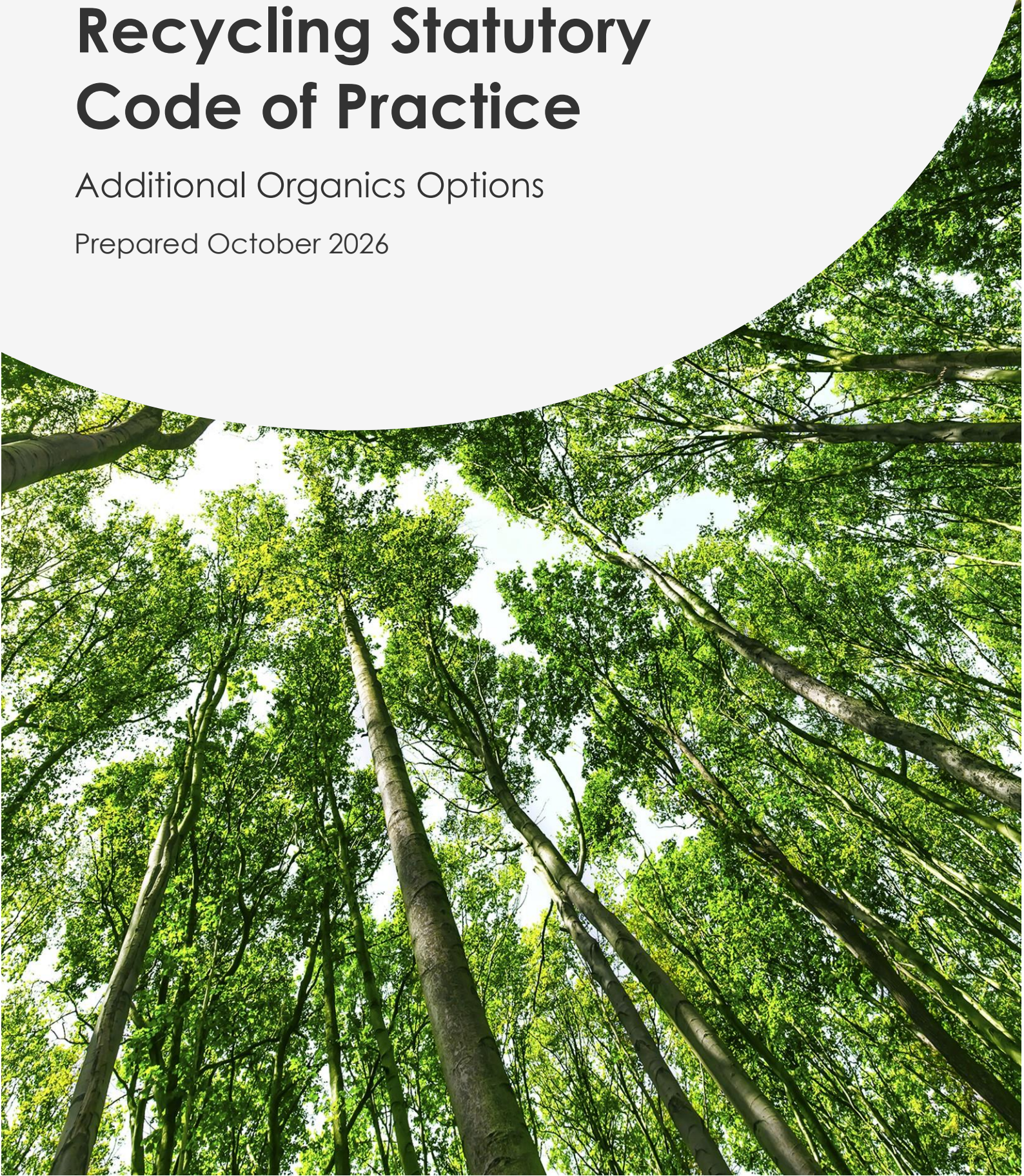


Household Recycling Statutory Code of Practice

Additional Organics Options

Prepared October 2026



Report For

Scottish Government

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V1.0	06/10/26	Peter Jones	QA-ed key figures and WIP draft (sent to client)
V1.1	08/10/26	Peter Jones	Completed infrastructure section
V1.2	12/10/26	Claire Walker, Peter Jones, Daniel Card, James Brooke, Emily Cevallos Janssen	Revised first draft
V1.3	26/10/26	Claire Walker, Peter Jones, Daniel Card, James Brooke, Emily Cevallos Janssen	Finalised second draft

Executive Summary

This study builds on the Scottish Government's Co-design process for the development of a Statutory Household Recycling Code of Practice for Scotland (CoP). The Co-design process culminated in two options that included weekly separate food waste collections and separate garden waste collections for all households in UR1-5*, differing only in whether garden waste collections were free or charged.

Local authorities and industry stakeholders have expressed concerns about the potential logistical complexities and infrastructure costs associated with implementing separate weekly food waste collections alongside separate garden waste collections. The Scottish Government therefore requested a further analysis to consider alternative options that would allow local authorities to operate mixed organics collections, while also providing greater flexibility over organics collection frequencies.

The results presented in this report should be treated as indicative estimates rather than precise forecasts, due to the limited composition data for authorities that operate mixed organics services.

Approach

Table E- 1 sets out the new "Organics" options examined in this study, alongside the options that emerged from the co-design work. In the Co-design Options, all authorities have separate food and separate garden waste collections, which necessitates authorities that currently have mixed organics services making significant changes to collection and treatment arrangements. The Organics Options change this by allowing mixed organics collections.

In order to model the options, it was necessary to determine their effect on how waste would flow through local authority collection systems. Eunomia undertook this by examining the performance of authorities that operate services similar to those being modelled, and instances where the specific service change being modelled has been introduced in isolation, while the wider service remains unchanged.

The challenge in this instance is that there is limited evidence to work with. Inverclyde is unique amongst Scottish authorities in offering a fortnightly separate collection as its main food waste service. Meanwhile, though mixed organic collections are relatively widespread, they combine food and garden waste in a single stream, which means that the quantity of each material cannot be directly identified. This makes it difficult to know with certainty how much food is being collected prior to any change, and how much difference the proposed change would make. It was necessary to also make use of relatively old studies by WRAP in order to build a sufficient evidence base for assessment.

Table E- 1: Definition of Organics Options and Co-Design Options

Baseline system		Organics Option 1	Organics Option 2	Co-design Option 1	Co-design Option 2
Reporting		Further organics modelling with results presented in this report		Co-design results presented in the Co-design Report	
Residual	240-litre bin	60 litres (four-weekly)		60 litres (four-weekly)	
	180-litre bin	60 litres (three-weekly)		60 litres (three-weekly)	
	140-litre bin	60 litres (240-litre bin, four-weekly or 180-litre bin, three-weekly)		60 litres (240-litre bin, four-weekly or 180-litre bin, three-weekly)	
	Communal	No change		No change	
Recycling	Recycling	Separate fibres (paper/cardboard)		Separate fibres (paper/cardboard)	
	Separate glass	Separate		Separate	
	Mixed glass	Mixed		Mixed	
	Bring glass	Bring		Bring	
Food	Separate UR1-3+	Separate ¹ , UR1-4	Separate ² , UR1-4	Separate, UR1-5*	
	MO UR1-3+	MO ¹ , UR1-4	MO ² , UR1-4	Separate, UR1-5*	
Garden	Separate £	Separate, £		Separate, £	
	MO £	MO, £		Separate, £	
	Separate free	Separate, free		Separate, free	Separate, £
	MO free	MO, free		Separate, free	Separate, £
	None	Separate, free		Separate, free	Separate, £
	Community	Community			

Notes ¹ No minimum frequency. Collection frequency and method for food and garden are as per the baseline.

² Minimum food collection frequency = weekly.

Key findings

Table E- 2 presents the capital and annual revenue cost change, together with the recycling and carbon impacts of the Organics Options alongside the Co-design Options.

Table E- 2: Headline results for Co-design Options and Organics Options

Headline results		Organics Option 1	Organics Option 2	Co-design Option 1	Co-design Option 2
Reporting		Further organics modelling with results presented in this report		Co-design results presented in the Co-design Report	
New capital costs		£62.42m	£77.71m	£80.09m	£79.55m
Change in annual revenue costs		- £12.19m	- £5.04m	- £11.36m	- £28.04m
Recycling rate		45.9%	46.4%	47.2%	46.6%
Carbon emissions change (tonnes CO ₂ e per annum)		- 50,800	- 50,300	- 62,500	- 61,600
System:	Residual	60 litres per week for individual/low-rise, communal unchanged			
	Recycling	Separate fibres collections with glass unchanged			
	Food	UR1-4 coverage. Separate or mixed with garden, as per the baseline (2023)		UR1-5+ coverage. All separate collections	
	Garden	As per the baseline. Authorities without garden introduce a free service			Charged in all authorities

Both Organics Options result in lower additional capital costs than either Co-design Option. This is due to the reduced investment in additional food waste vehicles required in the Organics Options. The requirement for fortnightly separate collection of food waste in most mixed organic authorities in Organics Option 2 means that its capital costs are higher than in Organics Option 1. Significant investment in vehicles and containers for recycling services is still required across all options.

While all options reduce revenue costs compared to the baseline, the reduction is greatest in Co-design Option 2. This is due to income from charged garden waste services. Organics Option 2 produces the smallest saving, as it incorporates the additional cost of collecting food waste without the saving associated with separate food waste treatment.

Organics Options 2 has a very similar recycling rate to the Co-design Options, but the change in organic waste treatment (a shift away from anaerobic digestion) results in a more pronounced gap in carbon performance. The poor performance of mixed organics treatment in carbon terms can be seen by comparing Organics Option 2 with Organics Option 1, which has a lower recycling rate due to less food waste being collected, but which performs better in carbon terms.

In addition to these direct operational costs, the modelled options would give rise to a need for changes to depots (due to increased vehicle and crew numbers) and waste transfer stations (WTSS) (due to materials being separated into additional streams). Infrastructure costs are challenging to estimate as the costs can vary considerably depending on the availability of space on existing sites and the cost and

availability of alternatives. Taking the figures for depots and WTSs together, the central estimate of costs would be as shown in Table E- 3. More reliable figures could only be produced through a detailed site-by-site analysis.

Table E- 3: Total collection infrastructure costs

Item	Co-Design Study	Organics Option 1	Organics Option 2
Depot Costs	£23.5m	£2.1m	£9.6m
WTS Costs	£30.7m	£22.2m	£22.2m
Total	£54.2m	£24.3 m	£31.8m

The Organics Options would also result in a greater amount of separate food waste and mixed organics being collected, although separate food waste would not extend to any local authorities that do not already have services in place. There would also be two authorities that currently offer garden waste services at HWRCs only that would need to introduce garden waste collection services. The resulting additional material will require treatment.

Because of the waste streams collected remain similar to the baseline, it is likely that much of the additional material would be able to be treated in the facilities that authorities currently use. This may be most challenging in areas where tonnage increases greatly in absolute terms (e.g. Edinburgh collects ~4,500 tonnes more food waste) or relative terms (Argyll & Bute collects ~600 tonnes more food waste, representing an increase of more than 100%). The largest increase in garden waste tonnage is in Aberdeenshire, and this could plausibly be expected to require a new or expanded open air windrow treatment facility to build. Increasing the share of food waste in the waste that mixed organics authorities send for composting may affect the operation of the composters, but this would require further exploration with the operators.

Conclusions

The results of the analysis are presented in Table E- 4. The Co-design Options deliver the strongest environmental outcomes overall. Recycling rates are somewhat higher under the Co-design Options, reflecting the narrower food waste collection coverage under the Organics Options, alongside differences in collection frequency. The difference is particularly narrow between Organics Option 2 and Co-design Option 2, with the Co-design option collecting more food waste and the Organics Option collecting more garden waste.

However, both Co-design Options deliver annual carbon savings more than 10,000 tonnes CO₂e greater than the Organics Options. This reflects differences in the quantities of material captured, as well as the continued treatment of mixed organics through in-vessel composting rather than anaerobic digestion. Thus, despite Organics Option 2 and Co-design Option 2 having similar recycling performance, Co-design Option 2 has a substantially greater carbon benefit.

Table E- 4: Results summary

Headline results		Organics Option 1	Organics Option 2	Co-design Option 1	Co-design Option 2
Recycling rate		45.9%	46.4%	47.2%	46.6%
Carbon emissions change (tonnes CO ₂ e per annum)		- 50,800	- 50,300	- 62,500	- 61,600
New capital costs		£62.42m	£77.71m	£80.09m	£79.55m
Change in annual revenue costs		- £12.19m	- £5.04m	- £11.36m	- £28.04m
Depot/WTS costs		£24.3m	£31.8m	£54.2m	£54.2m
System:	Residual	60 litres per week for individual/low-rise, communal unchanged			
	Recycling	Separate fibres collections with glass unchanged			
	Food	UR1-4 coverage. Separate or mixed with garden, as per the baseline (2023)		UR1-5+ coverage. All separate collections	
	Garden	As per the baseline. Authorities without garden introduce a free service			Charged in all authorities

All options deliver annual revenue savings relative to the baseline, primarily through reductions in residual waste collection and treatment costs. Co-design Option 2 delivers the greatest saving (£28.0 million), largely due to income from garden waste charging. Organics Option 1 delivers a marginally greater saving than Co-design Option 1 (£12.2 million compared with £11.4 million), reflecting its less extensive collection requirements.

The differences between the options are also reflected in the capital investment and infrastructure required for implementation. Organics Option 1 has the lowest modelled vehicle and container capital costs (£62.4 million), reflecting its narrower food waste collection coverage and retention of existing collection frequencies. By contrast, Organics Option 2 requires only marginally less investment than the Co-design Options.

While both Organics Options reduce the extent of changes required to collection depots, investment in collection infrastructure remains necessary. Organics Option 2 has higher costs than Organics Option 1, due to the greater need for depot modifications to accommodate additional food waste collections. The Organics options make it more likely that much of the additional organic tonnage could be accommodated within existing facilities but there is considerable uncertainty regarding available capacity and site-specific requirements regarding feedstock.

