The background features large, abstract, curved shapes in shades of green and purple. A large green shape curves from the top left towards the bottom right. A purple shape curves from the top left towards the bottom left. Another purple shape is at the bottom right.

**Waste and recycling collection service
options modelling – Herefordshire Council**

19-Jul-19

Acknowledgements:

Frith Resource Management would like to thank the essential contributions from waste management officers at Herefordshire Council throughout these modelling phases, in particular we would like to thank Kenton Vigus, Nicola Percival and Rebecca Evison.

Disclaimer:

Frith Resource Management Ltd (FRM) is an independent waste and resource management consultancy providing advice in accordance with the project brief. FRM has taken all reasonable care and diligence in the preparation of this report to ensure that all facts and analysis presented are as accurate as possible within the scope of the project. However no guarantee is provided in respect of the information presented, and FRM is not responsible for decisions or actions taken on the basis of the content of this report.

Executive Summary

Frith Resource Management (FRM) has been engaged to undertake a waste collection services review for Herefordshire Council. At present Herefordshire performs below average in terms of recycling performance against other Unitary Authorities, however this is driven by the lack of organic waste collection services rather than householder participation in the collection schemes in place.

This report presents the findings from the modelling work carried out by FRM which assessed the comparative costs and anticipated performance of the following household waste collection systems (those elements in **bold** represent changes to the current collection system).

Scenario	Collection Stream	Frequency	Capacity (l)
Baseline <i>As current</i>	Residual waste	Fortnightly	180l wheeled bin
	Dry recycling (Commingled)	Fortnightly	240l wheeled bin
	Food waste	<i>No separate food collection</i>	
	Garden waste	<i>No formal garden collection service¹</i>	
Option 1 <i>Current AWC + food + garden</i>	Residual waste	Fortnightly	180l wheeled bin
	Dry recycling (Commingled)	Fortnightly	240l wheeled bin
	Food waste	Weekly	Kitchen caddy and 23l bin
	Garden waste (free)	Fortnightly	240l wheeled bin
Option 2 <i>Alternate Three Weekly (ATWC) + food + garden</i>	Residual waste	Three weekly (week 1)	180l wheeled bin
	Dry recycling (Twin stream, paper and card out)	Three weekly (week 2) Cans, plastic, glass	180l wheeled bin
		Three weekly (week 3) Paper and card	240l wheeled bin
	Food waste	Weekly	Kitchen caddy and 23l bin
	Garden waste (free)	Fortnightly	240l wheeled bin
Option 3 <i>Kerbside sort + food + garden</i>	Residual waste	Fortnightly	180l wheeled bin
	Dry recycling	Weekly	3x 50l boxes
	Food waste	Weekly	Kitchen caddy and 23l bin
	Garden waste (free)	Fortnightly	240l wheeled bin

The assessment applied industry standard collection modelling tools and also included a high-level appraisal of costs associated with subsequent recycling, treatment and disposal, to provide an indicative total net cost of each system, to facilitate comparison between options.

¹ Householders can purchase sacks and present garden waste to be collected with residual waste, however this is not considered a formal service as the garden waste does not go for recycling.

This table provides a comparison of the results across all options. All alternatives have a significantly greater cost, than the baseline. This is primarily because of the introduction of a dedicated food waste collection, and a free garden waste collection service in all alternative options. Similar collection systems have been referenced within the recent Government National Resources and Waste Strategy.

	Indicative Whole System Cost	Total number of vehicles required	Kerbside recycling rate ²	Indicative annual cost increase relative to baseline
Baseline (current service)	£7,962,501	19	32%	-
Option 1	£11,966,108	48	52%	c. £4 million
Option 2	£11,496,216	48	57%	c. £3.5 million
Option 3	£12,700,988	63	52%	c. £4.7 million

In all alternative systems additional vehicles are required. In each option, 8 collection vehicles are estimated to be required to collect the separate garden waste tonnage, and 21 or 22 vehicles are required to collect the food tonnage. The difference in vehicle numbers between the alternative options is largely driven by the collection of the dry recycling and residual waste. The same total number of vehicles is required for Option 1 and 2, where a saving in 1 vehicle for the recycling and residual system in Option 2 is offset by the need for an additional vehicle to collect the increased food waste arising.

In all alternative scenarios the kerbside recycling rate increases substantially against the baseline. Again, this is driven by the introduction of a food and garden waste collection service. Option 2 is the preferred option when comparing the anticipated recycling rate. It is also the least cost of the alternative collection systems, albeit whilst still a significant increase in costs above the baseline. Collecting two-stream recycling, via an alternate three-weekly collection, with the introduction of a food waste and garden waste collection scheme results in an estimated 'kerbside recycling rate' of 57%. This modelled high performance is enhanced by the restricted residual capacity (180l wheeled bin collected every three weeks, as opposed to every two weeks as at present). Three weekly collections are evident in increasing numbers of Councils in the UK to manage both performance and cost.

Both Option 1 and Option 3 result in a recycling rate of 52%. The main differential between these two options is the level of contamination reported. Option 1 has the highest dry recycling contamination tonnage, which can be typical of a commingled collection. Whilst Option 3 however, results in the lowest contamination rate of the modelled options and therefore is likely to yield higher quality recycling.

The implications of system changes would also need to be investigated in the light of the residual waste treatment contract and procurement of adequate recycling and organic waste treatment capacity.

² The total Council recycling rate would also include the waste flows from the Household Waste Recycling Centres, Bring Banks and other household waste streams not collected via the standard kerbside collection service. Therefore, for example, if a system in this report shows a +5% uplift in 'kerbside recycling rate', it would be envisaged that this would be a lower uplift in the total Council recycling rate (e.g. it could be +2, +3 or +4% depending on other factors within the Council).

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1 Introduction

1.1 Introduction to the scope and aims of the project

Frith Resource Management (FRM) has been engaged to undertake a waste services review for Herefordshire County Council. The council requires an assessment of the expected performance and associated costs of three different waste management collection options.

An inception meeting was held on 24th June 2019. Three options were proposed for modelling, in addition to the baseline service. These are shown in Table 1 below. Changes from the baseline (current service) are highlighted in **bold**.

Table 1: Outline of alternative scenarios

Scenario	Collection	Frequency	Capacity (l)
Baseline <i>As current</i>	Residual	Fortnightly	180l wheeled bin
	Dry (Commingled)	Fortnightly	240l wheeled bin
	Food waste	<i>No separate food collection</i>	
	Garden waste	<i>No formal garden collection service³</i>	
Option 1 <i>Current AWC + food + garden</i>	Residual	Fortnightly	180l wheeled bin
	Dry (Commingled)	Fortnightly	240l wheeled bin
	Food waste	Weekly	Kitchen caddy and 23l bin
	Garden waste (free)	Fortnightly	240l wheeled bin
Option 2 <i>Alternate Three Weekly (ATWC) + food + garden</i>	Residual	Three weekly (week 1)	180l wheeled bin
	Dry (Twin stream, paper and card out)	Three weekly (week 2) Cans, plastic, glass	180l wheeled bin
		Three weekly (week 3) Paper and card	240l wheeled bin
	Food waste	Weekly	Kitchen caddy and 23l bin
	Garden waste (free)	Fortnightly	240l wheeled bin
Option 3 <i>Kerbside sort + food + garden</i>	Residual	Fortnightly	180l wheeled bin
	Dry	Weekly	3x 50l boxes
	Food waste	Weekly	Kitchen caddy and 23l bin
	Garden waste (free)	Fortnightly	240l wheeled bin

³ Householders can purchase sacks and present garden waste to be collected with residual waste, however this is not considered a formal service as the garden waste does not go for recycling.

2 Background

2.1 Study area

Herefordshire County Council is a predominantly rural Unitary Authority (UA) with the fourth lowest population density in England.⁴ The main urban areas are Hereford, Leominster, Kington, Ledbury and Ross-on-Wye, and are located across the County. The current estimated population of Herefordshire is 189,300⁵ and the county covers an area of c. 842 square miles.

2.2 Summary of current waste collection system

The current waste collection system in Herefordshire is outlined in Table 2 below. The system has an alternate weekly collection (AWC) of residual waste and recycling. There is no separate garden waste collection scheme from the kerbside, however householders can present (purchased) garden waste sacks to be presented and co-collected with the residual waste. This does not currently contribute to the County's recycling rate as the material is disposed of at the Energy from Waste plant or landfill.

Food waste is not currently separately collected across the County, although waste composition analysis provided to FRM by Herefordshire for this project has identified that over 13,000 tonnes is potentially available for collection from the residual stream (see Table 4). As shown in Table 3, Herefordshire's recycling rate peaked in 2016/17 at 41.2% but has been generally steady between 38.6% and 41.2% since 2012/13.

Table 2: Herefordshire's current waste collection system

	Residual	Kerbside Dry recycling
Tonnage	32,925	18,882
Households	85,096	85,096
Frequency	Fortnightly	Fortnightly
Bin size	180l wheeled bin	240l wheeled bin
Vehicles used	26t RCV, 18t RCV, Narrow access	26t RCV, 18t RCV, Narrow access

Table 3 Herefordshire Recycling performance⁶

Household waste sent for recycling and composting (%)					
2012/13	2013/14	2014/15	2015/16	2016/17	2017/18
39.7%	38.6%	40.0%	40.0%	41.2%	39.8%

⁴ <https://understanding.herefordshire.gov.uk/population/>

⁵ Herefordshire Council (2018) The Population of Herefordshire. PDF

⁶ DEFRA (2017/18) MSW statistics, based on Local Authority reported data for WasteDataFlow.

