



The composition of household waste at the kerbside in 2021-23

Summary of findings

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Contents

| | |
|---|-----------|
| Acknowledgements | 3 |
| 1 Executive summary | 4 |
| 1.1 How much is collected at the kerbside in total? | 4 |
| 1.2 What is thrown away in the residual waste bin? | 5 |
| 1.3 What has changed in what is thrown away in the residual waste bin since 2013-15? | 5 |
| 1.4 How many items that could be recycled at the kerbside, are recycled? | 5 |
| 1.5 How common is it for the wrong items to end up in mixed recycling collections? | 6 |
| Conclusion | 6 |
| 2 Introduction | 7 |
| 2.1 Summary of methodology | 7 |
| 2.2 Key considerations when reading this report | 8 |
| 3 How much waste is collected at the kerbside in total? | 10 |
| 4 What is thrown away in the residual waste bin? | 13 |
| 4.1 What we throw away in the residual waste bin | 13 |
| 4.2 What is thrown away in the residual waste bin that could be recycled? | 15 |
| 4.3 What is thrown away in the residual waste bin that is currently difficult to recycle? | 18 |
| 4.4 The biodegradable content of the residual waste bin collected at the kerbside | 18 |
| 4.5 What has changed in what is thrown away in the residual waste bin since 2013-15? | 19 |
| 5 How many items that could be recycled, are actually recycled? | 23 |
| 5.1 How common is it for the wrong items to end up in mixed recycling collections? | 23 |
| Conclusion | 24 |
| 6 Appendices | 28 |
| 7 References | 30 |

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This report was prepared by Anastasios Markopoulos, Research and Analysis team at Zero Waste Scotland, with valuable input from Zero Waste Scotland colleagues. The detailed analysis of waste composition and

waste data flow datasets that underpins the findings in this report was conducted by Tim Reid (Gather (Scotland) Ltd). The extensive programme of waste composition analysis studies carried out between 2021 and 2022 was delivered by Anastasios Markopoulos, Phil Williams and Tim Reid.

For further information on this project please call Zero Waste Scotland on 01786 433 930 and ask to speak to a member of the Research and Analysis team, alternatively please use the [contact form](#) on the Zero Waste Scotland website



1 Executive summary

The objective of this study was to provide new estimates for the composition of household waste collected at the kerbside in Scotland.

The findings from this programme also provide a timely update on the national composition of household waste collected at the kerbside as the last time a similar study was conducted by Zero Waste Scotland was in 2013-15¹.

The estimates presented in this report have been derived using data collected from a series of waste composition analysis studies carried out between 2021-2023 in Scotland. This report presents analysis of the contents of the household residual waste bin, which is the bin that should be used to dispose of waste that cannot be recycled, including data on recyclable material that was incorrectly disposed of in the residual waste bin.

Analysis of the contents of kerbside recycling containers provided to households across Scotland is also presented. This includes analysis of what was correctly recycled across the recycling services provided by local authorities and information on the levels of contamination appearing in recycling containers. In order to carry out all aspects of the analysis, waste composition data was matched to the most appropriate reporting year on the WasteDataFlow reporting platform. The final analysis used the most recent available WasteDataFlow data reported in the year 2021, and is therefore, representative of this period.

The report excludes household waste collected at non-kerbside locations, such as recycling points and household waste recycling centres. It is worth noting that significant quantities of household waste material, particularly recyclable items, are also collected via these non-kerbside routes, so overall household recycling performance should not be inferred on the kerbside analysis presented in the report alone.

Findings presented in this report are based on analysis that was designed to support answering several questions, including:

1. How much waste is collected at the kerbside in total?
2. What is thrown away in the residual waste bin?
3. What has changed in what is thrown away in the residual waste bin since 2013-15?
4. How many items that could be recycled at the kerbside, are actually recycled?
5. How common is it for the wrong items to end up in recycling collections?

The data presented in this report represents a snapshot in time in which household behaviours were adapting to a range of factors, including changes in homeworking patterns, recovery from the COVID-19 pandemic, and the ongoing cost-of-living crisis.

1.1 How much is collected at the kerbside in total?

Scottish households put 1.8 million tonnes of material into kerbside collections (residual and recycling combined) per annum (see Appendix 6a for breakdown of kerbside tonnage by material category). Food waste, paper and cardboard, garden waste, and glass waste made up nearly 1.2 million tonnes, or approximately 66% of the total. Food waste made up the largest single waste type at approximately 440,000 tonnes, or just over 24% of the total. Please see Section 3 of this report for additional analysis.

From analysis carried out during the current programme, it was found that Scottish households correctly recycled just under 650,000 tonnes per annum of common waste types at the kerbside, or 36% of all kerbside waste collected. When compared to sending this waste to landfill, recycling avoided over 510,000 tonnes of CO₂e emissions² and £63 million in landfill costs³.

1.2 What is thrown away in the residual waste bin?

Scottish households put 1.1 million tonnes of material into residual waste bins per annum. The most commonly occurring waste types were food waste, paper and cardboard, plastic film and flexibles, dense plastics, absorbent hygiene products and the category 'other'⁴. Approximately 550,000 tonnes, or 52%, of residual waste is made up of waste types that can typically be recycled at the kerbside in Scotland. Section 4.1 of this report provides a detailed breakdown of what is thrown away in the residual bin.

1.3 What has changed in what is thrown away in the residual waste bin since 2013-15?

Between 2013-15 and 2021-23, the overall quantity of household residual waste collected at the kerbside reduced by approximately 64,000 tonnes (or 6%), from 1.13 million tonnes per annum in 2013-15 to 1.07 million tonnes per annum in 2021-23. The quantity of five of the seven most commonly occurring

waste types in the summary analysis have reduced or remained the same. Paper has shown the largest absolute reduction of approximately 32,000 tonnes, from 120,000 tonnes to 88,000 tonnes per annum between the previous and most recent programme. The level of food waste in 2021-23 has shown a small reduction (2,000 tonnes) from the previous estimate but remains at approximately 330,000 tonnes per annum, however, it continues to remain the largest single waste type in the residual waste stream, as was the case in the previous programme. Section 4.5 of this report provides further details of changes in what is thrown away since the previous programme.

1.4 How many items that could be recycled at the kerbside, are recycled?

Part of this analysis carried out was able to provide estimates of the proportion of the overall kerbside tonnage that was found in the correct recycling service container. The analysis was for the fifteen sampled authorities and showed that there is a wide variation in the level to which recycling services are used correctly. For glass and garden waste services the proportion of the overall kerbside tonnage that was found in the correct recycling container was high, with averages of 71% and 88%, respectively. Conversely, for kerbside food waste only 24% of the overall kerbside tonnage was found in the food recycling container. Even where recycling services are well established,



the analysis shows that households are still not using recycling services to their full potential. Analysis showed that, on average, only 44% of the kerbside tonnage of paper was found in the correct recycling container. Section 5.1. provides further details of the analysis of materials presented in the correct recycling container at the kerbside.

1.5 How common is it for the wrong items to end up in mixed recycling collections?

Contamination of recycling services occurs when incorrect items (either non-recyclable items or recyclable items placed in the incorrect recycling container) end up in the recycling collection. Waste composition analysis was carried out on six local authority dry mixed recycling services (commonly referred to as “co-mingled recycling”) and five local authorities with twin stream recycling (multiple containers provided to encourage at-home segregation of materials) to compare the levels of contamination resulting in each service.

Non-target materials (items that could be recycled in current services, but which have been placed in the wrong container – e.g. glass in a paper collection) and non-recyclable wastes (items that cannot be recycled in current kerbside services) made up an average of 20% of the overall recycling container for dry mixed recycling services, and an average of 17% for twin stream recycling. The most commonly occurring non-target material in both services was food waste.

Conclusion

In summary, this report details the findings of the Zero Waste Scotland study on household waste composition for 2021-23. Our analysis demonstrates that over half of the material found within residual waste could have been recycled within existing kerbside recycling services.

Despite the establishment of kerbside recycling across Scotland, the analysis suggests these services are underutilised and that opportunities to further increase capture

of key recyclable material remains. Food waste remains the most significant component of residual waste in Scotland and increased recycling of this material would significantly contribute towards reducing the carbon emissions associated with waste management.

Findings from this report will provide useful evidence in support of Scottish Government’s Circular Economy Bill⁵ and consultation on delivering a route map to a circular economy⁶. These aim to form a strategic plan to achieve Scotland’s zero waste and circular economy ambitions.

Further details and additional breakdown of key information is provided in the main body of the report.



2 Introduction

As part of its aim to achieve a zero-waste society and a circular economy, Scotland has set ambitious waste targets⁷.

Understanding the flow of materials and resources across households will help to inform and plan the actions necessary to enable the reduction of waste and maximise the potential for closing material loops. This report aids this understanding by providing a summary of the updated national estimates of the composition of household waste collected at the kerbside in Scotland following completion of the waste composition analysis programme conducted between 2021-23. The last time a similar study was conducted by Zero Waste Scotland was between 2013-15, so the findings provide an important update on kerbside waste composition.

The results of the analysis contribute to a robust evidence base that will inform the development of future circular economy strategy and policy development. This information can be used by local and national government to inform their waste management policy and communications, and support technical practitioners working in the fields of resource management and the circular economy.

The analysis includes:

- The total amount of waste collected at the kerbside
- The type of waste thrown away in the residual waste container
- Changes in what is thrown away in the residual waste container since 2013-15
- The proportion of the total recyclable material that is correctly recycled at the kerbside
- The levels of contamination in mixed recycling collections

The focus is on the composition of household waste collected at the kerbside. The analysis carried out does not include household wastes collected via recycling points, household waste recycling centres (HWRC) and other less common collection routes. This means that these findings are not comparable to the household recycling figures published by the Scottish Environment Protection Agency (SEPA) which include waste collected via recycling points, HWRC, etc.

By providing analysis of what households threw away and recycled during the data collection period there is the potential to highlight the opportunities for further waste prevention, recycling, and diversion from landfill. A brief analysis of the avoided carbon emissions and landfill tax associated with current levels of kerbside recycling is provided, but it was beyond the scope of this study to carry out a more detailed environmental and economic impact analysis⁸.

2.1 Summary of methodology

A total of fifteen Scottish local authority waste composition analysis studies were conducted in 2021-23, which involved the collection and physical sorting of residual waste and recycling presented at the kerbside that met an agreed methodological standard. Details of this standard can be found in an accompanying document produced by Zero Waste Scotland⁹. Additionally, Zero Waste Scotland has published key findings from the 2021-23 waste composition analysis programme on its website, which are available in the format of an [Excel dataset](#).

All waste compositional analysis studies funded by the Zero Waste Scotland programme used one phase of sampling. This sampling approach differs to that used

in the 2013-15 waste composition analysis programme, where two sampling phases were typically used as an attempt to smooth variation in composition, due to any seasonal effects. It should be noted that accurately assessing the effects of seasonality on waste composition would require a longer-term analysis, which was beyond the scope of this project. Individual waste composition analysis studies were designed to be representative of the range of households in a given local authority area, but it was not the objective of this programme to study the effects of socio-demographic factors on waste composition.

A separate technical [methodology report](#) has been written to provide a greater level of detail on how the updated national waste composition estimates were calculated.

