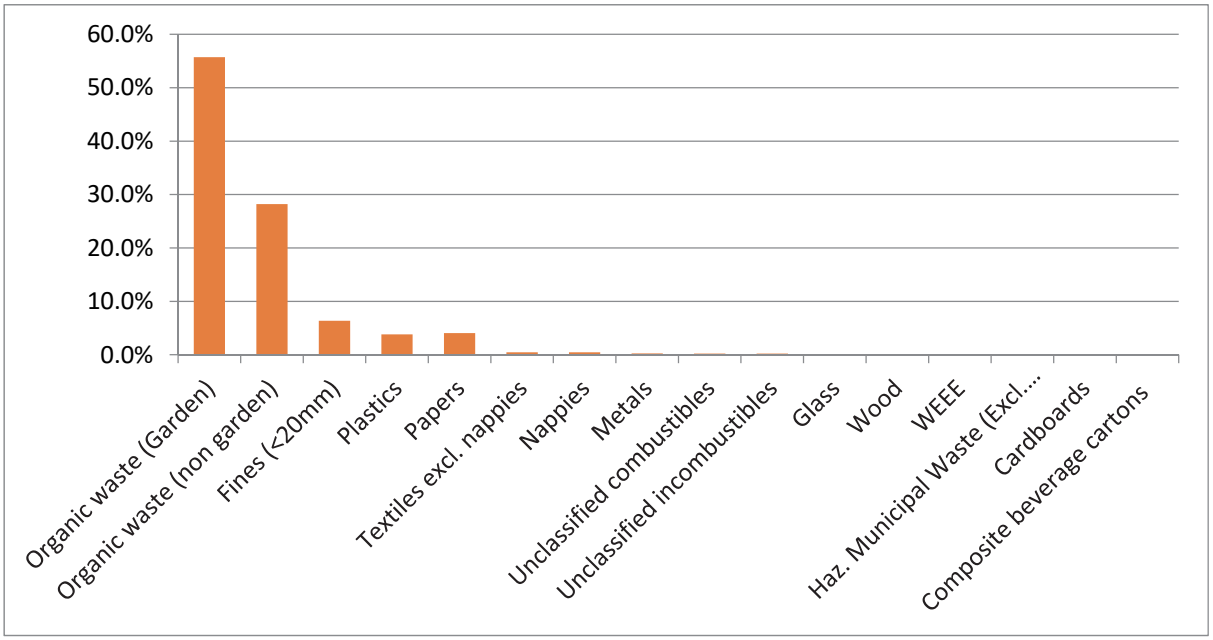


Figure 4.1 - Composition of Kerbside Collected Household Organic Waste

The most prominent primary category was **Organic waste (garden)** comprising 55.7% of the composition. This includes materials such as crass clippings, hedge trimmings, etc.

[20] While the mean for MRW and MDR is calculated using the household average, the mean for OW is calculated using a weighted average as 'kitchen caddy' use represents c.5% of household OW collections.

Organic waste (non-garden) was the second largest waste category and comprised 28.2% of organic waste collections. The majority of the food waste (22.1%) was unavoidable food waste, with 1.8% avoidable food waste and 3.1% possibly avoidable food waste.[21]

Fines (<20mm), were 6.4% of the composition, the third largest primary waste category.

Papers comprised 4.1%, mostly tissue (2.4%), recyclable and recoverable packaging (0.8%), Newspapers (0.3%) and 0.2% unrecyclable paper.

Textiles comprised 0.9% of the overall composition of the waste (including nappies 0.5%).

4.4 DISCUSSION

4.4.1 Non-target Materials

Non Target materials comprised 14.1% of the materials in the organic waste collections. Fines (<20mm) and Plastics were the chief non-target material (although fines may also be appropriate) in the organic waste collections and comprised 6.8% and 2.9% respectively. Textiles comprised 1.2%.

The analysis allowed us to determine the degree of non-target 'contamination' - meaning waste types incorrectly placed in the organic bin. Non-target includes items which have been placed in the wrong stream - e.g. plastic waste in an organic collection - and other wastes that cannot be recycled in kerbside services - e.g. glass or WEEE.

4.4.2 Packaging Waste

Packaging within this waste stream comprised 4.9%. It included plastics at 3.4%, papers and cardboard at 1.0%, metals at 0.3% and glass at 0.1%. **Figure 4.2** shows the detailed packaging waste categories.

[21] It must be noted that it is sometimes difficult to differentiate between avoidable and unavoidable food waste due to the advanced decomposition of some food materials.

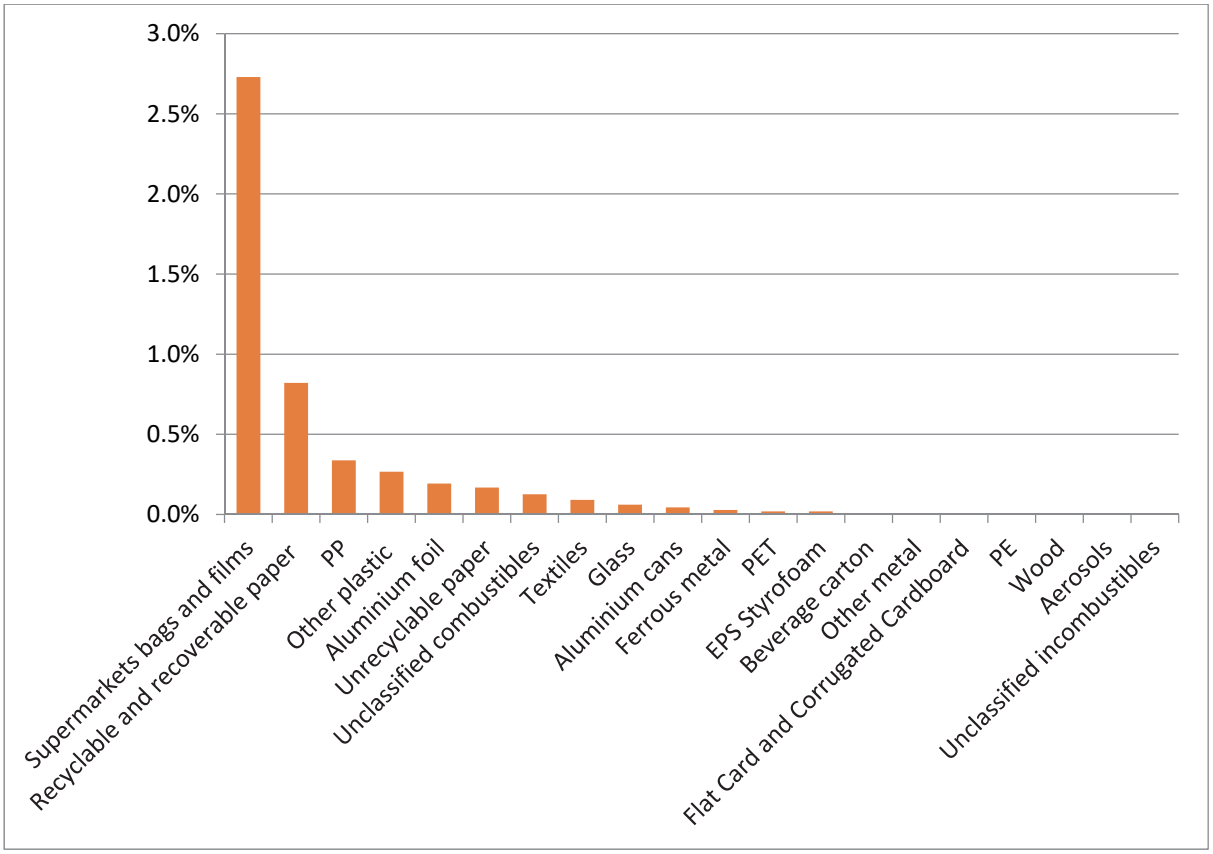


Figure 4.2 - Packaging in Kerbside Collected Household Organic Waste

4.4.3 Biodegradable Waste

The organic waste stream is estimated to comprise 91.8% biodegradable materials.

4.4.4 Main Changes 2008-2018

Figure 4.3 contrasts the organic waste composition for years 2008 and 2018.

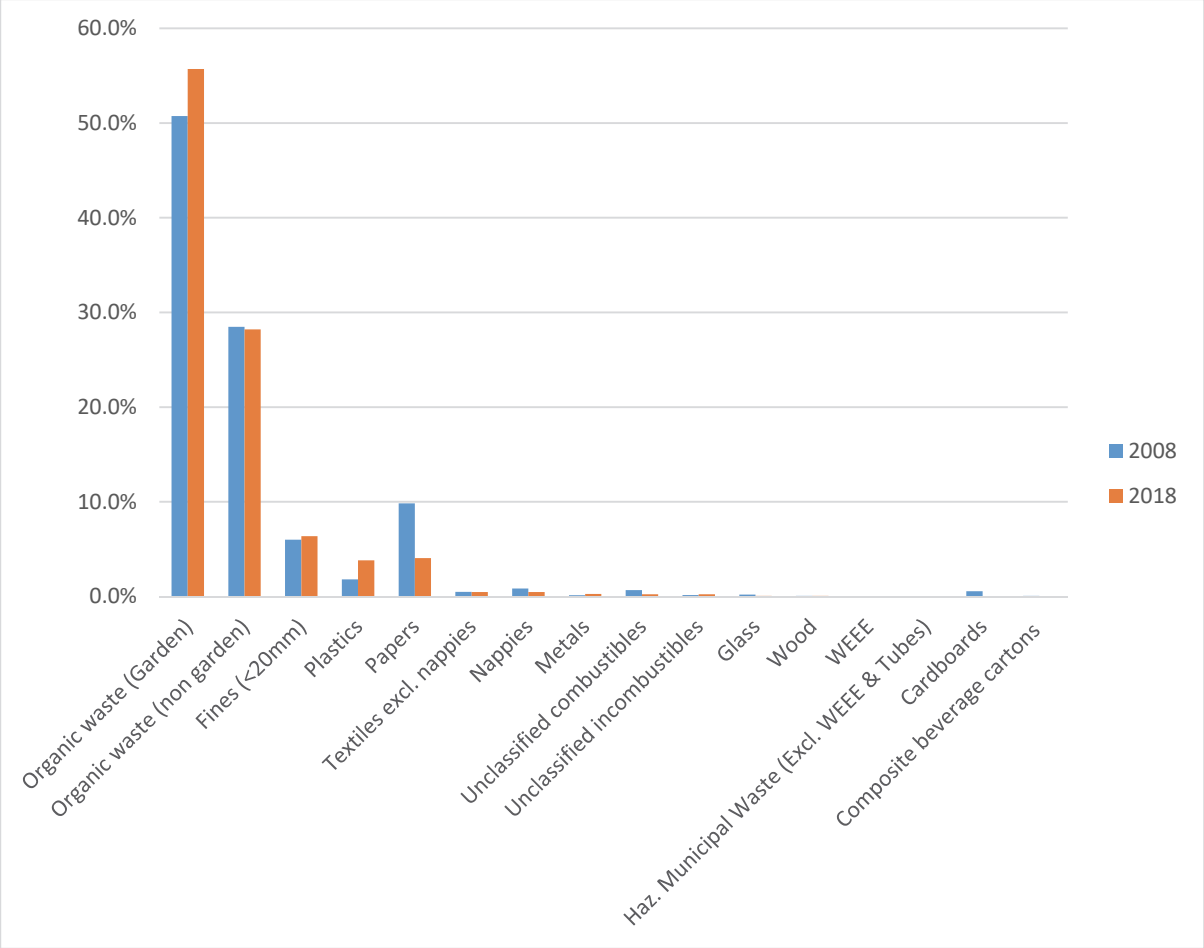


Figure 4.3 – Kerbside Collected Household Organic Waste Composition - Change 2008-2018

The changes in the organic waste composition from 2008 to 2018 were less pronounced than for mixed residual waste and mixed dry recyclables.

Organic waste (garden) consistently represents the largest waste category. This category increased from 50.7% in 2008 to 55.7% in 2018. Organic waste (non-garden) decreased from 28.5% in 2008 to 28.2% in 2018.

Fines (<20mm) were measured at 6.4%, up 0.4% from 2008.

Plastics in the organic waste collections rose 2.0% to comprise 3.8%.

Papers decreased of 5.8% from 9.8% in 2008 to 4.1% in 2018. Cardboard decreased from 0.5% to comprise 0.01% of the waste.

Non-target materials decreased from 19.1% in 2008 to 14.1% in 2018.

Biodegradable waste proportions moved from 53.6% in 2008 to 51.8% in 2018. This was attributable, in part, to a decrease in the quantity of newspapers.

The Packaging waste fraction of the composition increased from 3.2% in 2008 to 4.9% in 2018.

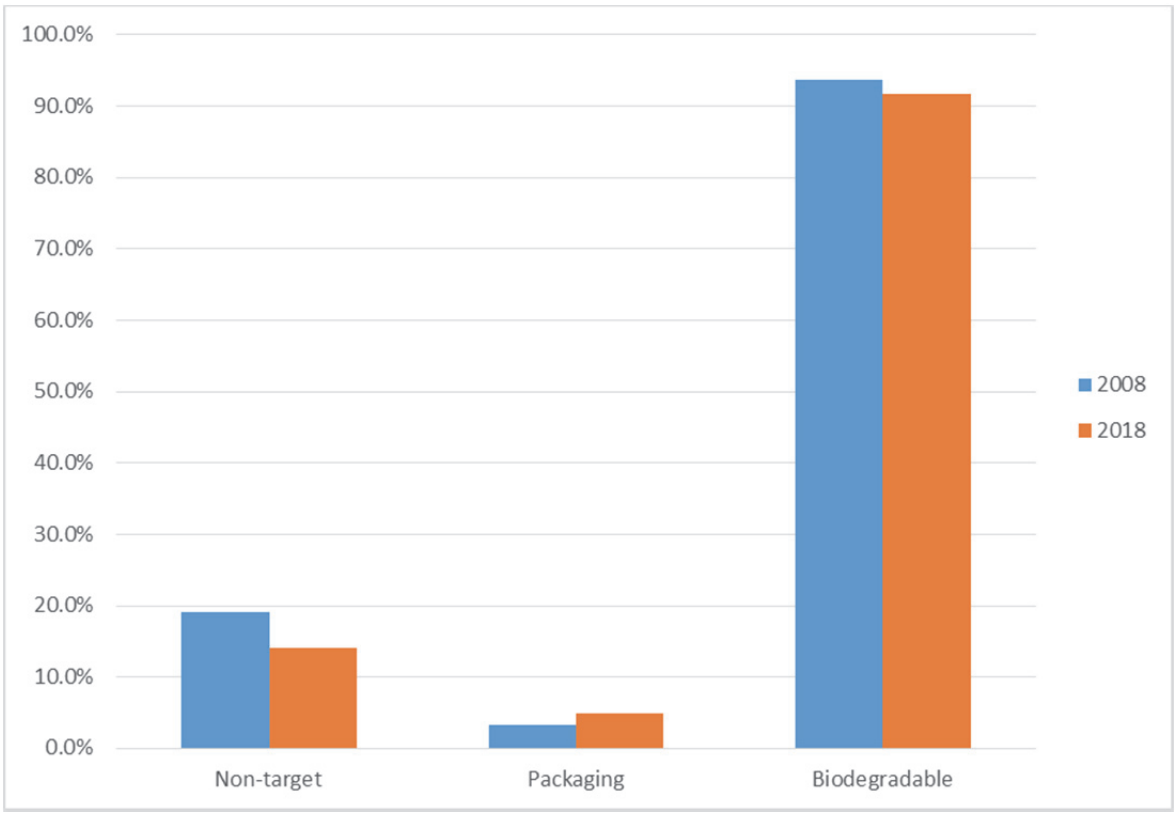


Figure 4.4 – Kerbside Collected Household Organic Waste, Non-Target, Packaging & Biodegradable Waste Content 2008-2018

Image 4.1 - Organic Waste Input Materials as Received

Image 4.2 - Packaged (L) and Unpackaged (R) Food Waste

Image 4.3 - Garden Waste

5 CONTAMINATION

The contamination of municipal waste (both residual waste and mixed dry recyclables streams) is an important factor to consider during any waste characterisation work as it can have significant impacts on the final results, especially when generating national waste classification statistics. Typically, there are 2 main types of contamination under consideration - **residual contamination** and **cross-contamination**. Residual contamination typically refers for example to food that is left over in recyclable containers after discarding (the container may be segregated for recycling, but because it is not clean it lowers the potential recyclability of the stream). Cross-contamination occurs when recyclable materials segregated at source are contaminated with other waste streams (e.g. garden or food waste contaminating mixed dry recyclables).

When conducting waste characterisation work, it is not possible to clean out every container and ensure that materials do have not contain contaminants. Therefore, the purpose of a contamination study, as part of a wider waste characterisation survey, is to determine statistically robust contamination correction factors for the main types of packaging waste collected in the mixed and recyclable waste streams. These factors can then be applied to the final data to provide accurate (corrected) packaging and organic percentages.

As part of the current waste characterisation programme an assessment of 13 of the main packaging materials was carried out. Initially a review of the contamination assessment methodology employed in 2008 was carried out. It was found that there were no international updates that impacted on the method. Therefore, that methodology is used in this current work. More information on this literature review, and the contamination assessment methodology, is available in Appendix to the contamination report.