Recent waste composition information was provided by Herefordshire CC and it was agreed that the data shown in Table 4 would be applied in the options modelling.

Table 4 Herefordshire Waste Composition Analysis

Material	Residual (%)	Dry recycling
Paper	6.05%	42.43%
Card	2.35%	11.45%
Plastic Film	6.23%	0%
Dense Plastic	5.45%	8.72%
Textiles	3.46%	0%
Misc Combustible	12.82%	0%
Misc Non-Combustible	8.35%	0%
Glass	1.46%	21.09%
Ferrous Metal	1.18%	3.79%
Non-ferrous Metal	1.30%	1.26%
Garden waste	6.80%	0%
Putrescibles	41.51%	0%
Non-putrescible Food	1.43%	0%
Fines	1.50%	0%
Other wastes	0.08%	0%
WEEE	0.03%	0%
Contamination	N/A	11.26% (contamination)
Total	100% (32,925 tonnes)	100% (18,882 tonnes)

3 High level overview of recycling performance

3.1 Introduction

This section summarises, at a high level, the performance of Herefordshire Council's (hereon 'Herefordshire') recycling rates compared to others, based on published data. Information was taken from WasteDataFlow⁷ and WRAP's Local Authority portal⁸. The charts in this section show Herefordshire's recycling rate performance, firstly against all Unitary Authorities (UA) in the UK, and then further analysed against those UAs providing comparable services to the Council, as follows:

Table 5: Herefordshire Council's current collection service as applied as comparator characteristics in benchmarking

	Collection	Frequency	Container	Comments
Herefordshire County Council	Residual	Fortnightly	180l WHB	<ul style="list-style-type: none">• Out-sourced service• Garden waste is collected if presented with residual collection but sent to landfill.
	Dry (commingled)	Fortnightly	240l WHB	
	Food waste	No separate food collection		
	Garden	No dedicated garden collection*		

WasteDataFlow was used to determine the UAs in the UK and the percentage of household waste sent for reuse, recycling or composting (referred to as 'household waste recycling rate'), as reported for 2017/18. WRAP's Local Authority portal scheme search was used to narrow the comparison to UAs providing similar household collection services to that of Herefordshire and summarised in Table 5.

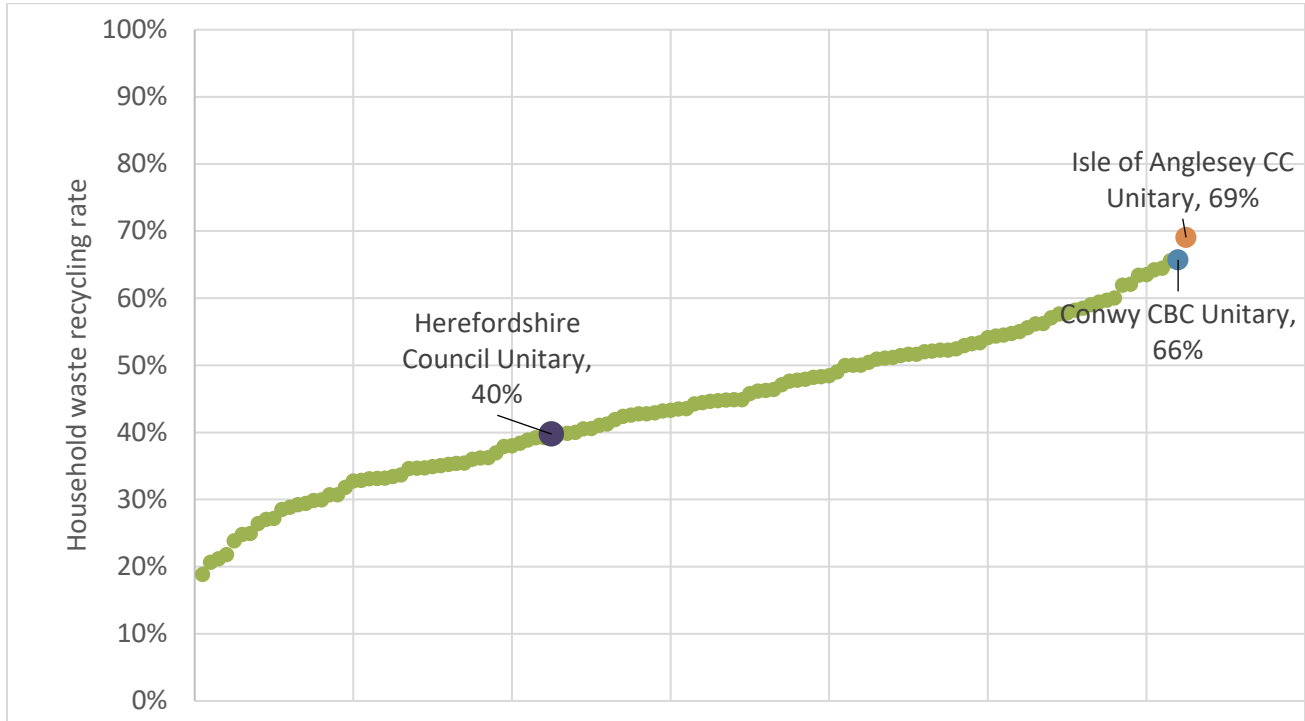
3.2 All-UK comparison

Figure 1 shows the household waste recycling rate for all UK Unitary Authorities, based on 2017/18 data. When compared to all UK unitary authorities Herefordshire currently perform below average (44%). However, it is important to note that the current collection system is not taken into account here.

⁷ <http://www.wastedataflow.org/>

⁸ laportal.wrap.org.uk/

Figure 1: Household waste sent for reuse, recycling and composting, UK Unitary Authorities 2017/18 (Source: WasteDataFlow Q100 UAs)



The two highest performing UAs (Isle of Anglesey) achieved a recycling rate of 69% and 66% respectively in 2017/18. According to information from WRAP’s LA portal and the websites of the respective local authorities, the following services are provided:

Table 6: Collection systems provided by Isle of Anglesey and Conwy CBC

	Collection	Frequency	Container	Comments
Isle of Anglesey CC	Residual	3-weekly	240l WHB	<ul style="list-style-type: none"> • Outsourced service
	Dry (Multi-stream)	Weekly	1 x 38l box, 2 x 55l boxes	
	Food waste	Weekly	Kitchen caddy, kerbside caddy	
	Garden waste	Fortnightly	240l WHB	
Conwy CBC	Residual	4-weekly	240l WHB	<ul style="list-style-type: none"> • In-house service except for outsourced garden • Residents must purchase garden waste sacks to present at kerbside
	Dry (Multi-stream)	Weekly	1 x 44l box, 2 x 55l boxes	
	Food waste	Weekly	Kitchen caddy, kerbside caddy	
	Garden waste	Fortnightly	Reusable sacks	

There are notable differences in service collection to that provided by Herefordshire and the highest performing UA's. These include a reduced bin collection frequency for residual waste collection, the collection of food waste, and the multi-stream collection of recycling. Collecting food waste, as a national generalisation provides c.5% increase in recycling rate⁹.

Interestingly, of the top 10 recycling rates across UK unitary authorities, 9 are Welsh. This high performance could be attributed to the Welsh Collections Blueprint introduced in May 2011 through the Welsh Assembly Government's 'Towards Zero Waste' Strategy. Under this, the Welsh Government recommend a service profile which results in increased rates of high-quality recycling and considerable cost savings. The Blueprint's model recommends, amongst others, the weekly collection of source-segregated dry recycling, weekly separate food waste collection and reduced capacity residual (either through smaller bin capacity, or reduced collection frequency).

The highest performing English Unitary Authority is East Riding of Yorkshire (64%) where the Council operate a commingled recycling collection and free mixed food and garden alongside the residual collection, all operated on a fortnightly basis.

Of the ten authorities with the highest recycling rates the UK, eight out of the ten have in-house service arrangements and two outsource their collection and disposal services (Isle of Anglesey CC and Bridgend CBC).

3.3 Comparison with similar collection services

No food waste collection

According to WRAP local authority data¹⁰, 41% of local authorities in the UK do not provide a food waste collection service, including Herefordshire. Of those that do provide a service, 39% provide a separate food waste collection while 14% collect food mixed with garden and 6% provide a combination of both schemes¹¹. The draft Resources and Waste Strategy for England proposes that all councils in England should have separate food waste collections from 2023.

Removal of those authorities which provide a separate food waste service from Figure 1 gives the data presented in Figure 2. This shows that Herefordshire, in comparison to other UAs not collecting food waste, performs slightly above average (which is 36%) but still has some margin for improvement.

⁹ This will vary according to socio-demographics and the specific food and residual waste collection systems employed

¹⁰ WRAP LA Portal 2018/19 Local authority statistics. Available here: <http://laportal.wrap.org.uk/Statistics.aspx>

¹¹ WRAP LA Portal (2018/2019) Local Authorities collecting food waste.

Figure 2: Household waste sent for reuse, recycling and composting, England 2017/18, UAs not collecting food waste (Source: WasteDataFlow Q100 UAs)



When comparing Herefordshire’s service to those higher performing UAs without food waste collection, the difference in collection service from Herefordshire, is that Rutland and Cheshire provide a service where garden waste is collected at no additional cost to the household. Herefordshire, at present, do not have a formal garden waste collection service. Householders can present garden waste for collection with residual waste, however this does not attribute to the recycling rate as it is currently sent for disposal at the Energy from Waste plant, or landfill. Also, of note, Rutland County Council’s waste collection service is currently outsourced.