In summary, the methodology consists of using information from the following sources:

- 1. Waste composition analysis data of kerbside residual and recycling streams collected from fifteen Scottish local authorities in 2021 and 2022**
- 2. Waste composition analysis data of kerbside mixed food and garden waste collections between 2014-2015**
- 3. Waste tonnages reported as collected at the kerbside by all thirty-two Scottish local authorities on waste data flow in 2021**
- 4. Residual kerbside waste data for the period 2022-2023 made available by three local authorities.**

Secondary analysis of the datasets is then carried out to calculate the national estimates. In the previous National Waste Composition study, the kerbside service available was found to be as important as the socio-economic characteristics of the Local Authority in deriving accurate kerbside estimates. Where materials are not collected

at the kerbside (e.g., where glass or garden waste is collected only at bring sites), a significant amount of that material will not arise within the kerbside composition or will be found in higher levels in the residual waste. As such, where the kerbside service at a Gap Authority (those Local Authorities not directly sampled from) was insufficiently similar to the most eligible 'nearest neighbour' Data Authority, it was necessary to prioritise the kerbside service when assigning an appropriate waste compositional analysis profile to the Gap Authority.

So, for the current study a hybrid model was developed whereby functionality was included to:

- use nearest neighbours or Local Authority groupings when appropriate, and
- derive residual compositions in one of two ways:
 - residual up, where residual compositions are derived by multiplying % compositions by WasteDataFlow tonnage
 - kerbside down, where residual compositions are derived by deduction by subtracting recycling from the kerbside composition.

2.2 Key considerations when reading this report

This report is designed to be a summary of the key waste composition analysis programme findings. The analysis focused on the most commonly occurring waste types, and those highlighting specific areas of interest, for example, estimating representative levels of waste and levels of recycling placed in the correct recycling container at the kerbside. The Excel dataset that accompanies this report contains the detailed national kerbside waste composition dataset.

As highlighted above, the focus of this analysis has been on household waste collected at the kerbside, meaning that it excludes household wastes collected via

recycling points, HWRCs, and other less common collection routes. As a result, is not a complete analysis of local authority or national recycling performance¹⁰.

The waste composition analysis that underpins this study took place during 2021-23. In order to carry out the analysis, waste composition data was matched to the most appropriate reporting year on the WasteDataFlow reporting platform. The final analysis used WasteDataFlow data reported in the year 2021 for the majority of the thirty-two local authorities¹¹. The analysis is, therefore, representative of the 2021 period and national tonnages being reported are those reported on WasteDataFlow for 2021.

Analysis of what is thrown away in the residual waste nationally, found in Section 4.2, identifies waste types that are defined as typically recycled at the kerbside nationally. It is understood that local authorities collect these waste types at the kerbside and, as such, no adjustment is made to the analysis in the rare cases where this is not the case¹².

Data for wastes that are not typically targeted for recycling at the kerbside are not presented in this report¹³.

The analysis of recycling at the kerbside (Section 5.1) focused on the fifteen local authorities that took part in waste composition analysis. In the summary analysis, any local authorities that did not target a recyclable waste type at the kerbside were excluded, but no adjustments were made for any variation in service coverage within a local authority (for example, when only a percentage of households in a local authority area are provided with a given recycling service).

A further key aspect of the findings to highlight is related to the waste composition analysis carried out at three of the participating local authorities, where an additional stage of physical sorting of food waste in packaging was carried out. This additional stage of sorting was introduced to enable analysis of packaging in both the food and drink in packaging categories and showed that 13% of the final food waste estimate was packaging. Scaled nationally, the analysis shows that this component of the packaging in the residual waste totals approximately 18,000 tonnes. However, a level of uncertainty remains around the accuracy of these estimates, given that they are based on a limited number of studies and would require further investigation to improve the reliability of the estimates produced. For this reason, findings presented in the report exclude this additional analysis of food and drink waste in packaging.

For information, all tonnage data in this report will normally have been rounded to two significant figures and therefore may not sum exactly. In some cases, data will also be reported to two decimal places for comparison purposes.

Finally, it should be highlighted that the material category list used for the most recent waste composition analysis programme has changed since the 2013-15 programme¹⁴. Most notably, the food waste category has been changed to support identification of both loose avoidable food waste (without packaging) and avoidable food and drink waste within packaging.



3 How much waste is collected at the kerbside in total?

This section summarises the overall composition of what was thrown away during the study period in the residual waste and recycled at the kerbside by households.

In 2021-23 Scottish households correctly recycled just under 650,000 tonnes per annum of common waste types at the kerbside, or 36% of all kerbside waste collected. When compared to sending this waste to landfill, recycling avoided over 510,000 tonnes of CO₂e emissions¹⁵ and £63 million in landfill tax costs¹⁶. Of the estimated 1.8 million tonnes of total household waste and recycling collected at the kerbside per annum, food waste, paper and cardboard, garden waste and glass waste make up nearly 1.2 million tonnes, or 66% of the total.

The food waste fraction made up the largest single waste type of the total estimated kerbside waste, at just under 441,000 tonnes per annum, or 24% of the total. Households produced just under an average of 175 kilogrammes of food waste each year at the kerbside, or approximately 81 kilogrammes per capita. Readers interested in a more complete picture of food waste produced in the home (including the contribution of disposal by other routes and the relative proportions of avoidable and unavoidable food waste) should refer to the separate food waste study produced by Zero Waste Scotland¹⁷.

Paper and Cardboard combined is the second largest waste type at approximately 330,000 tonnes per annum, or 18% of the total kerbside waste. Households produced just under an average of 130 kilogrammes of paper and cardboard each year at the kerbside, or approximately 60 kilogrammes per capita per year. Of the total paper and cardboard, newspapers and magazines, non-recyclable paper and other recyclable paper made up approximately 61,000

tonnes, 76,000 tonnes and 22,000 tonnes, respectively. Thin card packaging, board packaging and beverage cartons made up approximately 66,000 tonnes, 63,000 tonnes and 7,900 tonnes, respectively. The remaining other paper and cardboard material categories made up approximately 11,000 and 20,000 tonnes, respectively.

The proportion of garden waste in the estimated kerbside waste makes up just under 280,000 tonnes per annum, or approximately 15% of the total. Households produced just over an average of 110 kilogrammes of garden waste each year at the kerbside, or an estimated 51 kilogrammes per capita per year. There will also be significant quantities of garden waste taken to household waste recycling centres (HWRC) and composted at home.

The analysis showed that glass makes up just under 145,000 tonnes, or 8% of the total kerbside waste per annum. Significant quantities of household glass will also be collected at recycling points and household waste recycling centres (HWRC). It was estimated that households produced just over an average of 57 kilogrammes of glass each year at the kerbside, or approximately 26 kilogrammes per capita per year. Non-packaging glass contributes just under 6,000 tonnes, or around 4% of all glass collected at the kerbside.

The remaining waste streams (referred to as 'all other' in [Figure 1](#)) are comprised of nine broad waste types¹⁸ which comprise approximately 622,000 tonnes per annum or just over 34% of the total and consist of dense plastic (130,000 tonnes or 7%);

plastic films (just over 91,000 tonnes or 5%); absorbent hygiene products (72,000 tonnes or 4%), other¹⁹ (140,000 tonnes or 8%); metal (67,000 tonnes or 4%); textiles (58,000

tonnes or 3%); unclassified²⁰ (32,000 tonnes or 2%); wood (18,000 tonnes or 1%); and electrical and electronic items (14,000 tonnes or 1%).

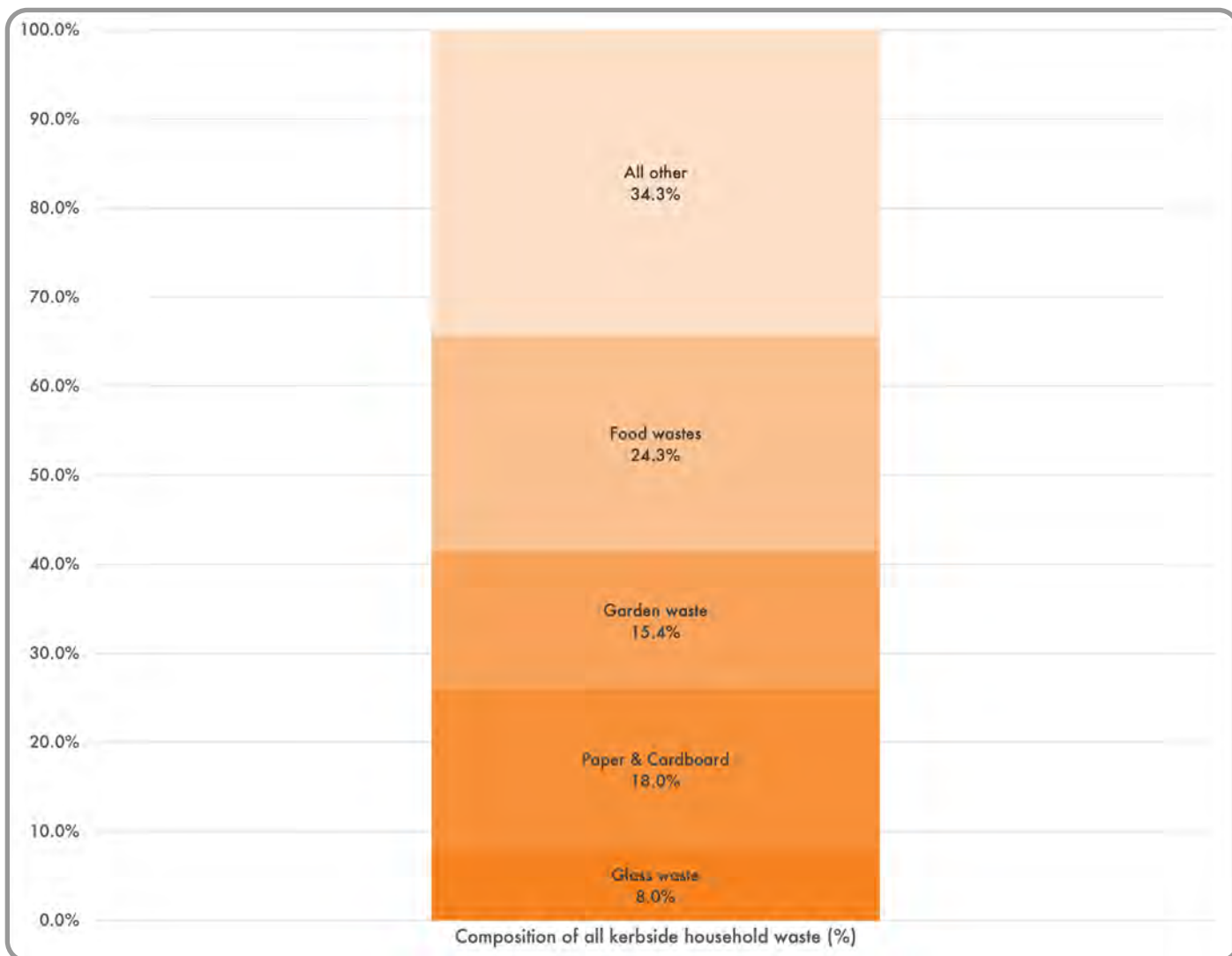


Figure 1: The composition of all household waste collected at the kerbside for the period analysed, with the four largest waste types, and thirteen other waste types combined into “All other” category.

