Cheshire East Weekly Food Waste Collections Options Appraisal

Cheshire East Council

May 2024

Open Fair Green

Cheshire East Council

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Executive summary

This report presents the results of the weekly food waste and two and three weekly residual collections modelling undertaken for Cheshire East Council (CEC). The purpose of this study is to:

- Understand the most cost-effective method of delivering a food waste service, in order to be compliant with 'Simpler Recycling' regulations, and to determine to what extent the 'New Burden' funding from Defra in capital, transitional and ongoing revenue costs will fund the service; and
- Assess the savings possible from moving to three weekly residual collections.

The options modelled are shown in Table 1. Due to the recent introduction of a charge for the garden waste service, two baseline scenarios were modelled. The 22/23 baseline models the 22/23 service, with a free mixed organics service and 22/23 tonnages (22/23 Baseline); and an amendment to this baseline models the current service, with charged garden waste and assumptions on final subscriber numbers and tonnages (£GW Baseline). The dry recycling collection remains fortnightly in each option. It is assumed that any new vehicles would be electric, in line with CEC's decarbonisation plan.

- **Option 1:** Weekly food waste collection, collected together with the garden waste round one week and separately as a food waste round on the alternate weeks, **fortnightly** residual waste collection.
- **Option 2:** Weekly food waste collection, collected together with the garden waste round on one week and separately as a food waste round on the alternate weeks, **three-weekly** residual waste collection.
- **Option 3:** Weekly separate food waste collection on a dedicated 7.5 tonne vehicle every week. Fortnightly chargeable garden waste service (with no food waste) and **fortnightly** residual waste collection.
- **Option 4:** Weekly separate food waste collection on a dedicated 7.5 tonne vehicle. Fortnightly chargeable garden waste service (with no food waste) and **three-weekly** residual waste collection.

Table 1: Options modelled

<table>
<tr><th>Option number</th><th>Option description</th><th>Residual</th><th>Organics (Food)</th><th>Organics (Garden)</th><th>Dry recycling</th></tr>
<tr><td>0</td><td>22/23 Baseline</td><td rowspan="3">Fortnightly</td><td colspan="2">Fortnightly mixed organics, 240 L WB, RCV</td><td rowspan="4">Fortnightly co-mingled</td></tr>
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Option number	Option description	Residual	Organics (Food)	Organics (Garden)	Dry recycling
3	Option 3: W FW, F Res, Sep organics	Fortnightly	Weekly food waste, 23 L caddy, 7.5 T separate food vehicle	Fortnightly charged garden waste without food, 240 L WB, RCV	
4	Option 4: W FW, 3W Res, Sep organics	Three weekly			

The results, in Table 2, show an increase in costs for every option relative to the £GW Baseline. The cost modelling shows:

- With the current IVC gate fee, it is more cost effective to collect food waste with garden waste one week, rather than using dedicated vehicles for every week. (Option 1 compared to Option 3)
- Moving to three weekly residual collections offers savings of over £1M compared to the same option with fortnightly residual collections (Option 1 compared to Option 2, and Option 3 compared with Option 4).

The performance modelling shows:

- Although data on how the introduction of charged garden waste will affect collected tonnages is not yet available, the modelled assumptions predict a fall in recycling rate of over 2 percentage points.
- Introducing a weekly food waste collection increases the recycling rate by over 5 percentage points. Although, it is just shy of the 55% target for 2025.
- Moving to three weekly residual collections is modelled to increase the recycling rate by a further 5 percentage points (10 percentage point increase relative to the £GW Baseline) and comfortably meets the 2025 recycling target.

Table 2: Recycling and financial performance results

Options	Difference in cost to £GW Baseline	Households recycling rate
Baseline	-	51.7%
£GW Baseline	-	49.4%
Option 1	£1,546,289	54.9%
Option 2	£116,660	59.8%
Option 3	£2,616,543	54.9%
Option 4	£1,526,609	59.78%

Table 3 shows the capital, transitional and ongoing revenue costs of the food waste service modelled for the options. Ongoing revenue costs does not include vehicle capital costs (which are included in

Table 2), so as to be equivalent to the 'New Burdens' funding categories. The results show that capital costs are higher than the funding for all options. The funding for transitional and ongoing revenue costs has not yet been confirmed. Since the costs in Table 3 relate only to the food waste service, they do not include the savings from the reduction in resources modelled for three weekly collections in Options 2 and 4. Food waste service costs are higher for the three weekly residual options (2 and 4) relative to the equivalent fortnightly options (1 and 3), because more vehicles are required to collect food waste due to increased participation under three weekly residual collections.

Table 3: Capital, transitional and ongoing revenue costs of the weekly food waste service and 'New Burdens' funding

	Option 1	Option 2	Option 3	Option 4	'New Burdens' funding
Capital	£3.3M	£3.6 M	£4.0 M	£4.5 M	£2.7M
Transitional	£0.5M	£0.8 M	£0.5 M	£0.8 M	Not yet confirmed
Ongoing revenue (annual cost)	£1.3M	£1.4 M	£2.4 M	£2.8 M	Not yet confirmed

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1 Introduction

Resource Futures has been commissioned by Cheshire East Council (CEC) to undertake modelling of a range of food waste and residual waste collection options. This work follows on from recent feasibility studies undertaken for CEC, which identified efficiencies and savings in CEC's kerbside collection service and in light of the upcoming Government's 'Simpler Recycling' regulations, which will require all local authorities to provide a weekly food waste collection by 31 March 2026. As part of this, CEC will receive 'New Burden' funding from Defra:

- Capital transition costs – £2.7M capital grant offer;
- Revenue resource transition costs – to be confirmed; and,
- Revenue ongoing resource costs – to be confirmed.

The purpose of this project is to review the comparative costs, anticipated performance and resource implications of the selected collection profiles to understand whether the funding available is sufficient for CEC to deliver the food waste service and to inform the future development of CEC's household waste collection service.

1.1 Baseline collections

CEC's household waste collection service includes a fortnightly collection of residual waste via 240 litre wheeled bins and a fortnightly collection of dry recycling via 240 litre wheeled bins. Until the end of 2023, CEC operated a free to all fortnightly mixed organics service. From 2024, CEC introduced a chargeable fortnightly collection of garden waste via 240 litre wheeled bins. Households subscribing to the scheme are able to place food waste in their garden waste bin.

Due to the recent introduction of the charged garden waste service, it was decided to model a 22/23 Baseline, assuming the 22/23 tonnages and a mixed organics service, and also a charged garden waste (£GW) Baseline, with assumptions on how the current service will be operated once it reaches peak subscriber numbers. For this, assumptions were made on subscriber numbers, how tonnages would be affected, and the number of vehicles required. These assumptions were agreed with CEC and are included in the Power Point presentation 'Baseline and Assumptions Presentation'.

The Government has clarified that if a local authority chooses to co-collect food and garden waste from households, they must ensure that food waste is collected for free on a weekly basis by 31 March 2026. Co-collection, with garden waste, can continue as long as it meets this requirement.

1.2 Options modelled

The options modelled are shown in Table 4. This includes the 22/23 baseline, modelling the 22/23 service with a mixed organics service and 22/23 tonnages (22/23 Baseline); and an amendment to this baseline, modelling the current service with charged garden waste and assumptions on final subscriber numbers and tonnages (£GW Baseline). The dry recycling collection remains fortnightly in each option. It is assumed that any new vehicles would be electric, in line with CEC's decarbonisation plan.

- **Option 1:** Weekly food waste collection, collected together with the garden waste round one week and separately as a food waste round on the alternate weeks, **fortnightly** residual waste collection.

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Table 4: Options modelled

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2 Benchmarking

This section presents the waste collection schemes and collected yields of comparator authorities to CEC to show possible outcomes from the proposed options. Comparator authorities were selected based on their socio-economic similarity to CEC using the CIPFA (Chartered Institute of Public Finance and Accountancy) Nearest Neighbours (NN) tool or their geographical closeness.

2.1 CIPFA Nearest Neighbours

The relevance to CEC of results from another authority depends on their socio-demographic similarity, measured using a nearest-neighbour rank. This figure is achieved using the CIPFA Nearest Neighbours Model, which broadly compares authorities using socio-economic and demographic criteria. This method ensures a systematic and clear approach to measuring the similarity between authorities,

considering a range of variables that have an impact on demographic profile and the likely demand on different services.