The collection systems operated by the top two performing authorities in this analysis (Rutland and Cheshire East) are summarised in table 7 below.

Table 7: Collection services provided by Rutland County Council

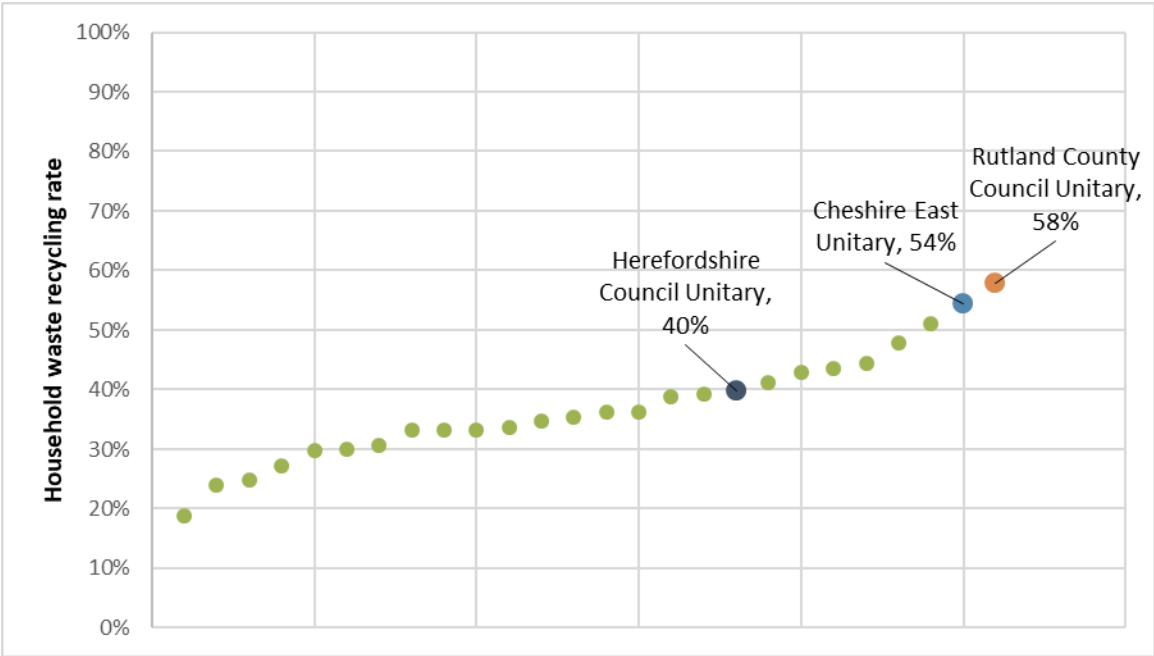
	Collection	Frequency	Container	Comments
Rutland County Council	Residual	Fortnightly	240l WHB	<ul style="list-style-type: none"> Charged garden waste subscription (£35/household/annum) introduced April 2018
	Dry (commingled)	Fortnightly	240l WHB	
	Food waste	No separate food waste		
	Garden waste (charged)	Fortnightly	240l WHB	
	Residual	Fortnightly	240l WHB	

	Collection	Frequency	Container	Comments
Cheshire East Unitary	Dry (commingled)	Fortnightly	240l WHB	
	Food waste	No separate food waste		
	Garden waste	Fortnightly	240l WHB	

Dry recycling

For further analysis, the list of UAs was subsequently filtered by those that provide fully commingled (single stream) dry recycling collections, as delivered by Herefordshire. Figure 3 demonstrates that Herefordshire performs above average (which in this case is 37%) and performs generally well against others offering a similar dry recycling collection, whilst not collecting food. Again, Rutland CC and Cheshire East Council are the top performers.

Figure 3: Household waste sent for reuse, recycling and composting, UK 2017/18, UAs with commingled dry recycling & not collecting food waste (Source: WasteDataFlow Q100 WCAs)



In 2017/18, 96% of local authorities (WCAs and UAs) in the UK provided a garden waste collection scheme (this includes collections where food or card waste may be co-collected with garden waste); 53% of which has an annual charge to householders¹². Herefordshire do not currently have a formal garden waste collection service. There is only one UA that provides a similar service (i.e. no food, no garden, commingled recycling). This authority is Westminster City Council and considering the differing demographics of the areas a comparison of performance is not necessary.

¹² WRAP LA Portal 2018/19 Local authority statistics (reporting 2017/18 data) <http://laportal.wrap.org.uk/Statistics.aspx>

It is evident that if Herefordshire separately collected garden waste (either through a charged kerbside scheme or more so via a free scheme) and sent this for composting that it would be among the higher performing Unitary Authorities in the country.

3.4 Summary

A high-level analysis of published household waste recycling rate data for 2017/18 shows that Herefordshire performs below average against all other UAs. When compared against Unitary Authorities with similar collection systems Herefordshire performed higher than the average, suggesting that participation and use of the collection systems in place is well established in Herefordshire. There is however margin for improvement when comparing against the highest performing UAs, and this would notably be a factor of adding further collection services from the kerbside.

The best performing UAs adopt a combination of collection services that will be explored within this modelling assessment. Of particular note, the UAs with a higher recycling performance than Herefordshire offer food waste collections, operate separate garden waste collections / composting services (modelled in all alternative scenarios) and restrict residual waste capacity (Option 2).

4 Methodology

4.1 Introduction – What is KAT modelling?

The Kerbside Analysis Tool (KAT) was utilised to provide a comparative assessment of cost and operational requirements for the baseline (current) service and three proposed alternative collection scenarios specified by the council.

The three alternative collection scenarios and key assumptions were agreed by the Council prior to modelling. A KAT data request proforma was originally completed by Council Officers to provide operational detail and costs to facilitate initial modelling of the current service. Further clarifications were provided by officers on request.

Key information gathered via the KAT proforma, included:-

- Number and type of vehicles
- Length of working day (averaged for task and finish)
- Number of crew / driver contribution to loading
- Average time taken to drive to key points (e.g. from depot to start of round, from end of round to tip)
- Round size
- Participation and set out (usually an estimate)
- Contamination rate
- Capital costs
- Financing costs
- Driver / loader salary
- Standing costs
- Running costs
- Overheads (management / depot)

This information allows KAT to model a Baseline service which reflects the current collection operations in Herefordshire.

What is KAT?

The Kerbside Analysis Tool (KAT) is an Excel based tool developed by the Waste & Resources Action Programme (WRAP) for the purposes of developing indicative and comparative costs between alternate collection systems. It is a peer reviewed model and the industry standard tool for collection systems.

FRM staff have developed >200 KAT models for some 75 different local authorities to provide comparative costs and performance of alternative collection systems. These have included all of the configurations within this project Options 1, 2 and 3. KAT alone however requires further detail to be added to provide 'whole system costs' and to present costs in a format that are appropriate, for example, to align to budgets. FRM have therefore also utilised KAT results within a more comprehensive costing spreadsheet for these purposes in around half of the models developed. This approach has been utilised in Herefordshire.

The baseline models are designed to reflect the current service operation, at time of analysis, and are therefore a modelled representation of the service. All cost elements are **annualised**, including existing bins, vehicles etc. This approach allows a 'like for like' comparison against alternative collection systems but would not be reflective of the differential capital investment required to install a new system straight away. In order to calculate actual costs of an alternative system that takes account of existing infrastructure and vehicles a more bespoke analysis should be undertaken including practical aspects of service implementation (e.g. swapping bins for different elements of the service, transferring/ selling redundant vehicles etc.).

The model results for alternative scenarios, where local data is more limited, remain a good comparative indicator of the direction and magnitude of cost and performance change anticipated through service changes, and are based on industry experience or other guidance / models as appropriate.

Please note that the costs identified by KAT for each scenario are annualised as noted above and the recycling rates outlined within this section are 'kerbside recycling rates' of the core¹³ kerbside service rather than the total recycling rate of the Council¹⁴. The focus of this report is on the collection of the waste, however the costs of managing the collected waste (e.g. recycling costs / revenues and disposal costs) is reflected in the net 'total system' modelling included in Section 5.8 of this report. The implications of these costs and revenue can alter the cheapest / most expensive options overall.

¹³ This does not include 'niche' elements of the collection service such as bring banks, bulky waste and certain specialist collections such as potentially from flats or clinical waste.

¹⁴ The total Council recycling rate would also include the waste flows from the Household Waste Recycling Centres, Bring Banks and other household waste streams not collected via the standard kerbside collection service. Therefore, for example, if a system in this report shows a +5% uplift in 'kerbside recycling rate', it would be envisaged that this would be a lower uplift in the total Council recycling rate (e.g. it could be +2, +3 or +4% depending on other factors within the Council).

4.2 Alternative Options

The key assumptions for each of the alternative options are outlined in Table 8 below. The options which have been agreed incorporate potential service changes highlighted within the recently published National Resources and Waste Strategy. Some of these changes are currently being consulted on, which include mandatory separate food waste collections, consistent recycling collections and free garden waste collections.