Specific recyclable waste types that contribute to the ‘all other’ combined category may be of particular interest to the reprocessing sector. The analysis showed that there was approximately 50,000 tonnes of plastic bottles in the kerbside waste in total per annum, which includes 23,000 tonnes of polyethylene terephthalate (PET) drink bottles and just over 9,000 tonnes of high-density polyethylene (HDPE) drink bottles. Metal wastes were also shown to make up 67,000 tonnes or approximately 4% of the estimated kerbside waste per annum, of which steel and aluminium drinks cans make up approximately 500 tonnes and 16,000 tonnes, respectively;

aerosols and aluminium packaging making up 4,500 tonnes and 9,300 tonnes, respectively. [Figure 2](#) provides an overview of the materials grouped as ‘all other’.

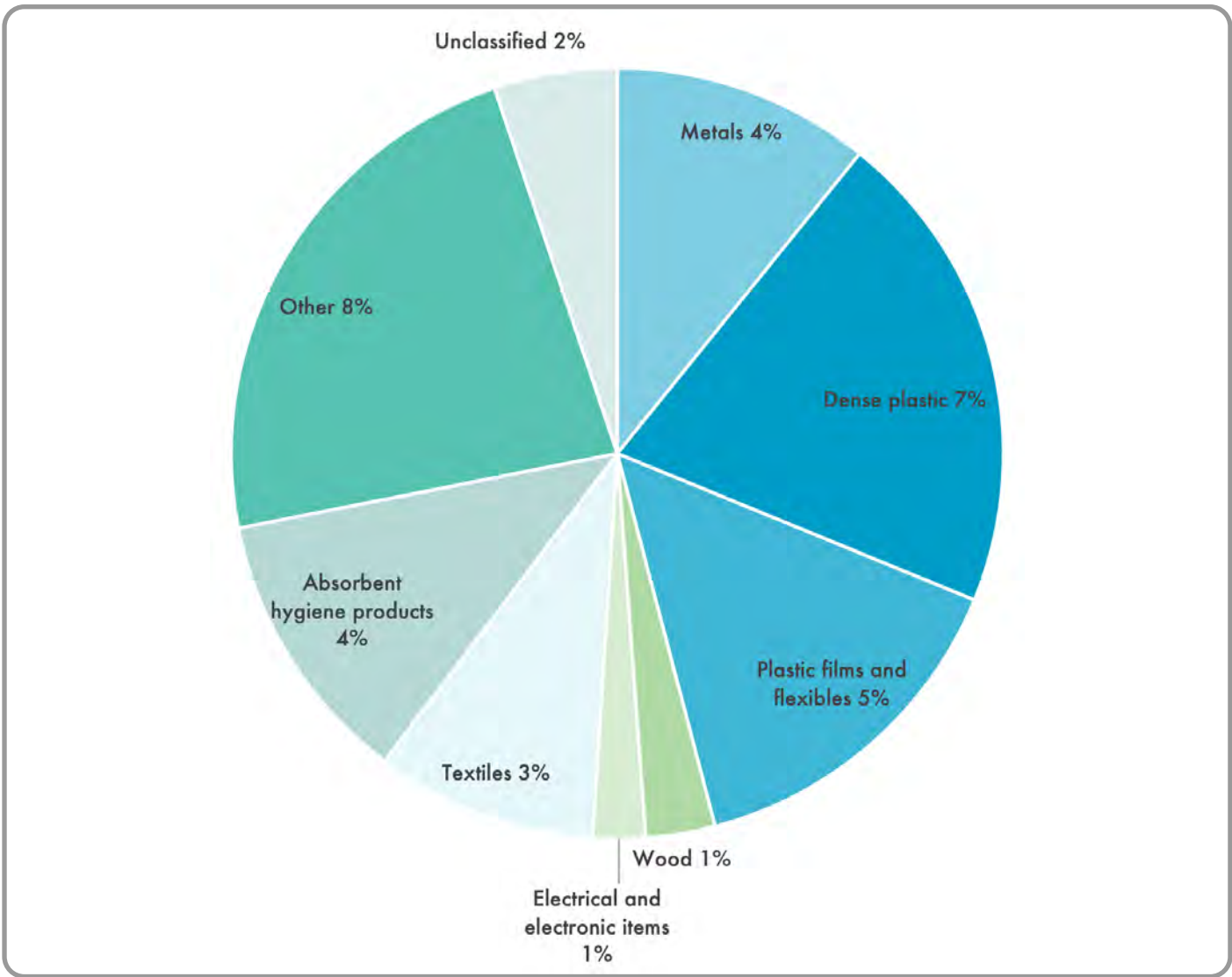


Figure 2: Overview of material composition profile comprising the ‘All other’ group in household waste collected at the kerbside.



4 What is thrown away in the residual waste bin?

The following section covers the contents of the residual waste, which is the bin that should be used to dispose of wastes that cannot be recycled.

The term residual waste is used regardless of whether the contents of that bin could be recycled or not. The majority of what is thrown away in the residual waste bin is sent to landfill or incineration and will not be recycled.

This section summarises:

- 4.1 What is thrown away in the residual waste bin**
- 4.2 What is thrown away that could be recycled**
- 4.3 What is thrown away that is currently difficult to recycle**
- 4.4 The biodegradable content of household residual waste**
- 4.5 Changes in what is thrown away since 2013-15**

4.1 What we throw away in the residual waste bin

Of the 1.1 million tonnes of household residual waste estimated at the kerbside per annum in the analysis, food waste, paper and cardboard, healthcare waste and plastic films make up just over 680,000 tonnes, or approximately 64% of the total residual waste.

The food waste makes up the largest single waste type of the total estimated kerbside residual waste, at just over 330,000 tonnes per annum, or 31% of the total. This equated to households throwing away an average of just over 130 kilogrammes of food waste in the residual waste bin, or approximately 60 kilogrammes per capita per year.

Paper and cardboard combined is the second largest waste type thrown away in the residual waste, at just over 136,000 tonnes per annum, or approximately 13% of the total. Household threw away an average of nearly 54 kilogrammes of paper and cardboard each year, or approximately 25 kilogrammes per capita per year.

The next most prominent waste type is material classified under the category 'other', which typically is comprised of items including (but not limited to) furniture, construction materials, and composite plastics. This waste type makes up just over 130,000 tonnes per annum, or approximately 12% of the kerbside residual.

Plastic films make up approximately 82,000 tonnes per annum, or just under 8% of the kerbside residual waste. If carrier bags and bin liners are excluded from this total, all other films (typically comprising food packaging) total just under 52,000 tonnes. The mass of plastic films is likely to be an overestimate as food and other decayable wastes are prone to sticking to films, thus adding weight during waste composition analysis²¹.

The remaining wastes (referred to as 'All other' in [Figure 3](#)) are comprised of nine waste types²² representing approximately 390,000 tonnes per annum or 37% of the total, and consist mainly of dense plastics (70,000 tonnes, or 7%), absorbent hygiene products (70,000 tonnes, or 7%), glass waste (60,000 tonnes or 6%), textiles (54,000 tonnes or 5%), and garden waste (40,000 tonnes, or 4%).

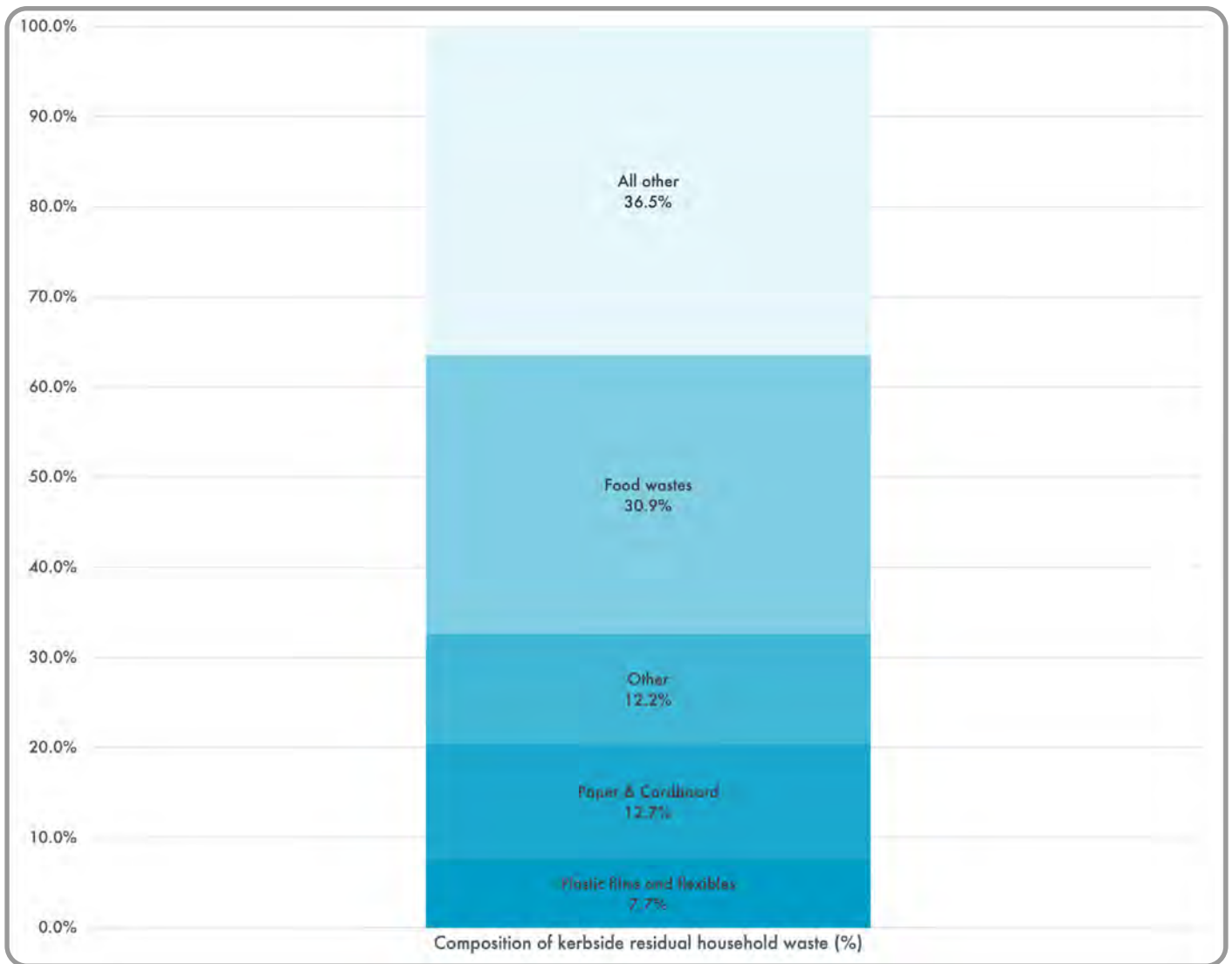


Figure 3: The composition of household residual waste collected at the kerbside for the period analysed. Graph shows the four largest waste types, and thirteen other waste types combined into “All other” category.

A breakdown of the material composition profile comprising the ‘All other’ group in Figure 3 has been provided below in [Figure 4](#).