Table of Contents

Executive Summary	1
Approach	1
1.0 Introduction	9
1.1 Background to the Co-design Options	9
1.2 Rationale for further organics modelling	10
2.0 Options	10
2.1 System design	10
2.2 Organics schemes	11
2.3 Food waste coverage	13
3.0 Waste flow modelling	14
3.1 Approach	14
3.2 Benchmarking	15
3.2.1 Overview	15
3.2.2 Fortnightly food waste	15
3.2.3 Mixed organic waste	16
4.0 Results	20
4.1 Cost, performance and carbon impact	20
4.2 Infrastructure	23
4.2.1 Collection Infrastructure	24
4.2.2 Overall cost and number of authorities affected	27
4.2.3 Treatment infrastructure	28
5.0 Conclusions	30
Appendix	33
A.1.0 Existing research on organic performance	34
A.2.0 Fortnightly food waste benchmarking	37
A.3.0 Organic waste arisings (2023)	39
A.4.0 Food in organics case studies	42

A.5.0 Residual case studies.....58

A.6.0 Assumptions 71

List of Co-design Report Appendices

This Organics Report is a supplementary document to the Co-design Final Report. Alongside this report, the Co-design Final Report is supported by eight additional appendices, which are provided as separate documents rather than included within the main report.

1. Appendix 1: 2023 Collection systems
2. Appendix 2: Modelling methodology and limitations
3. Appendix 3: Key CBA findings
4. Appendix 4: Workshop 2 report
5. Appendix 5: Workshop 3 report
6. Appendix 6: Options appraisal, VfM, and financial analysis result
7. Appendix 7: Review of service charging
8. Appendix 8: Code of Practice derogations and delays

1.0 Introduction

Eunomia supported the Scottish Government's Co-design process for the development of a Statutory Household Recycling Code of Practice for Scotland (CoP), including the development and appraisal of household recycling collection options. Following this work, in response to further Scottish Government engagement with stakeholders, Eunomia was commissioned by the Scottish Government to undertake additional modelling of options for the collection and treatment of organic waste.

The results of the initial appraisal are presented in the Co-design Report *Scotland's new Code of Practice for household recycling*. For the purposes of the present report, the options assessed through that earlier work are referred to as the 'Co-design Options,' while the additional options considered through this modelling exercise are referred to as the 'Organics Options'. Both appraisals compare the options in terms of implementation cost, recycling performance and environmental impacts, measured in terms of carbon emissions, across Scotland.

1.1 Background to the Co-design Options

During the Co-design work, five organics options were assessed. Each examined a different combination of separate weekly food waste collection and separate garden waste collection arrangements. The modelling considered scenarios in which separate food waste and garden waste services are offered to all households in Scotland that fall within urban-rural categories 1 to 3 (UR1–3) or, alternatively, categories 1 to 5 (UR1–5*). It also assessed the impact of providing garden waste collections either free of charge or as a charged service.

The Co-design Options built on and expanded the organics requirements set out in the voluntary CoP, published in 2016. The voluntary CoP specified that households should receive weekly separate food waste collections where required under the Waste (Scotland) Regulations 2012 (i.e. in UR1-3, although not all such properties currently receive collections) but did not set specific requirements for the collection of garden waste.

The Co-design Options were informed and refined through analysis of local authority recycling performance, stakeholder feedback from two Co-design workshops, and input from COSLA. The analysis found that separate weekly food waste collections were statistically associated with higher yields of food waste than mixed organics collections. Although the appraisal did not identify a clear preferred option, with costs and performance varying across the options, it found that moving to separate food and garden waste collections would have a positive impact on recycling rates and carbon savings, whichever of the charging approach or rural collection requirements is selected.

This process, repeated across the other waste streams, ultimately resulted in two preferred options for full system change. For organics, both options modelled weekly separate food waste collections and separate garden waste collections for all households in UR1-5*. Co-design Option 1 assumed a free garden waste collection service, while Co-design Option 2 assumed a charged service.

Both options resulted in improved recycling performance, reduced carbon emissions and lower system costs relative to the baseline. Co-design Option 1 performed better environmentally because the free garden waste service captures more material for recycling. However, Co-design Option 2 delivered greater annual system cost saving, largely because of revenue from garden waste subscription charges.

The Co-design Final Report also found that extending separate food and garden waste collections would require significant investment in additional infrastructure, including new tipping facilities and treatment capacity. Indicative estimates suggested costs of around £10 million for additional tipping infrastructure and £18–30 million for treatment infrastructure. However, a further detailed study would be needed to give a more robust assessment of these costs.

1.2 Rationale for further organics modelling

Co-design Workshop 3 on 14 May 2026 concluded without stakeholder consensus on the preferred approach to organic waste. The Scottish Government has received feedback from local authorities, many of whom attended a deep-dive session on organics collections on 4 August 2026, and from industry stakeholders expressing concerns about the potential logistical complexities and significant infrastructure costs associated with implementing separate weekly food waste collections alongside separate garden waste collections.

In response, the Scottish Government requested a further analysis to consider alternative options that would allow local authorities to operate mixed organics collections, while also providing greater flexibility over organics collection frequencies. The results of this additional analysis are presented in the sections below.

2.0 Options

2.1 System design

Table 2-1 defines the Organics Options assessed in this report. For comparison, the Co-design Options that were previously modelled are also shown. In the table, ‘MO’ refers to mixed organics collections, where food and garden waste are collected together. Under such schemes, households typically receive a wheeled bin, into which both food and garden waste are placed. However, some households (e.g. those with no gardens) may receive only a food waste caddy, while residents in communal bin properties may use a shared wheeled bin for food waste only.

The differences between the Co-design Options and Organics Options are (1) the extent of food coverage and (2) the way in which organic waste is collected and treated.

Table 2-1: Definition of Organics Options and Co-design Options

Baseline system		Organics Option 1	Organics Option 2	Co-design Option 1	Co-design Option 2
Reporting		Further organics modelling with results presented in this report		Co-design results presented in the Co-design Report	
Residual	240-litre bin	60 litres (four-weekly)		60 litres (four-weekly)	
	180-litre bin	60 litres (three-weekly)		60 litres (three-weekly)	
	140-litre bin	60 litres (240-litre bin, four-weekly or 180-litre bin, three-weekly)		60 litres (240-litre bin, four-weekly or 180-litre bin, three-weekly)	
	Communal	No change		No change	
Recycling	Recycling	Separate fibres (paper/cardboard)		Separate fibres (paper/cardboard)	
	Separate glass	Separate		Separate	
	Mixed glass	Mixed		Mixed	
	Bring glass	Bring		Bring	
Food	Separate UR1-3+	Separate ¹ , UR1-4	Separate ² , UR1-4	Separate, UR1-5*	
	MO UR1-3+	MO ¹ , UR1-4	MO ² , UR1-4	Separate, UR1-5*	
Garden	Separate £	Separate, £		Separate, £	
	MO £	MO, £		Separate, £	
	Separate free	Separate, free		Separate, free	Separate, £
	MO free	MO, free		Separate, free	Separate, £
	None	Separate, free		Separate, free	Separate, £
	Community	Community			

Notes ¹ No minimum frequency. Collection frequency and method for food and garden are as per the baseline.

² Minimum food collection frequency = weekly.

2.2 Organics schemes

Table 2-2 gives further details of the differences in scheme between the options. In the Co-design Options, all authorities have separate food and separate garden waste collections, which necessitates authorities that currently have mixed organics services making significant changes to collection and treatment arrangements. The Organics Options change this by allowing mixed organics collections.

- In Organics 1, authorities retain the same organics collection system as in the baseline.

- Households already serviced continue to use wheeled bins.
- Properties newly included within the service are provided with food caddies only, or, in the case of communal properties, shared wheeled bins.
- In Organics 2, food waste is collected at least weekly. Since some authorities offer less frequent collections of food waste, especially as part of a mixed organics service, this results in some assumptions:
 - Inverclyde's separate food waste collection service will increase its frequency from fortnightly to weekly.
 - East Renfrewshire's mixed organics service is unaffected, as it already operates weekly collections.
 - Other authorities that operate fortnightly mixed organic collections require more frequent food collections. This was modelled as follows:
 - Wheeled bins are retained only for households with a garden (where the service is free) or a garden waste subscription (where the service is charged).
 - Kerbside caddies, or shared wheeled bins for communal properties, are provided to both households already receiving the service and those newly brought into the service.
 - Under this approach, the scheme operates as a separate food and garden waste collection service from a resident's perspective. However, during one week of the fortnightly cycle, food and garden waste are co-collected on the same vehicles. During the alternate week, those vehicles collect food waste only. All collected food and garden waste is tipped together at the transfer station, as in the baseline scenario.
- In both organic options:
 - No changes were modelled to garden waste coverage in authorities that already provide collections.
 - Authorities that do not currently offer a garden waste service were assumed to introduce free collections (as per Co-design Option 1). Collection frequency was set to the baseline residual waste collection frequency. The number of households that would then receive a garden waste collection was determined by the estimated number of properties with gardens within UR1-4. Thus, the service expansion only extends to properties that receive a food waste service. In practice, authorities might offer additional garden waste coverage where it makes sense financially to do so.

Table 2-2: Organic collection systems (changes from baseline in bold)

Key					
UR	6-fold Urban/Rural classification	W / F / 3W		Weekly / fortnightly / 3-weekly	
FW	Food waste	GW		Garden waste	
MO	Mixed organics (food and garden waste co-collected on the same vehicle)				
£	Charged garden waste	Free		Free garden waste	
Baseline food and garden system	Baseline	Organics Option 1	Organics Option 2	Co-design Option 1	Co-design Option 2
Food coverage	UR1-3	UR1-4	UR1-4	UR1-5 ⁺	UR1-5 ⁺
No food waste	None	W-FW	W-FW	W-FW	W-FW
Weekly food waste	W-FW	W-FW	W-FW	W-FW	W-FW
Fortnightly food waste	F-FW	F-FW	W-FW	W-FW	W-FW
No garden waste	None	Free GW	Free GW	Free GW	£ GW
Free garden waste	Free GW	Free GW	Free GW	Free GW	£ GW
Charged garden waste	£ GW	£ GW	£ GW	£ GW	£ GW
Community garden		Community garden			
Weekly mixed organics (charged garden)	W-MO (£ GW)	W-MO (£ GW)	W-MO (£ GW)	W-FW £ GW	W-FW £ GW
Fortnightly mixed organics (charged garden)	F-MO (£ GW)	F-MO (£ GW)	F-MO (£ GW) + F-FW	W-FW £ GW	W-FW £ GW
Fortnightly mixed organics (free garden)	F-MO (Free GW)	F-MO (Free GW)	F-MO (Free GW) + F-FW	W-FW Free GW	W-FW £ GW
Three-weekly mixed organics (free garden)	3W-MO (Free GW)	3W-MO (Free GW)	3W-MO (Free GW)	W-FW Free GW	W-FW £ GW

2.3 Food waste coverage

Table 2-3 shows the number of households in each urban rural ('UR') group.

Extending food waste collection coverage from UR1-3 to UR1-4 represents an increase in service coverage by about 2% (~61,000 households). However, because service data suggests that only around 83% of households in UR1-3 have food collected as of June 2026, the actual change in coverage

modelled will be ~+19%. This is based on the assumption that the Code of Practice will be followed to a greater extent than previous requirements.

The amount of households covered by a food waste service in the Organics Options (UR1-4) is therefore 11 percentage points less than in the Co-design Options (UR1-5+).

Table 2-3: Households by UR group

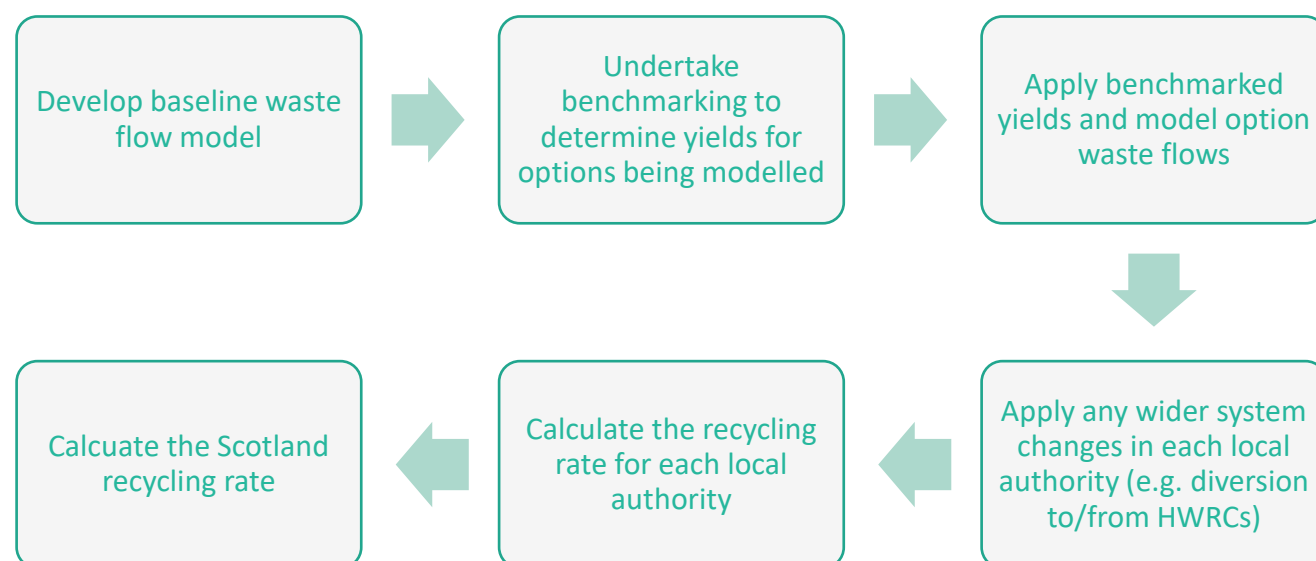
	UR1-3	UR4	UR5	UR6
Households	2,215,018	45,971	284,922	89,897
Households (%)	82%	2%	11%	3%

3.0 Waste flow modelling

3.1 Approach

The starting point for modelling the effects of the Organics Options is to examine their impact on how waste moves through the system. The “waste flow modelling” process followed is described in Figure 3-1. These are the same steps taken for Co-design Options.

Figure 3-1: Overview of waste flow modelling process



The following sub-sections present the benchmarking. This is key to understanding how the recycling rate was arrived at.