Table 8 Alternative option assumptions

Options	Collection
<p>Option 1 –</p> <ul style="list-style-type: none"> • <i>Dry recycling- as per current service</i> • <i>Residual- as per current service</i> • <i>Food - weekly collection</i> • <i>Garden- free fortnightly collection</i> 	<p>Dry recycling – as per current service</p> <p>Residual – as per current service</p> <p>Food waste</p> <ul style="list-style-type: none"> • ‘Low’ yield as per WRAP ready reckoner (5,311 tonnes/annum)¹⁵ • Dedicated 7.5 tonne food waste vehicles • Assume 1 crew member + driver • Set out – 45%¹⁶ • Participation – 55%¹⁷ • 23l bucket and kitchen caddy (inc. annual provision of compost sacks) • No compaction on vehicle <p>Garden waste</p> <ul style="list-style-type: none"> • 16,387 tonnes per annum (based on average of similar authorities operating a similar service, see Appendix D) • 240l bin • 26T Refuse Collection Vehicle (RCV) • Set out: 60% • Participation: 70% • Assume 95% of garden waste occurring in the residual stream contributes to this tonnage (2,127 tonnes using the waste composition analysis data) and the remaining 14,260 tonnes (the majority) comes from a combination of the HWRC, the Biffa collection and as ‘new material’ entering the Council collections.

¹⁵ The WRAP ready reckoner for food waste yields¹⁵ was applied to calculate the total tonnage of food waste collected. The ready reckoner formula is based on indices of deprivation and is the most accurate data set available to estimate projected food waste tonnages

¹⁶ Set out is the percentage of households putting out receptacles on a typical collection day

¹⁷ Participation is the percentage of households participating over three collection cycles, i.e. those using the system. These estimates are informed by WRAP food waste collection trials.

Options	Collection
<p>Option 2 –</p> <ul style="list-style-type: none"> • <i>Dry recycling- two stream collection - three weekly with residual.</i> • <i>Week 1: Paper and card, Week 2: plastic glass, metals</i> • <i>Residual- Three weekly collection (Week 3)</i> • <i>Food - weekly collection</i> • <i>Garden- free fortnightly collection</i> 	<p>Dry recycling</p> <ul style="list-style-type: none"> • Paper and card collected separately in a 240l wheeled bin • Plastic, glass, metals collected separately in a 180l wheeled bin • Single bodied as per baseline 20m³ (not sharing vehicles) • Increase dry recycling capture by + 5%¹⁸ • +2% participation (97%) • Partial compaction on vehicle <p>Residual – three weekly frequency (tonnages reduced as per the impacts on dry and organic waste separation)</p> <p>Food waste</p> <ul style="list-style-type: none"> • ‘Medium’ yield as per WRAP ready reckoner (7,085 tonnes) • Dedicated 7.5 tonne food waste vehicles • Set out – 55% • Participation – 65% • Assume 1 crew member + driver • 23l bucket and kitchen caddy (inc. annual provision of compost sacks) • No compaction on vehicle <p>Garden waste</p> <ul style="list-style-type: none"> • 16,387 tonnes per annum (based on average of similar authorities operating a similar service see Appendix D) • 240l bin • 26T RCV • Assume 95% of garden waste occurring in the residual stream contributes to this tonnage (2,127 tonnes using the waste composition analysis data) and the remaining 14,260 tonnes (the majority) comes from a combination of the HWRC, the Biffa collection and as ‘new material’ entering the Council collections.
<p>Option 3 -</p> <ul style="list-style-type: none"> • <i>Dry recycling- weekly kerbside sort collection</i> • <i>Residual- as current service</i> • <i>Food - weekly collection</i> 	<p>Dry recycling</p> <ul style="list-style-type: none"> • 3x 50l boxes • Kerbside sort vehicle, 5 streams/compartments (80% utilisation)¹⁹ <ol style="list-style-type: none"> 1. Paper

¹⁸ The capture of materials is the percentage of available materials separated by the householder, also known as recognition rate

¹⁹ ‘Utilisation’ is a reflection of how full on average each of the compartments on the vehicle are before it has to tip.

Options	Collection
<ul style="list-style-type: none"> <i>Garden-free fortnightly collection</i> 	<ol style="list-style-type: none"> Card Plastic bottles + Pots, trays and tubs (PTT) Steel and aluminium Cans Glass <ul style="list-style-type: none"> No change to participation (95%) Contamination – KAT default 2%. <p>Residual – as per baseline</p> <p>Food waste – ‘Low’ yield as per WRAP ready reckoner (5,311 tonnes)</p> <ul style="list-style-type: none"> Dedicated 7.5 tonne food waste vehicles Set out – 45% Participation – 55% Assume 1 crew member + driver 23l bucket and kitchen caddy (inc. annual provision of compost sacks) No compaction on vehicle <p>Garden waste</p> <ul style="list-style-type: none"> 16,387 tonnes per annum (based on average of similar authorities operating a similar service see Appendix D) 240l bin 26T RCV Assume 95% of garden waste occurring in the residual stream contributes to this tonnage (2,127 tonnes using the waste composition analysis data) and the remaining 14,260 tonnes (the majority) comes from a combination of the HWRC, the Biffa collection and as ‘new material’ entering the Council collections.

4.3 KAT Modelling

4.3.1 Modelling the baseline

FRM firstly modelled the baseline using the information provided in the KAT proforma by Herefordshire to derive the current operation. Any results which required moderation were addressed in discussion with officers at Herefordshire Council. Local operational factors can influence the averages applied in any modelling exercise including smaller / narrow access vehicles.

4.3.2 Assumptions

Modelling alternative Options requires due consideration of the effects of service changes, in this regard, there are two approaches which FRM adopt. These are, using theoretical modelling / industry data (e.g. WRAP or KAT assumptions / other published information) or actual performance data

gathered from the authorities operating the proposed collection systems. Both were applied through this exercise and agreed with the client.

4.3.3 Modelling Alternate Options

The KAT model is specifically designed for the purpose of modelling alternative collection options, calibrated against current performance and cost and the results are included in section 5.

5 KAT modelling results

A detailed breakdown of collection results is highlighted in Appendix A and a summary is included in sections 5.1 – 5.6. The additional costs and revenue of managing the collected wastes and recyclables is included in section 5.7 and a total net system cost presented in section 5.8.

5.1 Baseline Service

As outlined below the total annualised collection cost of Herefordshire’s current collection service, according to the KAT modelling is c. £3.9m. The current kerbside (core collection only) recycling rate is 32%. The collection service operates with 20 RCVs of varying size. KAT only allows for one type of collection vehicle to be modelled for each service. Therefore, based on the current total vehicle capacity, nineteen, 20m³ RCVs were modelled to deliver the AWC recycling and residual collection system, which reflects the available capacity from twenty different sized vehicles in the Herefordshire fleet. Table 10 illustrates the current vehicles and operatives and Table 11 shows the modelled vehicles as applied in KAT, it should be noted that an additional driver has been allocated to appropriately account for salary costs versus actuals.

Table 9: Baseline annualised collection costs

Total gross collection cost	c. £3.9 million
Kerbside recycling rate²⁰	32%

Table 10: Baseline vehicle and crew requirements

	Drivers	Loaders	Vehicles
26t RCV	1	2	12
18t RCV	1	1	6
12t RCV	1	1	1
7.5t RCV	1	1	1
Total	20	32	20

²⁰ Note that this is not the total Local Authority Recycling rate which also includes the performance of Bring Banks, the HWRC and other collection activity, but is purely the performance of the main collection systems from households

Table 11. Baseline vehicle and crew requirements as modelled in KAT.

	Drivers	Loaders	Vehicles
20m ³ RCV	20	38	19
Total	20	38	

5.1 Option 1 – Introducing separate food waste collection and free garden

Option 1 models the current collection service but with the addition of a weekly food waste collection service and a free fortnightly garden waste collection.

Each household being provided with a small kitchen caddy and a 23l bin. The food waste would be collected in 7.5T specialist food waste collection vehicles.

The WRAP ready reckoner for food waste yields was applied to calculate the total tonnage of food waste collected. The ready reckoner formula is based on indices of deprivation and is the most accurate data set available to estimate projected food waste tonnages. Calculations are outlined in Appendix C. For this option we assumed a ‘low yield’ of 5,311 tonnes. Based on evidence from WRAP food waste collection trials a set out rate of 45% and a participation rate of 55% was applied. The food waste yields calculated by the WRAP ready reckoner have been cross checked against residual waste compositional analysis data provided by Herefordshire to ensure that there is sufficient food waste in the residual mix available.

The implementation of a separate food waste collection service, using the modelled assumption would be estimated to cost Herefordshire c. £2m per annum as highlighted in Table 12 below.

Option 1 also models a free fortnightly garden waste collection.

Table 12 Option 1 annualised collection costs

Annualised recycling and residual collection cost	£4,157,409
Annualised organics (garden waste) collection cost	£1,684,144
Annualised food waste collection costs	£2,058,219
Total gross collection cost	£7,899,722
Kerbside recycling rate²¹	52%

²¹ Note that this is not the total Local Authority Recycling rate which also includes the performance of Bring Banks, the HWRCs and other collection activity, but is purely the performance of the main collection systems from households

The implementation of a separate food waste collection and a free garden waste collection significantly increases the 'kerbside' recycling performance from 32% to 58% as food waste is being diverted from the residual waste stream and is sent for either digestion or specialist composting. However, it is assumed that some of this garden waste has been diverted from the HWRC stream (as already composted), so the table above deducts the recycling contribution from this element (as it is already being realised by the Council), hence the 'kerbside recycling rate' reduced to 52%.