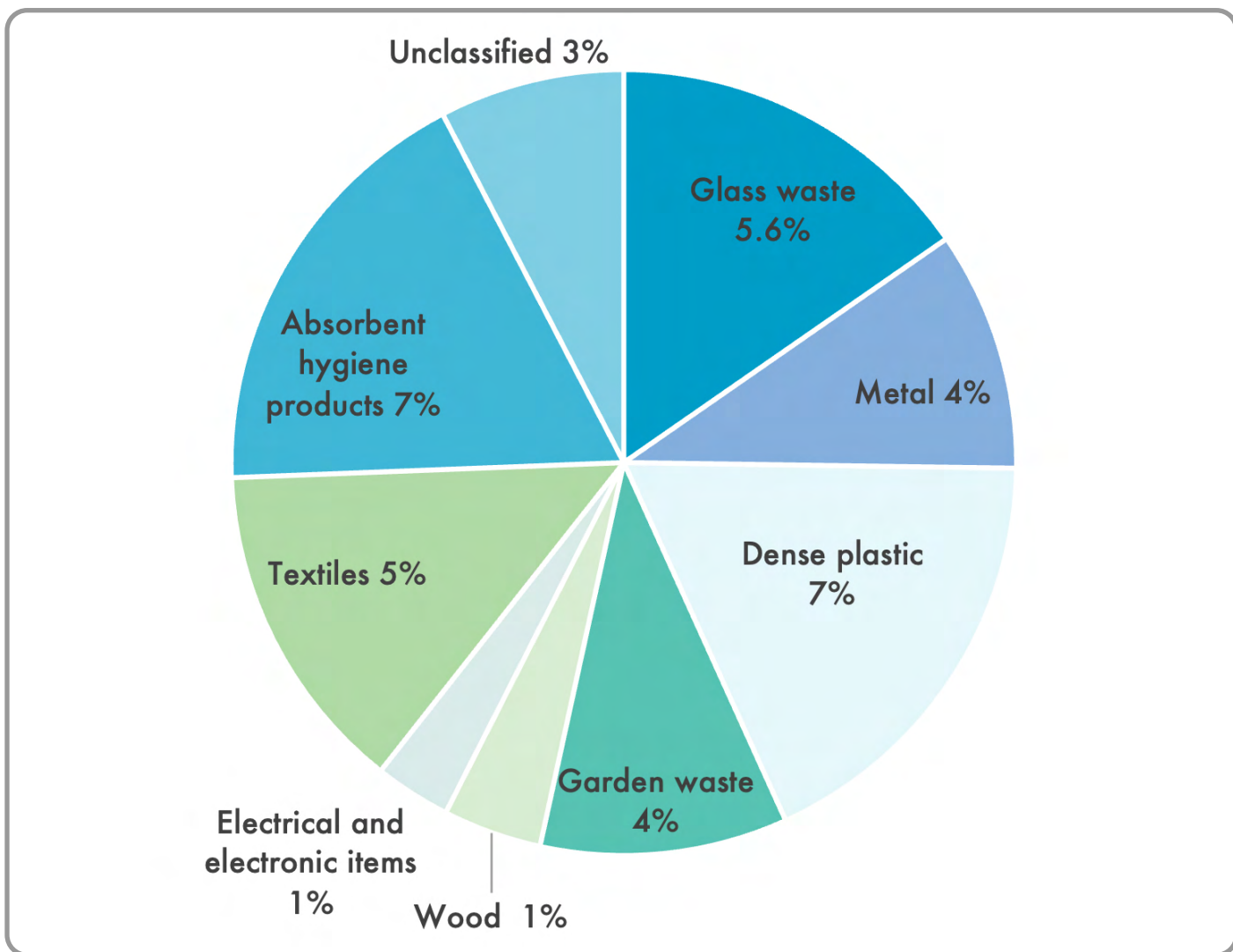


Figure 4: Overview of material composition profile comprising the ‘All other’ group in household residual waste collected at the kerbside.

4.2 What is thrown away in the residual waste bin that could be recycled?

This section focuses on those waste types found in the residual waste that are typically targeted²³ for recycling by local authorities using kerbside recycling services. The analysis is a gross national estimate to highlight the scale of what is currently thrown away that could have been recycled. Variation in the coverage of kerbside services for individual local authorities is not accounted for in this analysis. For example, a local authority may not collect glass at the kerbside, or only a percentage of households in a local authority area might be provided with a particular recycling service.

From the analysis, it was shown that approximately 550,000 tonnes per annum, or 52% of the 1.1 million tonnes of residual waste is made up of waste types that can typically be recycled at the kerbside in Scotland. This equates to just over 219 kilogrammes per household each year, or 101 kilogrammes per person each year.

Proportion of what we throw away in the kerbside residual waste that is typically recycled at the kerbside

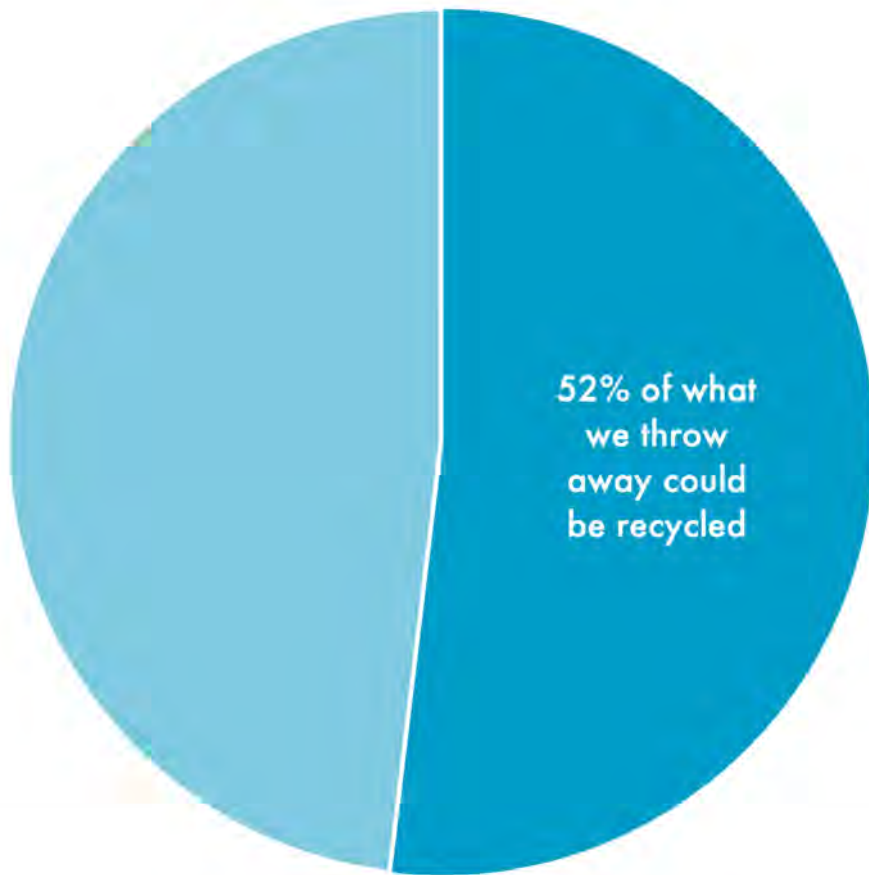


Figure 5: The proportion of what we throw away in the kerbside residual waste that is typically recycled at the kerbside.

[Figure 6](#) below highlights selected waste types thrown away in the residual waste which are typically recycled at the kerbside. To aid interpretation only tonnages over 5,000 tonnes are shown. The 330,000 tonnes of food waste that could have been recycled at the kerbside that is found in the residual waste has been excluded so that the other (smaller) tonnages are visible. Please see Appendix 6b in this report for the data that underpins Figure 6, including quantities expressed on a per capita and per household basis.

Of the remaining 48% of residual waste in Figure 5, 95,000 tonnes could have been typically recycled at household waste recycling centres (HWRC). An overview of the material composition profile for this waste is shown in Figure 7. The remaining 420,000

tonnes is made up of a range of wastes that have to date proved challenging to establish sustainable recycling services (e.g. disposable nappies, dense plastics).

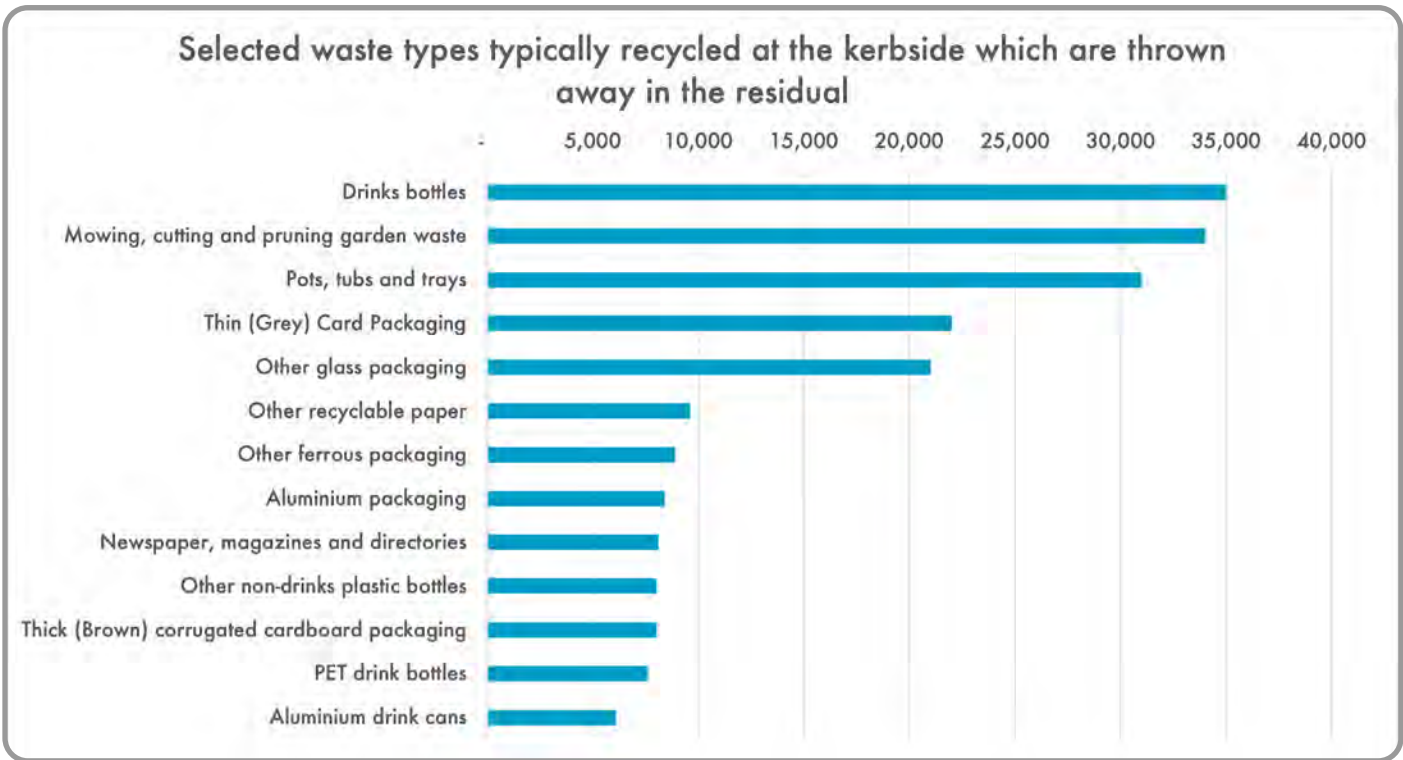


Figure 6: Selected waste types typically recycled at the kerbside which are thrown away in the residual waste. Only tonnages over 5,000 are shown for the period analysed and we have excluded the additional 330,000 tonnes of food waste typically recycled at the kerbside that is found in the residual waste. All tonnages rounded to two significant figures.