3.2 Benchmarking

3.2.1 Overview

Benchmarking was undertaken to determine waste flows. Previous Co-design benchmarking assessed the impact of restricting residual waste capacity to 60 litres alongside weekly separate food collections. It also assessed the impact of introducing garden waste collections in areas where no service currently exists.

The impact of three and four-weekly residual collections on current services was considered during an earlier Co-design stage (see the Co-design Report). To model the two Organics Options, the impact of a 60-litre residual waste limit was assessed for:

- Inverclyde's fortnightly food collections.
- the fourteen authorities that operate mixed organic waste collections.

Benchmarking requires isolating individual system changes to understand the impact. This can be done in two ways:

1. Identifying comparable authorities that already operate the target system configuration. Their performance can be used to estimate the impact of the overall service design.
2. Identifying real-world examples where a specific service change has been introduced in isolation, while the wider service remains unchanged. These examples serve as case study evidence that can be used to quantify the impact of the individual change.

The benchmarking process accounted for deprivation by placing authorities into one of three groups: low, mid and high. Individual/low rise properties were considered separately from communal properties. The provision of liners and service quality was not assumed to change.

The background findings from existing research are presented in A.1.0.

3.2.2 Fortnightly food waste

Inverclyde is unique amongst Scottish authorities in offering a fortnightly separate collection as its main food waste service. In Organics 1, Inverclyde is modelled to continue to collect separate food waste fortnightly. The yields modelled for Inverclyde are summarised in Table 3-1. (More details are provided in A.2.0).

- **Baseline.** Fortnightly yields are based on the 2023 baseline year (29.1kg/hh/yr).
- **Organic 1.** Reducing the residual waste capacity to 60-litres per week, food yields were predicted to increase from 29.1 kg/hh/yr to 38.4 kg/hh/yr.
- **Baseline with weekly food.** Historic performance and examples from other authorities with weekly food waste suggest that Inverclyde's would food waste yields would increase to 46.8 kg/hh/yr if collections were increased from fortnightly to weekly.

- **Organic 2.** Where a weekly food waste service was introduced alongside the 60-litres per week residual waste capacity restriction, it was predicted that food waste yields would rise further to 61.6 kg/hh/yr.

Communal properties are not expected to see the same residual waste restrictions and so do not see a similar yield increase in these options.

Table 3-1: System and food waste yield (kg/hh/yr) modelled

Inverclyde	Baseline system	Organics Option 1	Baseline with weekly food	Organics Option 2 (As per Co-design)
Residual collection frequency	Fortnightly	Four-weekly	Fortnightly	Four-weekly
Food collection frequency	Fortnightly	Fortnightly	Weekly	Weekly
Yield – individual/low rise	29.1	38.4	46.8	61.6
Yield – communal	15.4	15.4	15.4	15.4

3.2.3 Mixed organic waste

3.2.3.1 The challenge

There is strong evidence that reducing residual frequency increases food waste yields when food is separately collected. WRAP also identified higher food waste yields in mixed organic systems alongside fortnightly residual waste collections compared with weekly,¹ but this finding was based on rather less evidence. As a result, any relationship between residual collection frequency and mixed organic yields is less certain, particularly given the inherent limitations associated with mixed organic waste data. (Findings from existing research is presented in A.1.0).

The aim of benchmarking was to understand the impact of 60-litre restricted residual waste on the mixed organic arisings. However, benchmarking mixed organic collections is challenging because:

- Garden waste arisings are highly sensitive to weather conditions. This can result in large fluctuations throughout the year and variations between years. This makes it difficult to distinguish the impact of a service change from natural variation in garden waste capture. Using longer data periods and ensuring garden service delivery was consistent throughout (e.g. approach to charging and winter suspensions) mitigates this as far as it is possible.
- Mixed organic collections combine food and garden waste in a single stream, which means that the quantity of each material cannot be directly identified. There are no publicly available datasets that show the composition of mixed organic waste in sufficient detail. The information that is available regarding the amount of food within mixed organic waste is dated. SEPA

¹ WRAP (2016) *Supporting evidence and analysis: The case for greater consistency in household recycling*. Available at: https://static.wrap.org.uk/consistency/Learn_more_about_the_evidence.pdf

reporting assumes a co-collected food and garden is split 25%/75% into the categories: 'Animal and mixed food waste' and 'Vegetal wastes'. However, SEPA does not provide a source for this assumption, which has been in place since 2015.

3.2.3.2 Organic waste arisings in Scotland

Mixed organics yields for the fourteen authorities with mixed organics collections were collated for 2023. The detailed findings are provided in A.3.0.

The key finding was that the data (Table 3-2) suggests that there is an inverse relationship between effective weekly residual waste capacity and mixed organic yield (by garden system). i.e. Reducing residual waste capacity shows an upward trend in mixed organic yields.

Table 3-2: Average mixed organic yields by effectively weekly residual capacity

Garden system	Residual capacity (litres per week)	Authority or number of authorities in group	Yield (kg/hh/yr)	Rank (highest =1)
Charged	60	Stirling	199.5	2
	70	Perth & Kinross	231.7	1
	80	3	197.8	3
	90	Aberdeen City	193.0	4
Free	70	2	199.4	1
	80	4	166.9	2
	120	2	147.9	3
Notes	Where there is more than one data point for a particular residual capacity and mixed organics frequency, the average yield is presented. However, some data points represent a single authority. The rank in the last column is from 1 (highest), by garden system.			

3.2.3.3 Case studies: Food waste in the mixed organic stream

The most detailed publicly available information on the makeup of mixed food and garden collections can be found in WRAP's 2010² report. This gave the results of compositional analysis conducted on samples from six authorities and found that food made up just over 10% of mixed organics when collected fortnightly.

The benchmarking aim was to find authorities that had switched from mixed organics to separate food and garden. Scheme data dating back to 2012/13 was analysed to identify local authorities that had changed their organics system. Comparing tonnages before and after the change would help isolate the contribution of food waste to overall organic tonnages. However, owing to the introduction of garden waste charging by many local authorities that made this change, the pool of suitable case studies was

² WRAP (2010) *Performance analysis of mixed food and garden waste collection schemes*. Available at: <https://www.wrap.ngo/sites/default/files/2021-02/WRAP-performance-analysis-mixed-food-garden-waste-collection-schemes.pdf>

limited. The analysis was therefore expanded to include authorities with mixed food and garden waste collections that later discontinued food waste, as any decrease in tonnage would inform estimates of the food waste content of mixed organic collections. Detailed findings are provided in A.4.0.

The key finding was that the data largely suggested food yields were lower when food was mixed with garden waste. However, data was limited to three authorities that has changed their organics system and three where a mixed organics service was changed to garden waste only collections. Also, the data is ten years old or more, as this was the period when many authorities across the UK were moving away from mixed organics. In the decade since, food waste collections have become more normalised and increased familiarity is likely to have resulted in greater participation and thus yields per household. However, the impact may not be the same for mixed and separate services.

3.2.3.4 Case studies: Three-weekly residual waste

Scheme data dating back to 2012/13 was analysed to identify local authorities that had changed their reduced residual waste frequency. Across the UK, nine authorities have introduced three-weekly residual waste collections while operating a mixed organic service. The local authorities were East Renfrewshire, Glasgow, North Ayrshire, Renfrewshire, Western Isles, Bury, Oldham, Salford and Wigan. The detailed findings are provided in A.5.0.

The key findings were that the data showed that:

- the increase in the mixed organic yield for local authorities in Scotland (excluding Glasgow) when changing from fortnightly to three-weekly residual was 9.0%. The median increase was 8.2%. However, the results span a wide range, from a 7.4% decrease (North Ayrshire) to a 27.1% increase (Western Isles).
- tonnage change at HWRCs was highly variable. This was also found in previous benchmarking exercises when assessing the impact of restricted residual collections for individual local authorities.

3.2.3.5 Assumptions

This section uses the findings above to produce a set of assumptions to enable the impact of the Organics Options to be calculated. More details are provided in A.6.0.

Food waste in the mixed organic stream

Applying a blanket uplift to the mixed organics stream for three-weekly residual is not appropriate. It is therefore necessary to first determine the amount of food in the mixed organic stream, so that this can be made the focus of the uplift.

The most robust data point is the 2010 WRAP trial data, as this compared food waste yields across six mixed organic (using the measured composition) and six separate food authorities at a similar point in time. Table 3-3 shows how WRAP's 2016³ finding was used with Scotland food yield data and the

³ WRAP (2016) *op. cit*

benchmarking findings to estimate the ratio between separate and mixed organic collections. (This was not needed for current four-weekly residual authorities as their performance will not change).

The resulting 'mixed organic performance ratio' was then applied to average food yield for each group (based deprivation and residual frequency) or the most similar local authority with separate food collections. This is shown in Table 3-3.

Table 3-3: Estimating baseline yield of food in mixed organics

Data Point	Source	Fortnightly ¹	Three-weekly ¹	Four-weekly ¹
Food in fortnightly mixed organics	WRAP (2016) ⁴	30.4		
8.2% increase of food in mixed organics	Benchmarking		32.9	
12.3% increase of food in mixed organics (see Table 3-4)				34.2
Scotland average separate food yield	2023 WDF	48.6 (n=10)	49.3 (n=5)	66.4 (n=1)
Mixed organic performance ratio	-	0.63	0.67	0.70
Notes	¹ Yields are in kg/hh/yr			

60 litres per household per week residual capacity

Within the case studies, three-weekly residual waste collections equate to a residual capacity of 80 litres per household per week. No suitable case studies were identified for four-weekly residual waste collections (equivalent to 60 litres per household per week). The impact of this reduction was therefore estimated from the benchmarked uplift of 8.2%, assuming a linear relationship between residual capacity and food waste yield. Under this assumption, each 10-litre reduction in weekly residual capacity results in a 2.05% increase in food waste yield. Accordingly, a reduction from 120 to 60 litres per household per week would be expected to increase food waste yields by 12.3%. All other capacity-change assumptions were derived from this and are presented in Table 3-4.

The assumed yields are summarised in Table A - 37 within the Appendix. In some authorities, the mixed organic food yield exceeded the separate food yield assumption. Where this happened, it was capped at a mixed organic performance ratio of 0.7.

⁴ WRAP (2016) *op. cit*

Table 3-4: Estimating baseline yield of food in mixed organics

Residual capacity before	Residual capacity after	Increase in food yield	Yield before	Yield after
Litres	Litres	%	Kg/hh/yr	Kg/hh/yr
120	80	8.2	60.0	64.9
120	60	12.3	60.0	67.4
90	60	8.1	62.4	67.4
80	60	3.8	64.9	67.4
70	60	1.9	66.1	67.4
60	60	0.0	67.4	67.4

4.0 Results

4.1 Cost, performance and carbon impact

Table 4-1 presents the capital and annual revenue cost change, together with the recycling and carbon impacts of the Organics Options alongside the Co-design Options.

Table 4-1: Headline results for Co-design Options and Organics Options

Headline results		Organics Option 1	Organics Option 2	Co-design Option 1	Co-design Option 2
Reporting		Further organics modelling with results presented in this report		Co-design results presented in the Co-design Report	
New capital costs		£62.42m	£77.71m	£80.09m	£79.55m
Change in annual revenue costs		- £12.19m	- £5.04m	- £11.36m	- £28.04m
Recycling rate		45.9%	46.4%	47.2%	46.6%
Carbon emissions change (tonnes CO ₂ e per annum)		- 50,800	- 50,300	- 62,500	- 61,600
System:	Residual	60 litres per week for individual/low-rise, communal unchanged			
	Recycling	Separate fibres collections with glass unchanged			
	Food	UR1-4 coverage. Separate or mixed with garden, as per the baseline (2023)		UR1-5+ coverage. All separate collections	
	Garden	As per the baseline. Authorities without garden introduce a free service			Charged in all authorities

Both Organics Options result in lower additional capital costs than either Co-design Option. This is due to the reduced investment in additional food waste vehicles required in the Organics Options. The introduction of fortnightly separate collection of food waste in most mixed organic authorities in Organics Option 2 means that this reduction in additional cost, relative to the Co-design Options, is notably lower than in Organics Option 1; there is only a small difference in additional capital cost between Co-design Option 2 and Organics Option 2. Significant investment in vehicles and containers for recycling services is still required across all options.

Ongoing revenue costs are lower across all options than the baseline, driven by reductions in residual waste collection and treatment costs. This reduction is greatest in Co-design Option 2, where income for charged garden waste services is key, and lowest in Organics Option 2, which incorporates the additional cost of collecting food waste without the saving associated with separate food waste treatment.

Recycling rates and carbon savings are highest in Co-design Option 1, with Co-design Option 2 closely behind on both measures. Organics Options 2 has a very similar recycling rate to the Co-design Options, but the change in organic waste treatment (a shift away from anaerobic digestion) results in a more pronounced gap in carbon performance. The poor performance of mixed organics treatment in carbon terms can be seen by comparing Organics Option 2 with Organics Option 1, which has a lower recycling rate due to less food waste being collected, but which performs better in carbon terms as the carbon

benefit of collecting and treating food waste in in-vessel composters is worse than collecting and treating via incineration.

Organic and Co-design Options differ in food coverage and the approach to how food is collected. Co-design Option 2 is different in that all garden collections are charged. This change is why the recycling rate is 0.6% percentage points lower in Co-design Option 2, compared with Co-design Option 1. Table 4-2 shows how the Organic Options would compare if local authorities with free garden waste, which include those with no service in the baseline, switched to charged.

Compared with Co-design Option 1, the introduction of charging for garden waste in areas that currently provide free services (Co-design Option 2) reduces the total tonnage of material collected for recycling almost as much as the lower food coverage in Organics Option 2. Garden waste yields are much higher than food yields across a greater number of households, and the tonnage reduction at the kerbside is larger, overall. However, a lot of garden waste is diverted to HWRCs, which means the overall impact is less than reducing food coverage from UR1-5 to UR1-4.

Table 4-2: Impact of charged garden waste on Organics Options

Waste stream	Organics Option 1	Organics Option 2	Co-design Option 1	Co-design Option 2
Recycling rate	45.9%	46.4%	47.2%	46.6%
Free garden waste	45.9%	46.4%	47.2%	n/a
Impact of charged garden waste	-	-	-	-0.6%
Charged garden waste	45.3%	45.8%	n/a	46.6%

Table 4-3 shows the results for the Organics Options in more detail.