The model allows for different variables to be switched on or off independently, thus allowing the inclusion of only variables that are likely to be relevant to the compositions and capture of recyclables. The variables selected include those related to deprivation, age profile, rurality, household size and ethnic profile.

The CIPFA Model provides a list of nearest neighbour authorities based on their socio-economic profiles. The nearest neighbours are ranked based on their statistical distance (represented by a numerical score) from CEC. The nearest neighbour authority with the lowest score, therefore closest in terms of statistical distance, is considered to have the most similar characteristics to CEC. The CIPFA model is based on 2018 data, and CEC's top 50 Nearest Neighbour (NN) local authorities are shown in Table 5.

Table 5: CEC's CIPFA top 50 Nearest Neighbours

CIPFA Rank	Nearest Neighbour	Score		Rank	Nearest Neighbour	Score
1.	Shropshire	0.015		26.	Central Bedfordshire	0.037
2.	Wiltshire	0.017		27.	Mid Devon	0.038
3.	North Somerset	0.018		28.	Bath & North East Somerset	0.038
4.	Lichfield	0.021		29.	Hambleton	0.039
5.	Cheshire West & Chester	0.021		30.	Babergh	0.040
6.	Harrogate	0.023		31.	Blaby	0.040
7.	Stafford	0.023		32.	Hinckley & Bosworth	0.041
8.	Chelmsford	0.024		33.	Rugby	0.041
9.	Herefordshire	0.024		34.	St Edmundsbury	0.041
10.	Mendip*	0.027		35.	Tewkesbury	0.042
11.	Maidstone	0.028		36.	High Peak	0.042
12.	South Gloucestershire	0.030		37.	Ryedale	0.042
13.	Solihull	0.030		38.	Warwick	0.042
14.	Bromsgrove	0.030		39.	Stratford-on-Avon	0.043
15.	Craven	0.032		40.	Warwickshire	0.043
16.	South Kesteven	0.033		41.	East Northamptonshire	0.043
17.	Test Valley	0.033		42.	Maldon	0.043
18.	Stockport	0.033		43.	North Hertfordshire	0.044
19.	Stroud	0.033		44.	Mid Sussex	0.044
20.	Taunton Deane*	0.034		45.	Chorley	0.045
21.	South Somerset*	0.035		46.	Colchester	0.045
22.	Braintree	0.035		47.	Melton	0.046

CIPFA Rank	Nearest Neighbour	Score		Rank	Nearest Neighbour	Score
23.	South Ribble	0.036		48.	Worcestershire	0.046
24.	Huntingdonshire	0.036		49.	West Devon	0.046
25.	Ashford	0.037		50.	Cornwall	0.046

* report as the Somerset Waste Partnership (SWP)

CEC's first and fifth most socio-economically similar local authorities, Shropshire and Cheshire West and Chester are also selected as Geographic neighbours. The results from the CIPFA NN model were used to make meaningful comparisons to authorities with similar collections schemes and with the collection schemes we are modelling in the following sections.

Figure 1 below shows the 2022/23 recycling rate of CEC's top 50 CIPFA NN listed above. CEC has the 22nd highest recycling rate of 52%. Also, shown is the projected recycling rate for CEC following implementation of the charged garden waste service. Based on the assumptions, CEC will fall by 3 places to 25th highest recycling rate of their top 50 NN.

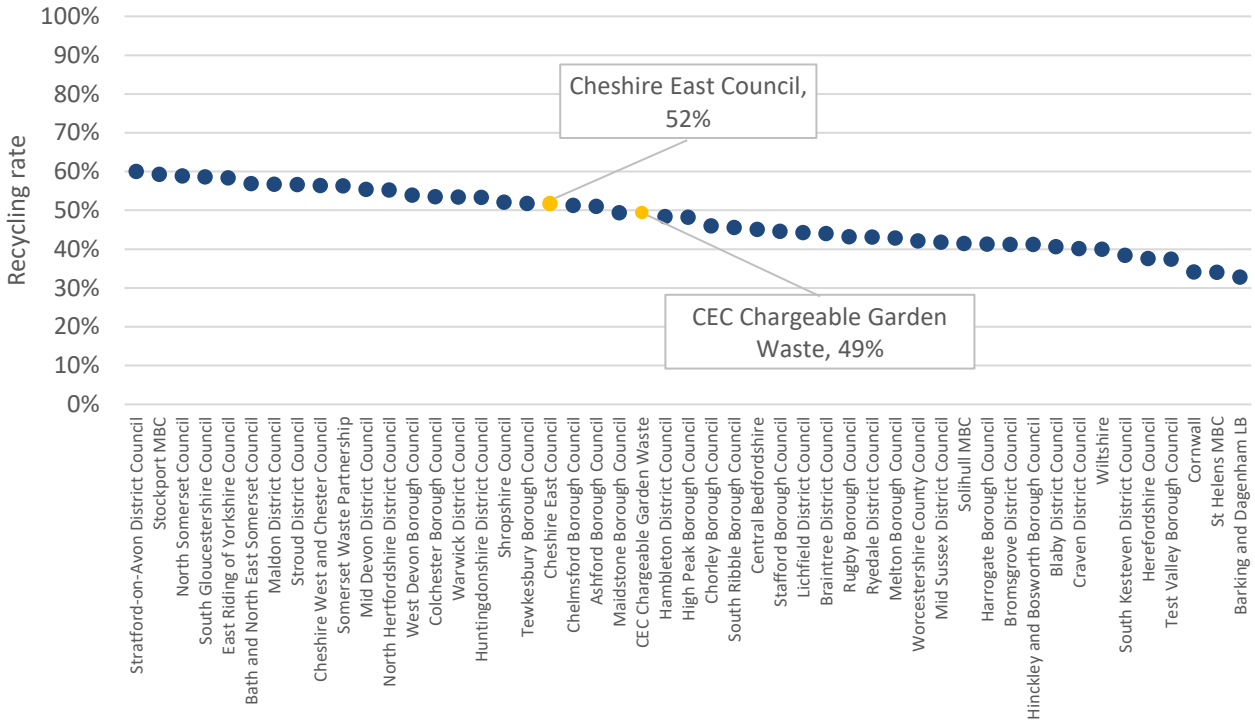


Figure 1: CEC's CIPFA Nearest Neighbours' recycling rate comparison

2.2 Geographic Nearest Neighbours current schemes

CEC's direct geographical neighbours are Cheshire West, Staffordshire, Shropshire, Derbyshire, Warrington and Manchester. CEC currently have the third lowest recycling rate and the highest residual waste yield of all six neighbouring authorities. CEC rank 29 places lower than their direct neighbour

Cheshire West and Chester in the Let's Recycle 2022/2023 league table[1], who are the highest performing of their geographic nearest neighbours.

Table 6: Geographic nearest neighbours current scheme comparison to CEC

Local Authority	Residual frequency	Residual Wheeled Bin Size (litres)	League Table Rank 22/23	Recycling Rate 22/23	Residual waste KG/HH/ YR
Cheshire West and Chester Council	Fortnightly	180	23	56%	435
Staffordshire Moorlands District Council	Fortnightly	180	42	53%	383
Derbyshire Dales District Council	Fortnightly	240	45	53%	347
Shropshire Council	Fortnightly	240	49	52%	483
CEC Council	**Fortnightly**	**240**	**52**	**52%**	**449**
Warrington Borough Council	Fortnightly	240	126	44%	412
Manchester City Council	Fortnightly	140	206	39%	294

2.3 Similar authorities with separate food waste

Local authorities were selected from the CIPFA NN that currently have a weekly separate food waste collection service and fortnightly residual waste collection, as frequency of residual collection is known to be a main driver of food waste participation. As there was a sufficient sample size, we were able to restrict the benchmarking to the top 30 NN, which are the most similar to CEC. There are twelve authorities within CEC's top 30 CIPFA NN that currently have a separate food waste collection service, as shown in Table 7.