The estimated food waste yield is a factor of the residual waste capacity and socio-demographics of the authority.

In this option, it is assumed that the recycling and residual waste collection systems will operate as per the current service and will continue to share vehicles. There is no modelled change to the number of vehicles and collection crew required for this service, this is despite a lower tonnage collected on the residual waste as a result of the food waste collection (in particular).

As outlined in Table 13 below the implementation of a dedicated food waste collection and separate garden waste collection will result in the requirement of 29 additional vehicles, combination of 26T RCV's and dedicated 7.5T food waste vehicles. The number of vehicles required for the joint residual and recycling service does not reduce in this service option, 48 vehicles are required to operate the service. 51 drivers²² and 75 loaders²³ (crew members) would be required to operate the service.

This scenario does not provide any cost savings to the Council from the collection activity, an additional £3.7m is modelled as required to operate this system, with the total annualised collection cost at c. £7.9million.

Table 13 Option 1 vehicle requirements

	Recycling	Residual	Garden	Food	Total
20m ³ RCV	19	-	-	-	19
26m ³ RCV	-	-	8	-	8
7.5t Food waste vehicle	-	-	-	21	21
				Total	48

Table 14 Option 1 crew requirements

	Recycling	Residual	Garden	Food	Total
Drivers	20	9	22		51
Loaders	38	16	21		75

²² As the current service (baseline) is delivered by a range of vehicles sizes we have added an additional driver for each service i.e. 1 additional driver for the recycling and residual waste collection (as vehicles are shared across the service), 1 for the garden waste collection and 1 for the food waste collection system (3 additional drivers in total increasing the total number of drivers from 48 to 51).

²³ We have assumed that the driver of the food waste collection vehicle will contribute 50% of their time to collection i.e. the number of food waste loaders is 1.5

5.2 Option 2 – Alternate three weekly collection, food waste and free garden waste.

Option 2 models an alternate three weekly recycling and residual waste service as illustrated in Table 1 above. Over a three-week period, recycling will be collected via two streams (paper and card separate from other dry recyclables) in weeks 1 and 2 (week 1 Paper and Card, and week 2 Plastics, Glass and Metals respectively), and residual waste will be collected in week 3. Residual waste is modelled to be collected in a 180l bin, which is the current bin size provided. However, this is a reduction in total residual waste capacity as the collection frequency has reduced from two weeks to three weeks i.e. previously residents would have been provided with 90l a week, a three-week collection provides residents with 60l a week.

Food waste is separately collected once a week, and a fortnightly free garden waste collection service is operated.

Due to the residual waste capacity restriction a 5% increase was applied to the set out and capture rate from the baseline for the dry recycling streams. An increase of 2% was applied in terms of participation, as the current participation rate for Herefordshire is already particularly high (95%).

Each household would be provided with a small kitchen caddy and a 23l bin. The food waste would be collected in 7.5T specialist food waste collection vehicles. With regards to food waste, due to the residual waste capacity restriction, a 'medium' yield of 7,085 tonnes was assumed as per the WRAP ready reckoner. The rationale being that residents will be incentivised to participate in the food waste collection due to limited space within the residual waste bin.

When compared to Option 1, the total number of vehicles required to operate the alternate three weekly collection system for the dry recycling and residual waste service has decreased by 1 vehicle from 19 vehicles to 18 vehicles. In this option, when evaluating the costs, it is assumed that the recycling and residual waste services will not share vehicles²⁴ however, there may be an additional cost saving opportunity whereby vehicles are shared across the services, as currently happens in Herefordshire. The increased capture of food waste results in the requirement of 1 additional dedicated food waste vehicles from 21 to 22 when compared to Option 1. The total number of vehicles is the same as option 1, 48 vehicles are required to operate the service. With regards to crew, 2 additional drivers are required to operate the service compared to Option 1. This is due, in part, to the fact that the residual and recycling vehicles are no longer shared and the dry recycling is collected over two weeks via two streams (paper and card week 1 and plastics, glass and metals week 2) as highlighted in Table 17 below.

In each collection system, of each scenario, the number of drivers required has been increased by 1 driver to allow for an additional driver where more, smaller vehicles are required. This is to appropriately account for salary costs versus actuals. See Section 5.1.

²⁴ It is possible that further savings might be achieved through sharing of vehicles, however the Option 2 KAT model appears quite efficient in terms of utilising each vehicle.

This scenario does not provide any cost savings to the Council, an additional £4m is modelled as required to operate this system, with the total annualised collection cost at c. £8.15million as highlighted in Table 15 below.

However, the residual waste capacity restriction increases the kerbside recycling rate from 32% (current service) to 57%, an increase of 25%, after the garden waste contribution from the HWRC is taken into account.

Table 15 Option 2 annualised collection costs

Annualised recycling collection cost	£2,877,545
Annualised organics (garden waste) collection cost	£1,684,144,
Annualised food waste collection costs	£2,146,613
Annualised residual waste collection cost	£1,458,007
Total gross collection cost	£8,166,309
Kerbside recycling rate²⁵	57%

Table 16 Option 2 vehicle requirements

	Recycling (A – paper & card)	Recycling (B – plastic, glass, metals)	Residual	Garden	Food	Total
20m ³ RCV	6	6	6	-	-	18
26m ³ RCV	-	-	-	8	-	8
7.5t Food waste vehicle	-	-	-	-	22	22
					Total	48

Table 17 Option 2 crew requirements

	Recycling (A – paper & card)	Recycling (B – plastic, glass, metals)	Residual	Garden	Food	Total
Drivers ²⁶	7	7	7	9	23	53
Loaders	12	12	12	16	22	74

²⁵ Note that this is not the total Local Authority Recycling rate which also includes the performance of Bring Banks, the HWRCs and other collection activity, but is purely the performance of the main collection systems from households

²⁶ As mentioned above an additional driver has been added for each collection service.

5.3 Option 3 – Kerbside sort, weekly food, free garden

Option 3 models a weekly kerbside sort system for dry recycling, free fortnightly garden waste collection, and a weekly food waste collection. The dry recycling is collected in 3, 50 litre boxes, paper and card collected in one box, plastics and metals collected in another box, and glass bottles collected in the third box. The recycling is collected on a side loading, 5 compartment 21m³ kerbsider vehicle, separate compartments for:

- Glass
- Cans and plastic
- Card and;
- Paper

It was assumed that the vehicle will have 80% utilisation, which is a reflection of compartments filling differentially, i.e. when one compartment is full the vehicle needs to tip. No increase was applied to the participation rate, however the contamination rate was reduced from the current contamination rate of 12% to 2% (KAT default for kerbside sort). It is widely assumed that when provided with opportunity to sort recycling at the kerbside, householders will generally sort their recycling with better efficiency, reducing the amount of non-target material entering the recycling system. For this reason, there is a slight increase in residual tonnage as the previous ‘contamination’ material moves to this stream.

A ‘low’ yield of food waste has been assumed to be captured via this scenario, as calculated by the WRAP ready reckoner, at 5,311 tonnes. This is lower than Option 2 because the residual waste capacity has not been restricted.

The estimated annualised cost of collection is c. £9.9million (Table 18) an additional £5.7million compared to the cost of the current service. This is due to the number of kerbsider vehicles (25) required to operate the dry recycling service. 9 collection vehicles are required to operate the residual waste vehicle requirement. As per Option 1, 8 and 21 vehicles are required for the garden and food waste collection service respectively.

As outlined in Table 19 a total of 63 vehicles are required to operate the service, which would require 107 loaders (see Table 20). This is an increase of 69 from the current service.

Table 18 Option 3 annualised collection costs

Annualised recycling collection cost	£4,078,736
Annualised organics (garden waste) collection cost	£1,684,144
Annualised food waste collection costs	£2,058,219
Annualised residual waste collection cost	£2,078,787
Total gross collection cost	£9,899,886

Kerbside recycling rate²⁷	52%
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Table 19 Option 3 vehicle requirements

	Recycling	Residual	Garden	Food	Total
Side loading, lift, 21m ³	25	-	-	-	25
20m ³ RCV	-	9	-	-	9
26m ³ RCV	-	-	8	-	8
7.5t Food waste vehicle	-	-	-	21	21
				Total	63

Table 20 Option 3 crew requirements

	Recycling	Residual	Garden	Food	Total
Drivers	26	10	9	22	67
Loaders	50	20	16	21	107

This scenario does not provide any cost savings to the Council, an additional £5.7m is modelled as required to operate this system, with the total annualised collection cost at c. £9.9million.

5.4 Recycling Rates

Table 21 below illustrates the total tonnages collected across each Option, and the corresponding recycling rate. It is important to note here, that the kerbside recycling is artificially elevated as a proportion of the garden waste is assumed to come from the HWRCs across Herefordshire, (where it is already being recycled in the current service). It is assumed that 24% of the garden waste collected in Options 1 – 3 (3,989 tonnes) will be diverted away from the HWRC to the free kerbside garden waste collection service. Therefore, Table 22 illustrates the adjusted recycling rate taking this into account, approximately 6% of the kerbside recycling uplift is due to the diversion of garden waste from HWRC's to the kerbside collection. Option 2 continues to result in the highest recycling rate, this is because the residual waste capacity has been restricted from 90l a week to 60l a week. It was therefore assumed that the capture of dry recyclables and food waste increased, the total amount of waste sent for recycling increases from 16,756 tonnes in the baseline (current service) to 24,848 in Option 2.