Table 4-3: Detailed Organics Options results

Cost, performance and carbon results	Organics Option 1	Organics Option 2
New capital costs	£62,420k	£77,710k
<i>Comprising</i>		
Vehicles	£26,470k	£36,810k
Containers	£35,950k	£40,900k
Change in annual revenue costs	-£12,190k	-£5,040k
<i>Comprising</i>		
Container replacement	£530k	£980k
Treatment of waste diverted from HWRCs	£8,480k	£8,480k
Garden/mixed organic treatment	£2,400k	£3,410k
Food treatment	£930k	£930k
Glass treatment/income	-£110k	-£110k
Recycling treatment/income	-£6,540k	-£6,540k
Residual treatment	-£18,580k	-£20,590k
Garden/mixed organic collection	£5,690k	£4,690k
Food collection	£4,410k	£13,170k
Glass collection	£70k	£70k
Recycling collection	£2,740k	£2,740k
Residual collection	-£10,680k	-£10,740k
Garden waste revenue	-£1,530k	-£1,530k
Recycling rate	45.9%	46.4%
Increase over baseline	2.4%	3.0%
Carbon emissions change (tonnes CO₂e per annum)	-50,800	-50,300

4.2 Infrastructure

Data held by Eunomia indicates that there are currently 121 waste transfer stations (WTS) in use by local authorities across Scotland – although this is subject to some uncertainty, as not all local authorities submitted data containing information about their waste collection infrastructure. Some facilities are owned by the local authority; others are owned by third parties but used by the authority. Some may not be used for all material streams; but it is possible that the changes necessitated by the CoP could lead to facilities being used differently.

The collection infrastructure impacts of the Organics Options take the form of:

- Additional tipping facilities for garden waste, if this is not currently collected.
- An additional bay so that paper and card can be stored separately from plastic, metal and glass packaging.

No additional authorities are assumed to introduce separately-collected food waste, and so there are no adaptations required to accommodate food waste.

An analysis of the current services offered by each authority and the number of WTS that they use shows the following potential need for changes at some sites. The following analysis is based on modelling. The assumptions for this modelling are explained in the Co-Design Report.

4.2.1 Collection Infrastructure

4.2.1.1 Depots

Table 4-4 details the number of local authorities where the measures taken forward for inclusion in the CoP would be expected to have an impact on depot arrangements. It also shows the number of depots involved, and the modelled number of additional collection vehicle and staff parking spaces required. The majority of authorities are affected by the changes in one or more ways in both Organics Options, but fewer than the 24 in the recommended option in the previous study. The number of collection vehicle and staff parking spaces is also reduced (from 162 and 468 respectively), principally due to fewer additional food waste vehicles and crews being required.

Table 4-4: Local authorities with additional staff or vehicles

Type of change	Number of authorities affected	Depots affected	Additional vehicle parking spaces required	Additional staff parking spaces required
Any – Organics 1	15	48	72	216
Any – Organics 2	22	71	115	345

The proposed CoP could have several impacts on depots, due to increases in vehicles and the associated crew. The assumptions used are explained in the Co-Design Report. Cost estimates, based on the underlying assumptions explained above, are set out in Table 4-5.

Table 4-5: Modelled depot costs

Item	Unit Cost	Requirement	Organics Option 1 Units	Organics Option 1 Cost	Organics Option 2 Units	Organics Option 2 Cost
Hardstanding (Collection vehicles)	£122.50 per m ²	10m ² per vehicle	72	£157.2k	115	£231.6k
Hardstanding (Staff vehicles)	£122.50 per m ²	3m ² per space	216	£75.0k	345	£110.3k
Welfare facilities	£1,350 per m ²	Sites with >10 additional staff	1	£0.08m	3	£0.30m
Redesign	£1.75m	Depot with additional hardstanding of more than 75m ²	1	£1.75m	3	£5.25m
Relocation	£4m	Depot with additional hardstanding of more than 150m ²	0	£0	0	£0
Total				£2.1 m		£5.9m

The need for redesign or relocation at depots is very uncertain, and so figures are provided only to give an indication of scale. To show the implications of the uncertainty, two sensitivity scenarios were explored.

- If depots that need more than 50m² of additional hardstanding require re-design, the cost would increase to £9.0m for Organics 1 and £18.1m for Organics 2, compared with £42.7m for the equivalent sensitivity in the previous study.
- If it is only depots that need more than 100m² of additional hardstanding that require re-design, the cost would reduce to £0.3m for Organics 1 and £2.4m for Organics 2, compared with £9.6m for the equivalent sensitivity in the previous study.

4.2.1.2 Waste transfer stations

Service changes arising from the CoP would lead to a need to upgrade waste transfer stations in order to handle additional separated waste streams. The assumptions used are explained in the Co-Design Report. Each authority might need to accommodate up to two changes at a WTS. The assumptions made regarding each of these changes and the resulting costs are shown in Table 4-6.

Eunomia has assumed that:

- WTS do not have spare bays, or ones that could be repurposed e.g. because two bays are being used for the same material.
- Capacity cannot be obtained from third party WTS operators. This would incur a fee for tipping at the site but would avoid the need for capital investment.
- A WTS might often be able to accommodate one new bay without major redesign.
- Where new bays are needed for both separate fibres and garden waste, a more substantial re-design would be needed to accommodate the additional storage.

On this basis, the investment required for each option would be £22.2 million. However, these are broad-brush assumptions. To reflect this uncertainty, we have also calculated the cost if every site needing one additional bay were to require a re-design. This would lead to extra costs of £21.6 million, leading to a total investment of £43.8 million.

These costs are identical between options because the scope of the materials collected and the locations covered is the same in each case. The only variation is the frequency of collections, and thus the number of vehicles required. This affects depot arrangements, but should not result in differential impacts on WTSs so long as onward transportation can be arranged at sufficient frequency.

In some cases, a WTS may have no unused space within the parcel of land it occupies, and no flexibility to redesign its layout to accommodate additional bays. In these circumstances, re-location may be required. It is estimated that for each waste transfer station relocation, an additional £1.8m cost would be incurred. As discussed in relation to relocation of depots, this cost should be treated as highly indicative, because the cost of relocation can vary considerably depending on factors such as land values, the complexity of planning/permitting and the level of construction costs incurred.

Table 4-6: Modelled waste transfer station costs

Item	Unit Cost	Organics	Organics	Organics	Organics
		Option 1	Option 1	Option 2	Option 2
		Units	Cost	Units	Cost
Food waste	£400k per site	0 adding food waste	£0	0 adding food waste	£0
	£100k per site	0 switching from mixed organics	£0	0 switching from mixed organics	£0
Garden waste	£35k per site (open bay) ⁵	29	£1.1m	29	£1.1m
Separate fibres	£100k per site (covered bay) ⁶	7	£0.7m	7	£0.7m
Re-design	£1.2m per site for authorities needing two or more new bays	17	£20.4m	17	£20.4m
Total			£22.2m		£22.2m
<i>Additional Re-design</i>	<i>£1.2m per site (if all sites needing an extra bay require redesign)</i>	<i>18 (additional sites requiring redesign)</i>	<i>£21.6m</i>	<i>18 (additional sites requiring redesign)</i>	<i>£21.6m</i>
<i>Total, including additional re-design</i>			<i>£43.8m</i>		<i>£43.8m</i>

4.2.2 Overall cost and number of authorities affected

Taking the figures for depots and WTSs together, the central estimate of costs would be as shown in Table 4-7. However, if more collection infrastructure than anticipated were to require relocation rather than simpler redesign, the cost could increase significantly. While we have endeavoured to make

⁵ As far as we are aware, there is no general requirement to use covered bays for garden waste, though it may be required in some cases depending on individual site planning and permit conditions.

⁶ A covered bay would generally be preferred for paper/card to avoid material getting wet and the risk of material escaping due to wind.

reasonable estimates, a more reliable figure could only be produced through a detailed site-by-site analysis.

Table 4-7: Total collection infrastructure costs

Item	Previous Study	Organics Option 1	Organics Option 2
Depot Costs	£23.5m	£2.1m	£9.6m
WTS Costs	£30.7m	£22.2m	£22.2m
Total	£54.2m	£24.3 m	£31.8m

Table 4-8 shows the number of local authorities potentially affected (subject to the data limitations discussed above) by CoP collection system changes and therefore requiring collection infrastructure changes.

Table 4-8: Waste transfer station requirements by local authority

	Separate fibres	Garden waste	Number of local authorities	Number of WTSs
No change			19+ Highland	85
1 change	●		6	7
		●	4	12
2 changes	●	●	3	17
Authorities	9	7		
Sites	20	29		

19 authorities' collection infrastructure would be unaffected by the proposal. 10 authorities would have to make one change, while three would make two changes. Some authorities (e.g. Highland) would have to make a change at some of their transfer stations, but not at others, due to different baseline services being in place.

4.2.3 Treatment infrastructure

In addition to collection infrastructure, the Organics Options would result in a greater amount of separate food waste and mixed organics being collected, although separate food waste would not extend to any local authorities that do not already have services in place. This would result from restrictions on weekly residual waste capacity, filling in current gaps in provision in UR1-3 and the extension of services to UR4. There would also be two authorities that currently offer garden waste services at HWRCs only that would need to introduce garden waste collection services. The resulting additional material will require treatment.

The modelling carried out assumes that separately collected food treated via anaerobic digestion (AD) plants; mixed organics via in-vessel composters (IVC); and separately collected garden waste via open air windrow (OAW). The necessary treatment therefore needs to be in place to handle the additional material. The tonnage changes resulting from the Organics options are shown in Table 4-9.

Table 4-9: Tonnage changes

	Baseline	Organics 1	Organics 2	Organics 1	Organics 2
	Tonnes	Tonnes	Tonnes	Change	Change
Separate Garden	84,500	118,400	118,400	+33,900	+33,900
Separate Food	47,700	64,500	65,300	+16,800	+17,600
MO Garden	135,300	135,300	135,300	0	0
MO Food	30,500	37,400	49,900	+6,900	+19,400

4.2.3.1 Food waste

There are currently five AD plants in Scotland that are used by local authorities to treat separately collected food waste. None of these is further north than Perth. There are also two dry AD plants that treat local authority mixed organics and numerous on-farm AD plants that could potentially receive local authority food waste.

The need for additional AD capacity would arise in the 19 local authority areas that already have separate food waste collections. Most of these are in the central belt of Scotland. The majority see increases of only a few hundred tonnes per annum, which seem likely to be able to be accommodated within existing contracts. The largest increases are in Edinburgh (~4,500 tonnes) and the Highlands (~3,300 tonnes). Some other authorities see a smaller tonnage increase, but a significant percentage increase (the most extreme example being Argyll & Bute, which increases by ~600 tonnes, representing an increase of more than 100%).

A full analysis of where additional capacity would need to be constructed and how the locations could be optimised to balance haulage costs and capital costs would require an in-depth study.

4.2.3.2 Garden waste

There are currently 15 open air windrows (OAWs) that are used by local authorities in Scotland. Only the six authorities with no current garden waste collection service receive additional kerbside garden waste as a result of the Organics Options. One authority, East Dunbartonshire, has a reduction in tonnage. This is because, since the baseline year of 2023, the authority has moved from a free to a charged garden waste service, and so the modelled options reflect this change. Consequently, the total in Table 4-10 is greater than the net change for separate garden waste in Table 4-9.

Table 4-10: Authorities with garden waste tonnage increases

Authority	Organics Options Kerbside Tonnes Change	HWRC Tonnes Change	Net Change
Aberdeenshire	14,990	-3,477	11,513
Scottish Borders	6,295	-1,530	4,765
Argyll and Bute	5,176	-1,556	3,620
Orkney Islands	1,252	-397	855
Shetland Islands	1,417	0 ¹	1,417
Dumfries and Galloway	6,180	-1,019	5,161
Total	35,310	-4,502	30,808
Note	¹ Shetland Island allows garden waste to be dropped off at HWRCs, but does not report any garden waste tonnage. No diversion from HWRCs has therefore been included.		

Each of these authorities has current arrangements in place to receive and treat garden waste that is collected via HWRCs. While the kerbside tonnage represents an increase, in many instances there may be scope to manage much of the additional material through the existing treatment route. The largest increase in tonnage is in Aberdeenshire, and this could plausibly be expected to require a new or expanded open air windrow treatment facility to build.

4.2.3.3 Mixed organics

Mixed organic waste is assumed to be treated through IVCs. In practice, there are also two dry AD facilities that are used by councils in Comhairle nan Eilean Siar and Fife. There is no change in the number of authorities collecting mixed organics as a result of the Organics Options, and no increase in garden waste collected. However, food waste increases in both options.

In the context of the total tonnage of mixed organic waste being collected by these authorities, the increase in food waste tonnage is small. It is likely that the additional tonnage could be treated through existing contracts, and would not require new infrastructure to be built. However, some IVC and dry AD facilities can be sensitive to the relative proportions of food and garden waste that are treated, and so an increase in food waste could pose some operational challenges.

5.0 Conclusions

The results of the analysis are presented in Table 5-1.

Table 5-1: Results summary

Headline results		Organics 1	Organics 2	Co-design Option 1	Co-design Option 2
Recycling rate		45.9%	46.4%	47.2%	46.6%
Carbon emissions change (tonnes CO ₂ e per annum)		- 50,800	- 50,300	- 62,500	- 61,600
New capital costs		£62.42m	£77.71m	£80.09m	£79.55m
Change in annual revenue costs		- £12.19m	- £5.04m	- £11.36m	- £28.04m
Depot/WTS costs		£24.3m	£31.8m	£54.2m	£54.2m
System:	Residual	60 litres per week for individual/low-rise, communal unchanged			
	Recycling	Separate fibres collections with glass unchanged			
	Food	UR1-4 coverage. Separate or mixed with garden, as per the baseline (2023)		UR1-5+ coverage. All separate collections	
	Garden	As per the baseline. Authorities without garden introduce a free service			Charged in all authorities

Recycling rates are also higher under the Co-design Options, although the difference is less pronounced than for carbon savings. This reflects the narrower food waste collection coverage under the Organics Options, alongside differences in collection frequency. The difference is particularly narrow between Organics Option 2 and Co-design Option 2 (46.4% vs 46.6%, respectively), as the reduction in the tonnage of food waste captured is largely offset by increased garden waste recycling. This is because all authorities offer charged garden waste collections under Co-design Option 2.