5.1 RESULTS

The following Tables outline the contamination results for the 13 different packaging materials assessed from waste collected from households with 2 and 3 bin systems. These results are depicted graphically in **Tables 5.1** and **5.2.**

Table 5.1 - Household Contamination Factors for Kerbside Collected Household MRW and MDR in 2 Bins System

Packaging waste category	MRW		MDR	
	No. of items	Contamination (%)	No. of items	Contamination (%)
Paper Packaging	30	24	30	12.5
Cardboard Packaging	40	21.9	33	8.8
Glass Packaging	30	3.8	33	2.7
PET Packaging	30	10.3	30	8.4
PE Packaging	30	15.4	32	14.3
PP Packaging	30	26.1	26	6.3
Plastic Bags and Films	30	40.8	35	3
Other Plastic Packaging	40	18.6	32	5.3
Unrecoverable Plastic Packaging	20	48.9	9	35.9
Aluminium Cans Packaging	34	8.7	31	9.5
Aluminium Foil Trays Packaging	30	34.8	28	16.8
Tin Cans (Ferrous Pac)	27	16.6	33	5.2
Tetra Pak Packaging	32	38.9	31	23.2

Table 5.2 - Household Contamination Factors for Kerbside Collected Household MRW and MDR in 3 Bin Systems

Packaging waste category	MRW		MDR	
	No. of items	Contamination (%)	No. of items	Contamination (%)
Paper Packaging	12	38.8	31	22.8
Cardboard Packaging	32	23.3	39	22.6
Glass Packaging	13	5.4	6	1.5
PET Packaging	31	21.3	32	12.7
PE Packaging	31	24.2	31	12.2
PP Packaging	16	35.1	30	12.2
Plastic Bags and Films	17	18.2	18	9.3
Other Plastic Packaging	37	38.9	31	16.5
Unrecoverable Plastic Packaging	19	65.4	5	19.5
Aluminium Cans Packaging	32	26.5	32	6.9
Aluminium Foil Trays Packaging	30	53.3	27	53.2
Tin Cans (Ferrous Pac)	28	30.7	30	5.3
Tetra Pak Packaging	14	31.2	32	22.3

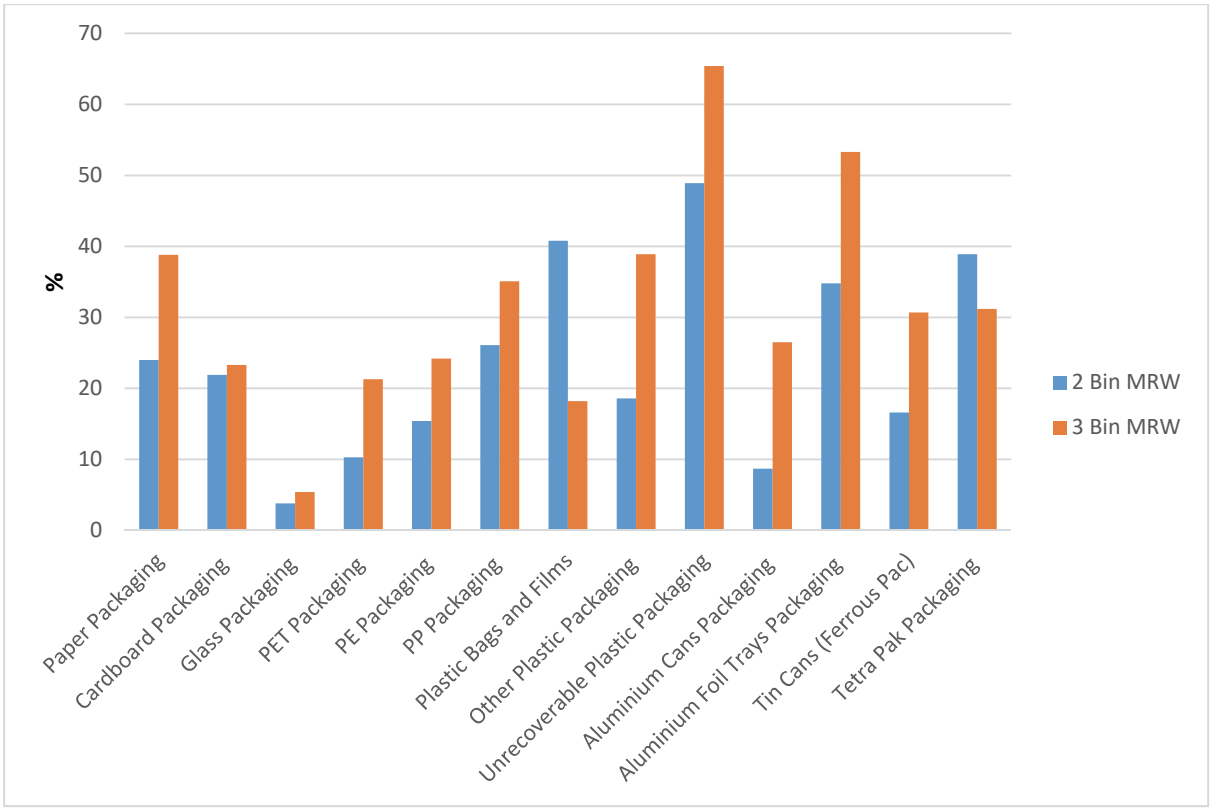


Figure 5.1 - Contamination Factors for Kerbside Collected Household MRW in 2 & 3 Bin Systems

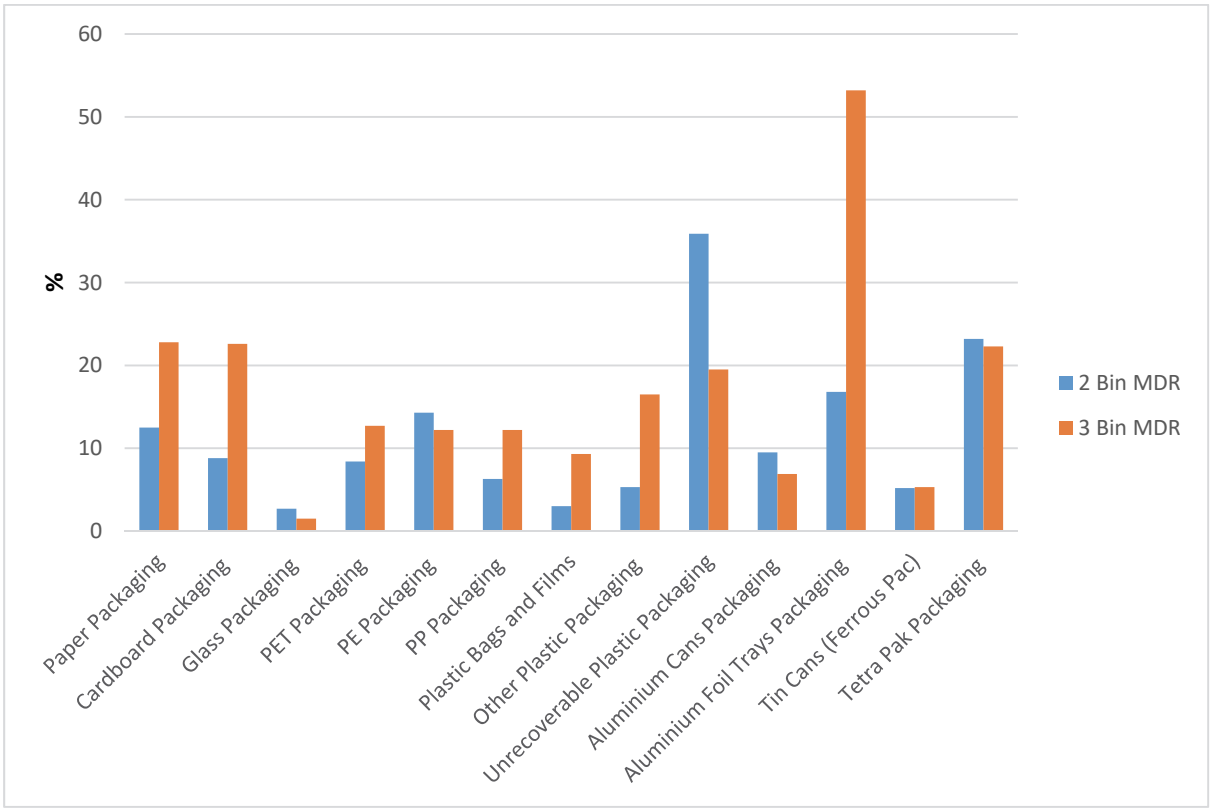


Figure 5.2 - Contamination Factors for Kerbside Collected Household MDR in 2 & 3 Bin Systems

5.2 DISCUSSION

Prior to analysing the samples, it would have been assumed that the level of contamination would have been higher for 2-bin systems as there should be higher levels of organics (as they do not have a brown bin service). However, even though there is no clear trend it does appear that the levels of contamination are slightly higher for the 3-bin systems. There are a number of potential reasons for this:

- The method of collecting waste from 2-bin systems was different to that for 3-bin systems and this may contribute to lower levels of cross contamination in MRW samples.
- Some of the MRW samples analysed from 3-bin systems included significant levels of ash contamination. While the statistical method used to determine the final contamination factor should mitigate such instances it may be a contributing factor.
- The lower levels of contamination in MDR samples from 2-bin systems are surprising. It may simply be down to better management practices by people living in apartments.

In order to produce an overall set of contamination factors for household waste the results from the 2 and 3 bin systems were combined. These are given in **Table 5.3** and shown graphically in **Figure 5.3**. As expected, MRW contamination factors are consistently higher than those determined for MDR.

Table 5.3 - Contamination Factors for Kerbside Collected Household MRW and MDR

Packaging waste category	MRW		MDR	
	No. of items	Contamination (%)	No. of items	Contamination (%)
Paper Packaging	42	28.2	60	18
Cardboard Packaging	72	22.6	72	16.3
Glass Packaging	43	4.2	37	2.7
PET Packaging	61	15.9	62	10.6
PE Packaging	61	19.8	51	13.6
PP Packaging	46	29.1	49	10.2
Plastic Bags and Films	47	32.7	37	5.3
Other Plastic Packaging	77	27.7	59	8.3
Unrecoverable Plastic Packaging	39	56.9	8	17.3
Aluminium Cans Packaging	66	17.3	63	8.2
Aluminium Foil Trays Packaging	60	44	31	26.6
Tin Cans (Ferrous Pac)	52	24.9	48	6.4
Tetra Pak Packaging	40	35.9	63	22.8

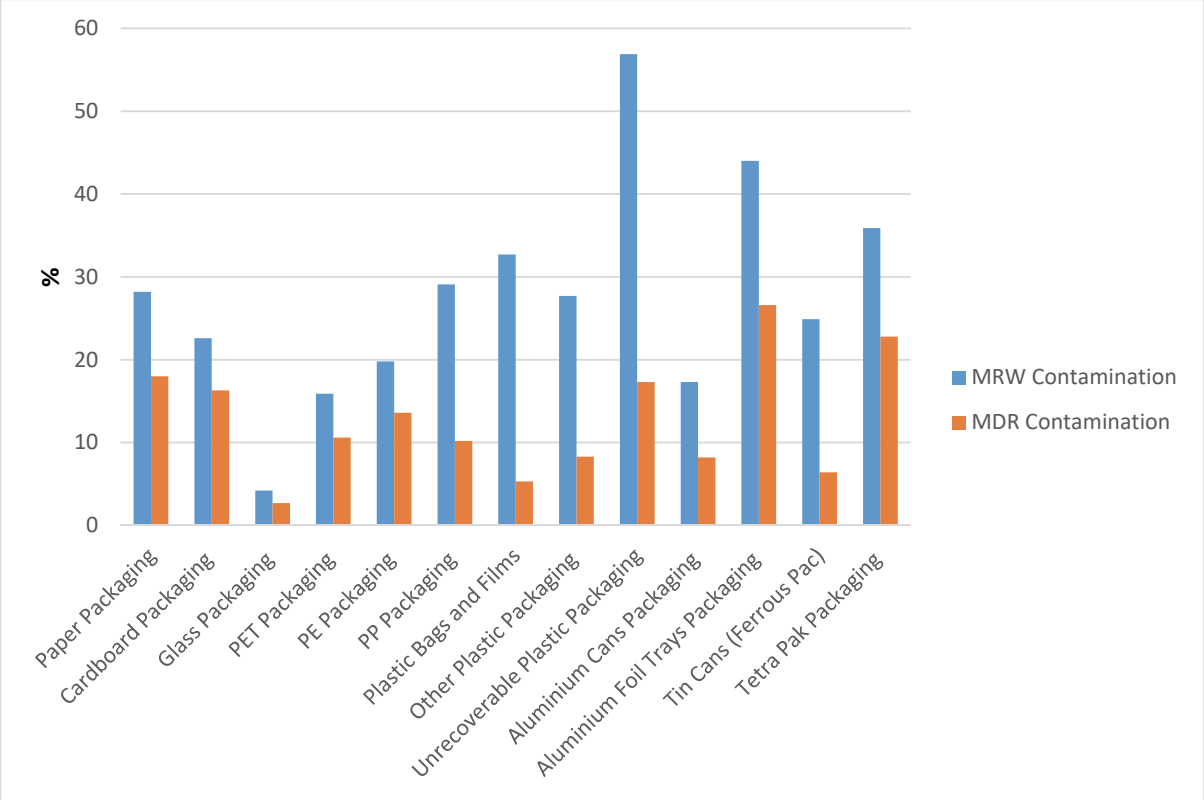


Figure 5.3 - Contamination Factors for Kerbside Collected Household MRW and MDR

A comparison between the results from this current study and those available from the household contamination study in 2008 are shown in **Figure 5.4** and **Figure 5.5**.

Across all materials assessed the contamination figures in 2018 are higher than those calculated in 2008.

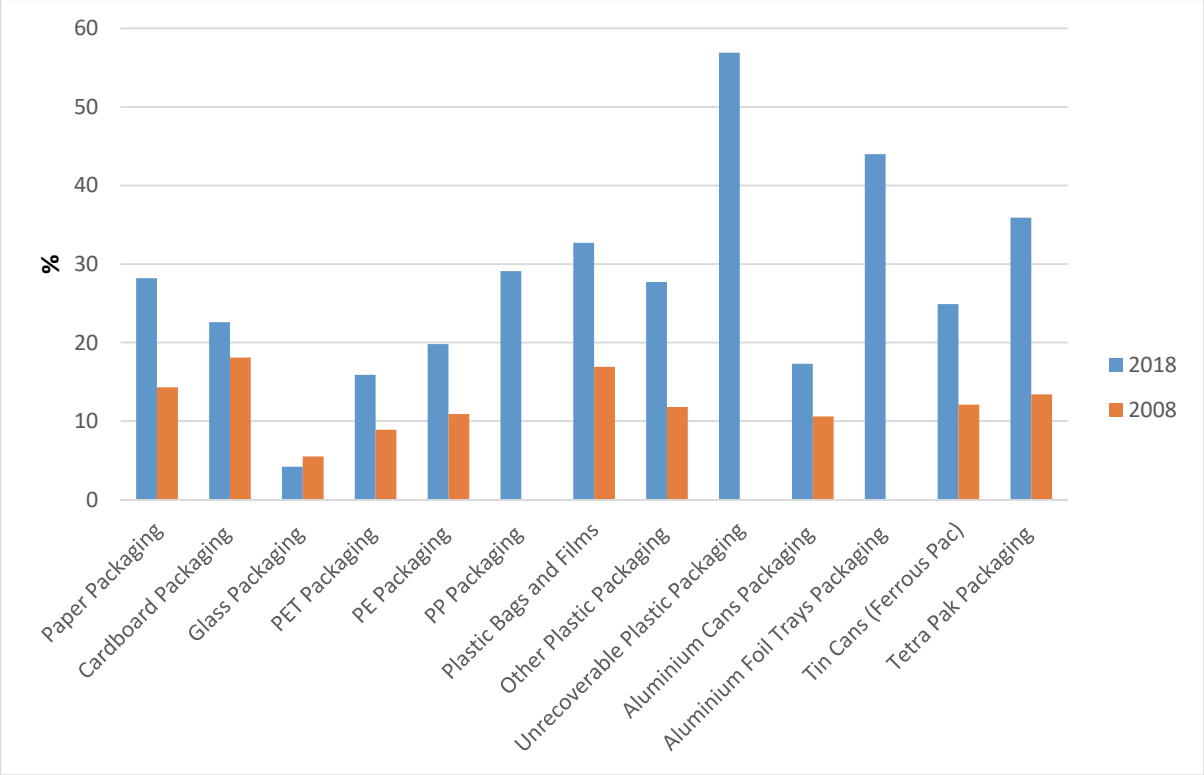


Figure 5.4 - Comparison of Contamination Factors 2018 & 2008 for Kerbside Collected Household MRW

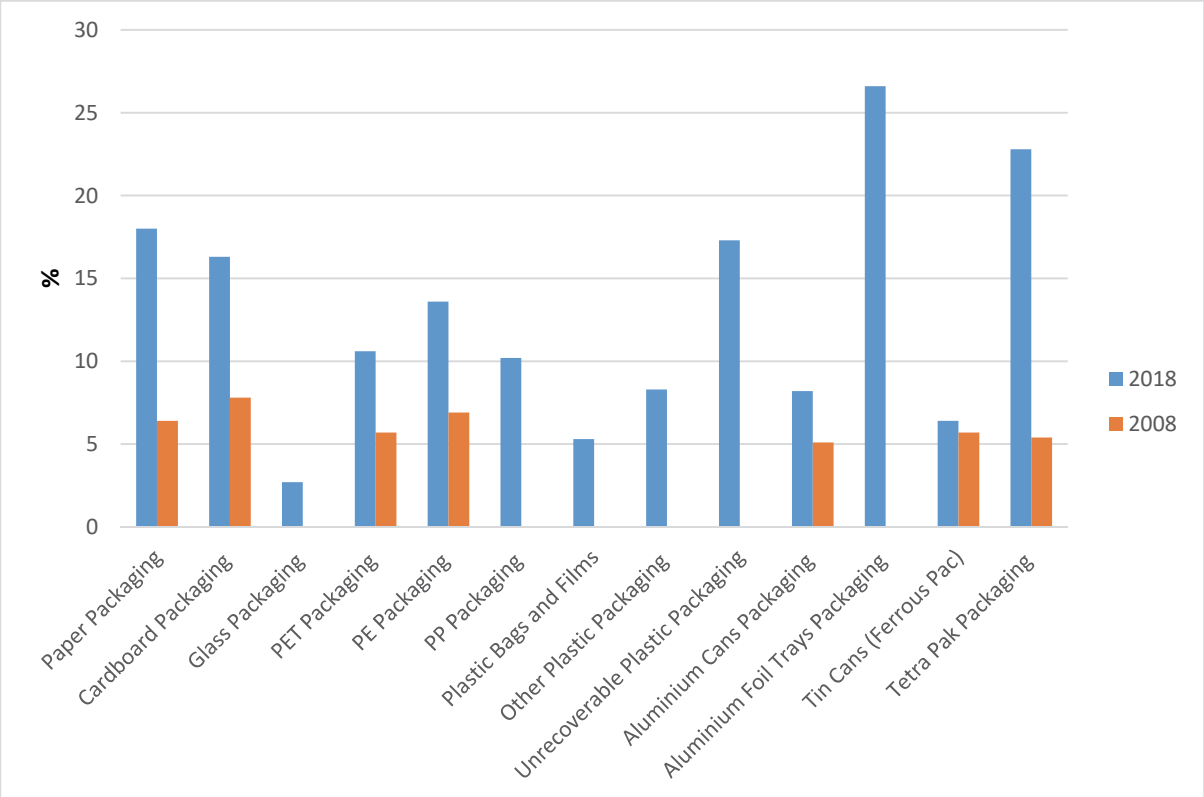


Figure 5.5 - Comparison of Contamination Factors 2018 & 2008 for Kerbside Collected Household MDR

6 NATIONAL PROFILE

6.1 RESULTS

In order to determine the national profile, the average waste composition (in percentage) for each kerbside waste stream (MRW, MDR and OW) was applied to the total quantities collected nationally in 2016[22] for each kerbside waste stream provided by the EPA.

Details at secondary waste categories level are presented in **Appendix J**.

Table 6.1 and **Figure 6.1** show the composition of the national profile.