²⁷ Note that this is not the total Local Authority Recycling rate which also includes the performance of Bring Banks, the HWRCs and other collection activity, but is purely the performance of the main collection systems from households

Table 21. Kerbside recycling performance (All options)

	Baseline	Option 1	Option 2	Option 3
Total Dry Recycling	16,756	16,756	18,132	16,756
Total Food	0	5,311	7,085	5,311
Total Garden	0	16,387	16,387	16,387
Total Contamination	2,126	3,211	3,475	1,420
Total Residual	32,925	24,401	20,987	26,193
Total	51,807	66,066	66,066	66,067

Dry Recycling Rate	32%	25%	27%	25%
Kerbside Recycling Rate	32%	58%	63%	58%

Table 22. Recycling rate (All options), garden waste HWRC recycling contribution netted off.

	Baseline	Option 1	Option 2	Option 3
Total Dry Recycling	16,756	16,756	18,132	16,756
Total Food	0	5,311	7,085	5,311
Total Garden	0	12,398	12,398	12,398
Total Contamination	2,126	3,211	3,475	1,420
Total Residual	32,925	24,401	20,987	26,193
	51,807	66,066	66,066	66,067

Recycling rate %, net of HWRC garden waste	32%	52%	57%	52%
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5.5 Other considerations

Kitchen caddy liners

Herefordshire also requested if the cost of liners could be modelled to provide an insight into the additional cost of providing liners to all households served with the food waste collection service. Research has shown that the cost of compostable caddy liners varies. We have assumed a cost of 5p per liner and that each household would be provided with 2 liners a week, a total of 104 liners per year. This equates to a cost of £5.20 per household per year, a total cost of £442,499 for the year.

Table 23: Cost of compostable caddy liners

Liners £/annum	
Cost per liner	0.05
Liners per household per year	104
Cost per household/annum	£5.2
Total cost/annum	£442,499

5.6 Total Collection Cost

The total collection cost of all options is summarised in Table 24 and included in detail in Appendix A. The implementation of a separate food waste collection will cost Herefordshire between c. £2million and c. £2.15 million per annum dependent on the degree of uptake and, in these options, whether a restriction is applied to the residual waste collection service. Where a restriction has been applied to the residual waste collection it has been assumed that more food waste will be captured within the separate collection.

It is assumed that the same tonnage of garden waste will be collected in each scenario at a cost of c. £1.7million to the Council.

Table 24. Total Collection Cost

	Baseline	Option 1	Option 2	Option 3
Annual Operating Costs				
Vehicle operating costs (labour, vehicle standing, vehicle running and fuel)	£2,679,618	£5,265,531	£5,306,603	£6,868,588
Vehicle capital costs	£561,588	£1,019,500	£999,806	£1,225,505
Container Costs	£535,079	£877,566	£1,116,976	£844,190
Overheads	£375,147	£737,174	£742,924	£961,602
Annual gross collection costs	£4,151,432	£7,899,772	£8,166,309	£9,899,886
Annual gross collection costs + liners	£4,151,432	£8,342,271	£8,608,808	£10,342,385

5.7 Gate fee assessment

To understand the annual net collection and treatment cost, the potential income revenue and associated treatment costs from each of the Options is shown in Table 25 (a negative figure represents an income, whilst a positive represents a cost). The annual treatment costs presented below were calculated using the output tonnage information from the KAT model, applying industry published data on material prices and gate fees. Further details are shown in Appendix B.

Table 25 Annual Treatment costs

	Price (£/t)	Baseline (Commingled)	Option 1 (Commingled)	Option 2 (ATWC)	Option 3 (Kerbside sort)
Transfer	£3.50	£173,882	£219,992	£219,070	£226,264
Haulage Fee	£3.00	£149,042	£188,564	£187,774	£193,941
Gate Fees (Revenue)		£251,628	£816,664	£417,512	-£636,392
<i>Dry Recycling (Total)²⁸</i>		£368,628	£368,628	-£76,648	-£1,084,428
<i>Cans: Aluminium: baled</i>	-£700.20				-£166,578
<i>Cans: Steel</i>	-£108.72				-£77,800
<i>Glass: Mixed</i>	-£12.60				-£50,176
<i>Mixed papers: domestic</i>	-£21.33			-£184,142	£0
<i>Paper: News & Pams</i>	-£78.48			-£43,042	-£628,750
<i>KLS card</i>	-£50.76			-£6,917	-£96,515
<i>Non-corrugated card</i>	-£50.76				-£13,228
<i>Plastic bottles: Coloured PET</i>	-£27.00				£0
<i>Plastic bottles: Mixed bottles</i>	-£32.85				-£38,891
<i>Plastic: other dense</i>	-£27.00				-£12,490
<i>Co-mingled DMR²⁹</i>	£22.00	£368,628	£368,628	-£76,648	
<i>Garden waste composting³⁰</i>	£25.00	0	£309,950	£309,950	£ 309,950
<i>Food Waste Treatment³¹</i>	£26.00	£0	£138,086	£184,210	£138,086
<i>Revenue from garden waste sacks</i>		-£117,000			
Residual Waste Treatment ³²	£98.00	£3,236,517	£2,398,617	£2,063,052	£2,574,790
Total		£3,811,069	£3,623,837	£2,887,408	£2,358,603

²⁸ Average Let's Recycle Material Price (Jan-May 2019) minus 10% to account for smaller buying power

²⁹ WRAP (2018) MRF Gate Fee Report

³⁰ WRAP (2018) MRF Gate Fee Report

³¹ WRAP (2018) MRF Gate Fee Report

³² WRAP (2018) MRF Gate Fee Report

5.8 Total net costs

Table 26 **Error! Reference source not found.** shows the modelled total net costs of each option once the annual collection and net treatment costs have been combined.

Table 26 Total (net) Indicative costs

	Baseline (Current service)	Option 1 (Current service + food and garden)	Option 2 (Alternate three weekly + food and garden)	Option 3 (Kerbside sort)
Annual gross collection cost (incl. cost of liners)	£4,151,432	£8,342,271	£8,608,808	£10,342,385
Transfer costs	£173,882	£219,992	£219,070	£226,264
Haulage costs	£149,042	£188,564	£187,774	£193,941
Gate fee for recycling	£368,627	£368,627	-£76,648	-£1,084,428
Food Waste Treatment	£0	£138,086	£184,210	£138,086
Garden Waste Treatment	0	£309,950	£309,950	£309,950
Residual Waste Treatment	£3,236,517	£2,398,617	£2,063,052	£2,574,790
Whole System costs	£7,962,501	£11,966,108	£11,496,216	£12,700,988

The Baseline has the lowest net collection cost at c. £7.9million, this is because the service has the lowest gross collection cost, with no food or garden waste collection service.

Option 1 is the second most cost effective alternative service (+ c.£470k more expensive than Option 2). Changes have not been made to the dry recycling and residual waste collections and these are directly comparable to the Baseline. The increase in collection and treatment (c.£4m) is due to the introduction of a separate food and garden waste collection service. It is assumed that vehicles will continue to share across the recycling and residual service in this option.

Option 2 has the lowest total net cost of all the alternative collection options with a separate food waste collection and free garden waste collection service. Although there is an increase in gross collection cost (+£4.5m to the Baseline), the increased diversion from the residual waste stream and material revenue gained from a separate paper and card system offsets this to become the most cost-effective option for collecting food and garden waste. A material income revenue of £76k is assumed for this option based

on the high proportion of paper and card found within Herefordshire current recycling composition and the overall net cost difference versus the baseline service is +£3.5m per annum.

Option 3 has the highest total net cost of all the options modelled. This is due to the high collection costs associated with operating a kerbside collection scheme (+£4.7m to the Baseline) and despite over £1m of material income estimated for this system via recyclate revenue, the system as a whole is the most expensive of the options assessed (+£4.7m to the Baseline).³³

³³ The price per tonne is based on Lets Recycle Material price (-10%) to allow for market presence.

6 Comparison of headline results across all options.

The summary table below (Table 27) contains a comparison of the results across all options. All options have a greater cost, in collection terms, than the baseline. This is mainly due to the introduction of both a dedicated food waste collection, and a free garden waste collection service in all alternative options.

Table 27 Comparison of headline results across all scenarios

	Whole System Cost	Total number of vehicles required	Kerbside recycling rate³⁴	Indicative cost increase relative to baseline
Baseline	£7,962,501	19	32%	-
Option 1	£11,966,108	48	52%	c. £4 million
Option 2	£11,496,216	48	57%	c. £3.5 million
Option 3	£12,700,988	63	52%	c. £4.7 million

In all alternative systems additional vehicles are required. In each option, 8 collection vehicles are required to collect the separate garden waste tonnage. The difference in vehicle numbers between the alternative options is largely driven by the collection of the dry recycling and residual waste. The same total number of vehicles is required for Option 1 and 2, where a saving in 1 vehicle for the recycling and residual system in Option 2 is offset by the need for an additional vehicle to collect the increased food waste tonnage.

In all alternative scenarios the kerbside recycling rate increases substantially against the baseline. Again, this is driven by the introduction of a food and garden waste collection service. Option 2 is the preferred option when comparing the anticipated recycling rate. It is also the least cost of the alternative collection systems, albeit whilst still a significant increase in costs above the baseline. Collecting two-stream recycling, via an alternate three-weekly collection, with the introduction of a food waste and garden waste collection scheme results in a recycling rate of 57%. This high performance is estimated due to the restricted residual capacity (180l wheeled bin collected every three weeks, as opposed to every two weeks as at present).