Compared with Co-design Option 1, the introduction of charging for garden waste in areas that currently provide free services (Co-design Option 2) reduces the total tonnage of material collected for recycling almost as much as the lower food coverage in Organics Option 2. The effect of charging is that some households stop using the kerbside garden waste service. However, much of the material is diverted to HWRCs rather than residual waste, and so the downward impact on recycling rate is not as great as might be expected from the impact on kerbside collection. Therefore, despite food yields per household being smaller than garden waste yields, the net tonnage reduction from moving from UR1-5 to UR1-4 is marginally greater than the effect of wider use of charged garden services.

The Co-design Options deliver the strongest environmental outcomes overall, particularly in terms of carbon savings. Both achieve annual carbon savings more than 10,000 tonnes CO₂e greater than the Organics Options. This reflects differences in the quantities of material captured, as well as the continued treatment of mixed organics through in-vessel composting rather than anaerobic digestion. Thus, despite Organics Option 2 and Co-design Option 2 having similar recycling performance, Co-design Option 2 has a substantially greater carbon benefit.

All options deliver annual revenue savings relative to the baseline, primarily through reductions in residual waste collection and treatment costs. Co-design Option 2 delivers the greatest saving (£28.0 million), largely due to income from garden waste charging. Organics Option 1 delivers a marginally greater saving than Co-design Option 1 (£12.2 million compared with £11.4 million), reflecting its less extensive collection requirements. Organics Option 2 delivers the smallest saving (£5.0 million), as the additional costs of more frequent food waste collections offset much of the savings from reduced residual waste collections.

The differences between the options are also reflected in the capital investment and infrastructure required for implementation. Organics Option 1 has the lowest modelled vehicle and container capital costs (£62.4 million), reflecting its narrower food waste collection coverage and retention of existing collection frequencies. By contrast, Organics Option 2 requires investment of £77.7 million, only marginally below the Co-design Options (£79.6–£80.1 million). This is partly because the additional food waste collections require large refuse collection vehicles (RCVs), which are considerably more expensive per unit than dedicated food waste collection vehicles.

While both Organics Options reduce the extent of changes required to collection depots, investment in collection infrastructure remains necessary. Total collection infrastructure costs are estimated at £24.3 million for Organics Option 1 and £31.8 million for Organics Option 2, compared with £54.2 million in the previous Co-design study. The higher costs associated with Organics Option 2 reflect the greater need for depot modifications to accommodate additional food waste collections, while waste transfer station requirements are the same under both options. A further £8–14 million is estimated to be required for additional treatment infrastructure, although much of the additional mixed organics tonnage is expected to be accommodated within existing facilities. These estimates remain subject to considerable uncertainty, particularly regarding existing capacity and site-specific requirements.

Appendix

A.1.0 Existing research on organic performance

A.1.1 Factors influencing food waste quantity

WRAP's 2026 Household Food Waste Collections Guide⁷ identifies several factors that influence the quantity of food waste collected through kerbside schemes. These are summarised in Table A - 1.

Table A - 1: Factors influencing food yields identified in WRAP's 2026 guide⁷

Factor	Effect
System design (whether food is collected separately or mixed with garden waste)	Separate food waste collections are more successful in capturing food waste for recycling than collections where food waste is collected mixed with garden waste.
Food collection frequency	When food waste is collected mixed with garden waste and that service is provided weekly, the amount of food waste collected is greater than for a service where mixed food and garden waste is collected fortnightly.
Residual collection frequency	Yields of food waste collected for recycling are strongly affected by the frequency of residual waste collections.
Deprivation	Generally, the greater the level of deprivation, the lower the overall yield of food waste collected for recycling.
Property type	The type of property and its tenure will have an impact on participation.
Provision of caddy liners	Liners and the cost and accessibility of liners influence participation.
Service quality	Good quality services will encourage participation. Conversely, negative experiences may discourage participation.

Benchmarking accounts for system design by isolating system changes. Additionally:

- Deprivation was accounted for when benchmarking food waste as part of Co-design by placing authorities into one of three groups: low, mid and high.
- Individual/low rise properties were considered separately from communal properties. The key difference between these property types is that individual/low rise households have to present their containers for collection in accordance with a published schedule, whereas householders in

⁷ WRAP (2026) *op. cit*

communal properties deposit their individual waste in communal bins, where the collection schedule is not necessarily transparent to the resident.

The provision of liners and service quality was not assumed to change.

A.1.2 Quantity of food in mixed organic collections

A.1.2.1 Reporting and composition

Where WasteDataFlow (WDF) reports mixed organic waste under the category 'Mixed garden and food waste', SEPA reports food and garden tonnages separately. This is based on a reporting assumption under which co-collected food and garden is split 25%/75% into the categories: 'Animal and mixed food waste' and 'Vegetal wastes'. SEPA does not provide a source for this assumption, which has been in place since 2015.⁸

Between 2011 to 2014, Zero Waste Scotland undertook seven compositional studies of kerbside mixed food and garden waste. Given both the timing and the finding of these studies, they are likely to have informed the SEPA's reporting assumption. While Zero Waste Scotland subsequently published the composition of household waste at the kerbside in 2021-23⁹ the mixed organics composition data used in that analysis was sourced from the earlier 2011-2014 studies. As a result, these studies remain the most recent evidence base for the assumed split. However, for the purposes of this analysis it is more accurate to account for local variations and specific circumstances (e.g. whether an area has a lot of large gardens, or relatively few). Instead, benchmarking must reasonably identify the quantity of garden and food, separately. Findings from publicly available data are shown in A.1.2.2.

A.1.2.2 Findings from existing research

The most detailed information on the makeup of mixed food and garden collections can be found in WRAP's 2010¹⁰ report. This gave the results of compositional analysis conducted on samples from six authorities and found that food made up just over 10% of mixed organics when collected fortnightly (Table A - 2).

⁸ SEPA (2016) *Household waste – Summary data 2015*. Available at: <https://www.sepa.org.uk/media/219489/2015-household-waste-summary-data-with-commentary.pdf>

⁹ Zero Waste Scotland (2023) *The composition of household waste at the kerbside in 2021-23*. Available at: <https://cdn.zerowastescotland.org.uk/managed-downloads/mf-zwfrku-1696500258d>

¹⁰ WRAP (2010) *op. cit*

Table A - 2: Food and garden composition in mixed organic collections¹¹

Metric	Weekly mixed organic collections		Fortnightly mixed organic collections	
	WRAP Data	Excluding card	WRAP Data	Excluding card
% of food waste	26.6	30.0	9.3	10.6
% of garden waste	62.0	70.0	78.8	89.4
% of cardboard	4.4	-	6.2	-

The best sourced publicly available evidence on mixed organics performance can be found in WRAP's 2016 report¹². This draws from the 2009 separate food waste trials,¹³ 2010 analysis of mixed food and garden schemes,¹⁴ and 2014 unpublished data on material splits in food collections. The findings are shown in Table A - 3 together with a 'mixed organic ratio' that shows the expected performance of food in mixed organic collections compared with separate weekly food collections.

Table A - 3: Estimating baseline yield of food in mixed organics, WRAP (2016)¹⁵

Data Point, yields are in kg/hh/yr	Weekly residual waste collections	Fortnightly residual waste collections ¹
Separate weekly food	68	78
Food in weekly mixed organics	28.1	41.3
Weekly mixed organic performance ratio	0.41	0.53
Food in fortnightly mixed organics	22.5	30.4
Fortnightly mixed organic performance ratio	0.33	0.39

The WRAP data covers six authorities with each food collection system and includes composition data. One thing to note, however, is that the separate food figures are towards the high end. This may be because data for the separate food collections was collected as part of trials.

¹¹ WRAP (2016) *op. cit*

¹² WRAP (2016) *op. cit*

¹³ WRAP (2009) *Evaluation of the WRAP Separate Food Waste Collection Trials*. Available at:

<https://www.wrap.ngo/sites/default/files/2021-08/Evaluation%20of%20the%20WRAP%20FW%20Collection%20Trials%20Update%20June%202009.pdf>

¹⁴ WRAP (2010) *op. cit*

¹⁵ WRAP (2016) *op. cit*.

A.2.0 Fortnightly food waste benchmarking

Inverclyde is unique amongst Scottish authorities in offering a fortnightly separate collection as its main food waste service. In Organics 1, Inverclyde is modelled to continue to collect separate food waste fortnightly. Benchmarking sought to estimate the impact of 60-litre restricted residual waste on the quantity of food waste when collected fortnightly.

Inverclyde's historical yields were examined in Table A - 4. This showed that following the transition from weekly to fortnightly food collections, the yield decreased by just over 39%. (Note that 2020 was excluded due to the impact of the Covid pandemic and 2022 was excluded as this is when the service transitioned from weekly to fortnightly).

Table A - 4: Inverclyde food waste yield (kg/hh/yr) of individual/low-rise households

Food waste	2018	2019	2020	2021	2022	2023	2024
Frequency	Weekly				Year of	Fortnightly	
Yield	52.1	50.5	40.1	44.3	change	29.1	30.3
Average yield	49.0 (excluding 2020)				↓ 39.4%	29.7	

All the Scottish authorities with 240-litre fortnightly residual waste collections and separate food waste collections are shown in Table A - 5.

- Capture rates can provide a fairer comparison between areas that have different waste arisings. However, Inverclyde's residual arisings are anomalously low (the lowest in Scotland and 34% lowest than the next lowest). So, for Inverclyde, benchmarking focussed on yield.
- Inverclyde's yield is 42% lower than the median yield of the weekly food authorities (50.1kg/hh/yr). While these authorities differ from Inverclyde to varying degrees, the median yield is very close to Inverclyde's historical weekly performance.

Table A - 5: Food waste yield (kg/hh/yr) of individual/low-rise households with 240-litre fortnightly residual waste collections

Authority	Deprivation	Rurality	Food waste frequency	2023 Yield (kg/hh/yr) and capture (%)	Median
Inverclyde	High	Low	Fortnightly	29.1 (34%)	29.1 (34%)
Dundee	High	Low	Weekly	26.4 (15%)	50.1 (33%)
East Dunbartonshire	Low	Mixed (urban)	Weekly	42.8 (33%)	
Midlothian	Mid	Mixed (rural)	Weekly	47.1 (29%)	
East Lothian	Mid	Mixed (rural)	Weekly	53.1 (36%)	
Highland	Mid	Very rural	Weekly	61.8 (41%)	
Dumfries & Galloway	High	Rural	Weekly	68.3 (32%)	

The yields modelled for Inverclyde are summarised in Table A - 6.

Reducing the residual waste capacity to 60-litres per week, food yields were predicted to increase from 29.1kg/hh/yr to 38.4kg/hh/yr whilst maintaining fortnightly food waste collections. Historic performance and examples from other authorities with weekly food waste suggest that Inverclyde's food waste yields would increase further if collections were increased from fortnightly to weekly. Where a weekly food waste service was introduced alongside the 60-litres per week residual waste capacity restriction, it was predicted that food waste yields would rise further to 61.6kg/hh/yr.

Communal properties are not expected to see the same residual waste restrictions and so do not see a similar yield increase in these options.

Table A - 6: System and food waste yield (kg/hh/yr) modelled

Inverclyde	Baseline system	Organic 1	Baseline with weekly food	Organic 2 (As per Co-design)
Residual collection frequency	Fortnightly	Four-weekly	Fortnightly	Four-weekly
Food collection frequency	Fortnightly	Fortnightly	Weekly	Weekly
Yield – individual/low rise	29.1	38.4	46.8	61.6
Yield – communal	15.4	15.4	15.4	15.4

A.3.0 Organic waste arisings (2023)

2023 mixed organics yields based on reported data are presented in Table A - 7. There is no relationship in the data between organic yields and residual frequency. However, of the fourteen authorities with mixed organics collections, only six report garden waste arisings at HWRCs. If the reported mixed organic tonnage includes HWRC garden waste arisings, the reported yield through kerbside collections would be inflated in these authorities. This inflation could affect the conclusion that there is no relationship between residual frequency and organic yields, but the data does not allow any firmer conclusion to be drawn.

Generally, charged systems have lower garden waste arisings than do free ones; but in this data set, the charged systems report higher yields. This may be because in Scotland many of the authorities that offer free garden waste are urban areas with high deprivation. High deprivation is associated with lower food waste yields and urban areas are likely to have lower garden waste arisings. This might explain why yields in Scotland are lower for garden waste services that are free. By contrast, all the authorities in Scotland in the low deprivation group provide a charged garden waste service.

Table A - 7: Mixed organic yields 2023 for individual low-rise properties

Local authority	Rurality group	Deprivation group	Residual frequency	Residual capacity (litres per week)	Mixed organics frequency	Garden system	2023 Yield (kg/hh/yr) (Rank in brackets)
Stirling	Mixed (Rural)	Mid	4-Weekly	60	Fortnightly	Charged	199.5
Perth & Kinross	Rural and inaccessible	Mid	Fortnightly	70	Fortnightly	Charged	231.7
Renfrewshire	Urban	High	3-Weekly	80	Fortnightly	Charged	157.4
East Renfrewshire	Mixed (Urban)	Low	3-Weekly	80	Weekly	Charged	253.5
Moray	Mixed (Rural)	Mid	3-Weekly	80	Fortnightly	Charged	182.4
Aberdeen City	Urban	Low	Fortnightly	90	Fortnightly	Charged	193.0
West Lothian	Mixed (Urban)	High	Fortnightly	70	Fortnightly	Free	191.9
Fife	Mixed (Urban)	Mid	Fortnightly	70	Fortnightly	Free	206.8
North Ayrshire	Mixed (Urban)	High	3-Weekly	80	Fortnightly	Free	166.1
Glasgow City	Urban	High	3-Weekly	80	Fortnightly	Free	170.5
North Lanarkshire	Urban	High	3-Weekly	80	Fortnightly	Free	167.7
Western Isles	Rural and inaccessible	Mid	3-Weekly	80	3-Weekly	Free	163.2
West Dunbartonshire	Urban	High	Fortnightly	120	Fortnightly	Free	133.9
South Lanarkshire	Mixed (Urban)	Mid	Fortnightly	120	Fortnightly	Free	161.9
Notes	¹ Yields based on number on individual low-rise properties on collection rounds.						