Table 6.1 – National Profile Kerbside Collected Household Waste 2016

Primary Waste Categories	MRW (t)	MDR (t)	OW (t)	2016 National Profile (t)	% Wet weight
Plastics	126,428	49,341	4,300	180,069	17.2%
Papers	68,624	86,950	4,562	160,137	15.3%
Organic waste (non-garden)	92,817	5,802	31,716	130,335	12.5%
Cardboards	26,193	63,088	10	89,292	8.5%
Fines (<20mm)	78,362	4,877	7,158	90,397	8.6%
Organic waste (garden)	16,902	144	62,659	79,704	7.6%
Textiles Excl. Nappies	70,478	8,334	520	79,332	7.6%
Nappies	68,491	839	524	69,854	6.7%
Metals	32,059	11,741	298	44,099	4.2%
Unclassified Combustibles	37,804	7,123	266	45,193	4.3%
Glass	21,660	5,239	69	26,969	2.6%
Unclassified Incombustibles	15,663	2,015	255	17,932	1.7%
Haz. Municipal Waste (Excl. WEEE & Tubes)	8,382	1,425	12	9,819	0.9%
Composite beverage cartons	3,779	4,235	10	8,025	0.8%
Wood	7,502	1,145	72	8,719	0.8%
WEEE & Tubes	5,884	1,028	32	6,943	0.7%
Total	**681,027**	**253,328**	**112,464**	**1,046,819**	**100.00%**

[22] Most recent dataset available. Source personal communication with the EPA on 01/11/2018.

Table 6.2 – Capture Rate per Waste Category and Collection System 2016

Primary Waste Categories	MRW (t)	MDR (t)	OW (t)	% Wet weight
Plastics	70%	27%	2%	100%
Papers	43%	54%	3%	100%
Organic waste (non-garden)	71%	4%	24%	100%
Cardboards	29%	71%	0%	100%
Fines (<20mm)	87%	5%	8%	100%
Organic waste (garden)	21%	0%	79%	100%
Textiles Excl. Nappies	89%	11%	1%	100%
Nappies	98%	1%	1%	100%
Metals	73%	27%	1%	100%
Unclassified Combustibles	84%	16%	1%	100%
Glass	80%	19%	0%	100%
Unclassified Incombustibles	87%	11%	1%	100%
Haz. Municipal Waste (Excl. WEEE & Tubes)	85%	15%	0%	100%
Composite beverage cartons	47%	53%	0%	100%
Wood	86%	13%	1%	100%
WEEE & Tubes	85%	15%	0%	100%
Total	**65%**	**24%**	**11%**	**100%**

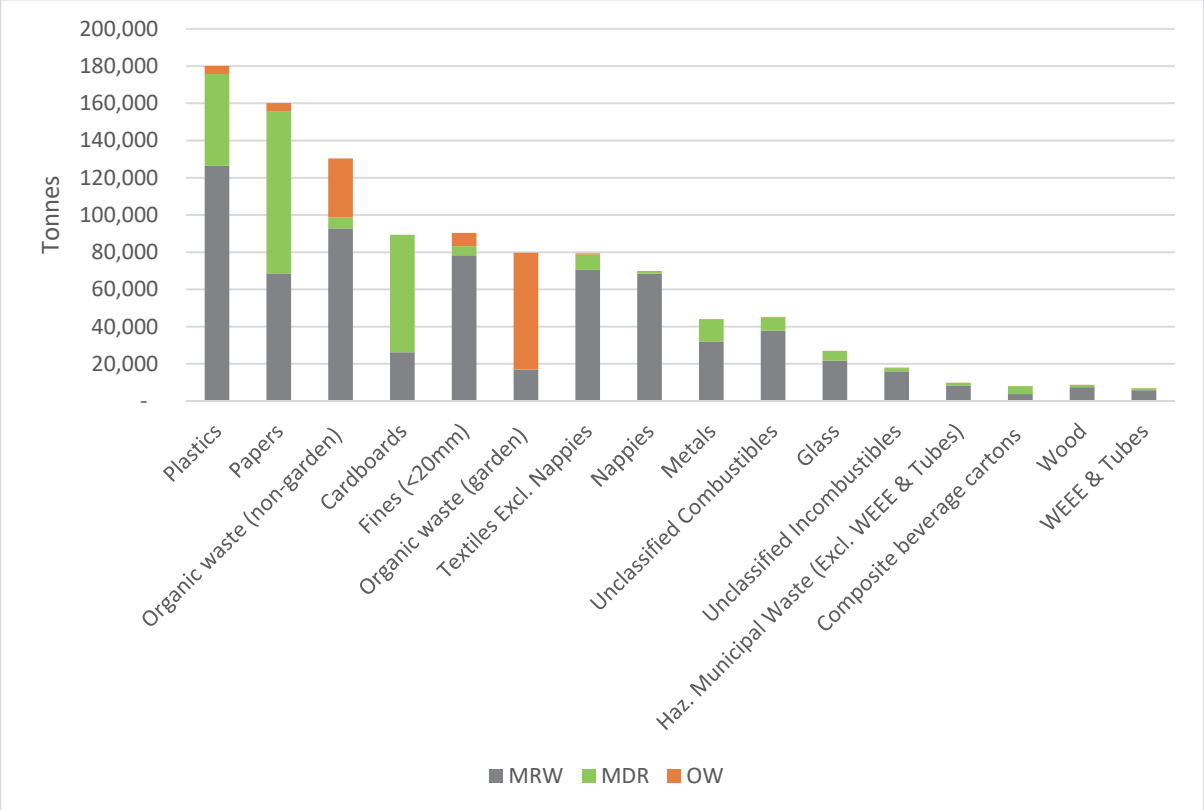


Figure 6.1 - National Profile for Kerbside Collected Household Waste 2016

6.2 DISCUSSION

6.2.1 National Composition Profile for Kerbside Collected Household Waste

The most prominent category was **plastics** averaging 17.2% of the total composition. Of this plastic waste, 70% remains in the MRW collection.

The second largest waste category was **paper waste** which comprised 15.3% of the total composition. Of this 54% is captured in the MDR collection and 43% remained in the MRW collection.

Organic waste (non-garden) averaging 12.5%, with 71% of organic wastes (non-garden) remaining in the MRW collection and 24% collected in the organic waste (e.g. brown bin) collection. It must be noted that 4% is also present as non-targeted material in the MDR collection.

Organic waste (garden) comprised 7.6%, mainly collected in the organic waste (e.g. brown bin) collection (79%) and the remainder in the MRW collection.

Cardboard waste comprised 8.5% of the total composition, mainly collected in the MDR collection (71%) with the remainder in the MRW collection (29%).

Textiles waste (excl. nappies) averaged 7.6%, mainly collected in the MRW collection (89%) with the remainder in the MDR collection (11%).

Metal waste averaged 4.2%, mainly collected in the MRW collection (73%) with the remainder in the MDR collection (27%).

Glass waste averaged 2.6% of the materials, mainly collected in the MRW collection (80%) with the remainder in the MDR collection (19%).

Wood averaged 0.8% mainly collected in the MRW collection (86%) with the remainder in the MDR collection (13%).

Composite beverage cartons averaged 0.8%, captured mainly in the MDR collection (53%) and MRW collection (47%).

Hazardous Waste (aerosols, paints, medicines and drugs) comprised 0.9% of the waste composition with an additional 0.7% comprising **WEEE**. These streams are mainly captured in the MRW collection (85%).

6.2.2 Packaging Waste

Packaging accounted for 32.9% of the total household kerbside waste.

Figure 6.2 and **6.3** show the main packaging waste categories, namely:

- Plastic packaging accounting for 14.8%
- Cardboards accounting for 8.0%
- Metals accounting for 3.3%
- Paper packaging accounting for 2.4%
- Glass accounting for 2.1%
- Composite beverage cartons accounting for 0.8%

It also shows that there is a significant proportion of cardboard packaging that is captured in the mixed dry recyclable collection, however the proportion of plastics, paper and metal packaging captured by the mixed dry recyclable collections are not as high as the cardboard capture rate. It must be noted that not all plastic packaging are materials targeted by the mixed dry recyclable collection. **Figure 6.3** provides more details.

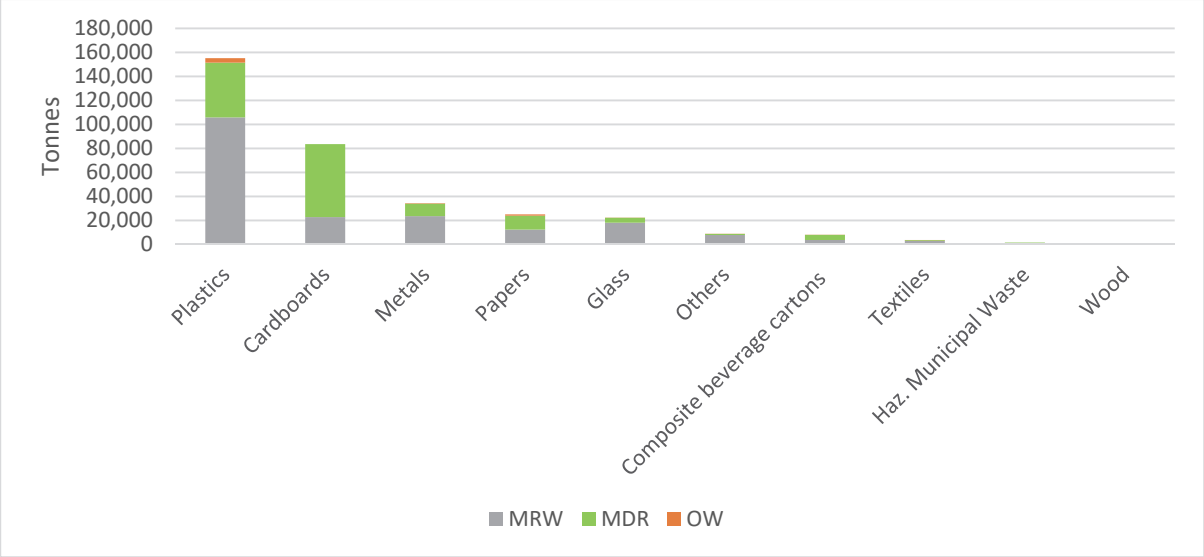


Figure 6.2 - National Profile for Kerbside Collected Household Packaging Waste by Main Material Stream

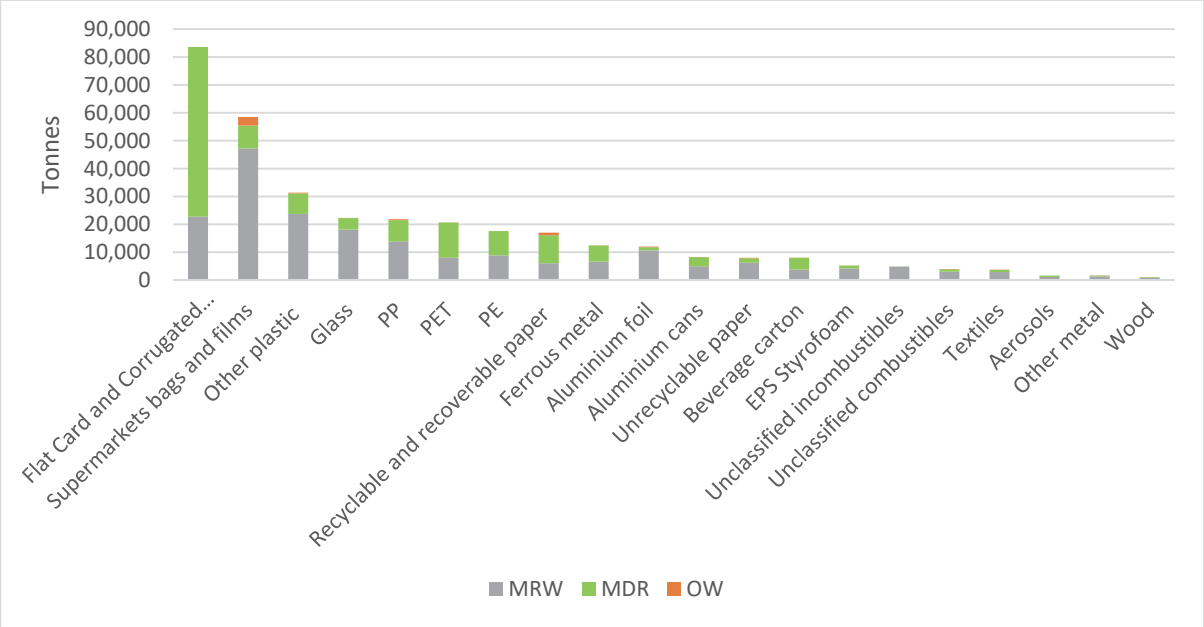


Figure 6.3 - National Profile for Kerbside Collected Household Packaging Waste by Secondary Waste Category

A significant proportion of cardboard is captured in the MDR collection (73%), with the remainder in the MRW collection (27%).

For plastics packaging, a significant proportion remains in the MRW collection (68%) with the remainder in the MDR collection (29%). At secondary waste category level, there are differences with

- PET captured mainly in the MDR Collection (61%) versus 39% in the MRW collection.
- PE captured evenly between MRW and MDR collections, 51% and 49% respectively.
- PP remaining mainly in the MRW collection at 63% and 35% in the MDR collection.
- Supermarkets bags and films are currently largely collected in the MRW collection (81%) versus 14% in MDR collection and 5% in the organic waste (e.g. brown bin) collection.

Metal packaging is mainly captured in the MRW collection (69%), with the remainder in the MDR collection (30%).

6.2.3 Biodegradable Waste

The kerbside household waste stream is estimated to comprise 57.9% biodegradable materials. The main sources of biodegradable materials are shown in **Table 6.1** and **6.2.**

6.2.4 Main Changes 2008-2018

Figure 6.4 shows the contrast the household kerbside waste composition between 2008 and 2018.

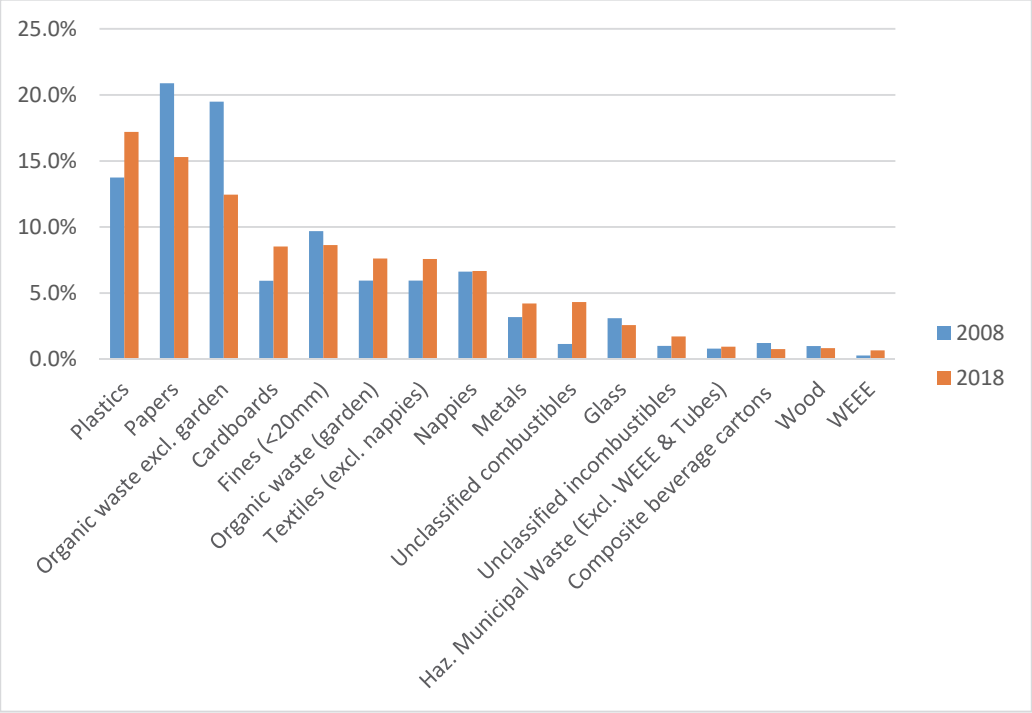


Figure 6.4 - National Profile for Kerbside Collected Household Waste Profile - Changes 2008-2018

The primary increases in the overall composition are:

- Plastics, which increased by 3.5%
- Unclassified combustibles, which increased by 3.2%
- Cardboards, which increased by 2.6%
- Organic waste garden increased by 1.7%
- Metals, which increased by 1.0%
- Textiles (excl. nappies), which increased by 0.9%
- Unclassified incombustibles, which increase by 0.7%
- Haz. Municipal Waste (Excl. WEEE & Tubes) increased by 0.1% and WEEE increased by 0.4%.

The primary decreases in the overall composition are:

- Organic waste excl. garden, which decreased by 7.0%
- Papers, which decreased by 5.6%
- Fines (<20mm), which decreased by 1.1%

7 COMMENTARY ON THE METHODOLOGY

Accurate and up to date information on the composition of waste is required for effective waste management planning, implementation and monitoring. Information on the composition of waste can be applied at various levels:

- Locally for assessing the feasibility of various collection, recycling and treatment options.
- Assisting compliance schemes in the determination of producers' fees and recovery operator subsidies.
- Assessing the proportion of biodegradable waste in mixed residual waste for monitoring compliance with the Landfill Directive.
- Assessing the proportion of packaging waste for monitoring compliance with the Packaging Directive.
- The calculation of REFIT subsidies for thermal treatment waste facilities.
- National and regional levels for strategic waste management planning.
- On the international level to compare with other European countries.

In **1996**, the EPA published a guidance document '*Municipal Waste Characterisation*'[23] setting out a standard procedure for conducting municipal waste characterisation surveys. The 1996 guidance was aimed at local authorities who were conducting waste characterisation surveys at the time. Surveys conducted using this procedure provided a breakdown of the composition of mixed residual waste collected from households or commercial outlets. Unfortunately any waste (such as glass, aluminium or paper) which had been collected for recycling and recovery was not captured by the surveys using this methodology.

In **2004**, the EPA commissioned an update of the 1996 methodology for conducting municipal waste characterisation surveys and the development of a national waste composition profile of municipal solid waste. The findings were published in 2005[24] and provided a municipal waste composition profile combining household and non-household waste. In total, 37 household waste samples in six local authorities[25] were analysed. The sampling was carried out in two campaigns in October/November 2004 and March/April 2005.

In **2008**, the EPA commissioned a new national municipal solid waste campaign (referred as NWD-2007-26). NWD-2007-26 built on and refined the methodologies used in the previous national waste characterisation studies undertaken in 1996 and 2004. A critical review of the methodology employed in previous waste characterisation studies was undertaken and it was concluded that due to budget and logistical constraints it was not possible to carry out the level of surveying recommended in 2005 to reach statistical validity. NWD-2007-26 also introduced a model to calculate a set of factors which could be applied by the EPA to the aggregated waste data that is collected nationally for mixed residual waste, mixed dry recyclables and mixed organics, for the

[23] EPA. 1996. EPA Municipal Waste Characterisation Manual. http://www.epa.ie/pubs/reports/waste/wastecharacterisation/EPA_municipal_waste_characterisation.pdf

[24] RPS & CTC. 2005. Municipal Waste Characterisation 2004/05 Surveys - Final Report. http://www.epa.ie/pubs/reports/waste/wastecharacterisation/EPA_municipal_waste_characterisation_final_report.pdf

[25] Each survey could include up to three sorting events, one for each waste stream (Mixed Residual Waste, Mixed Dry Recyclables and Organics).