Both Option 1 and Option 3 result in a recycling rate of 52%. The main differential between these two options is the level of contamination reported. Option 1 has the highest dry recycling contamination tonnage, which can be typical of a commingled collection. Whilst Option 3 however, results in the lowest contamination rate of the modelled options and therefore is likely to yield higher quality recycling.

³⁴ The total Council recycling rate would also include the waste flows from the Household Waste Recycling Centres, Bring Banks and other household waste streams not collected via the standard kerbside collection service. Therefore, for example, if a system in this report shows a +5% uplift in 'kerbside recycling rate', it would be envisaged that this would be a lower uplift in the total Council recycling rate (e.g. it could be +2, +3 or +4% depending on other factors within the Council).

Appendix A – KAT Outputs

		Baseline	Option 1	Option 2	Option 3
Type of collection	Dry recycling	Kerbside commingled or single stream	Kerbside commingled or single stream	Kerbside commingled or single stream	Kerbside sorted (more than 2 streams)
		select from list	select from list	Kerbside commingled or single stream	select from list
	Dry recycling	select from list	Kerbside commingled or single stream	Kerbside commingled or single stream	Kerbside commingled or single stream
		select from list	Kerbside commingled or single stream	Kerbside commingled or single stream	Kerbside commingled or single stream
	Food waste	select from list	Kerbside commingled or single stream	Kerbside commingled or single stream	Kerbside commingled or single stream
		select from list	Kerbside commingled or single stream	Kerbside commingled or single stream	Kerbside commingled or single stream
Garden waste	Refuse collection	Refuse collection	Refuse collection	Refuse collection	
Collection frequency	Dry recycling	once a week	once a week	every 3 weeks	once a week
	Dry recycling	select from list	select from list	every 3 weeks	select from list
	Food waste	select from list	once a week	once a week	once a week
	Garden waste	select from list	every fortnight	every fortnight	every fortnight
	Refuse	once a week	once a week	every 3 weeks	every fortnight
Collection Vehicle	Dry recycling	RCV, 20m3	RCV, 20m3	RCV, 20m3	side loading, lift, 21m3
		select from list	select from list	RCV, 20m3	select from list
	Food waste	select from list	Dedicated food 7.5T GVW	Dedicated food 7.5T GVW	Dedicated food 7.5T GVW
		select from list	RCV, 26m3	RCV, 26m3	RCV, 26m3
	Refuse	RCV, 20m3	RCV, 20m3	RCV, 20m3	RCV, 20m3
Number of households served	Dry recycling	85,096	85,096	85,096	85,096
	Dry recycling	0	0	85,096	0
	Food waste	0	85,096	85,096	85,096
	Garden waste	0	85,096	85,096	85,096
	Refuse	85,096	85,096	85,096	85,096
Percentage set out	Dry recycling	90%	90%	90%	90%
	Dry recycling	select from list	select from list	90%	select from list
	Food waste	select from list	45%	55%	45%
	Garden waste	select from list	60%	60%	60%
	Refuse	90%	90%	90%	90%
	Dry recycling	select from list	select from list	select from list	select from list
	Dry recycling	select from list	select from list	select from list	select from list

		Baseline	Option 1	Option 2	Option 3
Percentage set out (2nd stream)	Food waste	select from list	select from list	select from list	select from list
	Garden waste	select from list	select from list	select from list	select from list
Average participation	Dry recycling	95%	95%	97%	95%
	Dry recycling	100%	100%	97%	100%
	Food waste	100%	55%	65%	55%
	Garden waste	100%	70%	70%	70%
Average capture	Dry recycling	100%	62%	67%	62%
	Dry recycling	100%	100%	67%	100%
	Food waste	100%	55%	63%	55%
	Garden waste	100%	820%	820%	820%
Tonnes collected excluding contamination	Dry recycling	16,756	16,756	10,975	16,756
	Dry recycling	0	0	7,157	0
	Food waste	0	5,311	7,085	5,311
	Garden waste	0	16,387	16,387	16,387
	Refuse	32,925	24,401	20,987	26,193
Tonnes of contamination collected	Dry recycling	2,126	2,126	1,393	335
	Dry recycling	0	0	908	0
	Food waste	0	266	354	266
	Garden waste	0	819	819	819
Tonnes of biodegradable material collected	Dry recycling	10,174	10,174	10,975	10,174
	Dry recycling	0	0	0	0
	Food waste	0	5,311	7,085	5,311
	Garden waste	0	16,387	16,387	16,387
Number of collection vehicles required	Dry recycling	18.4	18.4	6.0	24.4
	Dry recycling	0.0	0.0	6.0	0.0
	Food waste	0.0	20.7	21.2	20.7
	Garden waste	0.0	7.9	7.9	7.9
	Refuse	18.1	17.9	6.0	9.0
Collection limited by weight or volume	Dry recycling	volume	volume	volume	volume
	Dry recycling	volume	volume	volume	volume
	Food waste	volume	weight	weight	weight
	Garden waste	volume	volume	volume	volume
	Refuse	weight	weight	weight	weight
Number of loads collected per vehicle per day	Dry recycling	1.9	1.9	1.3	1.5
	Dry recycling	1.0	1.0	1.8	1.0
	Food waste	1.0	0.3	0.5	0.3
	Garden waste	1.0	0.6	1.0	1.0
	Refuse	1.3	1.0	1.3	1.1

		Baseline	Option 1	Option 2	Option 3
Number of households passed per vehicle per day	Dry recycling	924	924	944	698
	Dry recycling	0	0	944	0
	Food waste	0	821	804	821
	Garden waste	0	1,076	1,076	1,076
	Refuse	940	952	943	943
Number of households collected from per vehicle per day	Dry recycling	832	832	850	629
	Dry recycling	0	0	850	0
	Food waste	0	369	442	369
	Garden waste	0	645	645	645
	Refuse	846	857	849	849
Pass rate	Dry recycling	117	117	120	92
	Dry recycling	0	0	120	0
	Food waste	0	93	91	93
	Garden waste	0	122	122	122
	Refuse	119	121	119	119
Productive time	Dry recycling	474	474	474	454
	Dry recycling	510	510	474	510
	Food waste	510	530	530	530
	Garden waste	510	530	530	530
	Refuse	474	474	474	474
Non productive time	Dry recycling	111	111	111	131
	Dry recycling	75	75	111	75
	Food waste	75	55	55	55
	Garden waste	75	55	55	55
	Refuse	111	111	111	111
Percentage of targeted materials collected	Dry recycling	76%	59%	67%	59%
	Dry recycling	0%	0%	61%	0%
	Food waste	0%	30%	41%	30%
	Garden waste	0%	574%	574%	574%
Annual cost for containers	Dry recycling	£244,053	£244,053	£244,053	£210,678
	Dry recycling	£0	£0	£239,411	£0
	Food waste	£0	£98,434	£98,434	£98,434
	Garden waste	£0	£244,053	£244,053	£244,053
	Refuse	£291,026	£291,026	£291,026	£291,026
Total capital cost of containers	Dry recycling	£1,565,766	£1,565,766	£1,565,766	£506,321
	Dry recycling	£0	£0	£1,535,983	£0
	Food waste	£0	£354,850	£354,850	£354,850
	Garden waste	£0	£1,565,766	£1,565,766	£1,565,766
	Refuse	£1,565,766	£1,565,766	£1,565,766	£1,565,766

		Baseline	Option 1	Option 2	Option 3
Annual capital cost of collection vehicles	Dry recycling	£0	£0	£177,344	£501,578
	Dry recycling	£0	£0	£177,344	£0
	Food waste	£0	£207,123	£216,986	£207,123
	Garden waste	£0	£250,789	£250,789	£250,789
	Refuse	£561,588	£561,588	£177,344	£266,016
Are vehicles used for more than one collection	Dry recycling	Yes, for refuse	Yes, for refuse	No	No
	Dry recycling	select from list	select from list	No	select from list
	Food waste	select from list	No	No	No
	Garden waste	select from list	No	No	No
	Refuse	Yes, for collection A	Yes, for collection A	No	No
Total capital cost of vehicles	Dry recycling	£0	£0	£990,000	£2,800,000
	Dry recycling	£0	£0	£990,000	£0
	Food waste	£0	£1,156,239	£1,211,298	£1,156,239
	Garden waste	£0	£1,400,000	£1,400,000	£1,400,000
	Refuse	£3,135,000	£3,135,000	£990,000	£1,485,000
Annual vehicle operating costs	Dry recycling	£0	£0	£888,920	£2,953,053
	Dry recycling	£0	£0	£900,022	£0
	Food waste	£0	£1,537,422	£1,606,309	£1,537,422
	Garden waste	£0	£1,043,248	£1,043,248	£1,043,248
	Refuse	£2,679,618	£2,684,861	£868,103	£1,334,864
Annual overheads	Dry recycling	£0	£0	£124,449	£413,427
	Dry recycling	£0	£0	£126,003	£0
	Food waste	£0	£215,239	£224,883	£215,239
	Garden waste	£0	£146,055	£146,055	£146,055
	Refuse	£375,147	£375,881	£121,534	£186,881
Annual gross collection cost	Dry recycling	£244,053	£244,053	£1,434,766	£4,078,736
	Dry recycling	£0	£0	£1,442,779	£0
	Food waste	£0	£2,058,219	£2,146,613	£2,058,219
	Garden waste	£0	£1,684,144	£1,684,144	£1,684,144
	Refuse	£3,907,379	£3,913,356	£1,458,007	£2,078,787