Table 7: Waste data of CEC's Nearest Neighbours that have a weekly separate food waste collection and fortnightly residual collections

Rank	Authority	Recycling rate	Residual wheeled bin size (litres)	Food waste yield (kg/hh/yr)	Residual waste yield (kg/hh/yr)
3.	North Somerset	59%	180	75	418

[1] Let's Recycle 2022/2023 League table: Link

Rank	Authority	Recycling rate	Residual wheeled bin size (litres)	Food waste yield (kg/hh/yr)	Residual waste yield (kg/hh/yr)
5.	Cheshire West & Chester	56%	180	60	435
8.	Chelmsford	51%	180	77	362
10.	Mendip (SWP)	56%	180	90	434
11.	Maidstone	49%	240	63	329
12.	South Gloucestershire	59%	140	83	394
19.	Stroud	57%	140	101	307
20.	Taunton Deane (SWP)	56%	180	90	434
21.	South Somerset (SWP)	56%	180	90	434
22.	Braintree	44%	240	69	388
26.	Central Bedfordshire	45%	240	74	426
28.	Bath & North East Somerset	57%	140	80	366

Figure 2 shows the 2022/23 food waste yields of CEC's nearest neighbours. As multiple authorities report collectively under SWP, this yield has only been included once. The median value is 76 kg per household per year. This is the value we have used in the options modelling.

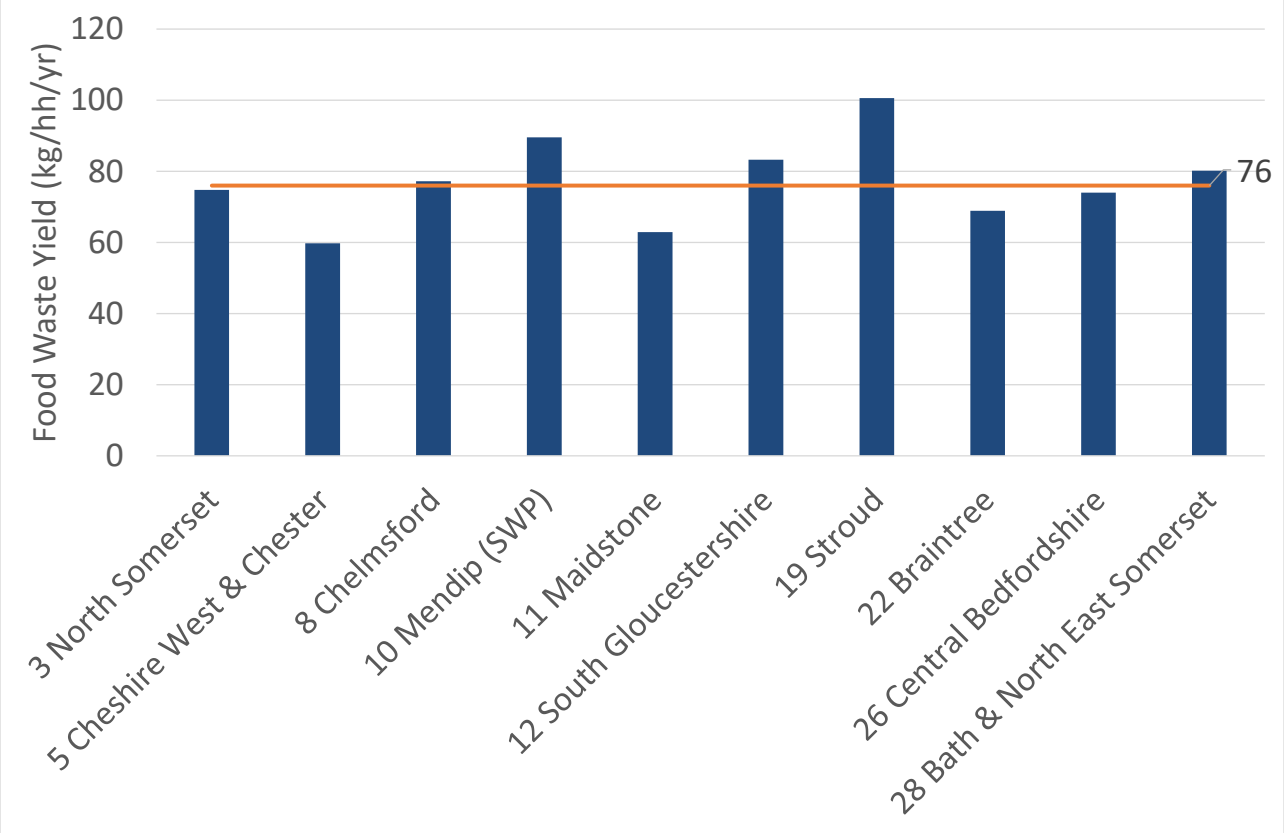


Figure 2: 2022/23 food waste yields of CEC's top 30 CIPFA NN

2.3.1 Food waste case study

Two authorities were selected based on their similarities to CEC to present their food waste collection scheme in further detail. Cheshire West and Chester was chosen due to the geographical proximity to CEC and because it is also CIPFA NN no. 5. Due to Cheshire West and Chester's similarity to CEC the LA's recycling performance is likely to be a good indicator of the food waste recycling and overall recycling performance potential of CEC. North Somerset Council was selected as it is the highest ranking CIPFA NN to CEC that has a food waste collection service.

Table 8 Cheshire West and North Somerset waste performance summary 2020-2023

Local Authority	Cheshire West	North Somerset
Food waste service introduced	2012	2010
Recycling rate 2022-2023	56.4%	58.9%
LR League rank 2022-2023	23	10

Local Authority	Cheshire West	North Somerset
Recycling rate 2021-2022	57.6%	59.5%
LR League table ranking 2021-2022	24	12
Recycling rate 2020-2021	54.5%	60.4%
LR League ranking 2020-2021	42	7
Food waste yield 2022-2023	59.8	74.8
Food waste yield 2021-2022	66.4	81.3
Food waste yield 2020-2021	70.6	82.0
Residual yield 2022-2023	406.7	370.3
Residual yield 2021-2022	428.3	389.5
Residual yield 2020-2021	446.1	404.0

North Somerset introduced food waste collections in 2010. Cheshire West introduced a separate food waste collection in 2012. Both schemes use 23 litre kerbside caddies and 7 litre kitchen caddies. North Somerset has performed consistently high in overall recycling percentage since the introduction of the weekly food waste collections. The year that the separate weekly food waste collection was introduced in North Somerset, it ranked 46th on the LR League table with an overall recycling rate of 51%, the following year after the food waste service was piloted North Somerset climbed up 35 rankings to 11th highest overall recycling rate, with an increase of 8 percentage points to 59.7% overall recycling rate. North Somerset's recycling rate has stayed consistently around 58-60%.

Prior to Cheshire West and Chester introducing separate food waste collections in 2012, the LA ranked 81st in 2010/2011 and 76th 2011/2012. At this time CEC was a better performing local authority in overall recycling percentage and was ranked 10 places above Cheshire West and Chester in 2010/2011 at 71st place and 35 places above Cheshire West and Chester in 2011/2012 at 41st place. Cheshire West and Chester overtook CEC and moved up the recycling league table to 24th place in 2012/2013 after the food waste service collection was introduced. Although there has been a few years of fluctuation, Cheshire West and Chester has performed at around 55% or higher since the food waste service introduction.

2.4 Similar authorities with 3-weekly residual collection

In 2021, a feasibility study of three weekly residual waste collections was undertaken on behalf of CEC. In order to determine the likely changes in tonnages of moving to three weekly residual collections, the feasibility study examined the yields of authorities before and after the change and calculated the percentage change. We build on this information here, by including Mid Devon District Council, who has since made the change to three weekly residual waste collections (October 2022) and is NN rank 27, so very comparable to CEC. As Mid Devon made the change part way through the most recent year of data, for this we compare the six months after the change with the same six months a year earlier. Table

9 shows the results of comparing the available data after the change with the same time period a year previously. As with almost all authorities moving to three weekly residual collections, there is an overall reduction in kerbside waste. Analysis as part of the three weekly residual feasibility study examined HWRC and fly-tipping tonnages before and after the service change and found no clear evidence of an increase in either. This suggests that there may be a genuine waste prevention effect of moving to three weekly residual collections, but caution must be used when considering the savings possible.

Table 9: Mid Devon pre and post 3-weekly residual service introduction yields (kg/hh/yr equivalent)

Mid Devon	Dry recycling	Food waste	Residual waste	Total
October 2021 - March 2022 (annualised)	180	93	355	626
October 2022- March 2023 (annualised)	181	95	307	582
% Change	0.4%	2.9%	-13.5%	-7.1%

Table 10 shows the percentage changes of authorities included in the three weekly feasibility study and the new data available from Mid Devon.