The 2023 mixed organics yields were also analysed in comparison with the effective weekly residual capacity offered by the authority (Table A - 8). Where there is more than one data point for a particular residual capacity and mixed organics frequency, the average yield is presented. However, some data points represent a single authority. The rank in the last column is from 1 (highest), by garden system. Looking at the data in this way suggests an inverse relationship between residual waste capacity and mixed organic yield, within each garden system's data.

Table A - 8: Average mixed organic yields by effectively weekly residual capacity

Garden system	Residual capacity (litres per week)	Authority or number of authorities in group	Yield (kg/hh/yr)	Rank (highest =1)
Charged	60	Stirling	199.5	2
	70	Perth & Kinross	231.7	1
	80	3	197.8	3
	90	Aberdeen City	193.0	4
Free	70	2	199.4	1
	80	4	166.9	2
	120	2	147.9	3

A.4.0 Food in organics case studies

A.4.1 Long list

Scheme data dating back to 2012/13 was analysed to identify local authorities that had changed their organics system. Historic information was checked by searching news articles and public documents (e.g. Committee reports).

Table A - 9: Local authorities that changed from separate collections to mixed organics

Local authority	Country	Waste function	Year ¹	Suitable case study	Details
Causeway Coast and Glens	N Ireland	Unitary	2015/16	No	Incomplete and inconsistent historic data.
North Lanarkshire	Scotland	Unitary	2017	No	Reduced residual collection frequency from October 2017.
Renfrewshire	Scotland	Unitary	2017/18	No	Garden waste reported in WDF prior to 2017 and reduced residual collection frequency from 2018.
Stirling	Scotland	Unitary	2016/17	No	No garden waste reported in WDF prior to 2017.
Notes	¹ Refers to the year in which the new organics collection system was reported in WDF.				

Table A - 10: Local authorities that changed from mixed organics to separate collections

Local authority	Country	Waste function	Year ¹	Suitable case study	Other changes
Barnet	England	WCA	2013/14	Yes	Changed from mixed organics to separate collections between October 2013 and March

Local authority	Country	Waste function	Year ¹	Suitable case study	Other changes
					2014. Food collections ceased in Q3 of 2018/19.
Bexley	England	Unitary	2015/16	No	Introduced charged garden waste at the same time.
Blackpool	England	Unitary	2013/14	Yes	Introduced mixed organics July 2012. Stopped collected food January 2014. Introduced charging for garden waste in 2016.
Brent, Mid Devon, Teignbridge, Three Rivers	England	WCA	2015/16	No	Introduced charged garden waste at the same time.
Broxbourne	England	WCA	2016/17	No	Introduced charged garden waste at the same time. Reduced residual collection frequency.
Cannock Chase	England	WCA	2015/16	Yes	Stopped collecting food waste 1 February 2016.
Dacorum	England	WCA	2015/16	Yes	Changed from mixed organics with cardboard to separate collections between January and March 2015.
Fenland	England	WCA	2015/16	No	Introduced charged garden waste at the same time.
Forest Heath	England	WCA	2015/16	No	Introduced charged garden waste at the same time.

Local authority	Country	Waste function	Year ¹	Suitable case study	Other changes
Fylde	England	WCA	2015/16	Yes	Stopped collected food 1 April 2016.
Lancaster	England	WCA	2015/16	Yes	Stopped collected food 1 April 2016.
St Edmundsbury	England	WCA	2015/16	No	Stopped collected food 31 March 2016. Introduced charged garden waste at the same time.
Teignbridge	England	WCA	2015/16	No	Changed from mixed organics to separate food collections from Q4 2015/16. Introduced charged garden waste just before this in June 2015.
Wyre	England	WCA	2015/16	No	Stopped collected food 1 April 2016. Introduced charged garden waste at the same time.
Harrow, Waveney (now part of East Suffolk)	England	WCA	2016/17	No	Introduced charged garden waste at the same time.
St Albans	England	WCA	2016/17	Yes	Started collecting food separately in July 2016.
East Staffs	England	WCA	2017/18	Yes	Stopped collected food April 2017.
North Devon	England	WCA	2017/18	No	Introduced charged garden waste at the same time.
Torridge	England	WCA	2018/19	No	Introduced charged garden waste at the same time.

Local authority	Country	Waste function	Year ¹	Suitable case study	Other changes
					Reduced residual collection frequency.
West Berkshire	England	Unitary	2018/19	No	Introduced charged garden waste at the same time.
Enfield	England	WCA	2019/20	No	Introduced charged garden waste at the same time. Reduced residual collection frequency from 2020/21.
Southwark	England	Unitary	2019/20	No	Introduced charged garden waste at the same time.
Tonbridge and Malling, Tonbridge Wells	England	WCA	2019/20	No	Introduced charged garden waste at the same time.
West Lothian	Scotland	Unitary	2020/21	Yes	Rolled out 140-litre bins in 2016, leaving only two years data before mixed organics was introduced.
Watford	England	WCA	2021/22	No	Introduced charged garden waste at the same time.
Notes ¹ Refers to the year in which the new organics collection system was reported in WDF.					

A.4.2 Data

The following tables detail the findings of the local authorities selected.

A.4.2.1 Barnet

Table A - 11: Barnet – change in arisings when mixed organics separated

	Mixed garden and food waste	Separate garden and food
Data period	2011/12 to 2012/13	2014/15 to 2016/17
Months	36	36
Tonnes collected	56,940	60,721 (+6.6%)
Summary:	The tonnage increased slightly when garden and food were separated. This could suggest higher food yields when separately collected. If all properties received the service, the food waste yield was about 37.1 kg/hh/yr. Assuming the change in tonnage is due to food, the food in mixed organics would have been around 34.8 kg/hh/yr.	

A.4.2.2 Blackpool

Table A - 12: Blackpool – change in arisings when food removed

	Mixed garden and food waste	Green garden waste only
Data period	Jul-12 to Dec-13	Jul-14 to Dec-15
Months	18	18
Tonnes collected	10,605	10,629
Summary:	The tonnage did not decrease when food waste was removed, indicating minimal food waste in the mixed organic stream.	

A.4.2.3 Cannock Chase

Table A - 13: Cannock Chase – change in arisings when food removed

	Mixed garden and food waste	Green garden waste only
Data period	Jan-13 to Dec-15	Apr-16 to Mar-19
Months	36	36
Tonnes collected	26,254	22,749 (-13.3%)
Summary:	The tonnage decreased by 13.3% when food waste was removed. Assuming the change in tonnage is due to food, the food in mixed organics would have been around 27.6 kg/hh/yr. Separate food collections were introduced 27 April 2026. The council reported collecting 95.4 tonnes in the first week, which would equate to a yield of over 100kg/hh/yr. Tonnages tend to peak initially before stabilising after several months, so this figure will likely come down. A comparison between 2026 and 2013-2015 could be an unfair assessment of the service change – although there are examples where food yields have across this time frame in certain authorities (e.g. Ealing). Despite these caveats, this still suggests separate food collections will have a considerably higher yield.	

A.4.2.4 Dacorum

Table A - 14: Dacorum– change in arisings when mixed organics separated

	Mixed garden, food waste and cardboard	Separate garden, food waste and cardboard
Data period	2011/12 to 2012/13	2014/15 to 2016/17
Months	36	36
Tonnes collected	46,227	50,219 (+8.6%)
Summary:	The tonnage increased when garden, food and cardboard were separated. This analysis relied on using the LAPortal for cardboard estimates, which may not be accurate as the co-mingled recycling composition is an estimate. If all properties received the service, the food waste yield was about 73.0 kg/hh/yr. Assuming the change in tonnage is solely due to food, the food in mixed organics would have been around 67.2 kg/hh/yr.	

A.4.2.5 East Staffordshire

Table A - 15: East Staffordshire – change in arisings when food removed

	Mixed garden and food waste	Green garden waste only
Data period	Apr-14 to Mar-17	Apr-17 to Mar-20
Months	36	36
Tonnes collected	37,333	30,560 (-18.8%)
Summary:	The tonnage decreased by 18.8% when food waste was removed. Assuming the change in tonnage is due to food, the food in mixed organics would have been around 44.7 kg/hh/yr.	

A.4.2.6 West Lothian

Table A - 16: West Lothian – change in arisings when mixed organics separated

	Separate garden and food	Mixed garden and food waste
Data period	2017 and 2018	2022 to 2024
Months	24	36
Average tonnes collected	12,855	12,855 (+8.4%)
Average tonnes recycled	14,923	13,726 (-8.0%)
Summary:	The tonnage increased 8.4% when garden and food were mixed. At 100% coverage food waste yield was ~62.3 kg/hh/yr when separate. Assuming the change in tonnage is due to food, the food in mixed organics would have been around 67.6 kg/hh/yr. However, it is difficult to be confident in the data as West Lothian does not report HWRC garden waste separately. When the amount composted is reviewed, the total decreased by 8.0%. The same calculation would lead to a food yield in the mixed organics of 57.3 kg/hh/yr.	

A.4.2.7 Summary

Table A - 17: Case studies findings for local authorities that changed organic systems

Local authority (waste function, deprivation)	Details of change	Year ¹	Impact	Food yield: separate	Food yield: mixed	Ratio of mixed to separate
WRAP findings	Fortnightly residual, weekly food waste vs weekly mixed organics	n/a	Higher yield and capture when food collected separately	78	41.3	0.53
	As above but using the Scotland 2023 average yield		Higher yield when food collected separately	48.6	41.3	0.85
WRAP findings	Fortnightly residual, weekly food waste vs fortnightly mixed organics	n/a	Higher yield and capture when food collected separately	78	30.4	0.39
	As above but using the Scotland 2023 average yield		Higher yield when food collected separately	48.6	30.4	0.63

Local authority (waste function, deprivation)	Details of change	Year ¹	Impact	Food yield: separate	Food yield: mixed	Ratio of mixed to separate
Barnet (WCA, Mid)	Changed from mixed organics to separate collections between October 2013 and March 2014. Food collections ceased in Q3 of 2018/19.	2013/14	Tonnages increased by 6.6% when food and garden were separated	37.1	34.8	0.94
Blackpool (Unitary, High)	Introduced mixed organics July 2012. Stopped collected food January 2014. Introduced charging for garden waste in 2016.	2013/14	The tonnage did not decrease when food waste was removed.	0	0	-
Cannock Chase (WCA, Mid)	Stopped collecting food waste 1 February 2016.	2015/16	The tonnage decreased by 13.3% when food waste was removed. Indicative yield from separate collections, which commenced in Apr-26 was over 107.6kg/hh/yr.	(107.6) 81.1 ²	27.6	(0.26) 0.34

Local authority (waste function, deprivation)	Details of change	Year ¹	Impact	Food yield: separate	Food yield: mixed	Ratio of mixed to separate
Dacorum (WCA, Low)	Changed from mixed organics with cardboard to separate collections between January and March 2015.	2015/16	The tonnage increased by 8.6% when garden, food and cardboard were separated.	73.0	67.2	0.92
West Lothian (Unitary, High)	Stopped collected food 1 April 2016	2015/16	As HWRC garden waste was not separately reported, the amount composted was compared. This decreased by 8.0%.	62.3	57.3	0.92
			The tonnage collected increased by 8.4% when garden and food and cardboard were mixed.	62.3	67.6	1.08
Notes	¹ Refers to the year in which the new organics collection system was reported in WDF. ² Predicted using WRAP Ready Reckoner.					

A.4.3 Findings

The aim of the research was to find authorities that had switched from mixed organics to separate food and garden. Comparing tonnages before and after the change would help isolate the contribution of food waste to overall organic tonnages. However, owing to the introduction of garden waste charging by many local authorities that made this change, the pool of suitable case studies was limited. The analysis was therefore expanded to include authorities with mixed food and garden waste collections that later discontinued food waste, as any decrease in tonnage would inform estimates of the food waste content of mixed organic collections.

Barnet switched from mixed organics to separate collections between October 2013 and March 2014. Three years of data following the change (2014/15 to 2016/17) were compared with the three years prior (2011/12 to 2012/13) (Table A - 18). By assuming the change in yield was solely due to food waste, it was possible to estimate the amount of food in the mixed organic stream. The data suggests that the food yield per household was 6.2% lower when food was mixed with garden waste.

Table A - 18: Barnet – Estimated mixed organics food yield (weekly residual)

Barnet	Mixed garden and food waste	Separate garden and food
Tonnes collected	56,940	60,721 (+6.6%)
Food yield (kg/hh/yr)	Estimated as 34.8	37.1 average over 3 years

Dacorum switched from mixed organics, including cardboard, to separate collections between January and March 2015. Three years of data from before and after the service change was used to make comparisons (Table A - 19) and suggests that the food yield was 7.9% lower when food was mixed with garden waste.

Table A - 19: Dacorum – Estimated mixed organics food yield (fortnightly residual)

Dacorum	Mixed garden, food and cardboard	Separate garden and food
Tonnes collected	46,227	50,219 (+8.6%)
Food yield (kg/hh/yr)	Estimated as 67.2	73.0 average over 3 years

West Lothian switched from separate food and garden to mixed organics in 2019. As they introduced 140-litre wheeled bins for residual waste in 2016, it was only possible to use data from two years before the change (2017 to 2018). This was compared with the three years after the change and the Covid-19 pandemic (2022 to 2024) (Table A - 20). By assuming the change in yield was solely due to food waste, it was possible to estimate the amount of food in the mixed organic stream. The data suggest that the food yield was 8.4% higher when mixed with garden waste. However, there are possible issues with this figure:

- West Lothian does not report HWRC garden waste separately. If the garden waste tonnage was included in the reported figures for the mixed organic stream, it would inflate the yield.

- SEPA data for organics recycled, which is what counts towards the recycling rate, showed an 8.0% decrease in tonnage. (85.1% of IVC inputs were composted. 5.5% was sent to EfW. Of the remaining 9.4%, some may have gone for further treatment but at least some of this is likely to be mass loss from moisture evaporation and off-gassing of biogenic carbon as carbon dioxide during composting).