Appendix B – Total Costs Net of Treatment

	Baseline	Option 1	Option 2	Option 3
Annual Operating Costs				
Vehicle operating costs (labour, vehicle standing, vehicle running and fuel)	£2,679,618	£5,265,531	£5,306,603	£6,868,588
Vehicle capital costs	£561,588	£1,019,500	£999,806	£1,225,505
Container Costs	£535,079	£877,566	£1,116,976	£844,190
Overheads	£375,147	£737,174	£742,924	£961,602
Annual gross collection costs	£4,151,432	£7,899,772	£8,166,309	£9,899,886
Annual gross collection costs + liners	£4,151,432	£8,342,271	£8,608,808	£10,342,385
		£4,190,839	£4,457,376	£6,190,953
Additional Costs				
Liner cost	£0.00	£442,499.20	£442,499.20	£442,499.20
Treatment Costs				
Transfer costs	£173,882	£219,992	£219,070	£226,264
Haulage fee	£149,042	£188,564	£187,774	£193,941
Gate Fees	£251,628	£816,664	£417,512	-£636,392
<i>Dry Recycling</i>	£368,627	£368,627	-£76,648	-£1,084,428
<i>Garden waste composting (HWRCs)</i>	0	£ 309,950	£ 309,950	£ 309,950
<i>Food Waste Treatment</i>	£0	£138,086	£184,210	£138,086
<i>Revenue from garden waste sacks</i>	-£117,000			
Residual Waste Treatment/Disposal (EfW)	£3,236,517	£2,398,617	£2,063,052	£2,574,790
Total Treatment Cost	£3,811,069	£3,623,837	£2,887,408	£2,358,603
Total Cost	£7,962,501	£11,966,108	£11,496,216	£12,700,988
Difference from baseline	£0	£4,003,607	£3,533,715	£4,738,488

Average material price 2019 Lets Recycle (Jan- May 2019) - 10%
 Average material price 2019 Lets Recycle (Jan- May 2019) minus 10%

-£778.00
 -£120.80
 -£14.00
 -£23.70
 -£87.20
 -£56.40
 -£56.40
 -£30.00
 -£36.50
 -£30.00

-£700.20
 -£108.72
 -£12.60
 -£21.33
 -£78.48
 -£50.76
 -£50.76
 -£27.00
 -£32.85
 -£27.00

	Baseline	Option 1	Option 2	Option 3
Materials	Commingled	Commingled	Twin-stream	Kerbside sort
Recycling				
Cans: Aluminium: baled	237.9	237.9	252.6320236	237.9
Cans: Steel	715.6	715.6	783.5040453	715.6
Glass: Mixed	3982.2	3982.2	4259.613542	3982.2
Paper: Mixed papers: domestic	0	0	0	0
Paper: News & Pams	8011.6	8011.6	8633.01467	8011.6
KLS card	1901.4	1901.4	2017.916072	1901.4
Non-corrugated card	260.6	260.6	324.2651412	260.6
Plastic bottles: Coloured PET				
Plastic bottles: Mixed bottles	1183.9	1183.9	1257.668118	1183.9
Plastic: other dense	462.6	462.6	603.5176668	462.6
Food	0	5311	7085	5311
Garden	0	16387	16387	16387
<i>Total</i>	<i>16755.8</i>	<i>38453.8</i>	<i>41604.13128</i>	<i>38453.8</i>
Residual Waste (tonnes)	32,925	24,401	20,987	26,193
Income per tonne	Baseline	Option 1	Option 2	Option 3
Cans: Aluminium: baled				-£166,577.58
Cans: Steel				-£77,800.03
Glass: Mixed				-£50,175.72
Paper: Mixed papers: domestic			-£184,142.20	£0.00

Average material price 2019 Lets Recycle (Jan- May 2019) - 10%

Average material price 2019 Lets Recycle (Jan- May 2019) minus 10%

		Baseline	Option 1	Option 2	Option 3
	Materials	Commingled	Commingled	Twin-stream	Kerbside sort
	Paper: News & Pams			-£43,042.15	-£628,750.37
	KLS card			-£6,916.58	-£96,515.06
	Non-corrugated card				-£13,228.06
	Plastic bottles: Coloured PET				£0.00
	Plastic bottles: Mixed bottles				-£38,891.12
	Plastic: other dense				-£12,490.20
£22.00	Commingled DMR	£368,627.60	£368,627.60	-£76,648.35	
£26.00	Food Waste Treatment (AD)	£0.00	£138,086.00	£184,210.00	£138,086.00
£25.00	Garden Waste Treatment (OWC)	£0.00	£309,950.00	£309,950.00	£309,950.00
	Garden Waste Income	-£117,000.00			
	Gate Fees Total	£251,627.60	£816,663.60	£417,511.65	-£636,392.14
£98	Residual Waste Treatment EfW	£3,236,516.59	£2,398,617.22	£2,063,051.71	£2,574,789.99
£3.50	Transfer (All tonnage)	£173,882.41	£219,991.76	£219,070.01	£226,264.44
£3.00	Haulage (All tonnage)	£149,042.07	£188,564.37	£187,774.30	£193,940.95
	Total Treatment Costs	£3,811,068.67	£3,623,836.95	£2,887,407.68	£2,358,603.25

Appendix C – Food Waste ‘ready reckoner’

Food waste ‘ready reckoner’³⁵

For areas with fortnightly residual waste collection (i.e. alternate weekly collection): = **2.1614 – (% Social Groups D and E X 2.2009) ± 0.40 kg/hh/week.**

Calculation for expected yield of food waste (kg/hh/week).

				kg/hh/week		
A	B	C	D	E		
LA	Social Grade D & E 2011 (%)		(BXC)	Medium (C-D)	High (E+0.4)	Low (E-0.4)
Herefordshire	25.5%	2.1614	0.55	1.60	2.00	1.20

Tonnage calculation

LA	Number of households	Medium	High	Low
Herefordshire	85,096	7,085	8,858	5,311

= 2.1614 – (% Social Groups D & E x 2.2009) +/- 0.4 kg/hh/week

= 2.1614 – (25.5% x 2.2009) +/- 0.4 = 1.600171 kg/hh/week

Minimum yield = **1.200171 kg/hh/week** (5,311 tonnes per annum)

Maximum yield = **2.00171 kg/hh/week** (8,858 tonnes per annum)

³⁵ Household food waste collections guide, Section 3: How much food waste can be collected for recycling? WRAP 2016

Appendix D – Garden waste tonnage

Local Authority	Rurality	No. HHs	Garden waste collected per HH (kg)	Garden waste collected (tonnes)	Residual waste per HH kg	BVPI82b (comparator) – numerator 'Household Waste Sent For Composting'	BVPI82a (comparator) – numerator 'Household Waste Sent For Dry Recycling'	HH waste sent for reuse, recycling or composting	% of garden in total recycling	NI192 (comparator) – Percentage HH waste sent for Reuse, Recycling or Composting	Collection
Allerdale DC	5	46,780	151.60	7,092	590.75	7,423.35	6,922.91	14,346.26	52%	34.2%	Garden only
Braintree	6	64,060	175.94	11,271	460.68	15,639.62	13,234.20	28,873.82	54%	49.5%	Garden only
Copeland	5	33,530	139.76	4,686	509.60	4,686.40	3,669.99	8,356.39	56%	32.8%	Garden only
Daventry	6	34,900	281.29	9,817	476.41	11,215.00	6,521.89	17,736.89	63%	51.7%	Garden only
Derbyshire Dales DC	6	33,580	219.03	7,355	312.56	15,865.65	7,145.00	23,010.65	69%	60.3%	Garden only
North West Leicestershire	5	43,190	242.72	10,483	515.66	11,092.37	7,758.98	18,851.35	59%	45.9%	Garden only
Wealden DC	6	68,530	218.56	14,978	432.20	15,865.65	15,304.97	31,170.62	51%	51.3%	Garden only
Wellingborough	5	34,700	160.46	5,568	516.40	5,488.19	11,215.00	16,703.19	33%	41.4%	Garden only
West Lancashire	5	49,180	171.13	8,416	502.52	9,247.70	9,235.50	18,483.20	50%	42.9%	Garden only

			Estimates								
Herefordshire (WCA + WDA)	5	85,096	192.58		545.16	7,978.52				39.80%	
Herefordshire WCA Only	33359.29	85,096	192.58		392.01	0	18,913.97	18,913.97		36.18%	No Food No garden
Frith Estimates					Estimate	16,387.47	18,882.00	35,269.47	46%		

The following assumptions have been regarding the garden waste collection tonnage. It is assumed that 95% of the garden waste occurring the residual stream contributes to the 16,387 tonnage. It is assumed that 25% of the garden waste tonnage is diverted from the HWRC.

Garden waste	
Garden waste to move into collections from residual HWRCs	2127
New material	10271
Total calculated garden waste	16387

Garden waste estimate: $192.58 \times 85,096 = 16,387.47$

Recycling tonnage as reported by Council (exc. Garden) = 18,882

Total = 35,269.47 % of total which is garden = 46