Table 10: Percentage change in kerbside tonnages for authorities implementing three weekly residual collections (Mid Devon comparing 6 months after the change with the same 6 months the year before; other authorities' data from the three weekly feasibility study)

Authority	Dry recycling	Food	Residual
Bury	1.9%	*	-16.3%
Daventry	15.5%	57.3%	-15.6%
East Devon	23.0%	7.7%	-22.5%
Gwynedd	4.1%	24.8%	-15.7%
Isle of Anglesey	28.2%	31.7%	-26.2%
Oldham	-8.1%	*	-17.2%
Powys	-3.0%	25.0%	-28.5%
Rochdale	8.2%	*	-29.2%
Mid Devon	0.4%	2.9%	-13.5%
New average change	**7.8%****	**21.1%**	**-20.5%**

* unknown as mixed organics service

** excludes outliers of Powys and Isle of Anglesey (as in three weekly feasibility study)

We have modelled a 21.1% increase in food waste (compared to the value found from benchmarking authorities with fortnightly residual waste collections) and a 20.5% reduction in residual waste.

The previous analysis noted that CEC already diverts significant amounts of material for recycling and so a lower increase was modelled equivalent to 4.3%. This is also the percentage increase we have used for this study.

3 Methodology

The following section provides an overview of the methodology adopted by Resource Futures to complete the options modelling. This includes our approach to modelling resource requirements and financial modelling.

3.1 Operational modelling

All operational modelling was completed using WRAP's Kerbside Assessment Tool (KAT) which allows current collections to be modelled and potential kerbside collection profile options to be forecast and evaluated. Costs were calculated for each option by identifying the performance and resources necessary to deliver each of the modelled options. The financial assessment considered operational costs including staff costs, vehicle maintenance and fuel, fleet replacement costs, and fees for treating, sorting and/or disposal of materials. Any potential income estimated from the sale of recyclable materials was included as part of the treatment and disposal costs. Capital costs were calculated to provide the initial investment required for each option for vehicles and containers. It assumed that future service design will be mirrored across all household types.

KAT projections are based on a large number of assumptions with specific local data entered, where available, to estimate resource requirement. KAT therefore models only generic systems. This is appropriate to allow comparison of options but, at the implementation stage, a more detailed specification and operational development process will be needed to define the specific details of the system. This will also need to consider additional cost elements to be included, for example, operational base requirements, and legal and communications support.

3.2 Financial modelling

The process of calculating costs for each option was undertaken following the identification of performance levels and the quantification of resources necessary to deliver each of the modelled options. Costs are presented as follows:

- Operational costs comprising the annual cost to operate the services: including staff costs, vehicle hire and running costs, container replacements (accounting for damaged and lost bins) and fees for the treatment, sorting or disposal of materials.
- Capital costs provide the initial investment required for each option for vehicles, containers and communications. Vehicle costs are based on typical unit costs for each vehicle type. The financial modelling does not include the costs associated with the removal of existing containers or distribution of new containers.
- Transitional costs include service mobilisation costs as requested.

3.3 Developing baseline

Before modelling alternative options and their sensitivities, the Baseline model, representative of current operations and performance, was modelled within KAT. CEC completed data sheets for both operational and financial information, at the start of the project, to inform the development of this model. All data and assumptions used in the modelling of the baseline model were presented to CEC, with the opportunity to review and comment on assumptions before modelling commenced. These are in the PowerPoint file of the 'Baseline and Assumptions Presentation' submitted to CEC. This section provides a summary of the characteristics of the Baseline model, as well as any updates made to the model based on feedback received from CEC.

The Baseline model was built to reflect waste arisings, recycling performance, set out and participation rates and resources (vehicles and collection crew) required. This model reflects CEC's core rounds that serve kerbside and flatted properties, where both recycling and residual waste are collected by:

- 14 x 26 tonne RCVs
- 1 x 18 tonne RCV
- 1 x 7.5 tonne RCV

When mixed organics was free, it was collected using:

- 15 x 26 tonne RCVs (of which two were hired for 6 months over the summer months)
- 1 x 18 tonne RCV
- 1 x 7.5 tonne RCV

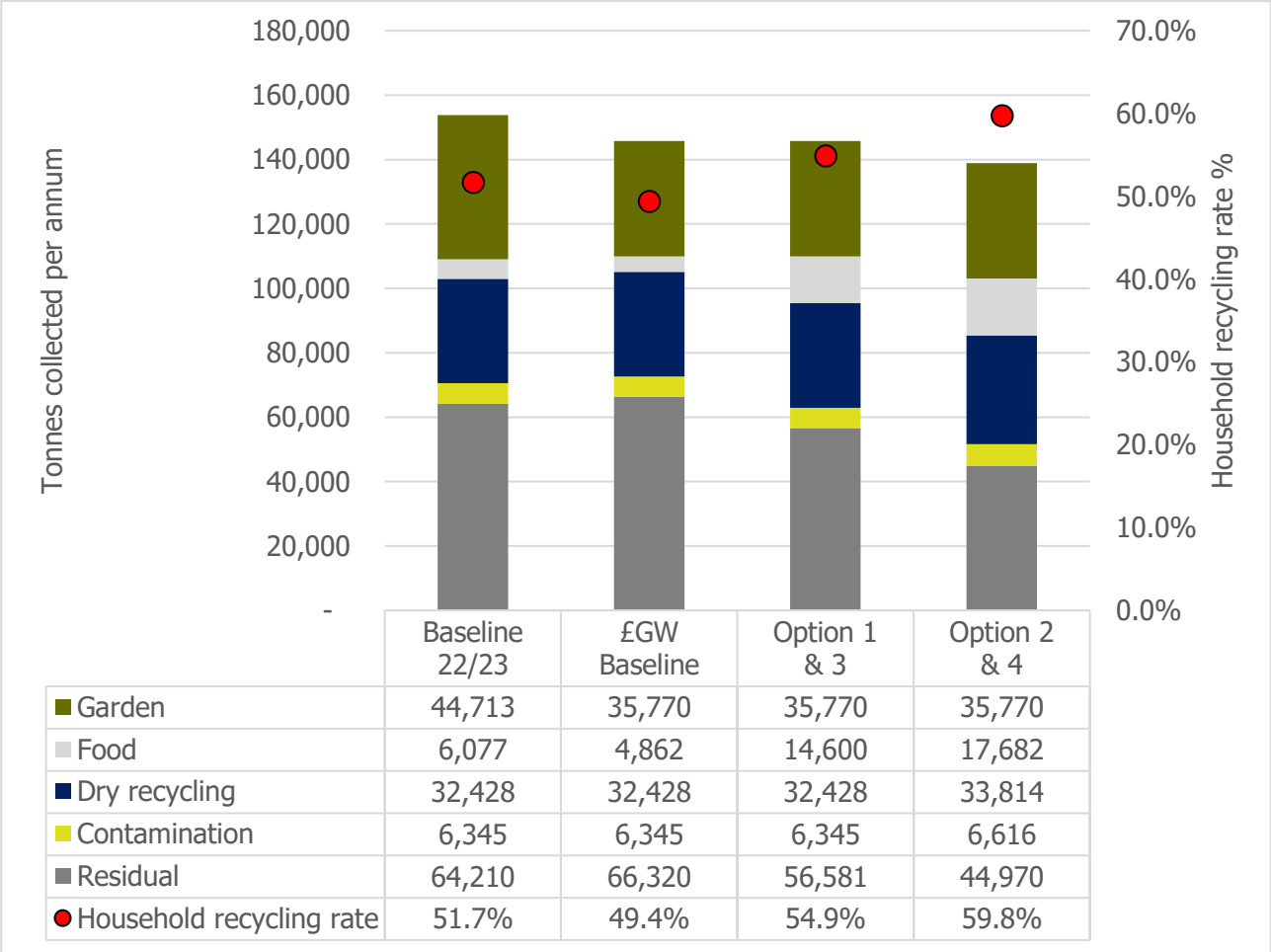
Vehicle numbers required for the charged service are not yet known, with rounds currently being largely unchanged, but it is assumed that there will be a reduction of two vehicles. It was agreed with CEC to exclude the 7.5 tonne vehicles from the modelling, as these have vastly different payloads and round sizes compared to the larger vehicles and these smaller vehicles would be required in all options.

4 Results

The following provides the results of the modelling completed, including a summary of the recycling performance, resourcing requirements and cost implications of each option.

4.1 Kerbside recycling performance

This section presents the recycling performance calculated for each option.