National Waste Report. In total, 39 household waste samples were analysed; 36 of these were obtained from kerbside collections and 3 were obtained from civic amenity sites. Of the 36 kerbside samples, 34 were from collection routes serving individual houses and 2 were from collection routes serving apartment blocks.

In **2009**, the EPA commissioned RPS to develop methodologies to determine the amount of BMW (biodegradable municipal waste) in MSW (municipal solid waste) sent to landfill. The methodologies based on the requirements of the EPA *Guidance on Municipal Solid Waste Pre-treatment & Residuals Management* (2009) were compiled in a "bespoke" protocol. These methodologies were tested at 22 facilities in winter 2009-2010, spring 2010 and autumn 2010. The facilities surveyed handled approximately 85% of the municipal waste that was being mechanically treated in Ireland at the time and therefore provided a very good representation of waste residues being produced. Validation included sampling, waste characterisation and collection of samples for laboratory testing. Following the validation and consultation phases, the EPA published 17 no. BMW factors on their website in June 2010 [26] and guidelines were published by the EPA in 2011[27].

Since completion of these studies there have been significant changes in Ireland, which undoubtedly have had an impact on waste generation and composition. These include:

- Legislation - separate collection of organics through roll out of biodegradable waste bin ('brown bin'), initially to commerce and now householders.
- Waste collection - changes due to the fact that local authorities are no longer involved.
- Tax - the landfill tax and availability of landfill space.
- Economics - the financial downturn and the recent improvements in the economy which impact on consumption and disposal patterns.
- Population - population, employment and demographics which have changed since the 2008 survey.
- Prevention programmes - many of the EPA's National Waste Prevention Programmes are now well established.

While each of these will have an impact on the quantities of household waste, as is clear from the changing volumes of municipal waste managed nationally, what was not clear was how the waste character has been affected. The 2008 EPA Waste Characterisation Methodology was therefore updated in **2015** to provide a solid footing for updating the composition analysis of municipal waste at a national level.

In 2017, the EPA commissioned RPS to carry out a new national municipal campaign. In total, 50 household waste samples from kerbside collections were analysed. Of these 46 samples were from collection routes serving individual houses and from collection routes serving 4 apartment blocks. The samples were collected from 8 AWCs accounting for 47% of households provided with kerbside collection and 11 local authorities.

As the 2015 methodology was first tested in 2017-2018, some of the challenges and suggestions for improvements are presented in Table below.

[26] EPA. 2011. EPA approved factors to calculate the BMW content of Municipal Waste Streams. https://www.epa.ie/pubs/advice/waste/municipalwaste/Table_of_Approved_EPA_Factors.pdf

[27] EPA. 2011. Protocol For The Evaluation Of Biodegradable Municipal Waste Sent To Landfill. http://www.epa.ie/pubs/advice/waste/municipalwaste/EPA_Protocol_For%20BMW%20Final.pdf

Table 7.1 - Suggestions for Improvements

Item	Challenge	Recommendations
Sampling Plan	The minimum number of samples per stratum, and additional requirements (relating to geographical distribution, minimum number of AWCs, housing types, and social class) is difficult to satisfy if the AWCs are not fully engaged in the project.	The sampling plan should recommend which requirements need to be met in priority.
Sampling Plan	The development of the sampling plan is based on data that is 2 years old. The household waste market is dynamic with changes in legislation; new service offering (e.g. glass collection) whose extent is unknown at sampling plan stage.	The findings from the analysis of EPA/NWCPO data should be discussed with the AWCs prior to finalising the sampling plan.
AWC Recruitment	The AWC recruitment has been more challenging than in the previous campaigns.	There are duplications with other waste characterisation events required by other organisations. Alignments between methodologies would increase participation and reduce costs.
Waste categories	Due to reduced frequency of collection for mixed residual waste and organic waste, it is difficult to differentiate 'Edible kitchen & canteen waste Unused non-packaged food' and 'Inedible kitchen & canteen waste'.	Consider merging the two categories.

APPENDIX A

Waste Categories

(Main changes since 2008 shown in red)

MUNICIPAL WASTE COMPOSITION CATEGORIES & EXAMPLES					
EWC CODES	**WASTE CATEGORIES**	**TYPICAL EXAMPLES**		**Survey 2014**	**Materials targeted**
ORGANIC WASTE					
20 01 08	Edible kitchen & canteen waste	Unused Packaged food	Unused or partially used packaged food that can't easily be separated from packaging, e.g. jar of honey, tub of soft cheese	H / Non-H	
		Unused non-packaged food	Vegetables, fruit, cheese or sausages removed from packaging	H / Non-H	Targeted by BB
20 01 08	Inedible kitchen & canteen waste	Vegetable peelings, tea bags, meat carcasses		H / Non-H	Targeted by BB
21 01 08	Liquid fit for human consumption	Liquid contained in drink or milk containers		H / Non-H	
20 02 01	Biodegradable waste from garden & park	Grass and bush cutting, twigs, soil, flowers, leaves, tree branches, weeds		H / Non-H	Targeted by BB
20 01 25	Vegetable oil	Waste cooking oil		**Non-H**	
PAPERS					
15 01 01	Paper Packaging	recyclable and recoverable paper packaging	Brown or white paper bags, egg cartons, bread wrappers	H / Non-H	Targeted by MDR
		Non-recyclable and recoverable paper packaging	Plastic contaminated	H / Non-H	
20 01 01	Newspapers	Local and national newspapers, newsprint-type advertising publications, other newsprint		H / Non-H	Targeted by MDR and BB (latter if used for wrapping food)
20 01 01	Magazines & glossy paper	Magazines and ads on glossy paper, shop catalogues		H / Non-H	Targeted by MDR
20 01 01	Office papers	Office type envelopes, letters, print outs		H / Non-H	Targeted by MDR
21 01 01	Tissue Paper/ Kitchen Roll	Tissue Paper/ Kitchen Roll		H / Non-H	Targeted by BB
20 01 01	Other papers	Till receipts, books, telephone directories, non-glossy junk mail, loose leaf paper, non-glossy brochures and catalogues, notebooks, envelopes		H / Non-H	Targeted by MDR
CARDBOARDS					
15 01 06	Flat Card and Corrugated Cardboard (Packaging)	Recoverable flat card packaging	Cereal boxes, toy boxes, washing powder containers, Corrugated packaging cardboard used for household items packaging (TV, PC, furniture etc.)	H / Non-H	Targeted by MDR
		Unrecoverable flat card packaging	Ready packed meats, Contaminated pizza box	**Non-H**	Targeted by BB if soiled

20 01	Other Cardboards (Non Packaging)	Greeting cards, postcards, files and folders, tickets		H / Non-H	Targeted by MDR
COMPOSITES					
15 01 05	Beverage Carton (Packaging)	Beverage/juice cartons (Tetrapak)		H / Non-H	Targeted by MDR
TEXTILES					
15 01 09	Textiles Packaging	Some types of potato sacks		H / Non-H	
20 01 11	Textiles Non-Packaging	Rags, household soft furnishings (cushions) and upholstery, blankets, towels, carpets, curtains, ruck-sacks,		H / Non-H	
20 01 10	Clothes	Clothes		H / Non-H	
	Nappies	Nappies and incontinence wear		H / Non-H	
18 01 04	Healthcare Textiles	Dressings, plasters, linen, disposable clothing, sanitary towels, bandages		H / Non-H	
PLASTICS					
20 01 39	PET (Packaging)	Soft drinks bottles, water bottles		H / Non-H	Targeted by MDR
20 01 39	PE (Packaging)	Milk bottles, detergent/shampoo bottles, bottle caps, yoghurt drink bottles		H / Non-H	Targeted by MDR
21 01 39	PP (Packaging)	Microwaveable meal trays, butter tubs, dessert containers, disposable drink cups, yoghurt pots, ice cream containers, rashers trays		H / Non-H	Targeted by MDR
22 01 39	Styrofoam (EPS) (Packaging)	EPS foam - electronic goods packaging, burger boxes, some meat trays, some vegetable trays		**Non-H**	
15 01 02	Supermarkets Bags and Films (Packaging)	Shopping bags, fertiliser bags, cling film, compost/peat-moss bags, sandwich bags, cereal packets (inside box), biscuit wrappers, pallet wrap		H / Non-H	Targeted by MDR
15 01 02	Other Plastic (Packaging)	recyclable and recoverable plastic packaging	Toothpaste tubes, cosmetics tubes, CD/DVD/tape covers	H / Non-H	
		Non-recyclable and recoverable plastic packaging	Meat containers, contaminated film packaging etc.	**Non-H**	
20 01 39	Other Plastic Waste (Non Packaging)	Refuse bags, clothes hangers, toys, air freshener holders, plant pots, seed trays, video cassettes, CDs, DVDs. tapes, washing up bowls, racks,, gardening equipment, lighters, rulers, shoes (plastic only), plastic frames, babies bottle		H / Non-H	
GLASS					
15 0107	Glass (Packaging)	Wine bottles, beer bottles, water bottles, jam jars and medicine bottles		H / Non-H	
20 01 02	Non Packaging Glass	Mirrors, plate glass, flat glass, cookware (Pyrex), mixed broken glass, drinking glasses		H / Non-H	
METALS					
15 01 04	Ferrous Metal (Packaging)	Food cans, can lids, beer bottle lids, biscuit tins, polish tins, lids from glass jars		H / Non-H	Targeted by MDR
15 01 04	Aluminium Cans (Packaging)	Beverage cans - soft drinks, beer		H / Non-H	Targeted by MDR
	Aluminium foil trays (packaging)	Foil sheets, foil trays, some toothpaste/cosmetic products tubes, wine bottle screw caps, chocolate bar foil wrapper, foil yoghurt lids, stock cube wrapper.		H / Non-H	Targeted by MDR
15 01 04	Other Metal (Packaging)	Non-ferrous, non-aluminium metal packaging		H / Non-H	

20 01 40	Other Metal Waste	Copper wiring, include previous secondary waste categories: Other Ferrous Metal Waste, Other Aluminium Waste	H / Non-H	
WOOD				
15 01 03	Wood Packaging	Bottle corks, cork packaging, pallets, ice-cream sticks	H / Non-H	
20 01 37	Non-Packaging Natural Wood	Wood fencing (unpainted/unvarnished), some wood from DIY	H / Non-H	
20 01 37* / 20 01 38	Treated/ composite woods (e.g. MDF/chipboard)	Kitchen units, particle wood, toilet seats, skirting (chipboard, plywood, mdf), baskets.	H / Non-H	
HAZARDOUS MUNICIPAL WASTE				
20 01 27* / 20 01 28	Paint and associated products	Paint tins, heavily soiled paint brushes	H / Non-H	
20 01 33*/34	Batteries & Accumulators	Lead acid, nickel cadmium, other car and household batteries and accumulators (including rechargeable batteries)	H / Non-H	
20 01 99	Aerosols	Deodorant, perfume, hairspray	H / Non-H	
21 01 35*/36	Electronic equipment	Household appliances (toasters etc.), electronic toys, remote controls, phone chargers. Include previous secondary category Fluorescent tubes and other mercury containing wastes	H / Non-H	
20 01 31*/32	Medicines and drugs	Out of date antibiotics, steroids, tablets, etc. separated from packaging, inhaler	H / Non-H	
20 01 29*/30	Detergents	Laundry detergents separated from packaging i.e. the liquid or powder only	H / Non-H	
20 02 03	Garden chemicals	Sprays, feeds	H / Non-H	
20 01 99	Healthcare risk waste	Sharps, vials	H / Non-H	
20 03 99	Other (hazardous) municipal waste	Any other items - Description to be provided during survey e.g. hair dye, incl. previous secondary waste categories: Waste oil and oil filters, Ink cartridges and toner	H / Non-H	
20 03 99	Other (hazardous) municipal waste	Any other items - Description to be provided during survey	H / Non-H	
UNCLASSIFIED COMBUSTIBLES				
20 03 99	Unclassified combustibles packaging	Include previous Other Composite Packaging secondary waste category	H / Non-H	
20 03 99	Other unclassified combustibles	Animal hair, non-mercury containing light bulbs, linoleum (lino), rubber/latex gloves, cigarette butts, candles, full tube body lotion, paint brush	H / Non-H	
UNCLASSIFIED INCOMBUSTIBLES				
20 03 99	Unclassified incombustibles packaging	Include previous Other Composite Packaging secondary waste category	H / Non-H	

20 03 99	Other unclassified incombustibles	Inert waste e.g. ceramics, crockery, stone/ceramic floor and wall tiles, vases, stones, bricks	H / Non-H	
COMPONENTS SMALLER THAN 20 MM ROUND MESH				
20 03 99	Fines smaller than 20mm round	Any items going through the 20mm mesh	H / Non-H	

	Primary Category	13
	Secondary Category	51
	Tertiary Category	8

APPENDIX B

Sampling Methodology

The sampling methodology for the characterisation of household municipal solid waste is based on the 2015 methodology published and the limits set out in the RFT.

The main output of the sampling methodology is the sampling plan (see **Appendix C**) prepared following background research and using the most up to date household waste management data available at project initiation[28].

The sampling plan was updated in September 2017 (See **Appendix D**) to reflect the changes in the household collection market and preliminary data on household waste collected provided by the EPA[29].

Using the 2015 methodology, the data provided by the NWCPO and the EPA was used to update:

- The allocation of sampling effort for each waste stream (Mixed Residual, Mixed Dry Recyclables and Organics Collections).
- The allocation of sampling effort per for each stratum.
- The list of Authorised Waste Collectors (AWCs) provided a collection service in each stratum.

Allocation of Sampling Effort between Material Types

In this current characterisation campaign 50 household waste characterisation events have been requested by the EPA.

In theory, the resources available should be allocated taking into account variability within each waste stream and the quantity of the waste stream collected. However from a practical point of view, it is not possible to use the variability in each waste stream as it changes for each waste category.[30]

Therefore, the numbers of waste characterisation events were **only** allocated based on the quantities collected in 2015 (initially) and revised based on preliminary data for 2016. The total number of samples to be analysed for each waste stream is shown in **Table B.1**.

[28] The 2015 data submitted in the annual return by the Authorised Waste Collectors (AWCs) obtained from NWCPO at Offaly County Council. The data is made of the quantities collected and households serviced per waste stream (residual waste, recyclables, and organic waste), AWC and local authority.
[29] Personal Communication with the EPA on 01/08/2017.
[30] See Section 4.6 of 2015 Methodology.

Table B.1 - Allocation of Sorting Events between Material Types

	Mixed Residual Waste	Mixed Dry Recyclables	Organic Waste	Total
Number of Samples	32	12	6	50
Percentage	64%	24%	12%	100%

Allocation of Sampling Effort per Stratum

Table B.2 shows the number of samples to analyse in each stratum.[31]

Table B.2 - Allocation of Sorting Events per Stratum

Stratum	C2B	C3B	C4B	R2B	R3B	R4B	Total
Stratum Key: [C or R for city or rural] [2,3 or 4 for number of bins] [B for Bins]							
Mixed Residual Waste	3	9	1	5	12	2	**32**
Mixed Dry Recyclables	1	4	0	2	4	1	**12**
Organic Waste	0	4	0	0	2	0	**6**
Total Nu. samples	**4**	**17**	**1**	**7**	**18**	**3**	**50**
Total %	8%	34%	2%	14%	36%	6%	**100%**

Because of the small quantities collected in the strata 1-bin, no sorting events were allocated to this stratum.

Additional Sampling Requirements

To be representative of the household waste population, specific requirements shown in Table B.3 were set for the allocation of sorting events. These requirements relate to:

- Geographic distribution,
- Minimum number of AWCs per stratum,
- Minimum numbers of apartment samples.

[31] The total number of samples to be analysed for each waste stream shown in Table 2-1 was allocated to each stratum based on the proportion of each waste collected in these strata. See Sampling Plans in Appendices B & C for further details.

Table B.3 - Specific Requirements for the Allocation of Sampling Effort

<table>
<tr><th></th><th colspan="2">Mixed Residual Waste</th><th colspan="2">Mixed Dry Recyclables</th><th colspan="2">Organic Waste</th></tr>
<tr><td>Area</td><td>City</td><td>Rural</td><td>City</td><td>Rural</td><td>City</td><td>Rural</td></tr>
<tr><td>East</td><td></td><td>40% of rural samples & min. 2 AWCs</td><td></td><td>40% of rural samples</td><td colspan="2" rowspan="5">min. 3 AWCs</td></tr>
<tr><td>Dublin</td><td>80% of city samples & min. 2 AWCs</td><td></td><td>80% of city samples & min. 2 AWCs</td><td></td></tr>
<tr><td>West</td><td rowspan="2">20% of city samples and 1 AWC</td><td>20% of rural samples & min. 2 AWCs</td><td></td><td>20% of rural samples</td></tr>
<tr><td>South</td><td>40% of rural samples & min. 2 AWCs</td><td></td><td>40% of rural samples</td></tr>
<tr><td>Apartments</td><td>20-25% of city samples</td><td>5% of rural samples</td><td>20-25% of city samples</td><td></td></tr>
</table>

Frequency and Timing of Sampling

In order to account for seasonal variation, two survey campaigns per year should be undertaken. The first campaign should take place in the spring, between the months of March and April **where possible**, and the second campaign should take place in the autumn, between the months of September and October **where possible**.

APPENDIX C

Initial Sampling Plan February 2017

Characterisation of Municipal Waste

Document Control Sheet

Client:	Environmental Protection Agency (EPA)
Project Title:	Characterisation of Municipal Waste
Document Title:	Sampling Plan for the Characterisation of Household Municipal Solid Waste in Ireland
Document No:	MDR1300Rp0001

Text Pages:	7	Appendices:	1

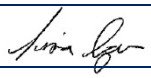
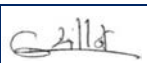
Rev.	Status	Date	Author(s)		Reviewed By		Approved By	
A01	Draft	10th February 2017	LE		OG		OG	

TABLE OF CONTENTS

APPENDICES

LIST OF TABLES

1 INTRODUCTION

The sampling plan for the characterisation of household municipal solid waste is the first deliverable of Task 1 of the EPA Request for Tender SPCP-2016-49 Municipal waste characterisation.

This sampling plan takes into consideration the updated methodology published in 2015[1], the limits set out in the RFT and also the methodology used in previous studies from 2004 and 2008.

The sampling plan has been prepared following background research and using the most up to date waste management data available at project initiation. Namely, the 2015 data submitted in the annual return by the Authorised Waste Collectors (AWCs) obtained from NWCPO at Offaly County Council. The data is made of the quantities collected and households serviced per waste stream (residual waste, recyclables, organic waste), AWC and local authority.

Using the methodology developed in 2015, the background information from the NWCPO was used to update:

- The allocation of sampling effort per for each waste stream (Mixed Residual, Mixed Dry Recyclables and Organics Collections).
- The allocation of sampling effort per for each stratum[2].
- The list of Authorised Waste Collectors provided a collection service in each stratum.