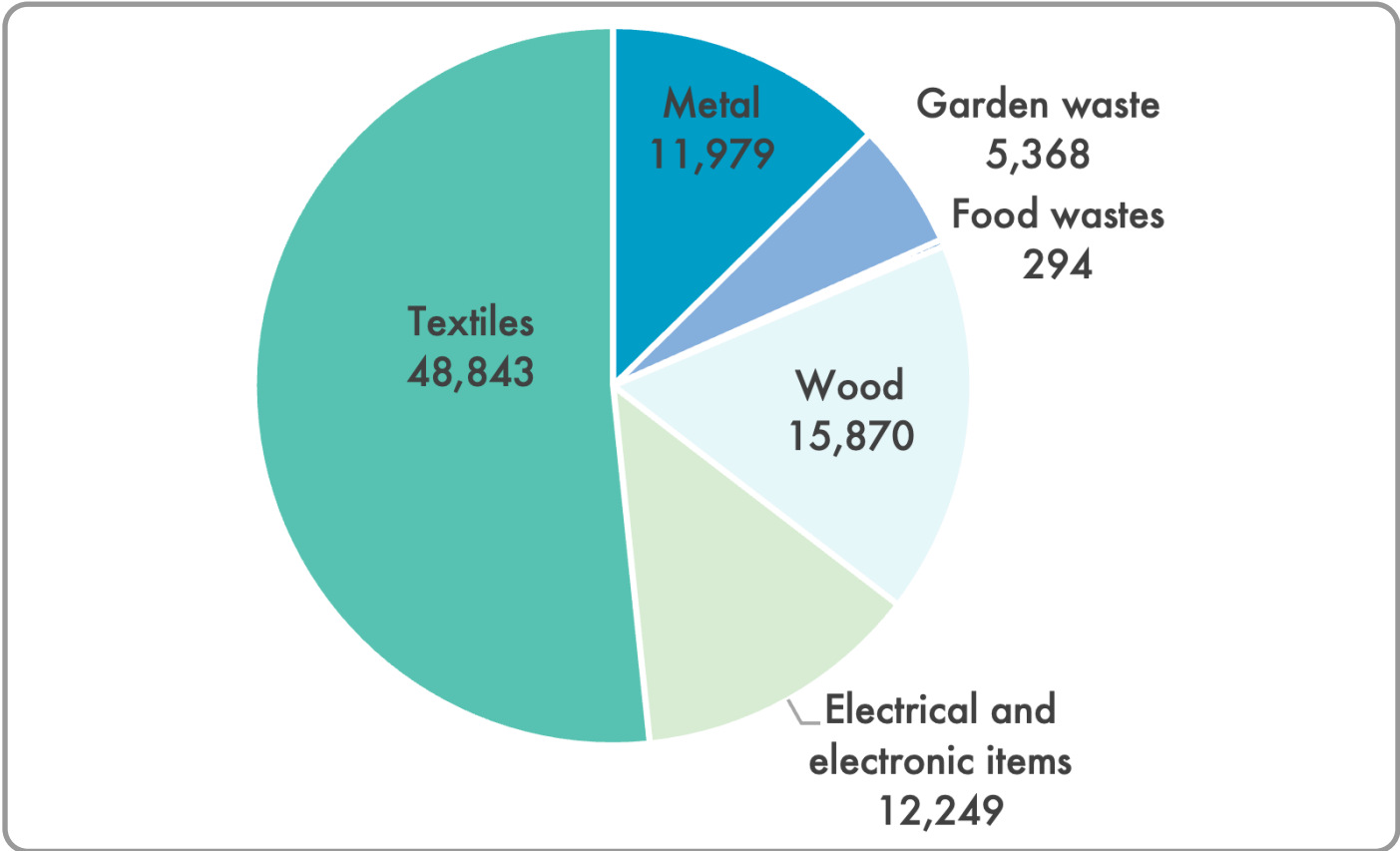


Figure 7: Overview of the material composition of residual waste that could typically be recycled at a household waste recycling centre (unit of values presented is tonnes).

Recycling more of these materials not only prevents emissions arising from waste sent to landfill but also reduces the greenhouse gas emissions associated with the manufacture of products from virgin materials (e.g., the oil and other products that are used to produce a plastic bottle). There is an economic price for this waste paid directly through local authority costs for disposal, and indirectly through the lost value of this material to Scotland's economy. A significant portion (26.7%) of household waste currently ends up in landfill.

4.3 What is thrown away in the residual waste bin that is currently difficult to recycle?

In addition to the large quantities of waste that could be recycled using existing kerbside services, residual waste also contains other waste types that have the potential to be recyclable. For example, absorbent hygiene products, of which disposable nappies made up approximately 5% of the residual composition (or 57,000 tonnes), and plastic

films and flexibles (8% or 82,000 tonnes of the total residual composition) per annum.

4.4 The biodegradable content of the residual waste bin collected at the kerbside

The biodegradable content of kerbside residual waste is of interest to local authority waste managers, and technical and policy practitioners working in the fields of resource management and the circular economy because it has the potential to be diverted from landfill via recycling, composting, or anaerobic digestion which ultimately limits harmful methane gas release when it decomposes in landfill.

Of the estimated 1.1 million tonnes of residual waste collected at the kerbside, approximately 650,000 tonnes per annum (or just under 61%) is biodegradable. It is important to highlight that this estimate is based on the composition of residual waste at the point of collection at the kerbside.





Figure 8: The composition of kerbside residual waste per annum (tonnes), according to bio-degradable content. The five largest bio-degradable waste types and combined "all other biodegradable" is shown for clarity. The contribution of non-biodegradable waste is also provided. Values are presented on a per annum basis.

Food waste and Paper and Cardboard are the largest individual material types in the bio-degradable portion of residual waste, making up approximately 31% and 13%, respectively. In total, approximately 421,000 tonnes (or 52%) of the waste items considered biodegradable within the residual waste is made up of waste types that can typically be recycled at the kerbside. A focus on food waste and paper and cardboard will be important in efforts to reduce the biodegradable content of kerbside residual waste. However, there are also significant quantities of biodegradable waste which to date have proved challenging to recycle cost-effectively (e.g., absorbent hygiene products). There are likely to be a number of related

factors (e.g. variation in householder utilisation of services, collection frequencies of all services, whether garden waste is targeted at the kerbside) that influence the overall biodegradable content of kerbside residual waste, which were beyond the scope of the current study.

4.5 What has changed in what is thrown away in the residual waste bin since 2013-15?

The previous study of the composition of household waste in Scotland was published following the completion of the waste composition analysis programme²⁵ carried out by Zero Waste Scotland in 2013-15. Although

the 2013-15 and 2021-23 studies used a largely similar approach, it is important to note that the methods are not identical. The primary difference when comparing the data between the studies is the number of sampling phases; the current 2021-23 waste composition programme implemented one phase of sampling, whereas the 2013-15 waste composition analysis programme used two sampling phases to smooth variation in composition due to any seasonal effects. For further information on the methodology

adopted during the current programme, please refer to the accompanying [methodology report](#).

From Figure 9 below the overall quantity of household residual waste collected at the kerbside between the two periods has reduced by approximately 64,000 tonnes, from 1.13 million tonnes in 2013-15 to just under 1.1 million tonnes²⁶ in 2021-23.

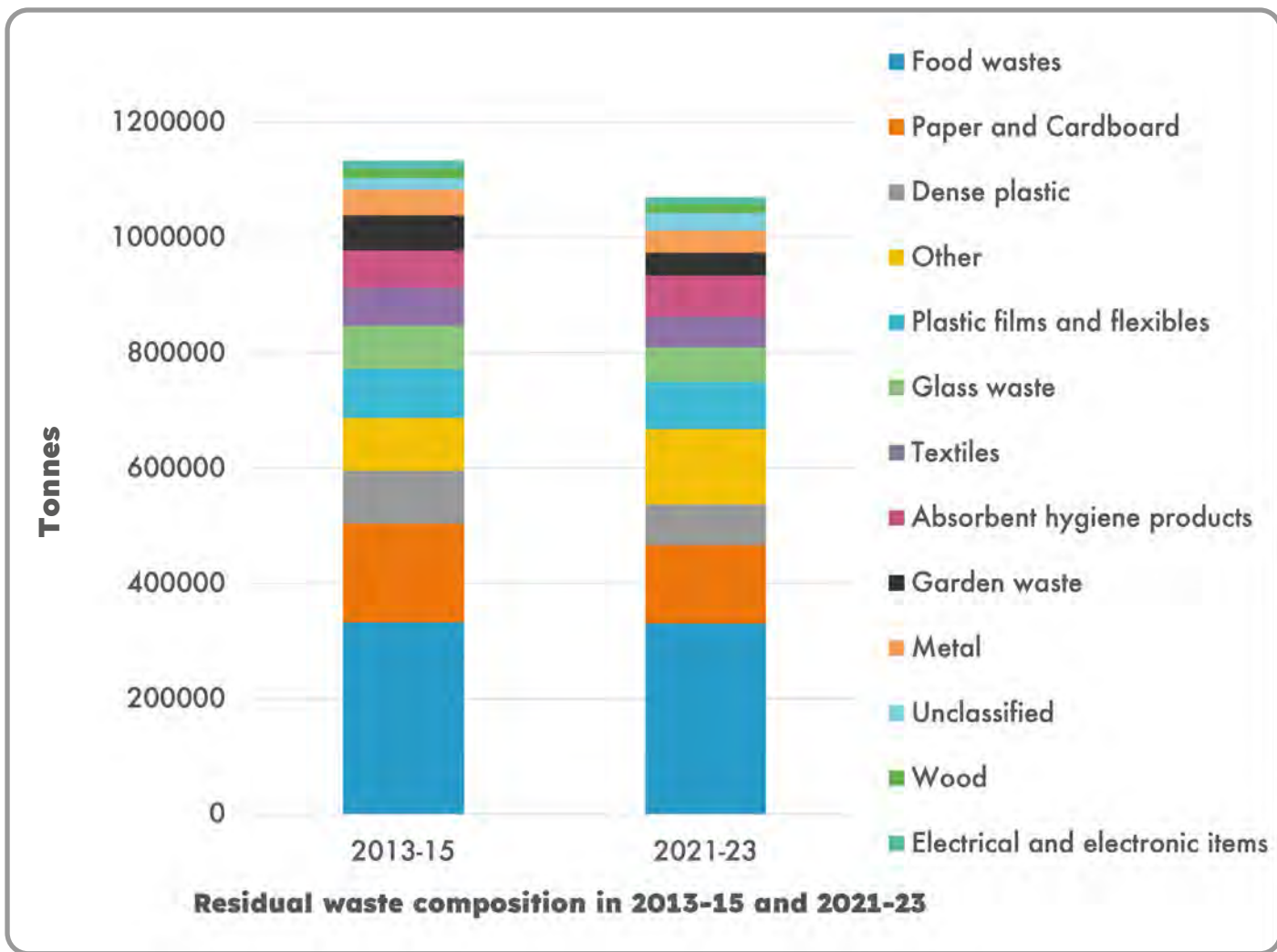


Figure 9: Comparison of the overall quantity of household residual waste collected at the kerbside per annum, from the previous waste composition study in 2013-15 and the current study.

Figure 10 summarises the change in tonnage of the seven most commonly occurring materials in the residual waste between the

previous and current programme. Five of the seven waste types have reduced in tonnage.