	Baseline 22/23	£GW Baseline	Option 1 & 3	Option 2 & 4
Garden	44,713	35,770	35,770	35,770
Food	6,077	4,862	14,600	17,682
Dry recycling	32,428	32,428	32,428	33,814
Contamination	6,345	6,345	6,345	6,616
Residual	64,210	66,320	56,581	44,970
Household recycling rate	51.7%	49.4%	54.9%	59.8%

Figure 3: Tonnages collected at kerbside and the household recycling rate (including non-kerbside) for each option

Figure 3 above displays the total tonnage collected for each option. The chart presents residual (grey bars), dry recycling (blue bars), garden waste (light brown bars) and food (light green bars) tonnages for ease of comparison. Contamination within the recycling collections is shown as an orange bar, with the data table provided within the chart displaying the tonnage figures for reference. The chart also provides the recycling rate for each option, indicated by the red dots. The chart shows:

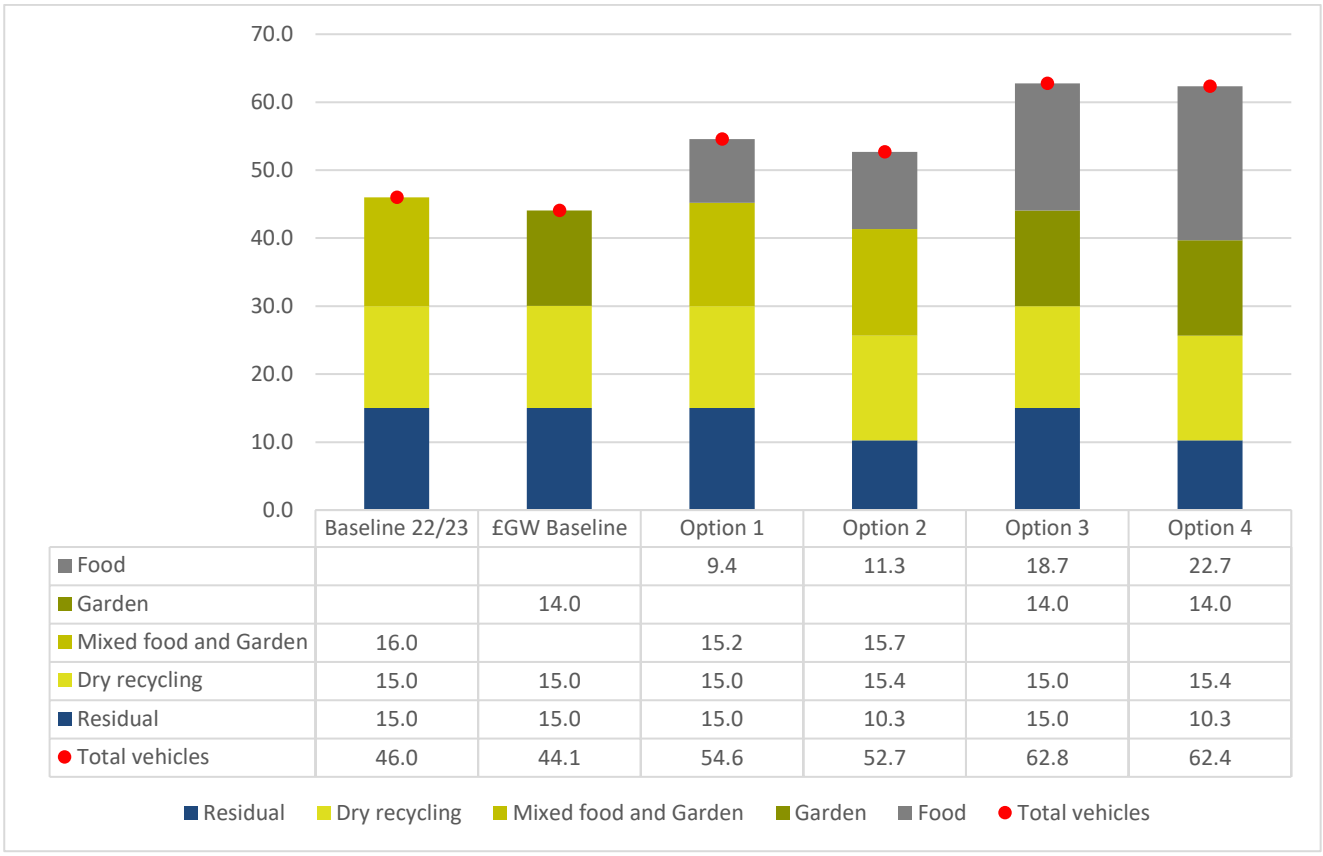
- A decrease in food and garden waste collected between the 22/23 baseline and the £GW baseline, and a slight increase in residual as some of this reduction in garden waste and all of the reduction in food waste are placed in the residual bin. This reduces the recycling rate by over 2 percentage points.
- When the food waste service is introduced in Options 1 and 3, there is a large increase in food waste collected compared to the £GW baseline and a corresponding decrease in residual waste. This increases the recycling rate by over 5 percentage points compared to the £GW baseline.
- Moving to three weekly residual waste collections, in Options 2 and 4 sees an increase in food and dry recycling and a large reduction in residual waste. Contamination is assumed to increase at the same rate as dry recycling. The recycling rate for this option is modelled to increase by

over 10 percentage points relative to the £GW baseline. This option models an overall decrease in kerbside waste, which is seen in almost all authorities when moving to three weekly residual collections.

4.2 Resource requirements

Output tables from the KAT modelling detailing the results for each option can be found in Appendix A. Figure 4 and Figure 5 below show the number of vehicles and staff required for each collection service for each option (excluding the D1 flats residual round and the 7.5 tonne vehicle for each service). The two extra vehicles required for garden waste in the summer are included here. Values are shown to 1 decimal place here but are rounded up for each service in the cost modelling.

- Between the 22/23 baseline and £GW baseline, there is a slight decrease in vehicles required for the mixed organics/garden waste service primarily due to the reduction in set out rate. There is no change in residual vehicles required despite the slight increase in tonnage.
- Option 1 assumes food waste is collected with garden waste one week and by dedicated separate vehicles the next week. This option requires 10 new food waste vehicles and a small increase in mixed organics vehicles, although not as high as the 22/23 baseline, as it is assumed that set out for the food waste and charged garden waste service combined would not be as high as when the garden waste service was free. There is no change in residual vehicles required despite the decrease in tonnage.
- Option 2 assumes a three weekly residual waste collection service (alongside food being collected with garden waste one week and dedicated separate vehicles the next). The theoretical maximum reduction in vehicles possible when moving between fortnightly and three weekly collections is one third. This is possible if the number of tips and set-out rate stay the same. The residual vehicle requirements output from KAT with three weekly residual collections are very close to this theoretical maximum, moving from 15 to 10.3, despite an increase in set out rate from 95% to 100%. (Set out rates in KAT can only be input in 5 percentage point increments. In reality, this increase would likely be slightly lower, say from 96% to 99%.) The number of vehicles is rounded up for the cost modelling, but caution should still be exercised with this value as the model showed that the vehicles were close to filling their second tip when collecting residual waste three weekly. If collected weights are regularly higher than the average weight, it is likely that a third tip would be required, which given the high driving times in CEC, would put drivers over time. Since crews work on a team completion principle, this risk is minimised.
- Option 3 and 4 model the same tonnages as Options 1 and 2 respectively but assume that food waste is collected exclusively by new vehicles and so require double the number of new food waste vehicles relative to Options 1 and 2 respectively, but the same number of garden waste vehicles as the £GW baseline. Overall, Option 3 requires around 8 more vehicles than Option 1 and Option 4 requires around 10 more vehicles than Option 2, showing that it is likely to be more efficient to collect food waste with garden waste on the fortnight where the vehicle is already passing households.