2 STRATIFICATION

In line with the 2015 methodology the following factors have been used for stratification:

- **Type of collection system:** The type (materials collected) and extent (quantities collected) of separate collections changes the composition of the residual waste, i.e. the proportion of food and garden waste in residual waste is lower for those areas which are provided with separate kerbside collection of household food and garden waste, thus reducing the organic waste content of mixed residual waste. Similarly the type of materials accepted in mixed dry recyclables collection has an effect on the composition of the mixed dry recyclables and on the composition of the remaining mixed residual waste collection. In the context of this programme four main collection systems have been identified:
    - **1, 2& 3-bin with Glass** which includes segregated glass collection combined with mixed residual collection, mixed dry recyclables collection and sometimes organic waste collection.
    - **3-bin** which includes mixed residual collection, mixed dry recyclables collection, and organic waste collection.
    - **2-bin** which includes mixed residual collection and mixed dry recyclables collection.
    - **1-bin** which includes mixed residual collection only.
- **Area type:** Ireland can be divided between “cities (and their suburbs)”[3] and “rural and mixed rural/urban areas” accounting respectively for 44% and 56% of household waste kerbside collected in 2015. In the “cities (and their suburbs)” stratum, in 2015, 4% of the households

[1] RPS, 2015. Review of the methodologies used for the characterisation of household municipal waste

[2] **Stratum/strata** are mutually exclusive and exhaustive parts of a population. They are identified either because they are believed to be different from each other or for the purposes of sampling.

[3] This stratum includes Dublin City (the four LAs), Cork City, Limerick City, Galway City and Waterford City.

serviced were provided with a 1, 2& 3-bin collection system including glass, 55% of the households serviced were provided with a 3-bin collection system, 37% with a 2-bin collection system and 3% with mixed residual waste collection only, while the service provision in the "rural and mixed rural/urban areas" stratum was 9%, 32%, 58% and 2% respectively[4]. The proportion of multi-dwelling units (apartment, flats and bed-sits) as a percentage of private households was 17% in "cities (and their suburbs)" stratum compared to 3% for the "rural and mixed rural/urban areas" stratum. [5]

3 ALLOCATION OF SAMPLING EFFORT PER WASTE STREAM

In this current characterisation campaign 50 household waste sorting events have been requested by the EPA.

In theory, the resources available should be allocated taking into account variability within each waste stream and the quantity of the waste stream collected. However from a practical point of view, it is not possible to use the variability in each waste stream as it changes for each waste category.[6]

Therefore, the number of sorting events has **only** been allocated based on the quantities collected in 2015, namely 641,335 tonnes of mixed residual waste collection, 299,665 tonnes in mixed dry recyclables collection and 98,455 tonnes for organic waste collection. The total number of samples to be analysed for each waste stream is shown in Table 3.1.[7]

Table 3.1 – Number of Samples

Waste Stream	Mixed Residual Collections	Mixed Dry Recyclables Collections	Organics Collections
Number of samples	31	14	5

The total number of samples to be analysed for each waste stream shown in Table 3.1 must now be allocated to each stratum.

As the variability in waste composition within each stratum is unknown, the allocation of sampling effort is **only** based on the proportion of each waste collected by the AWCs in these strata. These percentages were calculated from the 2015 quantities of household waste collected by AWC and local authority area provided by the NWCPO.

Note:

[4] Information on the number of households on a household service was obtained from the NWCPO.
[5] Note: the 2015 data provided by NWCPO does not distinguish between 'City' and 'County' in the cases of Limerick and Waterford, giving combined 'City and County' data. For the purposes of this exercise, the 2013 data was used to determine the approximate percentage split of households in each case, and these percentages were applied to the 2015 data.
[6] See Section 4.6 of 2015 Methodology.
[7] The results from the 2004 and 2008 waste composition surveys have been used to determine the number of samples required.

- Because of the small quantities collected in the strata 1-bin and 1, 2 & 3-bin with Glass collection system, consideration should be given to grouping the samples in the 1-bin collection system with the samples in the 2-bin collection system, plus grouping the samples in the 1, 2 & 3-bin with Glass collection system with the samples in the 3-bin collection system.
- To allow for measuring the variability in each stratum, a minimum of three samples are needed in a stratum.

4 ALLOCATION OF SAMPLING EFFORT FOR MIXED RESIDUAL COLLECTION

The allocation of sampling effort per stratum for mixed residual collection is shown in Table 4.1 and Table 4.2. The derived percentages presented in Table 4.1 are applied to the target total of 31 No. samples, to produce Table 4.4. An explanation of the methodology used to generate the percentages in Table 4.2 is provided in Appendix C of 2015 Methodology.

Table 4.1 – Proportion of Household Kerbside Mixed Residual Collection per Stratum[8]

Stratum	1-bin	2-bin	3-bin	1, 2& 3-bin with Glass	Total
Cities (and their suburbs)	1.8%	16.9%	20.3%	1.8%	41%
Rural and mixed rural/urban areas	1.4%	35.1 %	17.7%	5.0%	59%
Total	3.2%	52.0%	38.0%	6.8%	100%

Table 4.2 – Allocation of Sampling Effort for Household Kerbside Mixed Residual Collection

Stratum	1-bin	2-bin	3-bin	1, 2& 3-bin with Glass	Total
Cities (and their suburbs)	1	5	6	1	13
Rural and mixed rural/urban areas	0	11	5	2	18
Total	1	16	11	3	31

For the stratum Cities (and their suburbs):

- Circa 80% of the samples must come from the four Dublin local authorities
- The recruitment must include at least two AWCs from the Dublin Region and one AWC from another location (Galway, Cork, Limerick or Waterford City).
- Circa 20-25% of the samples will need to come from apartments..

For the stratum Rural and mixed rural/urban areas:

- Circa 40% of the samples must come from EMWR, 40% from SWR and 20% from CUWR.
- At least two AWCs must be recruited from each region.
- Circa 5% of the samples will need to come from apartments.

[8] This table is based on household waste quantities from the 2015 datasets.

5 ALLOCATION OF SAMPLING EFFORT FOR MIXED DRY RECYCLABLES COLLECTION

The allocation of sampling effort per stratum for mixed dry recyclables collection is shown in Table 5.1 and Table 5.2. An explanation of the methodology used to generate the percentages in Table 5.2 is provided in Appendix C of 2015 Methodology.

Table 5.1 – Proportion of Mixed Dry Recyclables Collection per Stratum[9]

Stratum	1-bin	2-bin	3-bin	1, 2& 3-bin with Glass	Total
Cities (and their suburbs)	0.0%	17.3%	23.3%	1.8%	42%
Rural and mixed rural/urban areas	0.0%	35.4%	17.4%	4.7%	58%
Total	0%	52.7%	40.7%	6.6%	100%

Table 5.2 – Allocation of Sampling Effort for Mixed Dry Recyclables Collection

Stratum	1-bin	2-bin	3-bin	1, 2& 3-bin with Glass	Total
Cities (and their suburbs)	-	2	3	0	5
Rural and mixed rural/urban areas	-	5	3	1	9
Total	-	8	6	1	14

For the stratum Cities (and their suburbs):

- Circa 80% of the samples must come from the four Dublin local authorities
- The recruitment must include at least two AWCs from the Dublin Region and one AWC from another location (Galway, Cork, Limerick or Waterford City).
- Circa 20-25% of the samples will need to come from apartments.

For the stratum Rural and mixed rural/urban areas:

- Circa 40% of the samples must come from EMWR, 40% from SWR and 20% from CUWR.
- At least two AWCs must be recruited from each region.

[9] This table is based on household waste quantities from the 2015 datasets.

6 ALLOCATION OF SAMPLING EFFORT FOR ORGANICS COLLECTION

The allocation of sampling effort per stratum for organics collection is shown in Table 6.1 and Table 6.2. An explanation of the methodology used to generate the percentages in Table 6.2 is provided in Appendix C of 2015 Methodology.

Table 6.1 – Proportion of Organics Collection per Stratum[10]

Stratum	1-bin	2-bin	3-bin	1, 2& 3-bin with Glass	Total
Cities (and their suburbs)	0.0%	0.0%	62.1%	1.7%	64%
Rural and mixed rural/urban areas	0.0%	0.0%	30.7%	5.5%	36%
Total	0.0%	0.0%	92.8%	7.2%	100%

Table 6.2 – Allocation of Sampling Effort for Organics Collection

Stratum	1-bin	2-bin	3-bin	1, 2& 3-bin with Glass	Total
Cities (and their suburbs)	-	-	3	0	3
Rural and mixed rural/urban areas	-	-	2	0	2
Total	-	-	5	0	5

Because of the limited number of samples, these samples will need to come from a minimum of three AWCs.

7 FREQUENCY AND TIMING OF SAMPLING

In order to account for seasonal variation, two survey campaigns per year should be undertaken. The first campaign should take place in the spring, between the months of March and April where possible, and the second campaign should take place in the autumn, between the months of September and October where possible[11].

The total number of samples to be analysed for each waste stream in Tables 4.2, 5.2 and 6.2 should be divided between these seasons i.e. 25 samples per campaign. The second campaign should ideally be a mirror image of the first campaign, assuming the AWCs agree to and are able to partake in both, so that the overall scaled up results can capture the seasonal variation.

[10] This table is based on household waste quantities from the 2015 datasets.

[11] For further information on seasonal variation see final report *A Programme for Municipal Waste Characterisation Surveys* published by the EPA in 2005

8 ALLOCATION OF AWC TO EACH STRATUM

Appendix A provides a list of 25 AWCs. In 2015, these AWCs offer a service to 93.3% of the households provided with a waste collection service and collect 92.7% of kerbside household waste.

In Table 8.1, each AWC in Appendix A was assigned to a stratum according to their predominant characteristics e.g. collection system ("1, 2 and 3-bin with Glass", "3-bin", "1-bin and 2-bin") and area type (Cities and their suburbs and Rural and mixed rural/urban areas)..

It must be noted that AWCs can be assigned to more than one stratum as they sometimes provide different types of collection systems and can collect in different area types.

Table 8.1 – Allocation of Authorised Waste Collector to Each Stratum[12]

Stratum	1, 2& 3-bin with Glass	3-bin	1-bin & 2-bin
Cities (and their suburbs)	• Country Clean Recycling; • Starrus Eco Holdings Ltd; and • Valcroft Ltd.	• Bruscar Bhearna Teo; • **Grehound Recycling and Recovery**; • KeyWaste Management Ltd; • **Killarney Waste Disposal**; • **Padraig Thornton Waste Disposal Ltd**; • **Panda Waste Services**; • Starrus Eco Holdings Ltd; • **The City Bin Company**; and • **Valcroft Ltd**.	• **Advanced Waste Recycling Ltd;** • **Bruscar Bhearna Teo**; • **Country Clean Recycling**; • Grehound Recycling and Recovery; • **KeyWaste Management Ltd**; • Killarney Waste Disposal; • Padraig Thornton Waste Disposal Ltd; • Panda Waste Services; • **Starrus Eco Holdings Ltd**; • The City Bin Company; and • Valcroft Ltd.
Rural and mixed rural/urban areas	• Advanced Environmental Solutions (Ireland) Ltd; • Clean (Irl) Refuse & Recycling Co.; • Country Clean Recycling; • Starrus Eco Holdings Ltd; and • Valcroft Ltd.	• Advanced Environmental Solutions (Ireland) Ltd; • Bruscar Bhearna Teo; • **Clean (Irl) Refuse & Recycling Co.**; • Exomex (Ireland) Ltd; • **Higgins Waste & Recycling Services Ltd**; • **Killarney Waste Disposal**; • Mulleadys Ltd; • Oxigen Environmental; • **Padraig Thornton Waste Disposal Ltd**; • **Panda Waste Services**; • **Quality Recycling Ltd**; • Starrus Eco Holdings Ltd; • **Valcroft Ltd**; and • Wiser Ltd.	• Ace Environmental Ltd; • **Advanced Environmental Solutions (Ireland) Ltd**; • **Bruscar Bhearna Teo**; • **Country Clean Recycling**; • **Doheny Wheelie Bins & Recycling Ltd**; • **Exomex (Ireland) Ltd**; • **G & J O'Neill Enterprises Ltd**; • Killarney Waste Disposal; • **Mulleadys Ltd**; • **Oxigen Environmental**; • Padraig Thornton Waste Disposal Ltd; • Panda Waste Services; • **Paul Ryan & Kevin Ryan**; • **Ray Whelan Ltd**; • **Starrus Eco Holdings Ltd**; • Valcroft Ltd; • **Wheeley Environmental Refuse Services Ltd**; and • **Wiser Ltd**.

[12] Based on NWCPO data for 2015. Bold indicates predominant collection system. If less than 10% of households are provided with a certain collection system, AWC is not included in the table.

APPENDIX A

Household Waste Collectors Data 2015

Redacted

APPENDIX D

Updated Sampling Plan September 2017

Memorandum

To:	Helen Searson	**From:**	Olivier Gaillot
Cc:		**Date:**	11/09/2017
Project:	**Characterisation of Municipal Waste**	**Email:**	Olivier.gaillot@rpsgroup.com
Project Number:	MDR1300	**File Reference:**	MDR1300Mo0002
Subject:	Update of household sampling plan		

The scale-up methodology for household waste is based on generating a waste composition profile for each kerbside waste stream[1] determined by calculating the **unweighted average** of the waste composition results for this waste stream.

This methodology was selected on the assumption that the allocation of samples in the sampling plan based on 2015 NWCPO data was close to the current situation. However, data made available recently suggests that the 2015 NWCPO data no longer reflects the current situation.

For example:

- Liaison with AWCs has shown that only a limited number of households remain on routes with 2-bin collection system only[2,3]. The majority of routes serve households on a 3-bin collection service only, with some routes servicing both households with 2-bin and households with 3-bin.
- Similarly it was not possible to identify any routes servicing a 1-bin collection system.

Therefore in order to consider whether to update the sampling plan to reflect the on-the-ground situation in 2017, further analysis of the 2016 NWCPO data was undertaken.

[1] Mixed Residual Collection, Mixed Dry Recyclables Collection and Organics Collection.
[2] The 2015 NWCPO data showed that 49% of households were on a 2 bin waste collection service.
[3] During the first campaign it was only possible to collect one sample in this stratum.

A comparison of the 2015 and 2016 data from the NWCPO indicates:

- The proportion of household waste collected per waste stream is shown in the table that follows. There has been a change from the 2015 date previously received, which will have an impact on the allocation of sampling effort per waste stream.

Waste Stream	Mixed Residual Collections	Mixed Dry Recyclables Collections	Organics Collections	Notes
2015 NWCPO data	62%	29%	9%	Based on a data export dated 09/01/2017 on which the allocation of sampling effort for the Spring 2017 campaign was based.
2015 NWCPO data (updated)	66%	24%	10%	Household kerbside collection data received from EPA on 04/09/2017
2016 NWCPO data	65%	24%	11%	

- A 12% increase in the number of brown bins from 572,833 in 2015 to 640,227 in 2016. 47% of households were provided with a brown bin in 2015 compared to 51% in 2016.
- A 5% increase in the number of green bins/green bags from 1,173,401 in 2015 to 1,228,205 in 2016. 96% of households were provided with a green bin in 2015 compared to 97.5% in 2016.
- An 11% increase in the number of glass bin from 83,740 in 2015 to 93,205 in 2016. 6.9% of households were provided with a glass bin in 2015 compared to 7.4% in 2016.

We also need to consider the impact of regulatory requirements on the waste collection services provided to household. For example, The European Union (Household Food Waste and Bio-waste) Regulations 2015 require that brown bins be rolled out to population centres greater than 500 persons, i.e. to most towns and villages (the previous requirement was for population centres greater than 1,500 persons) by July 2017[4]. According to the Department's website, only very small population areas, or small islands, will be exempt, because it is not technically, environmentally or economically practical to separately collect such waste in these areas.

It was therefore decided to make alterations to the project plan to ensure that it reflects as far as possible the current situation in terms of waste collections. Alterations undertaken include:

- Increase the number of mixed residual waste and or organics collections, and reducing mixed dry recyclables collection.
- Reducing the number of samples from the 2-bin collection system and increasing the samples from 3-bin collection system in the mixed residual waste and mixed dry recyclables collections.

[4] http://www.dccae.ie/en-ie/environment/topics/waste/the-householder-and-waste/bio-food-waste/Pages/default.aspx

- Reallocating the number of samples from 1-bin collection system only in the stratum rural and mixed rural/urban areas to another stratum.

Tables 4.1, 4.3, 4.4, 4.5 and 4.6 of the Sampling Plan issued in February 2017 were therefore updated with a September 2017 Sampling Plan. Number in brackets shows allocation in sampling plan issued in February 2017.

Table 3.1 – Number of Samples per Waste Stream

Waste Stream	Mixed Residual Collections	Mixed Dry Recyclables Collections	Organics Collections
Number of samples	32 (31)	12 (14)	6 (5)

Table 4.1 – Proportion of Household Kerbside Mixed Residual Collection per Stratum

Stratum	1-bin	2-bin	3-bin	1, 2& 3-bin with Glass	Total
Cities (and their suburbs)	0.0% (1.8%)	10.0%[5] (16.9%)	29.1% (20.3%)	1.8%	41%
Rural and mixed rural/urban areas	0.0% (1.4%)	15.0%[6] (35.1%)	39.1% (17.7%)	5.0%	59%
Total	0.0% (3.2%)	25.0% (52.0%)	68.2% (38%)	6.8%	100.0%

Table 4.2 – Allocation of Sampling Effort for Household Kerbside Mixed Residual Collection

Stratum	1-bin	2-bin	3-bin	1, 2& 3-bin with Glass	Total
Cities (and their suburbs)	- (1)	3 (5)	9 (6)	1	13
Rural and mixed rural/urban areas	-	5 (11)	12 (5)	2	19 (18)
Total	- (1)	8 (11)	21 (11)	3	32 (31)

[5] It was calculated that the only households provided with a 2-bin collection system in the stratum cities were apartments accounting for circa 10% of households collected.

[6] It was assumed that households in population centres smaller than 500 persons accounted for 15% of households collected.