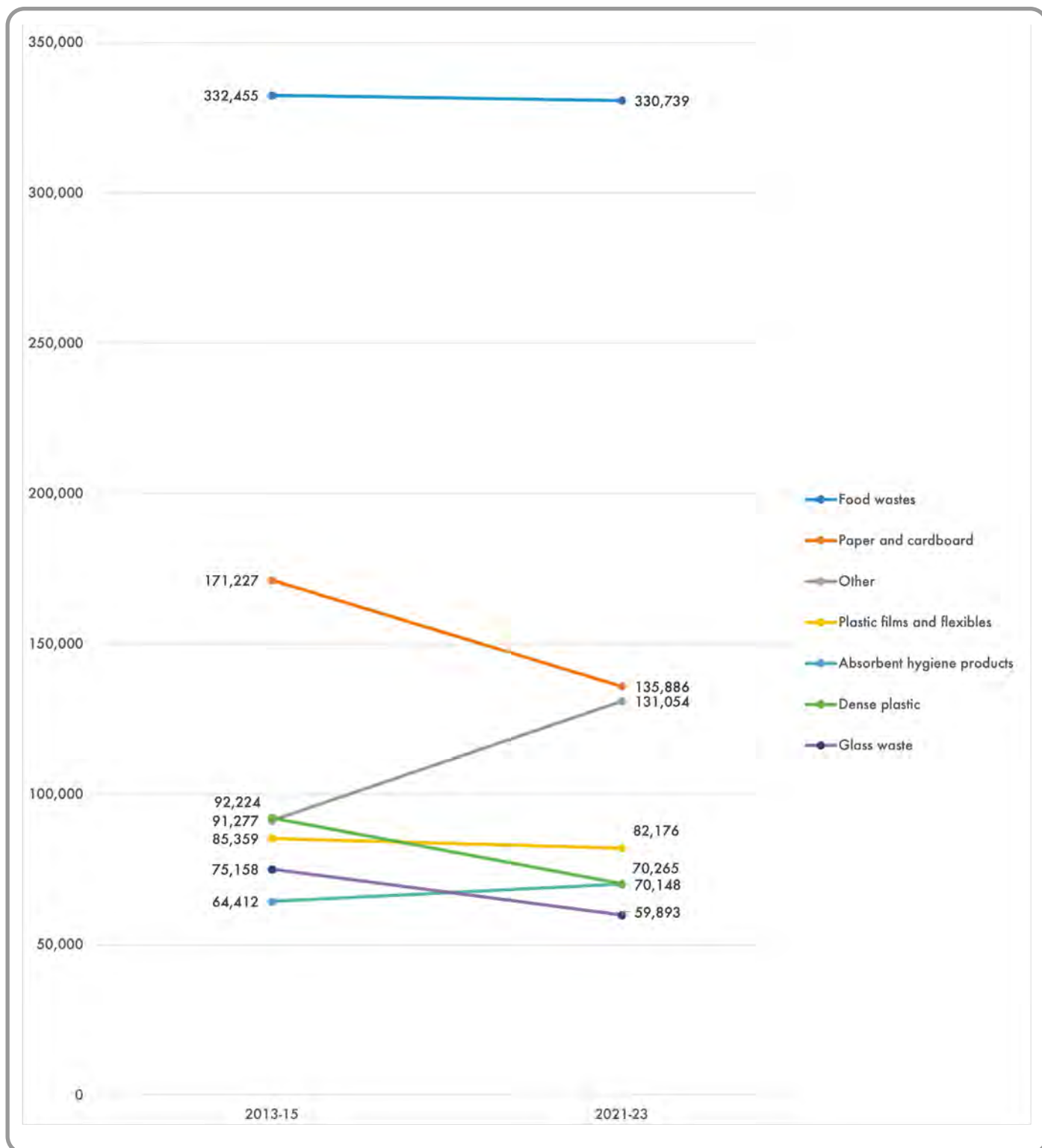


Figure 10: The seven largest waste types (tonnes) in household residual waste per annum collected at the kerbside in 2021-23, compared to previous composition.

The largest absolute and proportional reduction has been shown in paper and cardboard, from just over 170,000 tonnes per annum in 2013-15 to approximately 140,000 tonnes in 2021-23. The largest decrease in the paper category for residual collections was for newspapers, magazines, and directories which fell from 35,000 tonnes in 2013-15 to 8,000 tonnes in 2021-23. Although cardboard arisings decreased in the residual stream, the kerbside total showed an increase in the analysis.

The second largest proportional reduction was achieved for dense plastic, from just over 92,000 tonnes per annum to approximately 70,000 tonnes, or a 24% reduction on 2013-15. This reduction could be a reflection of the increased acceptance and capture of plastics in segregated recycling services (such as pots, tubs and trays) but equally could still be at least partly influenced by changes in packaging design by producers through measures such as "light weighting" or removing weight from product packaging.

Of the seven most commonly occurring materials in the residual waste, food waste and plastic films and flexibles showed small absolute reductions. Food waste in residual waste was shown to have reduced by approximately 2,000 tonnes per annum between 2013-15²⁷ and 2021-23. Despite this small absolute reduction, food waste has increased (from 29% to 31%) in terms of its overall proportion in the residual waste total due to a decrease in the total amount of residual waste collected. It is apparent that significant quantities of food waste remain in the residual waste bin in 2021-23 that could be recycled. Of the fifteen local authorities that took part in the most recent waste composition analysis programme, nine collected food waste separately and six operated a mixed food and garden waste collection.

Plastic films and flexibles have shown an absolute reduction of approximately 3,000 tonnes per annum between the two periods (approximately 85,000 tonnes in 2013-15 to just over 82,000 tonnes in 2021-23). However, as highlighted in Section 4.1,

estimates for plastic films should be treated with some caution, owing to the potential for contamination with other decayable wastes during composition analysis. Although there has been a reduction overall, evidence from the analysis shows that there has been an increase in certain material types classified as plastic films and flexibles. This includes plastic and/ or foil laminate pouches and plastic film packaging, which could reflect both the increased use of this packaging type in household groceries and a lack of kerbside recycling services for this waste. Extended Producer Responsibility (EPR) for packaging aims to increase capture of recyclable plastics films and flexible packaging for recycling to support development of reprocessing capacity for these materials²⁸.

Glass waste has shown an absolute reduction in arisings in the residual waste, from approximately 75,000 tonnes per annum in 2013-15 to just under 60,000 tonnes in 2021-23 (or a 20% decrease on 2013-15). This reduction could be the result of increased acceptance and capture in recycling services²⁹. This is reflected in the increase in glass recycling since 2013³⁰.

Of the seven most commonly occurring waste types in the residual waste, healthcare waste and materials classified as 'other' (which includes items such as construction waste, soft furnishings, and composite plastics) have shown an increase in absolute terms between the two periods. Healthcare waste (items such as disposable nappies and other absorbent hygiene products) has increased from 120,000 tonnes per annum in 2013-15 to 130,000 tonnes in 2021-23. As highlighted in Section 4.3, it has proved challenging to establish sustainable recycling services targeting healthcare waste, in particular. Materials classified as 'other' have increased in absolute terms from just over 91,000 tonnes per annum to approximately 130,000 tonnes between the two periods. Materials in this category include rubble, stones, plasterboard, soft furniture, wood furniture, construction and demolition materials.

5 Recycling at the kerbside

This section provides a summary of the typical proportions of waste presented in the correct recycling container at the kerbside and typical levels of contamination found in recycling collections.

Data focuses on the fifteen local authorities that took part in waste composition analysis. Unlike the national estimates in sections 3 and 4, the data was not extrapolated to local authorities that did not take part in waste composition analysis.

In Section 5.2 the term “non-recyclable” waste is used to define wastes not typically recycled anywhere within a local authority service e.g. non-recyclable paper and disposable nappies.

5.1 How many items that could be recycled, are actually recycled?

This part of the report combines data on the composition of kerbside residual waste, with mixed and segregated recycling, to estimate the proportion of waste that was presented in the correct recycling container at the kerbside. The outputs presented include the average, maximum and minimum percentages for seven waste types typically recycled at the kerbside, based on analysis of data collected from the fifteen local authorities that took part in the waste composition analysis programme. Any data points where a local authority did not target a given waste type at the kerbside was excluded³¹.

The analysis is a whole local authority assessment of what is collected for recycling at the kerbside, as a proportion of the total occurring at the kerbside (from compositional analysis of what is thrown away in the residual waste). No adjustments were made for kerbside service coverage, where a recycling service was provided to only a percentage of the households in a local authority area.

From [Figure 11](#) on the next page, it can be seen that there is a wide variation in the level of recycling presented in the correct container at the kerbside. The average rate for glass was 71%, with a maximum of 86% and a minimum of 40%. The minimum value for glass may reflect the use of alternative glass recycling (e.g., recycling points, etc.) and so does not capture all of the glass recycled from households, as combining alternative recycling with kerbside was beyond the scope of this study.



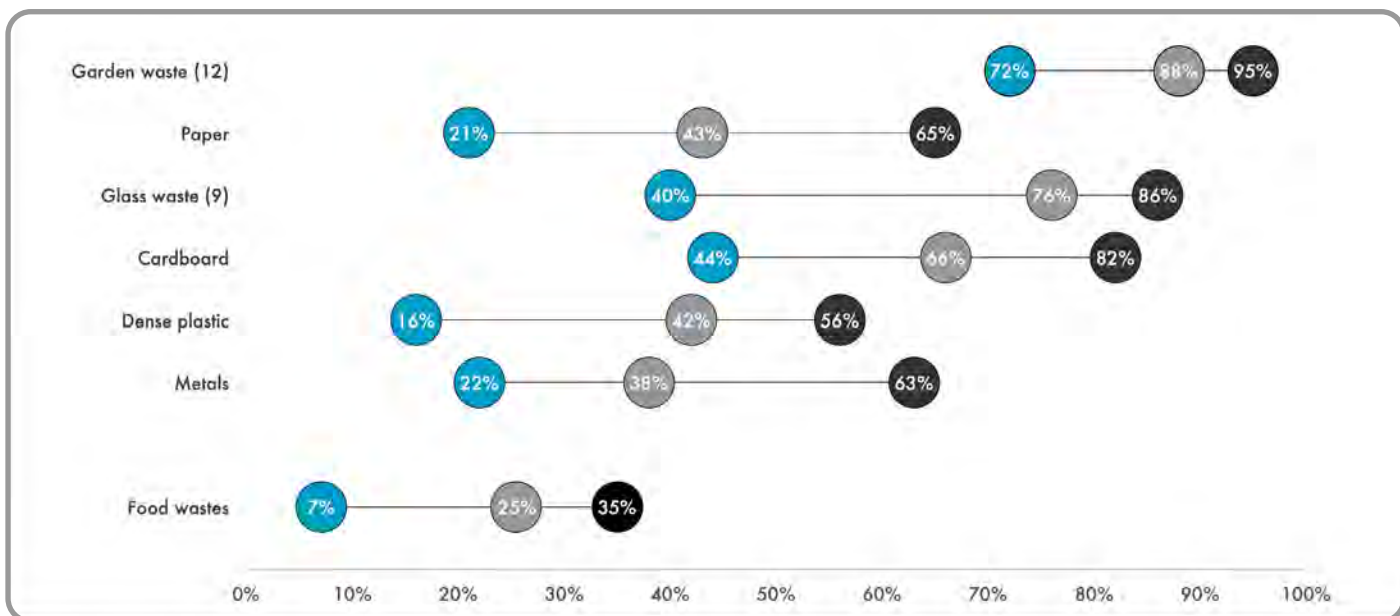


Figure 11: The proportions (%) of seven typically recycled waste types that we estimate are presented in the correct recycling container at the kerbside. The minimum (blue), average (grey) and maximum (black) are provided for each waste type. Number of local authorities that observations are based on is 15 (unless highlighted in brackets).