Table A - 20: West Lothian – Estimated mixed organics food yield (fortnightly residual)

West Lothian	Separate garden and food	Mixed garden and food waste
Average tonnes collected	12,855	12,855 (+8.4%)
Food yield (kg/hh/yr)	62.3 average over 2 years	Estimated as 67.6
Average tonnes recycled	14,923	13,726 (-8.0%)
Food yield (kg/hh/yr)	62.3 average over 2 years	Estimated as 57.3

A further three authorities were found where a mixed organics service was changed to garden waste only collections (Table A - 21).

- Blackpool's tonnage change was minimal, suggesting there was very little food waste before the service ended.
- The tonnage reduction in Cannock Chase meant it was possible to estimate the amount of food in the mixed organic stream. Separate food collections were introduced 27 April 2026. The council reported collecting 95.4 tonnes in the first week, which would equate to a yield of 107.6kg/hh/yr. This is likely to come down as the scheme beds in. WRAP's Ready Reckoner¹³¹⁶ calculates a yield of 81.1 kg/hh/yr. If the WRAP figure was achieved by Cannock Chase, it would mean that the food yield was 66% lower when mixed with garden waste.
- The tonnage reduction in East Staffordshire meant the amount of food in the mixed organic stream could be estimated. Separate food collections were introduced 27 April 2026. WRAP's Ready Reckoner¹³ calculates a yield of 82.9 kg/hh/yr. If the WRAP figure was achieved by East Staffordshire, it would mean that the food yield was 46% lower when mixed with garden waste.

¹⁶ WRAPs ready reckoner tool is not available online, but the methodology underlying it is explained in WRAP (2009) op. cit.

Table A - 21: Estimated mixed organics food yield from the removal of food waste

	Date of change	Data period (years)		Residual frequency	Annual change in tonnage (%)	Estimated food yield in mixed organics (kg/hh/yr)
		Before	After			
Blackpool	Jul-2012	1.5	1.5	Fortnightly	24 (+0.2)	0
Cannock Chase	Feb-2016	3	3	Fortnightly	-1,168 (-13.3)	27.6
East Staffordshire	Apr-2017	3	3	Fortnightly	-2,258 (-18.8)	44.7

Table A - 22 summarises the data available alongside WRAP's findings, showing the ratio between food yields in mixed organic systems and separately collected food. The yield ratio for food in fortnightly mixed organics case studies varied from 0.34 to 1.08, relative to the food yield in separate collections (fortnightly residual).

Table A - 22: Ratio of food in mixed organics compared to separate food

Local authority	Residual frequency	Yield ratio of mixed to separate	IMD Group ²
West Lothian (collected) ¹	Fortnightly	1.08	High
Barnet	Weekly	0.94	Mid
Dacorum	Fortnightly	0.92	Low
West Lothian (recycled) ¹	Fortnightly	0.92	High
WRAP ¹⁷	Fortnightly	0.53 (Weekly mixed organics)	Mixed group
	Fortnightly	0.39 (Fortnightly mixed organics)	Mixed group
WRAP ¹⁸ (Scotland data)	Fortnightly	0.85 (Weekly mixed organics)	Mixed group
	Fortnightly	0.63 (Fortnightly mixed organics)	Mixed group
Cannock Chase	Fortnightly	0.34	Mid
Average	Fortnightly	0.70 (Weekly mixed organics)	
		0.67 (Fortnightly mixed organics)	

Notes ¹ Collected data from WDF Q10. Organics recycled data from SEPA.

² England and Scotland each produce their own deprivation indices, so the groups are not directly comparable across countries.

The main issue with the data is that much of it is ten years old or more, as this was the period when many authorities across the UK were moving away from mixed organics. In the decade since, food waste collections have become more normalised and increased familiarity is likely to have resulted in greater participation and thus yields per household. However, the impact may not be the same for mixed and separate services.

The most robust data point is the 2010 WRAP trial data, as this compared food waste yields across six mixed organic (using the measured composition) and six separate food authorities at a similar point in time. However, the food yields measured in the separate food authorities were high (which may be because these were trials). Substituting the WRAP yields for the 2023 Scotland average is likely to make for a better comparison (this is shown in Table A - 22).

¹⁷ WRAP (2016) op. cit

¹⁸ WRAP (2016) op. cit alongside Scotland 2023 food yields were determined from work done for the Co-design Report.

West Lothian is the most recent data point. However, it is an outlier and there is a possible reporting issue in that HWRC garden arisings may be included in the figure. The before and after time case study time periods are separated by the Covid-19 pandemic. Food waste arisings spiked during the pandemic and have remained elevated compared to pre-pandemic arisings in some cases.

Barnet and Dacorum have the strongest data, as both separated food from garden and the data points are close together (three years before, the year of change, then three years after). Dacorum is more relevant as the residual was collected fortnightly.

A.5.0 Residual case studies

A.5.1 Long list

Scheme data dating back to 2012/13 was analysed to identify local authorities that had changed the organics system. Historic information was checked by searching news articles and public documents (e.g. Committee Reports).

Table A - 23: Local authorities with mixed organics and reduced residual waste frequency

Local authority	Country	Waste function	Year	Suitable case study	Details
Stirling	Scotland	Unitary	2021 (Sep)	No	Four-weekly residual. Introduced charged garden in Apr-2019. Due to Covid in 2020, there is no suitable data point for before the change.
East Renfrewshire	Scotland	Unitary	2016 (Oct)	Yes	Three-weekly residual.
Glasgow	Scotland	Unitary	2021 (Apr)	Yes	Three-weekly residual. Although only introduced mixed organics in 2019. Due to Covid, can only use 2019, which has the roll-out.
Moray	Scotland	Unitary	2019	No	Three-weekly residual. Introduced charged garden waste at the same time.
North Ayrshire	Scotland	Unitary	2019 (Apr)	Yes	Three-weekly residual.
North Lanarkshire	Scotland	Unitary	2017 (Oct)	No	Three-weekly residual. Changed from separate to mixed food and garden at the same time.
Renfrewshire	Scotland	Unitary	2018 (Nov)	Yes	Three-weekly residual. New mixed organics in 2016, so only 2017 (1 year) available for before service change.
West Dunbartonshire	Scotland	Unitary	2025 (Nov)	No	Three-weekly residual. Waste data relating to change has not been released yet.

Local authority	Country	Waste function	Year	Suitable case study	Details
Western Isles	Scotland	Unitary	2023 (May)	Yes	Three-weekly residual. Due to timing of Covid and roll out, only one year for after service change.
Bury	England	WCA	2014 (Oct)	Yes	Three-weekly residual. New mixed organics in 2011/12.
Oldham	England	WCA	2016 (Oct)	Yes	Three-weekly residual.
Rochdale	England	WCA	2015/16	No	Three-weekly residual. Mixed organics not introduced until after three-weekly residual.
Salford	England	WCA	2015/16	Yes	Three-weekly residual.
Wigan	England	Unitary	2017 (Oct)	Yes	Three-weekly residual.

A.5.2 Data

The following tables detail the findings of the local authorities selected.

A.5.2.1 East Renfrewshire

Table A - 24: East Renfrewshire – change in arisings from residual frequency reduction

Data	Fortnightly residual		Three-weekly residual		Change	
Data period	2013 to 2015		2017 to 2019		Three-weekly residual in Oct-2016.	
Months	36		36			
Average tonnes	Tonnes	%	Tonnes	%	Tonnes	%
Residual	16,110	57%	12,283	41%	-3,828	-23.8%
Recycling	3,043	11%	7,784	26%	4,741	155.8%
Organics	9,314	33%	9,904	33%	589	6.3%
Total	28,468	100%	29,971	100%	1,503	5.3%
Summary:	Tonnages increased slightly with three-weekly residual, but still made up 33% of the total. Residual waste tonnages decreased by a large amount – more than could be explained by the increase in recycling and mixed organics.					

A.5.2.2 Glasgow

Table A - 25: Glasgow – change in arisings from residual frequency reduction

Data	Fortnightly residual		Three-weekly residual		Change	
Data period	2019		2022 to 2023		Introduced mixed organics in 2019. Three-weekly residual in Apr-2021. Introduced charged garden Oct-2024.	
Months	12		24			
Average tonnes	Tonnes	%	Tonnes	%	Tonnes	%
Residual	166,597	76%	143,733	71%	-22,864	-13.7%
Recycling	31,957	14%	39,284	19%	7,327	22.9%
Organics	21,944	10%	20,811	10%	-1,133	-5.2%
Total	220,498	100%	203,828	100%	-16,670	-7.6%
Summary:	Glasgow’s mixed organics arisings decreased when three-weekly residual was introduced. However, as mixed organics were only introduced in 2019, tonnages					

may be inflated. Due to Covid, only 2019 was available to compare with the three-weekly period.

A.5.2.3 North Ayrshire

Table A - 26: North Ayrshire – change in arisings from residual frequency reduction

Data	Fortnightly residual		Three-weekly residual		Change	
<i>Data period</i>	<i>2016 to 2018</i>		<i>2022 to 2024</i>		<i>Three-weekly residual in</i>	
<i>Months</i>	<i>36</i>		<i>36</i>		<i>Apr-2019.</i>	
Average tonnes	Tonnes	%	Tonnes	%	Tonnes	%
Residual	24,772	50%	23,169	49%	-1,602	-6.5%
Recycling	13,229	27%	13,092	28%	-137	-1.0%
Organics	11,346	23%	10,612	23%	-734	-6.5%
Total	49,346	100%	46,873	100%	-2,473	-5.0%
Summary:	Mixed organics arisings decreased when three-weekly residual was introduced. The same patten was seen across all waste streams.					

A.5.2.4 Renfrewshire

Table A - 27: Renfrewshire – change in arisings from residual frequency reduction

Data	Fortnightly residual		Three-weekly residual		Change	
Data period	2017		2022		Separate food to mixed organics in 2016. Three-weekly residual in Nov-2018. Introduced charged garden in Jul-2023.	
Months	12		12			
Average tonnes	Tonnes	%	Tonnes	%	Tonnes	%
Residual	36,012	57%	32,924	55%	-3,088	-8.6%
Recycling	16,241	26%	14,417	24%	-1,824	-11.2%
Organics	10,856	17%	12,580	21%	1,724	15.9%
Total	63,109	100%	59,922	100%	-3,188	-5.1%
Summary:	The total tonnage decreased when the residual waste collection frequency was reduced to three-weekly. There was an increase in the organic tonnage collected. By proportion, the amount of residual decreased and organics increased. However, the short data periods mean this could be natural variation in garden arisings.					

A.5.2.5 Western Isles

Table A - 28: Western Isles – change in arisings from residual frequency reduction

Data	Fortnightly residual		Three-weekly residual		Change	
<i>Data period</i>	<i>2018 to 2019 & 2022</i>		<i>2024</i>		<i>Three-weekly residual in May 2023</i>	
<i>Months</i>	<i>36</i>		<i>12</i>			
Average tonnes	Tonnes	%	Tonnes	%	Tonnes	%
Residual	5,951	64%	4,977	55%	-974	-16.4%
Recycling	1,578	17%	1,864	21%	286	18.1%
Organics	1,765	19%	2,246	25%	480	27.2%
Total	9,295	100%	9,087	100%	-208	-2.2%
Summary:	Mixed organics arisings increased when three-weekly residual was introduced. Residual waste tonnages decreased more than could be explained by the increase in recycling and mixed organics.					

A.5.2.6 Bury

Table A - 29: Bury – change in arisings from residual frequency reduction

Data	Fortnightly residual		Three-weekly residual		Change	
Data period	2012/13 to 2013/14		2015/16 to 2017/18		Mixed organics (food added to garden) introduced in 2011/12. Three-weekly residual in Oct-2014.	
Months	24		36			
Average tonnes	Tonnes	%	Tonnes	%	Tonnes	%
Residual	31,294	51%	26,207	43%	-5,087	-16.3%
Recycling	16,261	26%	17,349	29%	1,088	6.7%
Organics	14,009	23%	16,915	28%	2,905	20.7%
Total	61,565	100%	60,470	100%	-1,094	-1.8%
Summary:	Mixed organics arisings increased when three-weekly residual was introduced. Residual waste tonnages decreased more than could be explained by the increase in recycling and mixed organics.					

A.5.2.7 Oldham

Table A - 30: Oldham – change in arisings from residual frequency reduction

Data	Fortnightly residual		Three-weekly residual		Change	
<i>Data period</i>	<i>2013/14 to 2015/16</i>		<i>2017/18 to 201/19</i>		<i>Three-weekly residual in Oct-2016.</i>	
<i>Months</i>	<i>36</i>		<i>24</i>			
Average tonnes	Tonnes	%	Tonnes	%	Tonnes	%
Residual	40,182	59%	33,946	52%	-6,236	-15.5%
Recycling	15,695	23%	16,691	26%	996	6.3%
Organics	12,558	18%	14,447	22%	1,889	15.0%
Total	68,435	100%	65,084	100%	-3,351	-4.9%
Summary:	Mixed organics arisings increased when three-weekly residual was introduced. Residual waste tonnages decreased considerably more than could be explained by the increase in recycling and mixed organics.					

A.5.2.8 Salford

Table A - 31: Salford – change in arisings from residual frequency reduction

Data	Fortnightly residual		Three-weekly residual		Change	
<i>Data period</i>	<i>2012/13 to 2014/15</i>		<i>2016/17 to 2018/19</i>		<i>Three-weekly residual in 2015/16.</i>	
<i>Months</i>	<i>36</i>		<i>36</i>			
Average tonnes	Tonnes	%	Tonnes	%	Tonnes	%
Residual	48,376	62%	38,782	51%	-9,594	-19.8%
Recycling	16,617	21%	19,633	26%	3,016	18.1%
Organics	13,270	17%	17,733	23%	4,463	33.6%
Total	78,263	100%	76,147	100%	-2,115	-2.7%
Summary:	Mixed organics arisings increased when three-weekly residual was introduced. Residual waste tonnages decreased more than could be explained by the increase in recycling and mixed organics.					