	Baseline 22/23	£GW Baseline	Option 1	Option 2	Option 3	Option 4
Food			9.4	11.3	18.7	22.7
Garden		14.0			14.0	14.0
Mixed food and Garden	16.0		15.2	15.7		
Dry recycling	15.0	15.0	15.0	15.4	15.0	15.4
Residual	15.0	15.0	15.0	10.3	15.0	10.3
Total vehicles	46.0	44.1	54.6	52.7	62.8	62.4

Figure 4: Vehicles required for each option

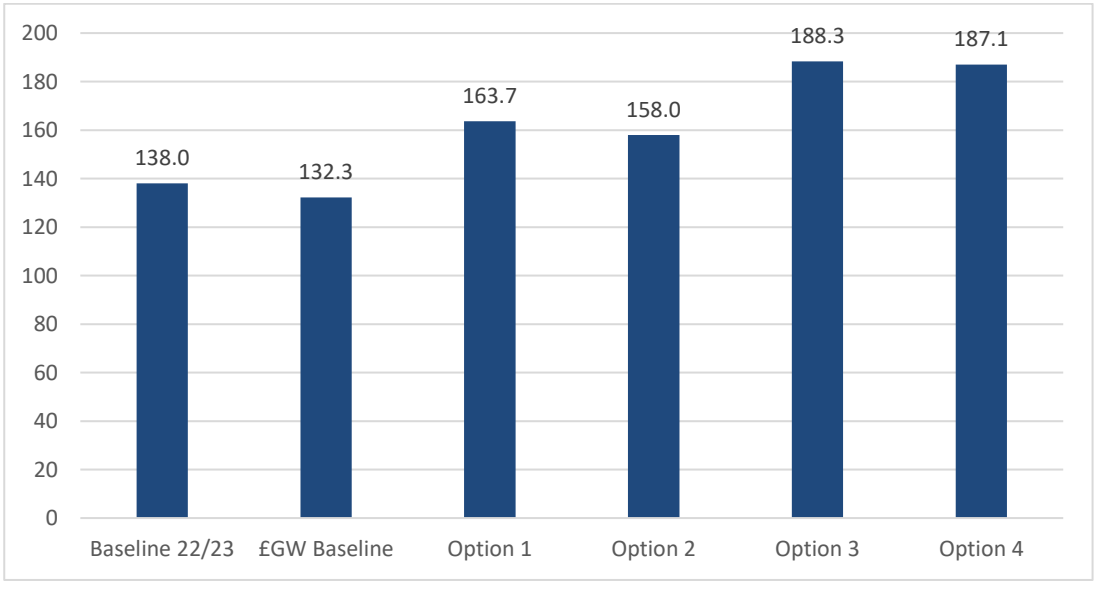


Figure 5: Number of staff required per option

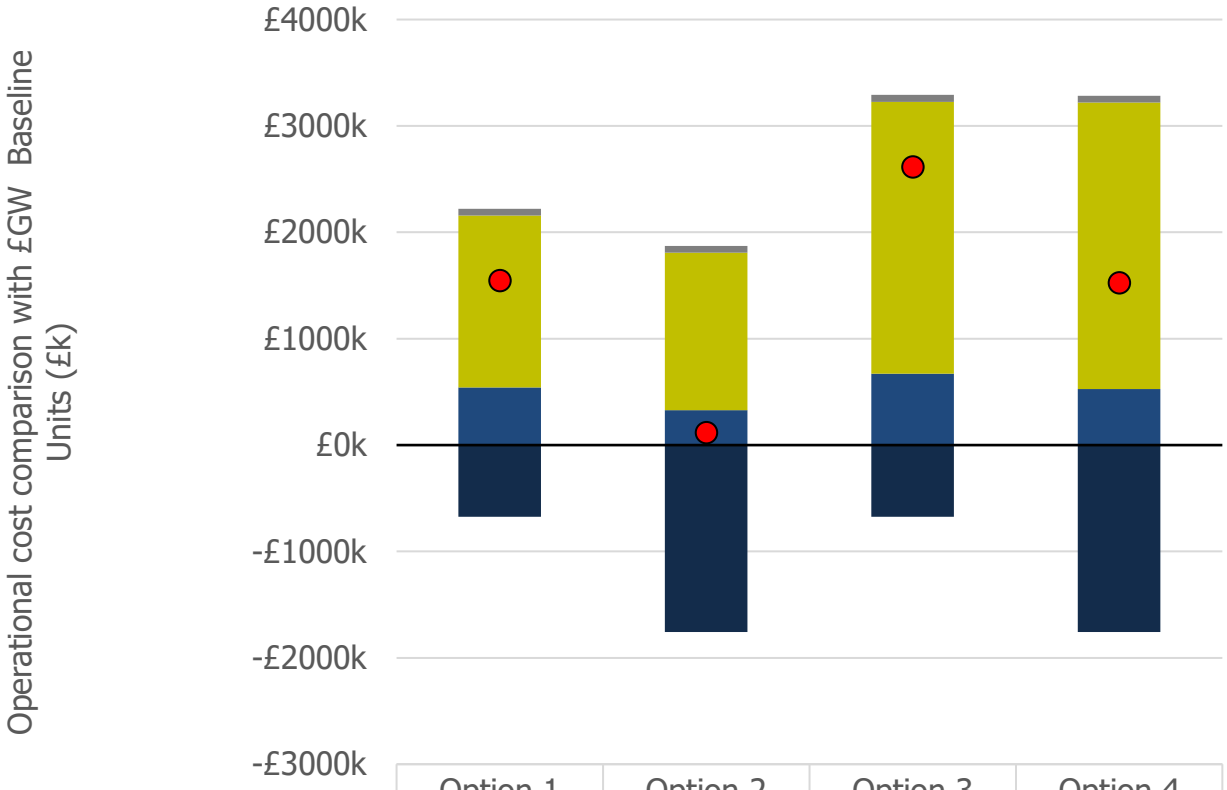
4.3 Financial performance

The differences in cost of each option compared to the £GW Baseline are presented in this section, which include both the costs associated with the collection of waste, and the disposal or treatment costs of material collected.

4.3.1 Annual operational costs

Figure 6 shows the annual cost of the service relative to the £GW baseline. This excludes any costs that are only incurred in year one, such as new containers and transitional costs. The results show that:

- All options show a decrease in disposal/treatment costs due to the diversion of recyclables away from residual waste. Options 2 and 4 (with three weekly residual collections) show the greatest savings, due to greater diversion and also the modelled waste prevention effect. In the worst case scenario that there is no waste prevention effect and the entire difference (6,872 tonnes) ends up being taken to HWRCs as residual waste, the reduction in savings of these options would be around £800k. As mentioned in section 2.4, there was no clear evidence from previous analysis that tonnages at HWRCS or street cleansing would be significantly affected by moving to three weekly residual collections at the kerbside.
- Container replacement costs covers the additional food waste container replacement and are the same for all options.
- Staff costs are increased in all options as more vehicles and hence staff are required in each option. Options 1 and 2 co-collect food waste with garden waste every fortnight and so additional staff costs are lower for these options than Options 3 and 4.
- Vehicle costs also increase in each option due to the additional vehicles required to collect weekly food waste.
- Overall, Option 2 is the lowest cost option, where food is co-collected with garden waste every fortnight and residual waste collections are every three weeks.



	Option 1	Option 2	Option 3	Option 4
Sorting / disposal / treatment	-£674k	-£1756k	-£674k	-£1756k
Container Replacements	£64k	£64k	£64k	£64k
Staff	£1614k	£1480k	£2556k	£2691k
Vehicles	£542k	£329k	£671k	£528k
Total	£1546k	£117k	£2617k	£1527k

Figure 6: Costs in comparison with the charged garden waste baseline

4.3.2 Capital costs

Capital costs for each option have been calculated to provide CEC with an indication of the initial capital investment required. Costs are included for vehicle purchase and container purchase, as shown in Table 11. In Options 1 and 2 two additional vehicles are required relative to the £GW baseline, so we have included the capital cost to show the possible capital costs of introducing a food waste service. In reality (and in the cost modelling presented in section 4.3.1), we assume that CEC would hire these vehicles, as they have previously when all households were offered the mixed organics service. The container costs are based on all standard access households receiving an external caddy, flats requiring one 140 litre wheeled bin per 10 households and all households receiving an internal caddy. We understand that all households on the mixed organics service were provided with an internal caddy several years ago. It is not known how many households still have these and to encourage participation in the service we recommend delivering a new container to each household, since these can be delivered at the same time as the external caddies. For Options 2 and 4, there is a reduction in residual vehicles required and slight increase in dry recycling vehicles, it is assumed that the overall decrease would come from the

hired vehicles with CEC retaining the same number of leased vehicles, thus these savings are not included in the table. The total capital cost for all options is greater than the £2.7 M that is being provided as capital funding by Defra. It should be noted that the new food waste vehicles are assumed to be electric. Electric vehicles have higher capital costs but lower fuel costs, so whilst the capital costs are higher than the funding available, this may be compensated for with lower ongoing revenue costs. Typically, the annualised capital and running costs of electric vehicles are similar to diesel vehicles. Since CEC have higher mileage than a typical authority, using electric vehicles instead of diesel could have a higher benefit within CEC.