The maximum estimate for garden waste is 95% in Figure 11 which aligns with the high average value (of 88%) across the 12 local authorities targeting garden waste at the kerbside.

The data shows that rates of waste presented in the correct recycling container at the kerbside could be improved for typical existing materials. For example, an average of 24% of food waste was correctly recycled at the kerbside, with a maximum of 35% and a minimum of only 7%. For paper and cardboard, an average of 44% and 67%, respectively, were found in the correct recycling container. This analysis highlights under-use of existing kerbside services for these waste materials but presents an opportunity to improve capture.

Zero Waste Scotland is leading various research activities focused on improving the level of waste presented in the correct recycling container at the kerbside, including providing support to Scottish Government on the development of a route map to deliver Scotland's zero waste and circular economy by 2025 and beyond³²; and the recently published Circular Economy Bill³³, which sets out the proposed steps for maximising the

quantity and quality of recycling and reducing waste. Actions relating to food waste, include Zero Waste Scotland trialling interventions to increase participation in food waste recycling services and engaging with residents to better understand the behaviours, motivations, and deeply held beliefs around food, food usage, and food waste.

5.2 How common is it for the wrong items to end up in mixed recycling collections?

Nearly half of the local authorities in Scotland provide a kerbside dry mixed recycling or co-mingled service, typically targeting paper, card, metals and plastic wastes produced by households. Since the last waste composition programme in 2013-15, increasing numbers of local authorities have introduced more source separation in their kerbside recycling services in alignment with Scotland's Household Recycling Charter and associated Code of Practice³⁴.

Contamination of recycling services occurs when incorrect items (either non-recyclable items or recyclable items placed in the incorrect recycling container) end up in the recycling collection. Contamination results in

increased costs, through equipment damage, additional sorting and operational costs, and waste disposal charges. Additionally, collection and sorting staff can be put at risk from dealing with contaminated recycling (e.g. cuts from hand sorting, exposure to hazardous waste etc.).

Waste composition analysis of recycling containers was conducted on eleven of the fifteen local authorities that took part in the overall study; six local authorities with dry mixed recycling services and five local authorities with twin-streamed services³⁵. Four local authorities were excluded as they did not target a given waste type at the kerbside (e.g., where glass was not targeted at the kerbside and households are encouraged to use recycling points).

To assess the data collected from these local authorities and the effectiveness of these services, wastes were classified into three groups:

- **Target** - wastes targeted for collection by the local authority e.g., recyclable paper and card
- **Non-target** - wastes not targeted but were targeted elsewhere by the local authority service e.g., recyclable glass might be targeted using a separate kerbside glass collection, or via recycling points
- **Non-recyclable** - wastes not typically recycled anywhere within a local authority service e.g., non-recyclable paper and disposable nappies.



Figure 12 below summarises the minimum (light blue), average (grey) and maximum (dark grey) observations (expressed as % of overall composition) from six samples of dry mixed recycling, for target, non-target and non-recyclable waste.

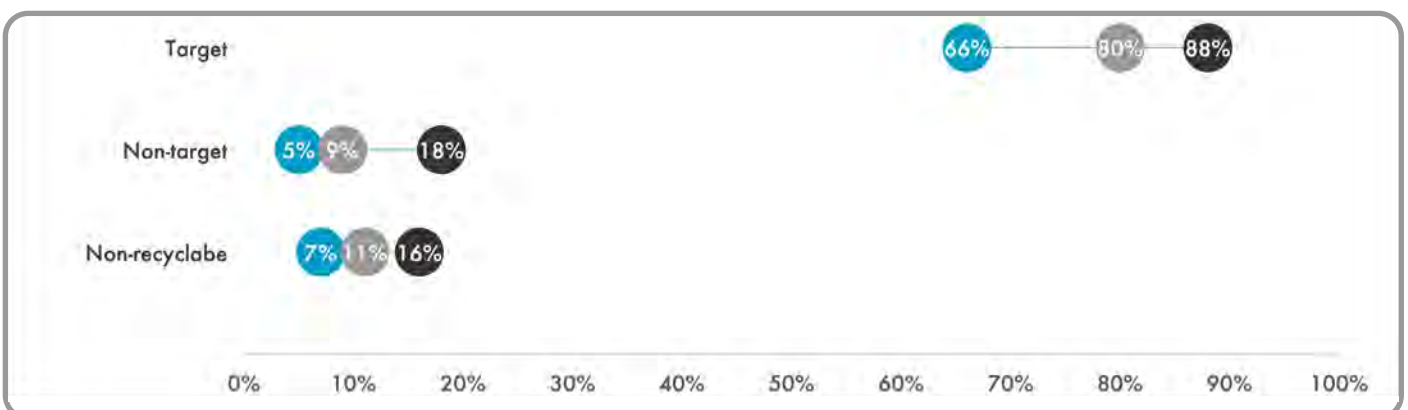


Figure 12: The proportions (%) of target, non-target and non-recyclable waste types in six local authority dry mixed recycling services. The minimum (blue), average (grey) and maximum (black) are provided for each waste type.

For dry mixed recycling services, target materials made up an average of 80% of the recycling container and ranged from a minimum of 66% to a maximum of 88%. Waste that had been incorrectly placed in the recycling container (non-target and non-recyclable contamination combined) made up an average of 20% and ranged from a minimum of 12% to a maximum of 34% of the recycling container.

Contamination by non-target wastes made up an average of 9% of the dry mixed recycling. The most commonly occurring non-target waste types in dry mixed recycling

services were food waste (3.7%), glass waste (1.9%³⁶) and textiles (1.2%). Non-recyclable wastes made up an average 11% of the six samples of dry mixed recycling. The highest non-recyclable materials found were 'other'³⁷ (2.5%), paper (2.4%), dense plastic (2.0%), and plastic films and flexibles (1.7%).

Figure 13 summarises the minimum (light blue), average (grey) and maximum (dark grey) observations (expressed as % of overall composition) from five samples of twin stream recycling, for target, non-target and non-recyclable waste.

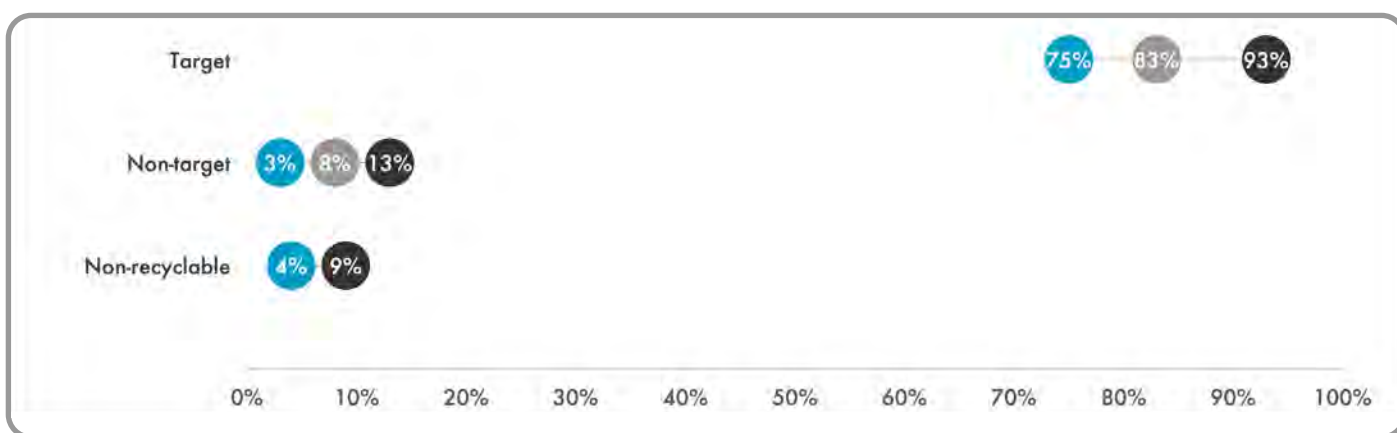


Figure 13: The proportions (%) of target, non-target and non-recyclable waste types in five local authority twin stream recycling services. The minimum (blue), average (grey) and maximum (black) are provided for each waste type.

For twin stream services, target materials made up an average of 83% of the recycling container and ranged from a minimum of 75% to a maximum of 93%. Waste that had been incorrectly placed in the recycling container (non-target and non-recyclable contamination combined) made up an average of 17% and ranged from a minimum of 7% to a maximum of 22% of the recycling container.

Contamination by non-target wastes made up an average of 8% of recycling services with twin stream. The most commonly occurring non-target waste types in twin stream services were food waste (3.2%), cardboard (1.1%) and metal (0.9%). The highest non-recyclable materials found were paper (2.2%), cardboard³⁸ (1.5%), and plastic films and flexibles (1.4%).

In a previous study of kerbside recycling³⁹, similarly lower level of contamination were found in recycling services targeting a small number of materials. The relatively lower levels of contamination in these services are contrasted with the findings for the co-mingled collections described above, where non-target and non-recyclable wastes made up an average of 20% of the overall recycling bin.

Conclusion

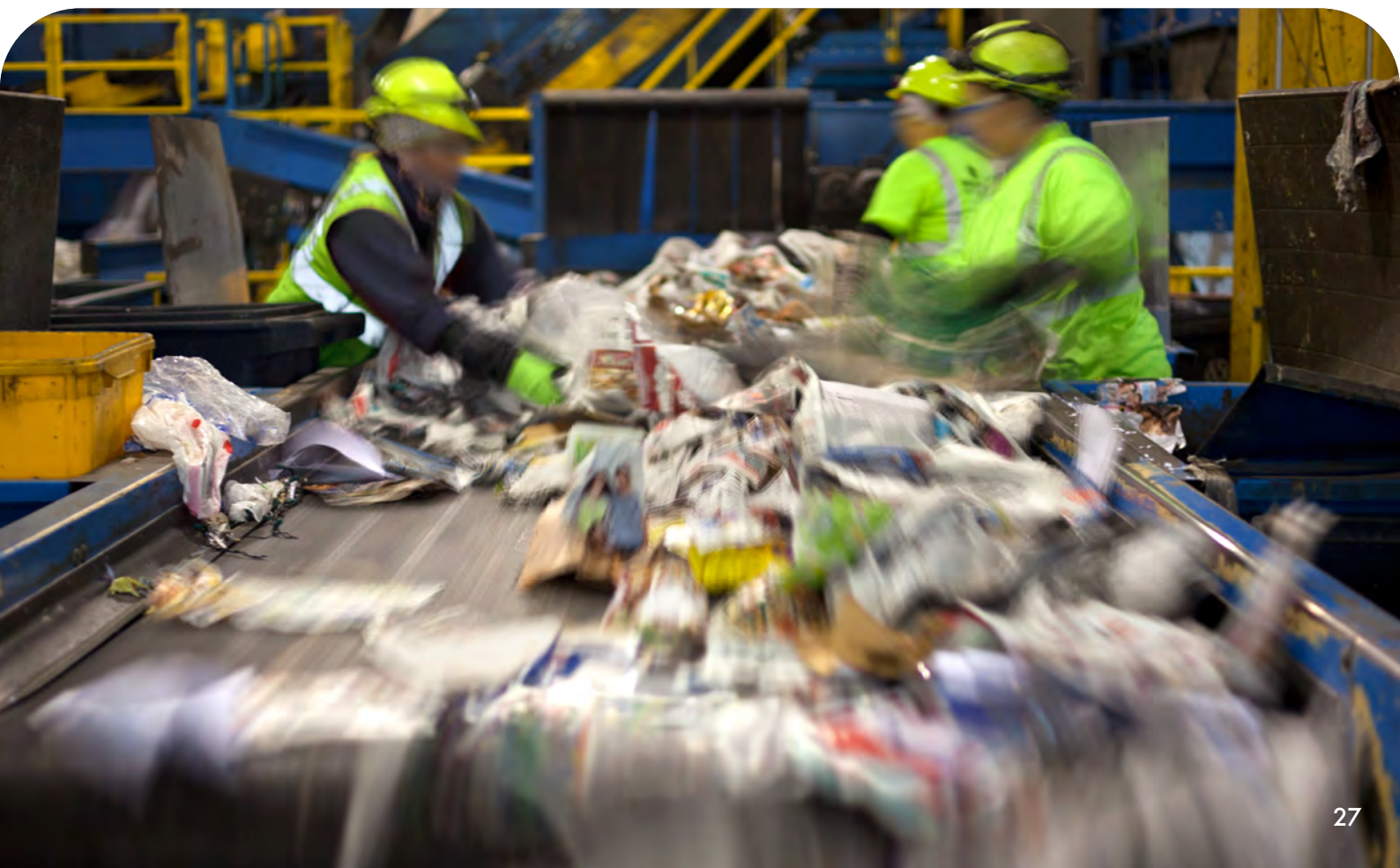
This updated analysis of household waste collected at the kerbside demonstrates that over half of the material found within residual waste could have been recycled within existing kerbside recycling services. Despite the establishment of kerbside recycling across Scotland, the analysis suggests that services are underutilised and that opportunities to further increase householder participation and capture of key recyclable materials remain. Scottish Government's Circular Economy Bill and consultation on delivering a route map for Scotland's circular economy, both include measures seeking to modernise recycling services and improve performance e.g. service co-design and statutory recycling performance targets.