A.5.2.9 Wigan

Table A - 32: Wigan – change in arisings from residual frequency reduction

Data	Fortnightly residual		Three-weekly residual		Change	
Data period	2014/15 to 2016/17		2018/19 to 2019/20		Three-weekly residual in Oct-2017.	
Months	36		24			
Average tonnes	Tonnes	%	Tonnes	%	Tonnes	%
Residual	59,182	55%	50,034	48%	-9,148	-15.5%
Recycling	27,471	25%	28,993	28%	1,523	5.5%
Organics	21,404	20%	24,351	24%	2,947	13.8%
Total	108,056	100%	103,377	100%	-4,679	-4.3%
Summary:	Mixed organics arisings increased when three-weekly residual was introduced. Residual waste tonnages decreased by quite a lot more than could be explained by the increase in recycling and mixed organics.					

A.5.3 Findings

There is strong evidence that reducing residual frequency increases food waste yields when food is separately collected. WRAP also identified higher food waste yields in mixed organic systems alongside fortnightly residual waste collections compared with weekly,¹⁹ but this finding was based on rather less evidence. As a result, any relationship between residual collection frequency and mixed organic yields is less certain, particularly given the inherent limitations associated with mixed organic waste data.

Eunomia therefore undertook benchmarking to examine whether case studies could provide data on how arisings change when residual waste frequency is decreased.

Scheme data dating back to 2012/13 was analysed to identify local authorities that had changed their residual waste capacity and/or their organics system. Case studies were sought of the following:

- Local authorities with mixed organic collections that reduced the residual collection frequency. This analysis sought to understand the impact that less frequent residual waste collections had on mixed organic arisings.
- Local authorities that had changed from/to mixed and separate collections of food and garden waste. This analysis sought to identify the amount of food waste in the mixed organic stream.

Across the UK, nine authorities have introduced three-weekly residual waste collections while operating a mixed organic service. These are shown in Table A - 33.

¹⁹ WRAP (2016) op. cit.

The analysis in Table A - 33 shows that, when residual frequency was reduced, the mixed organic tonnage increased in seven of the nine local authorities sampled and decreased in two. The same trend was seen in mixed organic yields (note that the percentage change differs between tonnage and yield because the number of households increases with time).

Eight authorities showed an increase in the mixed organics as a proportion of household waste collected. This suggests more organic waste was captured when residual waste frequency was decreased. The same authorities also saw a decrease in the total household collected arisings.

The increase in the mixed organic yield for local authorities in Scotland (excluding Glasgow) when changing from fortnightly to three-weekly residual was 9.0%. The median increase was 8.2%. However, the results span a wide range, from a 7.4% decrease (North Ayrshire) to a 27.1% increase (Western Isles).

Table A - 33: Impact of residual reduction on mixed organics (decreases in red)

Local authority	Fortnightly residual to:	MO frequency and garden system	Year of residual change	Tonnage change	Tonnage change	Before yield	After yield	Yield ¹ change	Change in % of total ²	Change in arisings
				Tonnes	%	Kg/hh/yr	Kg/hh/yr	%	%	%
East Renfrewshire	3-weekly	Weekly, Free ³	2016	589	6.3	239.7	252.2	5.2	0.3	5.3
Glasgow	3-weekly	Fortnightly, Free ³	2021	-1,133	-5.2	73.9	49.4	-6.1	0.3	-7.6
North Ayrshire	3-weekly	Fortnightly, Free	2019	-734	-6.5	178.1	164.9	-7.4	-0.4	-5.0
Renfrewshire	3-weekly	Fortnightly, Free ³	2018	1,724	15.9	127.8	142.2	11.2	3.8	-5.1
Western Isles	3-weekly	3-Weekly, Free	2023	480	27.2	137.9	175.4	27.1	5.7	-2.2
Bury	3-weekly	Fortnightly, Free	2014/15	4,657	33.2	170.9	225.3	31.9	5.6	6.9
Oldham	3-weekly	Weekly, Free	2016/17	2,048	16.3	132.7	151.8	14.4	4.0	-4.5
Salford	3-weekly	Weekly, Free	2015/16	6,070	45.7	119.6	168.6	40.9	6.3	6.3
Wigan	3-weekly	Fortnightly, Free	2017/18	566	2.4	167.9	168.2	0.2	3.4	-12.2
Scotland	All			185	7.6	149.8	168.7	6.0	1.9	-2.9
Scotland	Excl. Glasgow ⁴			515	10.7	170.9	183.7	9.0	2.4	-1.8
England	All			3,335	24.4	147.8	178.5	21.9	4.8	-0.9
Notes	¹ Yields based on total dwellings reported in WDF. ² Change in mixed organics as a proportion of total arisings, e.g. change from 25t of 100t (25%) to 27t of 100t (27%) = +2.0%. ³ Free at the time. Now charged. ⁴ Glasgow's 'before' year was 2019, the same year that the mixed organic service was introduced. (2020/21 could not be used due to Covid). The first year of service change often has high performance, making it an unfair comparison with later years.									

Without composition data, there is no way of knowing how much of the change is due to food waste and how much is garden waste. The change is assumed to be largely food waste because:

- Garden waste generation is driven primarily by seasonality, property type, garden size and charging policies. Garden arisings are not usually modelled to change when residual frequency is reduced, unlike other residual, recycling and food waste arisings.
- The case study group all operated free garden waste collections and residual waste composition studies for authorities with services of this kind generally show minimal garden waste (~3%).

The evidence presented does not precisely identify the change in food waste capture, because the starting proportions of food and garden will differ across authorities. In the absence of compositional data showing the situation before and after, the most sensible approach is to uplift total tonnes using the findings in Table A - 33, rather than yields.

Overall, the English authorities showed a more pronounced uplift in organic yields (+21.9%) than the Scottish ones (excluding Glasgow, +9.0%). The English case studies date from between 2014/15 and 2017/18, and are mostly older than the Scottish examples. This may have influenced the results as there was much greater opportunity for improvement in food waste yields at this time. However, food waste remains the largest single component of residual waste, and so this explanation is not wholly satisfactory.

When assessing the impact of less frequent residual waste collections, benchmarking would ideally look to understand whether there have also been changes at the HWRC. However:

- Scottish local authorities do not consistently report separate figures on HWRC tonnages recycled/composted. None of the benchmark group report HWRC recycling data.
- Except for Wigan, the English benchmarks report HWRC tonnage through the disposal authority (GMWDA) and these figures cannot be linked back to an individual authority.

The impact on HWRC residual waste arisings was previously assessed as part of the Co-design work. The work showed that reducing residual collection frequency often, but not always, led to the displacement of residual waste from the kerbside to HWRCs. The scale of the change was highly variable. Some local authorities recorded large increases in HWRC residual waste arisings and others only small increases; a few even showed a reduction. The same variation was found across the benchmarking group (Table A - 34).

The lack of clear impact led to applying the following assumptions, which will be applied to the Organics Options:

- Benchmarking findings that indicated a decrease in kerbside residual that exceeded the increase in recycling and organics would be applied.
- The waste that is no longer collected at the kerbside is assumed to be displaced to HWRCs.

This is a conservative approach that ensures that no residual waste reduction is assumed. While some sources indicate that reducing effective weekly capacity may reduce total residual waste, assuming this would risk inflating the impact of changes on recycling rates, vehicle resourcing or treatment costs.

However, as net residual waste reduction is achieved in some authorities (e.g. Wigan in the dataset below), this conservative approach may underestimate the benefit that the changes may achieve in practice.

Table A - 34: Change in HWRC arisings

Local authority	Before data period (years)	After data period (years)	Residual tonnage change tonnes (%)	Recycling tonnage ¹ change tonnes (%)	Garden tonnage change tonnes (%)	Total tonnage change tonnes (%)
East Renfrewshire	3	3	1,826 (+32%)	-	-	-
Glasgow	1	3	-3,427 (-28%)	-	-	-
North Ayrshire	3	3	426 (+8%)	-	-	-
Renfrewshire	1	3	-3,121 (-22%)	-	-	-
Western Isles	3	1	No data	-	-	-
Wigan	3	2	-3,597 (-36%)	176 (+9.8%)	-52 (-2.3%)	-3,473 (-25%)
Notes	¹ Recycling tonnage includes materials collected from households, only.					

A.6.0 Assumptions

A.6.1 Three-weekly residual waste

The assumptions taken forward to modelling were:

- The mean increase in mixed organic yield across local authorities in Scotland (excluding Glasgow) when residual waste was reduced from fortnightly to three-weekly was 9.0% and the median was 8.2%. However, the results are variable, ranging from a 7.4% decrease (North Ayrshire) and a 27.1% increase (Western Isles).
- The increase is attributed solely to food waste. Garden arisings are not usually modelled to change when residual waste is restricted as residual waste compositions contain minimal garden waste (~3%) and garden waste generation is driven by other factors (e.g. seasonality and charging policies). However, unless the mixed organics composition is known, it will be necessary to uplift total tonnes using the findings, rather than per household yields.
- Tonnage change at HWRCs was highly variable. This was also found in previous benchmarking exercises when assessing the impact of restricted residual collections for individual local authorities.

A.6.2 Food in the mixed organic stream

Applying a blanket uplift to the mixed organics stream for three-weekly residual is not appropriate. This is because:

- The impact depends on the baseline composition, which will vary between authorities.
- Garden waste does not tend to be greatly affected by changes in residual waste frequency.
- The percentage uplift will disproportionately increase tonnages in authorities with free garden collections, which have higher overall tonnages than charged systems.

It is therefore necessary to first determine the amount of food in the mixed organic stream, so that this can be made the focus of the uplift.

As discussed in A.4.3, the most robust data point is the 2010 WRAP trial data, as this compared food waste yields across six mixed organic (using the measured composition) and six separate food authorities at a similar point in time. However, substituting the WRAP yields for the 2023 Scotland average is likely to make for a better comparison (the food yields measured in the separate food authorities were high, which may be because these were trials). Table A - 35 summarises how WRAP's 2016²⁰ finding was used with Scotland food yield data and the benchmarking findings to estimate the ratio between separate and mixed organic collections. (This was not needed for current four-weekly residual authorities as their performance will not change). Note that the average of the case study data

²⁰ WRAP (2016) op. cit.

(0.67) is very close to the data points for WRAP (using the 2023 Scotland yield data instead of the trial data).

The resulting 'mixed organic performance ratio' was used to determine the quantity of food in mixed organic collections. This was done by applying the ratio to the average food yield for each group (based deprivation and residual frequency) or the most similar local authority with separate food collections to determine the yield in the mixed organics. This is shown in Table A - 37.

Table A - 35: Estimating baseline yield of food in mixed organics

Data Point	Source	Fortnightly ¹	Three-weekly ¹	Four-weekly ¹
Food in fortnightly mixed organics	WRAP (2016) ²¹	30.4		
8.2% increase of food in mixed organics	Benchmarking		32.9	
12.3% increase of food in mixed organics (see Table A - 36)				34.2
Scotland average separate food yield	2023 WDF	48.6 (n=10)	49.3 (n=5)	66.4 (n=1)
Mixed organic performance ratio	-	0.63	0.67	0.70
Notes	¹ Yields are in kg/hh/yr			

A.6.3 Weekly capacity of 60 litres per household

Within the case studies, three-weekly residual waste collections equate to a residual capacity of 80 litres per household per week. No suitable case studies were identified for four-weekly residual waste collections (equivalent to 60 litres per household per week). The impact of this reduction was therefore estimated from the benchmarked uplift of 8.2%, assuming a linear relationship between residual capacity and food waste yield. Under this assumption, each 10-litre reduction in weekly residual capacity results in a 2.05% increase in food waste yield. Accordingly, a reduction from 120 to 60 litres per household per week would be expected to increase food waste yields by 12.3%. All other capacity-change assumptions were derived from this and are presented in Table A - 36.

²¹ WRAP (2016) op. cit

Table A - 36: Assumed yields due to residual capacity changes

Residual capacity before	Residual capacity after	Increase in food yield	Yield before	Yield after
Litres	Litres	%	Kg/hh/yr	Kg/hh/yr
120	80	8.2	60.0	64.9
120	60	12.3	60.0	67.4
90	60	8.1	62.4	67.4
80	60	3.8	64.9	67.4
70	60	1.9	66.1	67.4
60	60	0.0	67.4	67.4

The assumed yields are summarised in Table A - 37. In some authorities, the mixed organic food yield exceeded the separate food yield assumption. Where this happened, it was capped at a mixed organic performance ratio of 0.7.

Table A - 37: Assumed food in mixed organics and increase under 60-litre residual waste (yields kg/hh/yr)

Local authority	Residual frequency	Mixed organics frequency	Garden system	Group / most similar local authority match	Closest match yield	Ratio	Baseline yield assumption	60-litre yield assumption
Aberdeen City	Fortnightly	Fortnightly	Charged	Edinburgh	65.8	0.63	41.2	56.7
East Renfrewshire	3-Weekly	Weekly	Charged	East Dunbartonshire	68.3	0.91	61.9	71.5
Fife	Fortnightly	Fortnightly	Free	Mid deprivation	50.6	0.63	31.7	35.6
Glasgow City	3-Weekly	Fortnightly	Free	Dundee City	26.4	0.67	17.6	23.6
Moray	3-Weekly	Fortnightly	Charged	Mid deprivation	42.7	0.67	36.4	43.3
North Ayrshire	3-Weekly	Fortnightly	Free	High deprivation	52.2	0.67	34.8	41.1
North Lanarkshire	3-Weekly	Fortnightly	Free	High deprivation	52.2	0.67	34.8	41.2
Perth & Kinross	Fortnightly	Fortnightly	Charged	Mid deprivation	50.6	0.63	31.7	36.1
Renfrewshire	3-Weekly	Fortnightly	Charged	High deprivation	52.2	0.67	34.8	40.7
South Lanarkshire	Fortnightly	Fortnightly	Free	Mid deprivation	50.6	0.63	31.7	32.8
Stirling	4-Weekly	Fortnightly	Charged	n/a, already 4-weekly	(66.4)	(0.70)	(34.2)	(34.2)
West Dunbartonshire	Fortnightly	Fortnightly	Free	High deprivation	32.8	0.63	20.5	21.1
West Lothian	Fortnightly	Fortnightly	Free	High deprivation	32.8	0.63	20.5	24.2
Western Isles	3-Weekly	3-Weekly	Free	Mid deprivation	42.7	0.67	36.4	42.6