Table 11: Capital costs

	Option 1	Option 2	Option 3	Option 4
Food waste vehicles	£1,300,000	£1,560,000	£2,470,000	£2,990,000
Mixed organics vehicles	£490,000	£490,000	£0	£0
Containers	£1,503,916	£1,503,916	£1,503,916	£1,503,916
Total	**£3,293,916**	**£3,553,916**	**£3,973,916**	**£4,493,916**

4.3.3 Transitional costs

Additional costs are likely to be required to ensure a successful transition into a 3-weekly and separate food waste service. These transitional requirements have been identified as:

- Communication costs:
    - £1.50 per household for Options 1 and 3 and £2.50 per household for Options 2 and 4. It is higher for the options with three weekly residual waste collections, as it is assumed this option is more likely to require a change in collection day for households and will require more engagement and communication with residents/citizens. The higher spend on the options with three weekly residual collection would allow for more touch points with residents.
- Temporary engagement officers to assist with rollout and education (community wardens and waste educationalists, as requested by CEC) to see a successful transition:
    - Modelled at £25,000 (plus employer's pension and national insurance contributions) and £7,000 per employee for vehicle costs. We understand there is currently a range of pay grades that these roles could sit within, dependent on responsibilities, this salary is in the middle of these.
    - It is assumed that four staff would be required for Options 1 and 3 and six staff for Options 2 and 4.
    - These staff are assumed to be employed for one year (it is anticipated that they would be recruited prior to the service changes as well as during the mobilisation).
- Crews to deliver food waste caddies to all residents:
    - Assuming 2000 households could be delivered on a daily basis per vehicle with a driver and one loader and a vehicle cost of £76/day.

Table 12: Transitional costs

	Options 1 and 3	Options 2 and 4
Waste educationalists and community wardens	£148,970	£223,454
Communications campaign	£293,772	£489,620
Container delivery	£39,963	£39,963
Total	**£482,704**	**£753,037**

4.3.4 Ongoing revenue costs

Ongoing revenue costs are identified as vehicle running costs, staff costs, container replacements and treatment costs. Table 13 shows the ongoing revenue costs of the food waste service relative to the charged garden waste baseline. The focus here is purely on the additional costs of collecting food waste, so does not include any additional savings from changing residual frequency to three weekly for Options 2 and 4. Fuel costs are included in vehicle running costs. As the separate food waste vehicles are assumed to be electric, fuel costs are modelled at half the cost of diesel vehicles.

Table 13: Ongoing revenue costs of the food waste service

	Option 1	Option 2	Option 3	Option 4
Vehicle running costs	£304,433	£350,100	£433,833	£525,167
Staff	£1,614,494	£1,883,577	£2,556,283	£3,094,447
Container replacement	£63,732	£63,732	£63,732	£63,732
Disposal costs	-£674,285	-£887,689	-£674,285	-£887,689
Total	**£1,263,375**	**£1,355,720**	**£2,294,063**	**£2,692,157**

4.4 Carbon assessment

A carbon assessment has been completed for each option using the Carbon Waste and Resources Metric (Carbon WARM) produced by WRAP[2]. The metric has been developed to allow monitoring and evaluation of the impacts of the Resources and Waste Strategy in England, in terms of its Greenhouse Gas (GHG) emissions impact, measured as carbon dioxide equivalent (CO_2e). The metric does not provide a "footprint" (i.e., it is not a statement of the absolute emission that can be attributed to a material, product or activity) but rather a relative measure that quantifies the carbon saving (or additional emission) for a given material / treatment combination. The assessment uses the following approach:

[2] WRAP (2021) Carbon Waste and Resources Metric https://wrap.org.uk/resources/report/carbon-waste-and-resources-metric

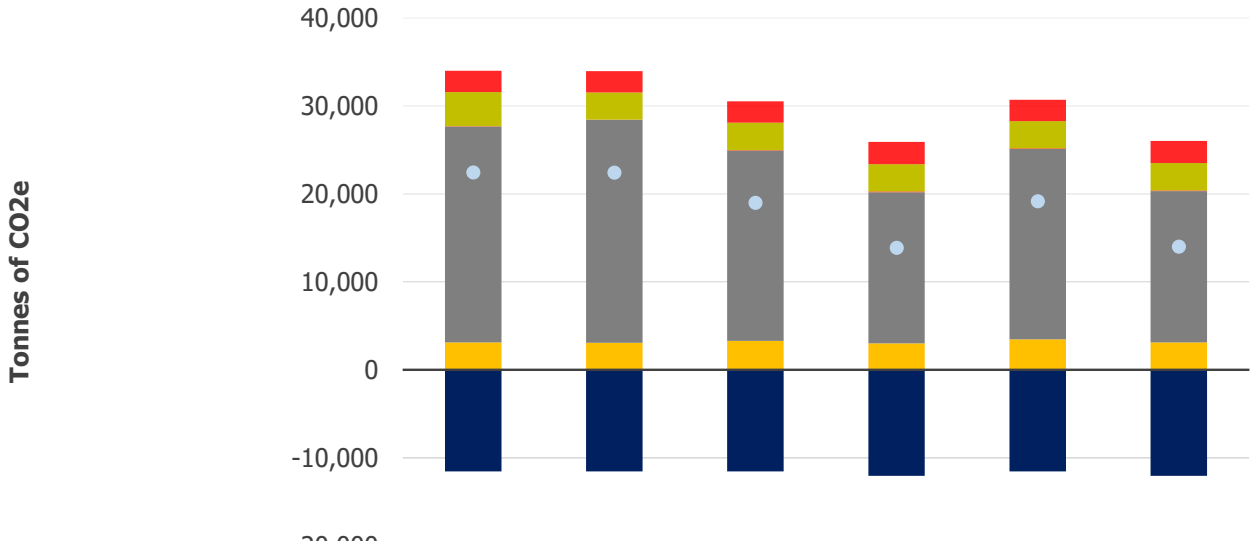
- The model accounts for the different treatment routes of the key dry recycling materials (paper, card, glass, plastics and metals) and organic materials (food and garden waste).
- For the residual waste stream, composition data has been used to identify the estimated quantity of each recyclable material and calculate the net impact of incinerating that mix of materials through Energy from Waste (EfW) in the Baseline.
- For future options, the model diverts recyclable materials in the residual stream to either the kerbside dry recycling or organics collection based on the yields modelled in KAT. For organics, the model accounts for food and garden waste sent to IVC.
- It is assumed that any contamination within the dry recycling stream will be treated through EfW. Contamination is modelled on the yields projected for each option. However, it does not account for any material lost through the MRF sorting process.
- In addition to the carbon assessment for materials, the annual CO_2e emissions from collection vehicles are also included. These are modelled based on the distance driven by the waste collection fleet, as calculated in the KAT model. For diesel vehicles, the assessment utilises the relevant vehicle emission factor (from UK Government GHG Conversion Factors for Company Reporting) for each vehicle type to calculate CO_2e emissions for the Baseline and each option. Electric vehicles were assumed to use 1.08kWh per km based on an electric vehicle trial[3], which resulted in emissions per km around half of those of a diesel vehicle.

The results of the assessment are shown in Figure 7 with the coloured bars identifying emissions by category, including residual waste sent to EfW (grey), dry recycling (dark blue), food (orange), garden (light green), dry recycling contamination sent to EfW (red) and collection vehicles (yellow). The light blue dot identifies overall annual tonnes of CO_2e.

The key results show:

- The effect on total emissions is primarily influenced by the tonnes of residual waste modelled in each option.
- Introducing a food waste collection (options 1 and 3) offers significant carbon savings due to the reduction in residual waste, despite small increases in emissions from treating the food waste at the IVC and the emissions of the additional vehicles required for collection.
- Moving to three weekly residual collections (options 2 and 4) offers further significant carbon savings again due to the reduction in residual waste. These options also have lower collection vehicle emissions than the same option with fortnightly collections due to fewer vehicles required.
- Collection vehicle emissions are slightly lower when food waste is collected with garden waste one week and a separate vehicle on the next week, despite the separate food waste vehicles being electric and having lower emissions than the mixed organics vehicles. This is because only two extra mixed organics vehicles would be required (Option 1 or 2) compared to 10 or 11 (Option 3 or 4) food waste vehicles. This results in Option 2 having the lowest emissions.