Food waste is by far the most significant component of residual waste in Scotland and presents the biggest opportunity. Increased recycling of this material would significantly contribute towards reducing the carbon emissions associated with waste management. Increased diversion of recyclable materials from residual waste also presents opportunities to minimise the economic

costs of managing household waste to local authorities, whilst also helping to maximise the impact of investments already made in recycling infrastructure.

The biodegradable element of residual waste in Scotland has reduced slightly between our studies. Increased capture of materials such as food waste and paper and card within recycling services will help to further reduce this.

Contamination within recycling continues to present a challenge to local authorities, with the analysis finding consistent levels of both non-target and non-recyclable materials present across different services. The Recycling Improvement Fund⁴⁰ has provided financial support to local authorities to improve service infrastructure, with the aim of improving the capture of recyclable material and reducing the level of contamination in the recycling containers. Continued reinforcement and education with householders will also be required to increase understanding of what materials can be recycled and where, to further improve the quality of materials being collected for recycling.



6 Appendices

Appendix 6a: Breakdown of total kerbside collected waste by material category on a per annum basis (figures presented to 2 significant figures)

| Level 1 material category | Total Kerbside tonnage (t) |
|--------------------------------|----------------------------|
| Food waste | 440,000 |
| Garden waste | 280,000 |
| Paper | 170,000 |
| Cardboard | 160,000 |
| Glass waste | 140,000 |
| Other | 140,000 |
| Dense plastic | 130,000 |
| Plastic films and flexibles | 91,000 |
| Absorbent hygiene products | 72,000 |
| Metal | 67,000 |
| Textiles | 58,000 |
| Unclassified | 32,000 |
| Wood | 18,000 |
| Electrical and electronic item | 14,000 |
| TOTAL | 1,800,000 |

Appendix 6b: Selected waste types in kerbside residual waste (tonnage figures are presented on a per annum basis)

| Waste type | Typically recycled at the kerbside in the residual waste (tonnes) | Typically recycled at the kerbside in the residual waste (kg/household/year) | Typically recycled at the kerbside in the residual waste (kg/capita/year) |
|---------------------------------------|---|--|---|
| Food waste | 330,000 | 130.6 | 60.3 |
| Drinks bottles (Glass) | 35,000 | 13.9 | 6.4 |
| Garden waste | 34,000 | 13.6 | 6.3 |
| Pots, tubs and trays | 31,000 | 12.3 | 5.7 |
| Thin (Grey) Card Packaging | 22,000 | 8.9 | 4.1 |
| Other glass packaging | 21,000 | 8.3 | 3.8 |
| Other recyclable paper | 9,600 | 3.8 | 1.8 |
| Other ferrous packaging | 8,900 | 3.5 | 1.6 |
| Aluminium packaging | 8,400 | 3.3 | 1.5 |
| Newspapers, magazines and directories | 8,100 | 3.2 | 1.5 |
| Other non-drinks plastic bottles | 8,000 | 3.2 | 1.5 |
| Thick (Brown) cardboard packaging | 7,900 | 3.1 | 1.5 |
| PET drink bottles | 7,600 | 3.0 | 1.4 |
| Aluminium drinks cans | 6,100 | 2.4 | 1.1 |

7 References

¹<https://cdn.zerowastescotland.org.uk/managed-downloads/mf-jk1pxc2e-1677510625d>

²Based on the emissions solely associated with landfilling waste. For a more detailed analysis of the carbon impacts of Scotland's waste, including household waste, please see The Carbon Footprint of Scotland's Household Waste, Reporting Year 2021 <https://www.zerowastescotland.org.uk/resources/carbon-metric-publications>

³Based on 2021-22 landfill tax rate of £96.70 per tonne, <https://www.mygov.scot/green-taxes-reliefs/scottish-landfill-tax>

⁴'Other' includes all of the following: potentially hazardous healthcare wastes, pet excrement and bedding, dead animals and cat litter, miscellaneous combustible, miscellaneous non-combustible, and miscellaneous hazardous.

⁵Scottish Government Circular Economy Bill

⁶Delivering Scotland's circular economy – route map to 2025 and beyond

⁷By 2025, Scottish Government aim to reduce total waste arising in Scotland by 15% against 2011 levels, reduce food waste by 33% against 2013 levels, recycle 70% of remaining waste, and send no more than 5% of remaining waste to landfill. <https://www.gov.scot/policies/managing-waste/>

⁸For a more detailed analysis of the carbon impacts of Scotland's waste, including household waste, please see The Carbon Footprint of Scotland's Household Waste, Reporting Year 2021 <https://www.zerowastescotland.org.uk/resources/carbon-metric-publications>

⁹A standard methodology for household sampling

¹⁰SEPA household waste summary data 2021: <https://www.sepa.org.uk/environment/waste/waste-data/waste-data-reporting/household-waste-data/>

¹¹In some instances, certain sampled local authorities will have provided their own most relevant tonnage data for the analysis.

¹²In relatively rare cases, a waste type that we define as typically recycled at the kerbside nationally (e.g. glass bottles) may not be targeted at the kerbside by a given local authority (i.e. where households are expected to use other non-kerbside recycling facilities).

¹³Examples of waste types not targeted at the kerbside include clothing and textiles, which are more commonly collected at bring banks, and waste electrical and electronic equipment (WEEE) which is more commonly collected at household waste recycling centres.

¹⁴<https://cdn.zerowastescotland.org.uk/managed-downloads/mf-zwfrfku-1696500258d>

¹⁵Based on the emissions solely associated with landfilling waste. For a more detailed analysis of the carbon impacts of Scotland's waste, including household waste, please see The Carbon Footprint of Scotland's Household Waste, Reporting Year 2021 <https://www.zerowastescotland.org.uk/resources/carbon-metric-publications>

[carbon-metric-publications](https://www.zerowastescotland.org.uk/resources/carbon-metric-publications)

¹⁶Based on 2021-22 landfill tax rate of £96.70 per tonne, <https://www.mygov.scot/green-taxes-reliefs/scottish-landfill-tax>

¹⁷For the separate food waste study, see Household food and drink waste in Scotland 2014. This gives a more detailed breakdown of food waste arisings (including some non-kerbside routes). Estimates for food waste collected at the kerbside in the current study and the earlier study differ slightly due to slightly different scaling assumptions being used; these differences are highlighted in the respective methodology sections. We recommend the dedicated food waste study is preferred for discussion of food waste amounts, and the current study is preferred for discussion of kerbside collected waste and recycling in the round.

¹⁸These are: metal, dense plastic, plastic films and flexibles, wood, electrical and electronic items, textiles, absorbent hygiene products, 'other', and unclassified.

¹⁹'Other' includes all of the following: potentially hazardous healthcare wastes, pet excrement and bedding, dead animals and cat litter, miscellaneous combustible, miscellaneous non-combustible, and miscellaneous hazardous.

²⁰Unclassified material category refers to material sorting residues that are less than 10mm (also recognised as fines).

²¹During compositional analysis effort is made to separate wastes contained within carrier bags, bin bags and plastic film packaging, but it is unlikely that 100% can be removed in practice

²²These are: glass waste, metal, dense plastic, garden waste, wood, electrical and electronic items, textiles, absorbent hygiene products, and unclassified.

²³Individual waste types defined as 'typically recycled' at the kerbside should refer to the appendix of the separate methodology document. <https://cdn.zerowastescotland.org.uk/managed-downloads/mf-zwfrfku-1696500258d>

²⁴Refer to 'Household waste summary data and text' report, at the following link: <https://www.sepa.org.uk/environment/waste/waste-data/waste-data-reporting/household-waste-data/>

²⁵<https://cdn.zerowastescotland.org.uk/managed-downloads/mf-jk1pxc2e-1677510625d>

²⁶As highlighted in Section 2 this analysis is representative of the 2021 period. The national residual waste tonnage used in our analysis is very similar to but will not exactly match those reported on waste data flow for the 2021 reporting year.

²⁷The food waste tonnage for both comparison year is taken from updated food waste estimates produced in 2014.

²⁸EPR Consultation Government response template (publishing.service.gov.uk)

²⁹SEPA household waste summary data 2021: <https://www.sepa.org.uk/environment/waste/waste-data/waste-data-reporting/household-waste-data/>

www.sepa.org.uk/environment/waste/waste-data/waste-data-reporting/household-waste-data/

³⁰SEPA household waste summary data 2021: <https://www.sepa.org.uk/environment/waste/waste-data/waste-data-reporting/household-waste-data/>

³¹At the time of waste composition studies in 2021-2023, six of the fifteen local authorities did not target glass for recycling at the kerbside, and three local authorities did not target garden waste at the kerbside.

³²Delivering Scotland's circular economy – route map to 2025 and beyond

³³Scottish Government Circular Economy Bill

³⁴<https://www.zerowastescotland.org.uk/resources/charter-household-recycling>

³⁵Allocation of multiple containers to increase at-home segregation of materials. For example, one container targeting paper and card and a separate container targeting plastics and metals.

³⁶Excludes one DMR service that includes glass in its collection.

³⁷'Other' includes all of the following: potentially hazardous healthcare wastes, pet excrement and bedding, dead animals and cat litter, miscellaneous combustible, miscellaneous non-combustible, and miscellaneous hazardous.

³⁸Non-target recyclable material is material that has been presented in the wrong container at the kerbside, or is collected through other routes, including recycling points. Card presented as non-target material in our analysis is material that has been presented in the containers stream, or in the form of tetrapak/ cartons in the fibres stream.

³⁹Contamination in source-separated municipal and business recycle in the UK 2013 240314.pdf

⁴⁰<https://www.zerowastescotland.org.uk/resources/recycling-improvement-fund>



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