Table 4.3 – Proportion of Mixed Dry Recyclables Collection per Stratum

Stratum	1-bin	2-bin	3-bin	1, 2& 3-bin with Glass	Total
Cities (and their suburbs)	0.0%	10.0%[5] (17.3%)	30.6% (23.3.%)	1.8%	42%
Rural and mixed rural/urban areas	0.0%	15.0%[6] (35.4%)	37.9% (17.4%)	4.7%	58%
Total	0.0%	15.0% (52.7%)	78.4% (40.7%)	6.6%	100%

Table 4.4 – Allocation of Sampling Effort for Mixed Dry Recyclables Collection

Stratum	1-bin	2-bin	3-bin	1, 2& 3-bin with Glass	Total
Cities (and their suburbs)	-	- (2)	5 (3)	-	5 (5)
Rural and mixed rural/urban areas	-	2 (5)	4 (3)	1	7 (9)
Total	-	2 (7)	9 (6)	1	12 (14)

Table 4.5 – Proportion of Organics Collection per Stratum

Stratum	1-bin	2-bin	3-bin	1, 2& 3-bin with Glass	Total
Cities (and their suburbs)	0.0%	0.0%	62.1%	1.7%	64%
Rural and mixed rural/urban areas	0.0%	0.0%	30.7%	5.5%	36%
Total	0.0%	0.0%	92.8%	7.2%	100%

Table 4.6 – Allocation of Sampling Effort for Organics Collection

Stratum	1-bin	2-bin	3-bin	1, 2& 3-bin with Glass	Total
Cities (and their suburbs)	-	-	4 (3)	-	4
Rural and mixed rural/urban areas	-	-	2 (2)	-	2
Total	-	-	6 (5)	-	6

A summary of the changes and an overview of the AWCs targeted in the second campaign is presented in Appendix A.

It must be noted that 6 samples will come from the SWMR and 5 from the CUR.

APPENDIX E

Sampling Procedure

The sampling procedure describes how the samples were collected.

AWC Recruitment

AWCs were recruited from the list of AWCs provided by NWCPO. In order to improve the cost-effectiveness of the programme, larger AWCs were targeted for recruitment in priority.

Logistics Planning

RPS engaged with the selected AWCs to plan the surveys. This included preparing for and resolving the practical issues involved, such as:

- Communication with the selected AWCs on an individual basis, to brief them on their role in the allocated survey(s), and profiling the AWC to understand the AWCs waste population for guiding sample selection.
- Reconciling waste collection routes with sets of socioeconomic factors at electoral division levels: RPS identified on a map the geographic coverage of the waste collection routes and cross-references the information with the socioeconomic factors (type of accommodations, and social class). The purpose of this exercise is to target collection routes that can provide a social class composition that broadly matches the national breakdown presented in **Table E.4**.
- Briefing AWC personnel involved in each survey. This typically involves an initial meeting at the facility in question.
- Checking availability at the treatment facility of a covered area and a machine and driver (bobcat or similar vehicle) for mixing and reducing the sampled waste.
- Sourcing equipment to carry out the physical sorting of the waste including sorting table with a network of holes that are 20mm diameter in size, buckets, weighing scales, shovels, sample bags if laboratory testing is taking place.
- The measures required for meeting the H&S requirements specific to the site in question - issues such as vaccinations, gloves, masks, protective clothing, and disinfectant wipes etc.
- Briefing and training of sorting staff in advance of each sorting event.

Selection of a Representative Sample from the AWC

Samples were collected from loads delivered by the selected AWC at a treatment facility. The loads were selected from the refuse collection vehicles deliveries which fit the following requirement:

- The loads must exclude commercial waste.
- The loads must fit within the stratum shown in the tables in **Appendix B**.
- The loads must include a mix of social classes to reflect the national average social class breakdown from the CSO. [32]

[32] It is possible to obtain social class information at electoral division levels and compare these with the waste collection routes.

Table E.4 - Population by Social Class 2011

A Professional workers, Managerial and technical and 1/3 of All others gainfully occupied and unknown	B Non-manual, Skilled manual and 1/3 of All others gainfully occupied and unknown	C Semi-skilled, Unskilled and 1/3 of All others gainfully occupied and unknown	Total
41%	39%	20%	100%

Source: CSO

In order to guide the selection of routes with AWCs, the information on social class at electoral division level was compiled in a map shown in **Figure E.1.** The map shows the deviation from national average of each electoral division in the country based on three bands. These three bands are less than or equal to 5%; greater than 5% and less than or equal to 10%; greater than 10%. Waste collection routes were selected from areas in green (in priority) and yellow (if no green available).

Composite samples were prepared by selecting **n** increments (grab samples) from selected loads. The increments were stored in an area where they cannot be compromised or contaminated (using a skip for example). Five increments are collected from the loads accepted over a day (where possible). The recommended sample collection parameters are provided in **Table E.5**.

Table B.5 - Recommended Sample Collection Parameters

Waste Type	Number of Increments (n)	Min. Size of Increment (kg)	Min. Composite Sample Size (kg)	Sample Reduction Coning & Quartering	Sample Size (after Coning & Quartering)(kg)
Mixed Residual Collection	5	400	2,000	Yes	100
Mixed Dry Recyclables	5	400	2,000	Yes	100
Organic Waste	5	400	2,000	Yes	100

The composite sample was then reduced to obtain a more manageable size for sorting. The size reduction was be obtained by the **Coning and Quartering technique.**

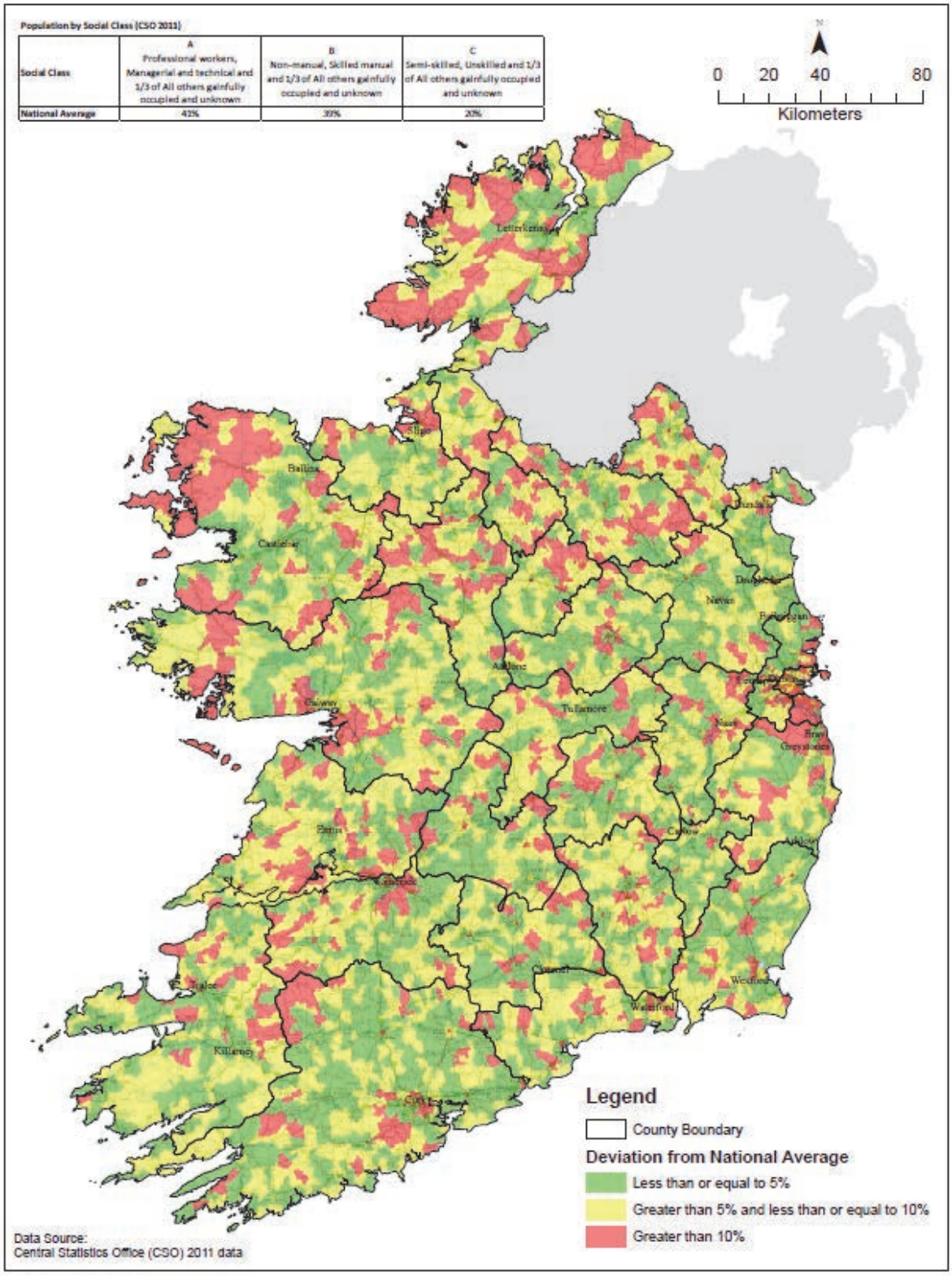


Figure E.1- Deviation of Population by Social Class (CSO 2011) National

Image E.1 - MDR (L) and MRW (R) Samples being Coned and Quartered

Sample Sorting

Once a reduced or workable sample had been obtained, the sub-sample was manually sorted into the categories shown in **Appendix A**.

The sorting team comprised of a supervisor and the sorting staff (at least four sorters are advised). Prior to carrying out the waste characterisation, the sorting staff were trained by the supervisor to recognise the different waste categories.

The supervisor ensured the quality control of the sorted material by checking the material placed in each container.

Any remaining material that passed through the 20 mm network of holes on the sorting table was classified as 'Fines < 20 mm'.

The weights of each category were recorded on an appropriate Waste Composition Form.

Image 7.2 - Sorting Table and Containers

APPENDIX F

Comparison Samples Collected with Samples Required

This Section presents an overview of the samples collected and any deviation with the sampling plan presented in Appendix B.

There have been some deviations from the sampling plan but, as these deviations are minor, it is not anticipated that these variations will affect the accuracy of results or alter the conclusion contained in the report.

Samples Collected per Stratum

Table F.1 presents the number of samples collected per stratum. Number in brackets indicates the number required by the sampling plan.

Table F.1 - Samples Surveyed per Stratum

	C2B	C3B	C4B	R2B	R3B	R4B	Total
Mixed Residual Waste	3	9	1	6 (5)	11 (12)	2	**32**
Mixed Dry Recyclables	1	**3** (4)	**1** (0)	2	4	1	**12**
Organic Waste	0	4	0	0	2	0	**6**
Total Nu. samples	4	16 (17)	2 (1)	8 (7)	17 (18)	3	**50**
Total %	**8%**	**32%**	**4%**	**16%**	**34%**	**6%**	**100%**

Additional Sampling Requirements

Table F.2 presents the number of samples collected compared with geographical distribution requirements and minimum numbers of apartment samples.

Table F.2 - Specific Requirements for the Allocation of Sampling Effort

	Mixed Residual Waste		Mixed Dry Recyclables		Organic Waste	
Area	City	Rural	City	Rural	City	Rural
East		42% (40%)		71% (40%)	N/A	
Dublin	85% (80%)		80% (80%)			
West	15% (20%)	21% (20%)		14% (20%)		
South		21% (40%)		14% (40%)		
Apartments	23% (20-25%)	0% (5%)	20%			

The requirement for the minimum number of AWCs per stratum was achieved.

Frequency and Timing of Surveys

Table F.3 presents an overview of the timing of the surveys.

Table F.3 - Timing of Surveys

Period	Mixed Residual Waste	Mixed Dry Recyclables	Organic Waste
March - April	15	7	3
September - October	9	1	2
Other	8 (5 in May, 3 early December)	4 (2 early May, 2 late January)	1 (early May)
Total	**32**	**12**	**6**
Percentage within Preferred Period	75%	67%	83%

APPENDIX G

Results Mixed Residual Waste

Authorised Waste Collector	AWC 1	AWC 1	AWC 1	AWC 1	AWC 1	AWC 2	AWC 2	AWC 3	AWC 3	AWC 3	AWC 3	AWC 4	AWC 4	AWC 4	AWC 4	AWC 1	AWC 1	AWC 1	AWC 1	AWC 5	AWC 5	AWC 6	AWC 6	AWC 7	AWC 6	AWC 6	AWC 7	AWC 2	AWC 2	AWC 7	AWC 5	AWC 8	AWC 8
Stratum	C3B	C3B	C3B	R2B	R3B	C3B	C3B	R2B	R3B	R3B	R3B	R3B	R3B	R3B	R4B	C3B	C3B	R3B	R3B	C3B	C3B	R3B	R3B	R3B	R2B	R2B	R2B	C2B	C2B	R2B	C2B	C4B	R4B
Frequency of collection	Fortnightly	Fortnightly	Fortnightly	Fortnightly	Fortnightly	Fortnightly	Fortnightly	Fortnightly	Fortnightly	Fortnightly	Fortnightly	Fortnightly	Fortnightly	Fortnightly	Fortnightly	Fortnightly	Fortnightly	Fortnightly	Fortnightly	Fortnightly	Fortnightly	Fortnightly	Fortnightly	Fortnightly	Fortnightly	Fortnightly	Fortnightly	Weekly	Weekly	Fortnightly	Fortnightly	Fortnightly + Glass every 4 weeks	Fortnightly + Glass every 4 weeks
Date of Sorting	18/04/2017	19/04/2017	19/04/2017	25/05/2017	27/04/2017	26/04/2017	26/04/2017	22/05/2017	22/05/2017	01/06/2017	01/06/2017	26/04/2017	27/04/2017	27/04/2017	19/09/2017	19/09/2017	19/09/2017	20/09/2017	25/09/2017	18/12/2017	18/12/2017	18/10/2017	19/10/2017	23/10/2017	18/10/2017	19/10/2017	23/10/2017	28/03/2018	29/03/2018	03/05/2018	19/04/2018	05/03/2018	05/03/2018
Quantity characterised (kg)	124.75	106.851	106.585	120.35	103.35	104.9	109.3	105.15	131.3	129.8	107.25	95.85	11.99	95.05	103.15	96.45	100.55	106.85	99.41	102.28	103.55	100.30	97.25	100.95	102.85	97.60	100.28	86.05	103.34	99.44	101.64	103.91	