[3] https://www.fleetnews.co.uk/features/four-key-takeaways-from-the-battery-electric-truck-trial



	22/23 BL	£GW BL	Option 1	Option 2	Option 3	Option 4
Dry recycling contamination (subsequently sent to EfW)	2,426	2,426	2,426	2,529	2,426	2,529
Garden Waste (composted)	3,857	3,086	3,086	3,086	3,086	3,086
Food Waste (composted mixed)	35	28	84	102	84	102
Dry recycling (reprocessed)	-11,542	-11,542	-11,542	-12,035	-11,542	-12,035
Residual waste (to EfW)	24,547	25,354	21,631	17,192	21,631	17,192
Collection vehicles	3,130	3,072	3,295	3,011	3,476	3,127
Total	22,453	22,424	18,980	13,885	19,161	14,001

Figure 7: Carbon assessment results

5 Conclusions

We have modelled a range of options introducing a weekly free food waste service in CEC to ensure the service is compliant with 'Simpler Recycling' regulations. As CEC will be provided with various funding for this (capital, transition, and ongoing revenue), we have broken the costs down for this new service into these categories to assess whether this funding will meet the costs incurred of introducing weekly free food waste collections. The options consider collecting food waste on the garden waste round one week, with food waste on a separate dedicated vehicle the next week (Option 1); and collecting food waste completely on dedicated separate vehicles (Option 3). We have also modelled these options with three weekly residual collections (Options 2 and 4) to show the savings possible.

All options showed significant reductions in overall treatment and disposal costs, due to the reduction in residual waste tonnage by the diversion of food waste; and increases in staff and vehicle costs.

The modelling showed that collecting food waste on a dedicated vehicle (Option 3) was more expensive than utilising the existing garden waste vehicles for one week per fortnight and a dedicated vehicle on the other week (Option 1). The modelled cost of Option 1 was around £1M below Option 3. It should be noted that all options were modelled using the current IVC gate fee for food and garden waste, as CEC is in a long-term contract. If it were possible to arrange for the treatment of food and garden waste separately in the future, it would be possible to lower the gate fees for garden waste, then Option 3 could have a lower cost than Option 1.

The options modelling three weekly residual collections showed savings of over £1M compared to their corresponding options with fortnightly residual collections. There is an overall reduction in staff and vehicles required, but the main reduction in costs is due to large savings in residual disposal. These options model a waste prevention effect, as has been seen in nearly every authority moving to three weekly residual collections. However, there is uncertainty on the size of the waste prevention effect and whether waste streams at HWRCS or fly tipping could increase, so these disposal savings should be treated with caution.

Again, collecting food waste with garden waste one week so that dedicated separate vehicles are only required to collect food waste every other week (Option 2) is cheaper than using separate dedicated vehicles weekly (Option 4).

The capital funding required to introduce a food waste collection is higher than the capital funding being provided by Defra. This is in part due to CEC's commitment to purchase electric vehicles, as these are more expensive than diesel vehicles. Electric vehicles have lower fuel costs, so using these vehicles will reduce ongoing revenue costs relative to diesel vehicles.

It is not yet known what funding will be provided to cover transitional costs or ongoing revenue costs. These costs are estimated in the model to be around £500k to introduce the food waste service to the current service (maintaining fortnightly residual) and will increase if residual waste is changed to three weekly, it is therefore anticipated in the region of £750k.

Appendix A

Description of output	22/23 Baseline		
	Standard Access + Flats		
	Refuse	Dry recycling	Mixed Organics
Type of collection	Residual	Co-mingled	Single stream
Collection frequency	Fortnightly	Fortnightly	Fortnightly
Number of hh served	194,683	192,109	189,927
Collection vehicle	RCV	RCV	RCV
Crew size	D+2	D+2	D+2
Number of collection vehicles	15.0	15.0	16.0
Tonnes collected including contamination	64,210	38,773	50790
Number of full loads collected per day	1.6	2.0	1.8
Number of hh passed by per vehicle per day	1,298	1,280	1187
Pass rate per hour of productive time	194	199	215
Number of hh collected from per vehicle per day	1,233	1,152	831

Description of output	£GW Baseline		
	Standard Access + Flats		
	Refuse	Dry recycling	£ GW + Food
Type of collection	Residual	Co-mingled	Single stream
Collection frequency	Fortnightly	Fortnightly	Fortnightly
Number of hh served	194,683	192,109	189,927
Subscribed hh	-	-	90,000
Collection vehicle	RCV	RCV	RCV
Crew size	D+2	D+2	D+2
Number of collection vehicles	15.0	15.0	14.0
Tonnes collected including contamination	66,320	38,773	40632
Number of full loads collected per day	1.7	2.0	1.6
Number of hh passed by per vehicle per day	1,295	1,280	1353
Pass rate per hour of productive time	194	199	254
Number of hh collected from per vehicle per day	1,230	1,152	609

Description of output	Option 1			
	Standard Access + Flats			
	Refuse	Dry recycling	Food Waste	Mixed Organics
Type of collection	Residual	Co-mingled	Single stream	Single stream
Collection frequency	Fortnightly	Fortnightly	Fortnightly	Fortnightly
Number of hh served	194,683	192,109	192,109	189,927
Collection vehicle	RCV	RCV	Dedicated food 7.5T GVW	RCV
Crew size	D+2	D+2	D+2	D+2
Number of collection vehicles	15.0	15.0	9.4	15.2
Tonnes collected including contamination	56,581	38,773	7,300	43071
Number of full loads collected per day	1.4	2.0	1.0	1.6
Number of hh passed by per vehicle per day	1,298	1,280	2,053	1,264
Pass rate per hour of productive time	194	199	365	230
Number of hh collected from per vehicle per day	1,233	1,152	1,026	759

Description of output	Option 2			
	Standard Access + Flats			
	Refuse	Dry recycling	Food Waste	Mixed Organics
Type of collection	Residual	Co-mingled	Single stream	Single stream
Collection frequency	Fortnightly	Fortnightly	Weekly	Fortnightly
Number of hh served	194,683	192,109	192,109	192,109
Collection vehicle	RCV	RCV	Dedicated food 7.5T GVW	RCV
Crew size	D+2	D+2	D+2	D+2
Number of collection vehicles	10.0	15.4	11.3	15.7
Tonnes collected including contamination	44,970	40,430	8,841	44612
Number of full loads collected per day	1.7	2.0	1.0	1.6
Number of hh passed by per vehicle per day	1,298	1,249	1,695	1,224
Pass rate per hour of productive time	194	195	302	222
Number of hh collected from per vehicle per day	1,233	1,124	932	796

Description of output	Option 3			
	Standard Access + Flats			
	Refuse	Dry recycling	Food Waste	Mixed Organics
Type of collection	Residual	Co-mingled	Single stream	Single stream
Collection frequency	Fortnightly	Fortnightly	Fortnightly	Fortnightly
Number of hh served	194,683	192,109	192,109	189,927
Collection vehicle	RCV	RCV	Dedicated food 7.5T GVW	RCV
Crew size	D+2	D+2	D+2	D+2
Number of collection vehicles	15.0	15.0	18.7	14.0
Tonnes collected including contamination	56,581	38,773	14,600	35770
Number of full loads collected per day	1.4	2.0	1.0	1.4
Number of hh passed by per vehicle per day	1,298	1,280	2,053	1,353
Pass rate per hour of productive time	194	199	365	254
Number of hh collected from per vehicle per day	1,233	1,152	1,026	609

Description of output	Option 4			
	Standard Access + Flats			
	Refuse	Dry recycling	Food Waste	Mixed Organics
Type of collection	Residual	Co-mingled	Single stream	Single stream
Collection frequency	Fortnightly	Fortnightly	Weekly	Fortnightly
Number of hh served	194,683	192,109	192,109	189,927
Collection vehicle	RCV	RCV	Dedicated food 7.5T GVW	RCV
Crew size	D+2	D+2	D+2	D+2
Number of collection vehicles	10.0	15.4	22.7	14.0
Tonnes collected including contamination	44,970	40,430	17,682	35770
Number of full loads collected per day	1.7	2.0	1.0	1.4
Number of hh passed by per vehicle per day	1,298	1,249	1,695	1,353
Pass rate per hour of productive time	194	249	228	254
Number of hh collected from per vehicle per day	1,233	1,124	932	609