Primary Waste Categories	Secondary Waste Categories	% Wet weight	% Wet weight	% Wet weight	% Wet weight	% Wet weight	% Wet weight	% Wet weight	% Wet weight	% Wet weight	% Wet weight	% Wet weight	% Wet weight	% Wet weight	% Wet weight	% Wet weight	% Wet weight	% Wet weight	% Wet weight	% Wet weight	% Wet weight	% Wet weight	% Wet weight	% Wet weight	% Wet weight	% Wet weight	% Wet weight	% Wet weight	% Wet weight	% Wet weight	% Wet weight	% Wet weight	% Wet weight	Average
Organics	Edible kitchen & canteen waste: unused package	1.96%	3.74%	3.39%	4.24%	6.23%	4.41%	6.75%	1.04%	3.12%	5.45%	7.08%	2.35%	5.37%	1.58%	7.13%	7.29%	4.48%	10.30%	0.09%	2.05%	1.79%	0.90%	0.93%	4.80%	4.33%	7.12%	4.19%	6.88%	5.42%	4.74%	13.63%	4.20%	4.6%
Organics	Edible kitchen & canteen waste: unused non-pac	6.77%	0.66%	1.55%	4.11%	1.35%	0.36%	8.91%	0.19%	4.74%	1.32%	2.48%	1.83%	1.21%	0.79%	1.45%	3.20%	0.94%	0.14%	6.68%	3.81%	3.33%	0.25%	0.77%	1.39%	0.73%	2.10%	1.89%	4.43%	2.98%	14.37%	2.32%	0.00%	2.7%
Organics	Inedible kitchen & canteen waste	4.85%	3.49%	2.27%	3.02%	4.44%	3.17%	7.45%	1.69%	1.75%	5.65%	4.22%	2.24%	0.78%	0.00%	0.73%	3.40%	2.03%	4.97%	11.94%	6.26%	2.22%	6.43%	6.29%	6.04%	3.55%	2.51%	22.69%	17.80%	8.61%	13.90%	16.68%	12.65%	6.1%
Organics	Liquid fit for human consumption	0.00%	0.00%	0.00%	0.66%	0.47%	0.00%	0.59%	0.00%	0.19%	0.50%	0.00%	0.00%	0.00%	0.00%	0.19%	0.39%	0.75%	0.00%	0.00%	0.14%	0.19%	0.00%	0.46%	0.00%	0.00%	0.05%	0.20%	1.78%	0.48%	0.24%	1.12%	0.00%	0.3%
Organics	Biodegradable waste from garden & park	1.52%	3.37%	4.42%	0.83%	0.42%	7.06%	7.80%	2.18%	1.12%	6.50%	1.85%	13.51%	0.83%	9.21%	0.44%	1.05%	0.25%	0.34%	1.15%	1.47%	0.48%	0.60%	0.99%	5.89%	0.24%	1.13%	0.70%	0.78%	2.25%	0.40%	0.23%	0.40%	2.5%
Organics	Vegetable oil	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.0%
Papers	Recyclable and Recoverable paper packaging	1.76%	0.33%	0.56%	1.88%	0.75%	2.60%	0.34%	1.22%	0.32%	1.94%	0.83%	2.89%	1.51%	0.48%	0.29%	0.13%	0.45%	0.42%	1.07%	1.39%	0.14%	0.35%	0.15%	0.05%	0.24%	0.00%	1.45%	2.59%	0.25%	1.82%	0.26%	0.15%	0.9%
Papers	Unrecyclable paper packaging	0.00%	0.19%	0.00%	0.64%	0.51%	0.32%	0.00%	1.42%	2.64%	0.63%	0.09%	0.00%	0.00%	0.00%	2.52%	1.50%	0.70%	0.94%	0.44%	0.69%	0.82%	1.69%	0.46%	0.54%	0.34%	0.20%	1.35%	0.48%	3.00%	5.29%	1.29%	0.63%	0.9%
Papers	Newspapers	0.00%	0.00%	1.31%	0.13%	0.28%	0.00%	0.84%	0.19%	0.95%	0.00%	1.20%	0.16%	1.04%	0.84%	0.00%	0.07%	0.25%	2.29%	0.60%	0.45%	0.39%	1.60%	1.70%	0.45%	1.90%	1.48%	0.10%	1.52%	0.39%	0.00%	1.01%	0.47%	0.7%
Papers	Magazines & glossy paper	0.04%	1.12%	1.13%	0.00%	3.19%	0.00%	1.18%	0.28%	1.08%	0.00%	0.83%	1.62%	0.00%	0.53%	0.58%	0.07%	1.34%	0.00%	0.30%	0.52%	0.00%	0.00%	0.77%	0.00%	0.00%	0.00%	0.75%	0.83%	0.88%	0.10%	0.16%	1.20%	0.6%
Papers	Office papers	0.16%	0.14%	0.14%	0.31%	0.00%	1.51%	0.17%	0.09%	0.57%	0.19%	1.02%	0.00%	0.00%	0.00%	0.29%	0.00%	1.14%	0.61%	0.08%	0.42%	0.97%	0.55%	2.42%	0.00%	7.10%	0.01%	0.15%	0.49%	1.02%	0.35%	0.06%	0.18%	0.6%
Papers	Tissue Papers	4.76%	0.94%	4.51%	4.91%	3.23%	4.03%	7.91%	6.01%	2.68%	6.29%	7.90%	3.44%	3.21%	1.58%	6.70%	8.13%	7.52%	8.73%	0.89%	5.88%	6.62%	4.14%	5.31%	3.32%	5.35%	5.59%	3.69%	3.51%	4.11%	5.24%	1.76%	4.82%	5.1%
Papers	Other papers	0.56%	0.28%	1.31%	1.25%	1.12%	1.46%	0.34%	0.57%	1.59%	1.59%	1.10%	0.11%	2.05%	3.58%	3.81%	1.18%	1.42%	0.56%	0.41%	0.01%	0.00%	5.75%	1.45%	2.18%	2.19%	0.10%	0.50%	0.77%	0.29%	0.55%	0.20%	1.28%	1.2%
Cardboards	Flat Card and Corrugated Cardboard (Packaging	3.40%	5.60%	3.42%	4.31%	1.54%	2.09%	2.28%	5.10%	4.55%	3.57%	4.97%	4.07%	2.95%	0.63%	4.54%	3.30%	0.65%	1.41%	3.80%	2.80%	6.77%	1.65%	1.81%	2.58%	0.83%	2.10%	4.21%	3.08%	2.12%	9.88%	3.06%	3.89%	3.3%
Cardboards	Other cardboards (Non-packaging)	3.07%	0.05%	0.47%	0.00%	0.00%	0.00%	1.10%	0.85%	0.57%	0.13%	0.00%	0.29%	0.83%	0.08%	0.00%	0.46%	0.00%	0.28%	0.11%	0.01%	0.05%	1.95%	1.75%	0.00%	1.96%	0.67%	0.45%	0.34%	0.40%	0.00%	0.06%	0.21%	0.5%
Composite beverage cartons	Beverage carton (packaging) (tetrapak)	0.08%	0.70%	0.33%	0.22%	0.66%	0.46%	0.59%	0.00%	0.32%	1.07%	0.46%	2.24%	2.53%	0.00%	0.10%	0.20%	0.30%	0.61%	0.16%	0.21%	0.82%	0.45%	0.72%	0.45%	2.14%	0.61%	0.00%	0.10%	0.34%	0.42%	0.18%	0.32%	0.6%
Textiles	Textiles Packaging	0.08%	1.36%	0.23%	0.13%	0.00%	0.00%	1.52%	0.00%	0.06%	2.26%	0.09%	0.80%	1.00%	0.53%	0.63%	0.26%	0.30%	0.09%	0.00%	0.00%	0.00%	0.05%	0.00%	0.05%	0.00%	0.00%	1.00%	3.13%	0.00%	0.00%	0.00%	0.00%	0.4%
Textiles	Textiles non-packaging	1.20%	2.95%	2.11%	1.69%	4.69%	5.83%	0.00%	4.26%	0.89%	9.65%	1.93%	3.03%	4.42%	6.37%	3.59%	0.88%	0.85%	2.20%	1.86%	5.92%	1.06%	2.44%	1.18%	3.37%	0.83%	2.61%	4.59%	2.74%	4.48%	0.00%	0.41%	10.71%	3.1%
Textiles	Clothes	8.99%	6.97%	3.38%	7.60%	10.40%	8.74%	2.70%	4.45%	4.07%	6.02%	5.80%	4.07%	3.74%	7.36%	5.11%	5.56%	8.95%	2.62%	1.64%	0.76%	4.54%	8.03%	5.86%	3.37%	3.21%	8.70%	11.07%	16.69%	4.21%	1.36%	7.35%	2.02%	5.8%
Textiles	Nappies	9.54%	7.07%	8.91%	13.29%	4.97%	30.51%	11.97%	13.36%	9.22%	5.89%	3.96%	8.03%	15.95%	8.21%	16.77%	20.34%	11.64%	16.19%	7.90%	8.53%	9.71%	8.82%	9.72%	9.61%	6.03%	8.40%	0.30%	0.01%	5.47%	9.18%	13.29%	9.06%	10.1%
Textiles	Healthcare textiles	2.28%	3.07%	1.08%	1.31%	1.61%	1.57%	2.28%	1.14%	0.67%	1.83%	1.01%	0.34%	0.11%	0.08%	0.19%	0.26%	1.14%	1.17%	1.38%	1.74%	1.11%	0.70%	0.05%	0.20%	0.49%	0.01%	1.55%	1.54%	0.93%	1.55%	0.34%	0.79%	1.0%
Plastics	PET packaging	0.64%	1.68%	3.33%	0.57%	0.28%	0.55%	1.10%	0.85%	1.21%	0.81%	0.64%	0.51%	0.74%	0.63%	1.02%	0.59%	0.75%	1.36%	1.16%	0.90%	2.27%	1.74%	2.37%	1.09%	1.51%	0.31%	0.85%	0.82%	1.26%	4.31%	1.45%	0.58%	1.2%
Plastics	PE packaging	1.36%	0.42%	0.14%	1.44%	0.75%	0.64%	0.51%	0.95%	0.70%	0.81%	1.10%	1.04%	1.16%	0.84%	1.65%	1.37%	3.95%	2.57%	0.43%	0.88%	1.11%	1.15%	3.08%	1.93%	1.31%	2.46%	1.25%	1.92%	1.66%	1.63%	0.82%	0.65%	1.3%
Plastics	PP Packaging	2.36%	1.64%	0.99%	3.13%	3.37%	0.87%	3.12%	1.71%	0.32%	4.20%	4.05%	1.56%	2.47%	1.53%	1.89%	3.43%	4.48%	4.09%	1.85%	0.00%	2.12%	2.69%	2.11%	1.14%	2.48%	3.74%	0.01%	0.10%	1.26%	1.31%	0.89%	0.33%	2.0%
Plastics	EPS Styrofoam Packaging	0.52%	0.00%	0.09%	0.42%	0.09%	0.23%	0.42%	0.66%	0.13%	0.13%	0.47%	0.26%	0.46%	0.05%	0.24%	0.23%	0.46%	0.82%	0.03%	0.65%	0.14%	0.25%	1.15%	0.10%	0.15%	0.01%	3.57%	7.02%	0.01%	0.50%	0.26%	0.10%	0.6%
Plastics	Supermarkets bags and films (packaging)	4.57%	6.18%	8.73%	4.72%	6.13%	4.51%	7.84%	1.80%	0.57%	4.26%	7.36%	4.64%	8.05%	6.68%	10.75%	9.34%	13.37%	7.59%	4.23%	5.50%	17.72%	14.36%	8.24%	13.57%	12.49%	11.11%	1.45%	0.72%	7.14%	5.10%	1.98%	1.00%	6.9%
Plastics	Other plastic (packaging)	6.64%	7.96%	5.68%	3.54%	2.26%	1.32%	2.53%	8.63%	6.65%	6.39%	0.38%	3.81%	1.32%	0.37%	0.46%	1.11%	0.55%	2.48%	4.81%	5.08%	1.25%	1.35%	3.39%	0.45%	1.70%	0.01%	4.74%	8.58%	6.04%	3.79%	4.42%	3.96%	3.5%
Plastics	Other plastic (non-packaging)	3.61%	2.48%	2.58%	2.08%	7.13%	0.64%	0.51%	8.44%	10.78%	3.22%	9.75%	3.18%	6.58%	2.21%	1.11%	2.22%	1.87%	2.08%	1.87%	2.17%	0.82%	0.90%	0.84%	0.99%	3.06%	3.90%	1.99%	0.00%	2.07%	0.29%	3.43%	3.50%	3.0%
Glass	Glass packaging	5.13%	2.57%	3.85%	3.65%	3.84%	3.57%	2.02%	1.52%	1.53%	2.32%	0.84%	1.15%	1.16%	0.58%	4.31%	0.88%	3.23%	2.20%	2.97%	1.01%	0.77%	1.69%	9.82%	4.01%	1.41%	1.13%	0.90%	1.60%	2.74%	7.34%	1.47%	3.93%	2.7%
Glass	Non Packaging glass	1.64%	2.10%	3.55%	1.12%	0.37%	0.00%	0.17%	0.57%	1.98%	0.28%	0.74%	0.00%	0.00%	0.00%	0.00%	0.00%	0.10%	0.00%	0.00%	0.00%	0.00%	0.00%	0.96%	0.20%	0.53%	0.52%	0.55%	0.82%	0.46%	0.00%	0.00%	0.00%	0.5%
Metals	Ferrous metal packaging	0.40%	1.17%	1.74%	1.27%	0.56%	1.02%	0.51%	0.95%	1.02%	1.07%	1.01%	0.00%	1.00%	1.58%	0.58%	0.85%	0.75%	1.31%	0.78%	1.29%	1.01%	1.35%	1.85%	0.20%	1.80%	1.38%	1.00%	0.88%	1.31%	1.65%	0.77%	1.15%	1.0%
Metals	Aluminium cans	0.76%	0.70%	0.94%	0.44%	0.66%	0.00%	0.59%	1.14%	1.08%	1.20%	0.00%	0.86%	0.40%	0.47%	1.21%	0.39%	0.75%	0.37%	0.53%	0.08%	0.82%	0.50%	0.51%	1.19%	0.88%	0.46%	0.00%	0.56%	1.79%	0.81%	1.18%	1.53%	0.7%
Metals	Aluminium foil	1.00%	2.11%	1.41%	0.94%	2.29%	1.91%	2.70%	1.52%	0.86%	1.88%	1.38%	1.04%	2.00%	0.53%	2.80%	2.29%	2.31%	1.17%	1.20%	1.12%	1.69%	1.81%	1.90%	1.49%	1.90%	1.18%	5.24%	0.43%	0.85%	0.22%	0.43%	0.47%	1.6%
Metals	Other metal packaging	0.08%	0.05%	0.28%	0.00%	0.00%	0.00%	0.00%	0.47%	0.06%	0.00%	0.00%	1.10%	1.64%	0.00%	0.00%	0.00%	0.00%	0.05%	0.62%	0.55%	0.00%	0.00%	0.82%	0.00%	0.00%	0.05%	0.00%	0.01%	0.47%	0.00%	0.00%	0.00%	0.2%
Metals	Other metal waste	0.36%	2.43%	1.74%	0.31%	1.78%	1.37%	0.34%	1.61%	5.63%	0.13%	5.51%	0.16%	0.84%	0.26%	0.53%	1.90%	2.29%	2.06%	0.37%	0.65%	2.12%	0.40%	0.67%	0.69%	1.90%	1.85%	0.01%	0.00%	0.70%	0.00%	0.99%	0.17%	1.2%
Wood	Wood packaging	0.00%	0.00%	0.00%	0.29%	0.00%	0.00%	0.00%	0.00%	0.00%	0.69%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%	0.00%	0.05%	0.00%	0.00%	0.00%	0.00%	0.01%	2.99%	0.01%	0.15%	0.00%	0.00%	0.00%	0.1%
Wood	Non Packaging Natural Wood	0.00%	0.00%	0.61%	0.26%	0.66%	0.00%	0.17%	1.33%	0.25%	0.20%	1.01%	0.68%	0.00%	0.00%	0.05%	0.42%	0.80%	0.09%	0.39%	0.39%	1.48%	1.20%	0.57%	0.15%	0.10%	0.05%	0.05%	0.01%	0.70%	0.00%	0.00%	0.00%	0.4%
Wood	Treated/ composite woods	1.32%	1.40%	0.09%	4.06%	0.00%	0.09%	0.00%	0.00%	0.31%	1.30%	0.21%	0.36%	1.21%	0.44%	0.13%	4.77%	0.05%	0.03%	0.39%	1.43%	0.15%	0.10%	0.00%	0.29%	0.26%	0.01%	0.38%	0.17%	0.00%	0.45%	0.00%	0.00%	0.6%
Haz. Municipal Waste	Paint and associated products	0.00%	0.00%	0.52%	0.00%	0.00%	0.00%	1.01%	0.00%	0.51%	0.63%	0.00%	0.00%	0.00%	0.00%	0.00%	0.65%	0.70%	0.00%	0.00%	0.00%	0.39%	0.00%	0.00%	0.25%	0.05%	0.00%	0.02%	0.34%	0.10%	0.00%	0.00%	0.00%	0.2%
Haz. Municipal Waste	Batteries & Accumulators	0.12%	0.28%	0.05%	0.13%	0.00%	0.09%	0.00%	0.00%	0.19%	0.00%	0.18%	0.08%	0.02%	0.08%	0.05%	0.33%	0.20%	0.26%	0.06%	0.00%	0.05%	0.10%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.13%	0.11%	0.13%	0.13%	0.1%
Haz. Municipal Waste	Aerosols	0.20%	0.33%	0.28%	0.13%	0.00%	0.00%	0.25%	0.00%	0.00%	0.19%	0.18%	0.19%	0.37%	0.21%	0.10%	0.13%	0.10%	0.28%	0.04%	0.10%	0.05%	0.15%	0.72%	0.15%	0.49%	0.00%	0.00%	0.00%	0.19%	0.15%	0.24%	0.12%	0.2%
Haz. Municipal Waste	Fluorescent tubes	0.00%	0.09%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.06%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.06%	0.00%	0.0%
Haz. Municipal Waste	Electronic equipment	0.40%	1.36%	0.14%	0.92%	0.98%	1.28%	0.42%	0.00%	0.51%	0.19%	0.46%	1.18%	0.79%	1.42%	3.97%	3.34%	0.25%	3.14%	0.32%	1.34%	0.00%	0.00%	2.57%	0.15%	0.00%	1.18%	0.00%	0.00%	0.19%	0.03%	0.00%	0.92%	0.9%
Haz. Municipal Waste	Medicines and Drugs	0.32%	0.14%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.51%	0.31%	0.00%	0.05%	0.17%	0.00%	0.00%	0.20%	0.05%	0.09%	0.17%	0.14%	0.00%	0.10%	0.05%	0.00%	0.10%	0.00%	0.01%	0.00%	0.00%	0.07%	0.00%	0.07%	0.1%
Haz. Municipal Waste	Detergents	0.00%	0.33%	0.09%	0.04%	0.00%	0.00%	0.00%	0.06%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.10%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.24%	0.27%	0.00%	0.0%
Haz. Municipal Waste	Garden chemicals	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.0%
Haz. Municipal Waste	Healthcare risk waste	0.04%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	2.94%	0.01%	0.39%	0.28%	0.00%	0.00%	0.1%
Haz. Municipal Waste	Other hazardous domestic waste	0.00%	0.00%	0.14%	0.92%	0.00%	0.64%	1.26%	0.00%	0.00%	0.00%	0.18%	0.00%	0.00%	0.00%	0.00%	0.13%	0.35%	0.47%	0.00%	0.00%	0.87%	0.05%	0.00%	0.00%	8.41%	0.00%	4.29%	1.06%	0.00%	0.00%	0.00%	0.00%	0.6%
Unclassified Combustibles	Unclassified combustibles packaging	0.40%	0.14%	0.66%	3.06%	0.60%	0.09%	0.00%	0.19%	0.19%	0.13%	0.18%	0.00%	0.00%	3.31%	0.05%	0.39%	0.45%	0.05%	0.16%	0.26%	0.97%	0.10%	0.31%	0.15%	0.15%	0.01%	0.00%	0.00%	0.00%	1.52%	0.00%	0.62%	0.4%
Unclassified Combustibles	Other unclassified combustibles	1.28%	4.79%	1.27%	2.12%	11.06%	2.06%	1.65%	5.81%	8.03%	1.95%	3.85%	10.28%	12.34%	15.78%	8.77%	8.86%	7.73%	5.51%	1.21%	10.85%	4.17%	3.83%	1.76%	6.88%	0.84%	9.04%	2.84%	0.14%	3.51%	1.51%	2.90%	0.89%	5.1%
Unclassified Incombustibles	Unclassified incombustibles packaging	0.00%	1.73%	1.23%	4.76%	0.42%	0.27%	0.25%	3.41%	0.45%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.65%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	4.49%	5.10%	0.00%	0.00%	0.00%	0.00%	0.7%
Unclassified Incombustibles	Other unclassified incombustibles	1.87%	0.88%	2.49%	8.61%	1.41%	1.37%	0.93%	0.00%	2.16%	1.57%	2.30%	0.55%	0.77%	0.16%	1.45%	0.46%	0.00%	0.80%	6.94%	2.37%	1.93%	1.15%	0.98%	1.19%	1.81%	1.74%	0.00%	0.00%	1.26%	0.00%	0.55%	3.15%	1.6%
Fines (<20mm)	Fines (<20mm)	13.92%	9.02%	16.88%	0.53%	9.50%	3.39%	7.01%	14.39%	13.53%	7.38%	9.10%	16.43%	10.84%	20.25%	3.39%	2.60%	3.68%	7.77%	23.10%	21.13%	15.81%	18.68%	12.34%	19.76%	15.23%	16.18%	0.00%	0.00%	17.71%	0.68%	14.21%	23.77%	11.5%
Total	Total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.0%

APPENDIX H

Results Mixed Dry Recyclables

	Authorised Waste Collector	AWC 1	AWC 1	AWC 2	AWC 2	AWC 2	AWC 2	AES	AES	AWC 6	AWC 2	AWC 8	AWC 8
	Stratum	R3B	C3B	C3B	R3B	R3B	C3B	R3B	R2B	R2B	C2B	C4B	R4B
	Frequency of collection	Fortnightly	Fortnightly	Fortnightly	Fortnightly	Fortnightly	Fortnightly	Fortnightly	Fortnightly	Fortnightly	Weekly	Fortnightly + Glass every 4 weeks	Fortnightly + Glass every 4 weeks
	Date of Sorting	27/04/2017	27/04/2017	28/04/2017	28/04/2017	25/04/2017	25/04/2017	29/05/2017	29/05/2017	18/10/2017	29/03/2018	29/01/2018	29/01/2018
	Quantity characterised (kg)	104.5325	101.2	101.05	101.9	109.7	126.81	116.45	127.8	100.9	108.65	102.997	96.67868
Primary Waste Categories	**Secondary Waste Categories**	**% Wet weight**	**% Wet weight**	**% Wet weight**	**% Wet weight**	**% Wet weight**	**% Wet weight**	**% Wet weight**	**% Wet weight**	**% Wet weight**	**% Wet weight**	**% Wet weight**	**% Wet weight**	**Average**
Organics	Edible kitchen & canteen waste: unused pa	0.64%	1.10%	3.04%	3.72%	0.00%	0.91%	0.44%	0.46%	0.35%	0.09%	0.00%	0.98%	1.0%
Organics	Edible kitchen & canteen waste: unused no	1.74%	0.10%	0.20%	0.77%	0.00%	0.26%	0.00%	0.07%	0.35%	0.09%	0.06%	0.00%	0.3%
Organics	Inedible kitchen & canteen waste	1.84%	0.10%	0.10%	0.66%	0.00%	0.46%	0.13%	0.00%	0.22%	2.81%	1.08%	0.05%	0.6%
Organics	Liquid fit for human consumption	0.92%	0.00%	0.49%	2.22%	0.09%	0.33%	0.40%	0.00%	0.00%	0.09%	0.00%	0.00%	0.4%
Organics	Biodegradable waste from garden & park	0.00%	0.13%	0.00%	0.54%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%	0.00%	0.00%	0.1%
Organics	Vegetable oil	0.00%	0.13%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.0%
Papers	Recyclable and Recoverable paper packag	4.34%	7.23%	4.80%	3.43%	7.56%	5.36%	3.02%	2.71%	0.75%	3.32%	2.23%	2.71%	4.0%
Papers	Unrecyclable paper packaging	0.00%	0.23%	0.69%	0.39%	0.77%	1.11%	0.09%	0.99%	0.85%	1.55%	0.50%	0.48%	0.6%
Papers	Newspapers	9.54%	14.87%	7.84%	3.28%	10.43%	12.37%	14.13%	11.37%	38.31%	6.01%	14.24%	17.60%	13.3%
Papers	Magazines & glossy paper	7.55%	11.16%	8.62%	4.11%	10.05%	11.55%	5.73%	7.34%	1.87%	3.45%	6.42%	5.99%	7.0%
Papers	Office papers	2.69%	3.34%	0.49%	1.41%	2.14%	2.76%	1.41%	1.06%	3.68%	3.17%	2.97%	1.02%	2.2%
Papers	Tissue Papers	1.75%	1.93%	2.15%	1.63%	1.73%	1.98%	2.08%	1.58%	1.82%	1.34%	0.90%	4.32%	1.9%
Papers	Other papers	2.21%	1.95%	8.81%	3.43%	4.69%	5.66%	7.32%	12.05%	1.75%	5.43%	8.89%	1.45%	5.3%
Cardboards	Flat Card and Corrugated Cardboard (Pac	30.83%	19.95%	29.38%	20.93%	26.52%	18.70%	19.55%	17.63%	19.55%	23.03%	29.09%	32.99%	24.0%
Cardboards	Other cardboards (Non-packaging)	0.00%	2.83%	0.20%	0.00%	1.00%	0.87%	2.33%	2.28%	0.72%	0.00%	0.23%	0.26%	0.9%
Composite beverage cartons	Beverage carton (packaging) (tetrapak)	1.56%	1.95%	2.55%	1.41%	2.64%	2.93%	1.11%	0.93%	1.37%	1.03%	1.22%	1.37%	1.7%
Textiles	Textiles Packaging	0.37%	0.29%	1.18%	1.16%	0.00%	0.20%	0.22%	0.20%	0.00%	0.01%	0.01%	0.00%	0.3%
Textiles	Textiles non-packaging	0.18%	0.00%	0.00%	1.21%	0.23%	0.26%	1.64%	0.07%	0.37%	1.97%	0.25%	0.92%	0.6%
Textiles	Clothes	0.83%	0.88%	0.29%	0.96%	0.50%	5.47%	2.18%	1.45%	1.60%	9.56%	0.24%	2.09%	2.2%
Textiles	Nappies	0.00%	0.78%	0.00%	1.16%	0.88%	0.13%	0.22%	0.33%	0.00%	0.18%	0.20%	0.09%	0.3%
Textiles	Healthcare textiles	0.22%	0.22%	0.20%	0.64%	0.18%	0.20%	0.22%	0.00%	0.00%	0.00%	0.45%	0.38%	0.2%
Plastics	PET packaging	4.40%	4.03%	4.41%	6.13%	6.84%	5.34%	4.98%	3.64%	5.16%	5.12%	3.88%	5.72%	5.0%
Plastics	PE packaging	4.13%	3.94%	3.92%	4.59%	4.17%	3.93%	3.05%	2.78%	1.65%	2.37%	3.20%	3.48%	3.4%
Plastics	PP Packaging	3.88%	4.93%	3.43%	2.85%	3.28%	4.50%	3.07%	3.23%	3.91%	1.53%	0.66%	0.76%	3.0%
Plastics	EPS Styrofoam Packaging	0.67%	0.63%	0.20%	0.25%	0.84%	0.61%	0.40%	0.00%	0.05%	0.09%	1.08%	0.14%	0.4%
Plastics	Supermarkets bags and films (packaging)	3.70%	2.44%	1.96%	4.71%	3.80%	2.56%	2.22%	1.92%	3.86%	6.41%	3.60%	1.88%	3.3%
Plastics	Other plastic (packaging)	3.06%	3.15%	4.31%	4.52%	2.59%	2.85%	1.91%	1.52%	0.42%	0.36%	5.04%	5.01%	2.9%
Plastics	Other plastic (non-packaging)	1.41%	3.64%	1.18%	1.72%	1.20%	0.52%	1.68%	0.85%	0.82%	0.67%	1.36%	3.04%	1.5%
Glass	Glass packaging	0.46%	0.00%	0.98%	1.50%	0.64%	1.89%	1.55%	3.47%	2.65%	3.27%	2.55%	0.51%	1.6%
Glass	Non Packaging glass	0.00%	2.76%	0.10%	0.28%	0.00%	0.20%	0.73%	0.13%	0.35%	0.80%	0.00%	0.00%	0.4%
Metals	Ferrous metal packaging	2.84%	1.27%	2.25%	5.94%	1.73%	2.24%	2.22%	3.10%	1.60%	1.92%	1.17%	1.10%	2.3%
Metals	Aluminium cans	1.77%	0.49%	1.76%	3.18%	1.32%	0.65%	1.82%	1.32%	0.90%	0.76%	0.88%	0.59%	1.3%
Metals	Aluminium foil	0.37%	0.00%	0.78%	1.31%	0.57%	0.33%	0.27%	0.52%	0.65%	0.13%	0.23%	0.20%	0.4%
Metals	Other metal packaging	0.64%	0.00%	0.00%	0.00%	0.09%	0.13%	0.45%	0.00%	0.00%	0.00%	0.00%	0.00%	0.1%
Metals	Other metal waste	0.37%	0.20%	0.10%	0.58%	0.18%	0.33%	1.60%	0.53%	0.00%	0.99%	0.52%	0.72%	0.5%
Wood	Wood packaging	0.00%	0.00%	0.00%	0.58%	0.00%	0.42%	0.00%	0.00%	0.05%	0.00%	0.00%	0.00%	0.1%
Wood	Non Packaging Natural Wood	0.00%	0.00%	0.00%	0.06%	0.00%	0.26%	0.00%	0.13%	0.00%	2.74%	0.00%	0.00%	0.3%
Wood	Treated/ composite woods	0.00%	0.00%	0.00%	0.10%	0.00%	0.00%	0.27%	0.59%	0.00%	0.04%	0.12%	0.07%	0.1%
Haz. Municipal Waste	Paint and associated products	0.00%	0.00%	0.00%	0.39%	0.00%	0.00%	0.80%	0.00%	0.00%	0.09%	0.00%	0.00%	0.1%
Haz. Municipal Waste	Batteries & Accumulators	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.22%	0.07%	0.05%	0.01%	0.00%	0.00%	0.0%
Haz. Municipal Waste	Aerosols	0.28%	0.20%	0.39%	0.19%	0.27%	0.33%	0.00%	0.07%	0.05%	0.00%	0.27%	0.33%	0.2%
Haz. Municipal Waste	Fluorescent tubes	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.43%	0.00%	0.0%
Haz. Municipal Waste	Electronic equipment	0.37%	0.78%	0.20%	0.00%	0.00%	0.26%	0.09%	2.12%	0.10%	0.00%	0.11%	0.42%	0.4%
Haz. Municipal Waste	Medicines and Drugs	0.00%	0.00%	0.49%	0.06%	0.00%	0.13%	0.09%	0.07%	0.00%	0.00%	0.00%	0.00%	0.1%
Haz. Municipal Waste	Detergents	0.00%	0.00%	0.00%	0.00%	0.00%	0.07%	0.00%	0.00%	0.00%	0.00%	0.46%	0.00%	0.0%
Haz. Municipal Waste	Garden chemicals	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.0%
Haz. Municipal Waste	Healthcare risk waste	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.0%
Haz. Municipal Waste	Other hazardous domestic waste	0.00%	0.57%	0.00%	0.00%	0.18%	0.07%	0.00%	0.00%	0.00%	0.45%	0.13%	0.00%	0.1%
Unclassified Combustibles	Unclassified combustibles packaging	0.12%	0.20%	1.37%	0.25%	0.09%	0.20%	0.53%	0.84%	0.22%	0.27%	0.00%	0.00%	0.3%
Unclassified Combustibles	Other unclassified combustibles	2.40%	0.49%	0.29%	5.96%	0.55%	0.00%	1.32%	5.52%	0.20%	7.17%	4.15%	1.58%	2.5%
Unclassified Incombustibles	Unclassified incombustibles packaging	0.00%	0.13%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.0%
Unclassified Incombustibles	Other unclassified incombustibles	0.00%	0.39%	0.00%	0.00%	0.96%	0.00%	5.07%	1.02%	0.00%	0.31%	0.71%	0.96%	0.8%
Fines (<20mm)	Fines (<20mm)	1.93%	0.59%	0.88%	1.82%	1.28%	0.72%	3.42%	6.06%	3.79%	1.35%	0.47%	0.80%	1.9%
Total	Total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.0%

APPENDIX I

Results Organic Waste

Authorised Waste Collector	AWC 1	AWC 2	AWC 3	AWC 4	AWC 1	AWC 5	
Stratum	C3B	C3B	R3B	R3B	C3B	C3B	
Frequency of collection	Fortnightly	Fortnightly	Fortnightly	Fortnightly	Fortnightly	Fortnightly	
Date of Sorting	19/04/2017	26/04/2017	29/05/2017	27/04/2017	20/09/2017	18/12/2017	
Quantity characterised (kg)	108.9	105.7	109.75	101.65	104.65	102.83	
Secondary Waste Categories	**% Wet weight**	**% Wet weight**	**% Wet weight**	**% Wet weight**	**% Wet weight**	**% Wet weight**	**Average (Mean)**
Edible kitchen & canteen was	0.00%	6.01%	2.65%	0.00%	0.48%	0.51%	1.8%
Edible kitchen & canteen was	1.42%	1.75%	14.42%	0.00%	1.67%	3.72%	3.9%
Inedible kitchen & canteen wa	3.63%	6.91%	0.37%	78.54%	16.01%	79.81%	22.1%
Liquid fit for human consump	0.00%	2.41%	0.00%	0.00%	0.00%	0.00%	0.5%
Biodegradable waste from ga	74.98%	72.85%	60.98%	0.13%	74.01%	4.27%	55.7%
Vegetable oil	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.0%
Recyclable and Recoverable	0.92%	0.05%	0.00%	3.21%	0.00%	0.00%	0.8%
Unrecyclable paper packagin	0.00%	0.00%	0.28%	0.00%	0.57%	0.00%	0.2%
Newspapers	0.23%	0.00%	0.14%	0.00%	1.15%	0.00%	0.3%
Magazines & glossy paper	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.0%
Office papers	0.05%	0.00%	0.00%	0.00%	0.00%	0.00%	0.0%
Tissue Papers	0.73%	0.95%	0.70%	9.69%	0.24%	0.00%	2.4%
Other papers	0.14%	0.00%	1.07%	0.00%	0.53%	0.00%	0.3%
Flat Card and Corrugated Ca	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.0%
Other cardboards (Non-packa	0.00%	0.05%	0.00%	0.00%	0.00%	0.00%	0.0%
Beverage carton (packaging)	0.00%	0.00%	0.05%	0.00%	0.00%	0.00%	0.0%
Textiles Packaging	0.14%	0.00%	0.33%	0.00%	0.00%	0.00%	0.1%
Textiles non-packaging	0.00%	0.00%	0.00%	1.05%	0.00%	0.00%	0.2%
Clothes	0.28%	0.05%	0.00%	0.00%	0.00%	0.00%	0.1%
Nappies	1.70%	0.33%	0.33%	0.00%	0.00%	0.18%	0.5%
Healthcare textiles	0.00%	0.33%	0.09%	0.00%	0.00%	1.06%	0.1%
PET packaging	0.00%	0.05%	0.00%	0.05%	0.00%	0.00%	0.0%
PE packaging	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.0%
PP Packaging	0.23%	0.14%	0.79%	0.36%	0.19%	0.00%	0.3%
EPS Styrofoam Packaging	0.00%	0.00%	0.00%	0.00%	0.10%	0.00%	0.0%
Supermarkets bags and films	0.96%	4.59%	1.81%	5.51%	1.00%	0.00%	2.7%
Other plastic (packaging)	0.55%	0.00%	0.33%	0.00%	0.24%	2.84%	0.3%
Other plastic (non-packaging	0.41%	0.05%	1.67%	0.06%	0.10%	0.07%	0.5%
Glass packaging	0.00%	0.00%	0.19%	0.11%	0.00%	0.19%	0.1%
Non Packaging glass	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.0%
Ferrous metal packaging	0.05%	0.00%	0.05%	0.00%	0.05%	0.04%	0.0%
Aluminium cans	0.00%	0.05%	0.00%	0.00%	0.14%	0.38%	0.0%
Aluminium foil	0.18%	0.00%	0.00%	0.65%	0.14%	0.04%	0.2%
Other metal packaging	0.00%	0.00%	0.00%	0.00%	0.00%	0.04%	0.0%
Other metal waste	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.0%
Wood packaging	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.0%
Non Packaging Natural Wood	0.14%	0.00%	0.14%	0.00%	0.00%	0.00%	0.1%
Treated/ composite woods	0.00%	0.00%	0.05%	0.00%	0.00%	0.00%	0.0%
Paint and associated product	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.0%
Batteries & Accumulators	0.00%	0.00%	0.00%	0.00%	0.05%	0.09%	0.0%
Aerosols	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.0%
Fluorescent tubes	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.0%
Electronic equipment	0.00%	0.00%	0.00%	0.00%	0.14%	0.00%	0.0%
Medicines and Drugs	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.0%
Detergents	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.0%
Garden chemicals	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.0%
Healthcare risk waste	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.0%
Other hazardous domestic wa	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.0%
Unclassified combustibles pa	0.00%	0.00%	0.00%	0.64%	0.00%	0.00%	0.1%
Other unclassified combustib	0.00%	0.43%	0.14%	0.00%	0.00%	0.00%	0.1%
Unclassified incombustibles p	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.0%
Other unclassified incombust	0.87%	0.00%	0.28%	0.00%	0.00%	0.00%	0.2%
Fines (<20mm)	12.40%	3.03%	13.16%	0.00%	3.20%	6.76%	6.4%
Total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.0%

APPENDIX J

National Profile Details

Primary Waste Categories	Secondary Waste Categories	MRW	MDR	OW	National Profile	% Wet weight
Organics	Edible kitchen & canteen waste: unused packaged food	31,272	2479	2030	35,781	3.4%
Organics	Edible kitchen & canteen waste: unused non-packaged food	18,528	766	4331	23,624	2.3%
Organics	Inedible kitchen & canteen waste	41,228	1575	24821	67,624	6.5%
Organics	Liquid fit for human consumption	1,789	956	534	3,279	0.3%
Organics	Biodegradable waste from garden & park	16,902	144	62659	79,704	7.6%
Organics	Vegetable oil	0	27	0	27	0.0%
Papers	Recyclable and Recoverable paper packaging	6,090	10017	923	17,030	1.6%
Papers	Unrecyclable paper packaging	6,242	1611	189	8,041	0.8%
Papers	Newspapers	4,596	33771	335	38,702	3.7%
Papers	Magazines & glossy paper	3,936	17696	0	21,632	2.1%
Papers	Office papers	4,285	5520	10	9,815	0.9%
Papers	Tissue Papers	35,052	4901	2722	42,675	4.1%
Papers	Other papers	8,423	13435	383	22,241	2.1%
Cardboards	Flat Card and Corrugated Cardboard (Packaging)	22,761	60826	0	83,587	8.0%
Cardboards	Other cardboards (Non-packaging)	3,432	2262	10	5,705	0.5%
Composite beverage cartons	Beverage carton (packaging) (tetrapak)	3,779	4235	10	8,025	0.8%
Textiles	Textiles Packaging	2,888	766	102	3,756	0.4%
Textiles	Textiles non-packaging	21,010	1500	233	22,743	2.2%
Textiles	Clothes	39,446	5499	71	45,016	4.3%
Textiles	Nappies	68,491	839	524	69,854	6.7%
Textiles	Healthcare textiles	7,134	569	114	7,817	0.7%
Plastics	PET packaging	8,057	12589	21	20,667	2.0%
Plastics	PE packaging	8,878	8697	0	17,575	1.7%
Plastics	PP Packaging	13,882	7608	380	21,870	2.1%
Plastics	EPS Styrofoam Packaging	4,176	1049	21	5,246	0.5%
Plastics	Supermarkets bags and films (packaging)	47,185	8248	3070	58,503	5.6%
Plastics	Other plastic (packaging)	23,755	7331	300	31,387	3.0%
Plastics	Other plastic (non-packaging)	20,494	3819	508	24,821	2.4%
Glass	Glass packaging	18,118	4109	69	22,296	2.1%
Glass	Non Packaging glass	3,542	1130	0	4,672	0.4%
Metals	Ferrous metal packaging	6,639	5782	32	12,453	1.2%
Metals	Aluminium cans	4,957	3264	49	8,270	0.8%
Metals	Aluminium foil	10,655	1131	217	12,003	1.1%
Metals	Other metal packaging	1,347	276	1	1,624	0.2%
Metals	Other metal waste	8,462	1288	0	9,750	0.9%

Primary Waste Categories	Secondary Waste Categories	MRW	MDR	OW	National Profile	% Wet weight
Wood	Wood packaging	896	221	0	1,116	0.1%
Wood	Non Packaging Natural Wood	2,473	673	61	3,207	0.3%
Wood	Treated/ composite woods	4,134	251	10	4,395	0.4%
Haz. Municipal Waste	Paint and associated products	1,097	269	0	1,366	0.1%
Haz. Municipal Waste	Batteries & Accumulators	592	74	12	678	0.1%
Haz. Municipal Waste	Aerosols	1,135	500	0	1,635	0.2%
Haz. Municipal Waste	Fluorescent tubes	44	91	0	136	0.0%
Haz. Municipal Waste	Electronic equipment	5,839	937	32	6,807	0.7%
Haz. Municipal Waste	Medicines and Drugs	543	176	0	719	0.1%
Haz. Municipal Waste	Detergents	242	112	0	354	0.0%
Haz. Municipal Waste	Garden chemicals	0	0	0	0	0.0%
Haz. Municipal Waste	Healthcare risk waste	779	0	0	779	0.1%
Haz. Municipal Waste	Other hazardous domestic waste	3,994	293	0	4,288	0.4%
Unclassified Combustibles	Unclassified combustibles packaging	3,007	865	141	4,013	0.4%
Unclassified Combustibles	Other unclassified combustibles	34,796	6258	125	41,180	3.9%
Unclassified Incombustibles	Unclassified incombustibles packaging	4,844	27	0	4,871	0.5%
Unclassified Incombustibles	Other unclassified incombustibles	10,818	1988	255	13,061	1.2%
Fines (<20mm)	Fines (<20mm)	78,362	4877	7158	90,397	8.6%
Total	**Total**	**681,027**	**253,328**	**112,464**	**1,046,819**	**100.0%**