Leicestershire Waste Partnership

Leicestershire Resources and Waste Strategy 2022 - 2050

Options Appraisal

Acknowledgements:

Frith Resource Management would like to thank the essential contributions from waste management officers at each of Leicestershire's District and Borough Councils (Blaby District Council, Charnwood Borough Council, Harborough District Council, Hinckley and Bosworth Borough Council, Melton Borough Council, North West Leicestershire District Council and Oadby and Wigston Borough Council) and Leicestershire County Council throughout these modelling phases.

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.

Final Report v.0.13

Executive Summary

Leicestershire Waste Partnership (LWP or Partnership[1]) are undertaking a review of the Leicestershire Municipal Waste Management Strategy (LMWMS) and developing a new Leicestershire Resources and Waste Strategy (LRWS) to set the direction of the recycling and waste management services for the Partnership from 2022 up to 2050. The updated LRWS presents a vision for the Partnership of developing the circular economy and achieving net zero carbon by 2050[2] in Leicestershire "embracing the waste hierarchy by preventing waste and keeping resources in circulation, through reuse, repair and recycling, to realise their maximum resource value whilst minimising environmental impacts." The circular economy is, as implied above, keeping resources in use for as long as beneficial, and to use less raw materials in the first place. Net zero carbon is the target to achieve balance between the amount of carbon dioxide we emit as a country and the amount we absorb or store (through trees and carbon capture technologies for example).

As part of the Strategy review, following the analysis of the current services, Frith Resource Management have modelled alternative waste collections for the Partnership. A number of collection options were selected (through a workshop with officers and councillors) for modelling against a set of agreed evaluation criteria to inform the development of a new LRWS for the Partnership. This modelling exercise is the focus of this report.

The Resources and Waste Strategy for England (2018) proposes key forthcoming changes that are anticipated to impact on local services, these are: mandatory separate food waste collections; free garden waste collections; the introduction of a deposit return scheme (DRS) for single use drinks containers; extended producer responsibility (EPR) for packaging; and a move towards 'consistent' collections for all Local Authorities across England. The service implications of these policies have been included in the modelling. The options modelled are summarised in the following table:

ES Table 1: Overview of options

Option	**Description**
Baseline	Current Service
Option 1 *Waste minimisation*	Focus on waste awareness / education / waste reduction / recycling and prevention initiatives.
Option 2 *Reuse and repair*	Focus on facilitating or promoting reuse / repair activities across Leicestershire
Option 3: *Revised Baseline with Consistent Collection measures, EPR and DRS*	As Baseline (current collection), except: • Recycling collection to include materials indicated in national consistent collections consultation (e.g. plastic film, cartons etc.) where not currently collected . • 'Free' garden waste collection

[1] The Leicestershire Waste Partnership comprises Leicestershire County Council (the Waste Disposal Authority) and the seven District and Borough Councils (Waste Collection Authorities). Leicester City Council is a Unitary Authority and sits outside of the Strategy and associated supporting documents

[2] This is in line with the national target.

Option	Description
	• Separate weekly food waste collection introduced across the Partnership (with food waste sent to Anaerobic Digestion, AD). • A national Extended Producer Responsibility[3] and Deposit Return Scheme[4] come into effect as set out in Government consultation. • Sensitivity on recycling to include batteries, textiles and small waste electrical and electronic equipment (WEEE) collections
Option 4 *Retained charged garden*	As Option 3, except: • Garden waste collection is retained as a charged service for all WCAs that currently operate a subscription service
Option 5A *Restricted residual waste by container size*	As Option 3, except: • Residual waste collected fortnightly in 140L wheeled bins.
Option 5B *Restricted residual waste by frequency*	As Option 3, except: • Residual waste collected three-weekly in 180L / 240L wheeled bins.
Option 6 *Twin stream recycling, fibre out (paper and card)*	As Option 3, except: • Fortnightly twin stream collection of dry recycling. Paper and card in one box, and plastics, glass and cans in wheeled bin.
Option 7 *Kerbside sort*	As Option 3, except: • Fortnightly kerbside sort collection of dry recycling.
Option 8 *Three-stream recycling*	As Option 3, except: • Fortnightly three-steam collection of dry recycling. Paper and card in box 1, glass in box 2, and plastic and cans in box 3.

Options 1 and 2 (waste prevention and reuse) are activities that all partners should undertake and vary widely in terms of their outputs and impacts. We have explored different initiatives that the Partnership currently undertake and additional ideas that could be considered. The best reuse and prevention initiatives will be subject to the resource available and the need in a particular area or point in time. We have therefore not scored options 1 and 2 within the Options Appraisal report but have identified good practice and the types of initiative that the Partnership could deliver which are included in the Headline Strategy.

[3] EPR is a policy approach which places responsibility (financial or physical) for the treatment of post-consumer products on producers. EPR incentivises producers (typically through the fees they pay) to ensure the products placed on the market are recyclable and that any unnecessary packaging material is reduced.

[4] A recycling system whereby consumers pay a small deposit on packaging items which can be refunded once returned via a designated recycling deposit site. At the time of writing this Options Appraisal it was understood that the DRS for England would mirror that of the system proposed in Scotland which includes plastic and glass bottles and cans. In March 2022, Defra announced that the DRS for England and Northern Ireland will exclude glass bottles.

The recycling options have been modelled using the Kerbside Analysis Tool (KAT[5]) which gives comparative annualised costs for different collection systems. The summary table (ES Table 2) and graph (ES Figure 1) below show a comparison of the collection cost and kerbside recycling rate for the Baseline and options 3 – 8 that would affect the LWP as a whole.[6] It should be noted that ES Table 2 is the cost of the collection operation only. Other aspects like recyclate revenue, garden waste subscription income, gate fees and disposal costs are summarised in ES Table 3 which has the total net costs of the service to the Partnership including both collection and treatment and disposal costs.

All of the alternative options have an increase in annual gross collection costs, in comparison to the baseline. This ranges from c.£5 million (options 4 and 5B) to over £10 million (option 8).

ES Table 2: Modelled kerbside collection cost and performance

	Annual gross collection cost[7]	Kerbside recycling rate[8]	Indicative collection cost increases relative to baseline	Collection cost per 1% increase in kerbside recycling performance[9]
Baseline (current service)	**£18,428,500**	**46.4%**	**-**	**-**
Option 3	**£24,441,700**	**57.12%**	**£6,013,200**	**£559,400**
Option 4	**£23,549,900**	**54.47%**	**£5,121,300**	**£632,300**
Option 5A	**£24,758,800**	**61.97%**	**£6,330,200**	**£405,800**
Option 5B	**£23,604,300**	**61.32%**	**£5,175,700**	**£346,200**
Option 6	**£27,914,100**	**56.76%**	**£9,485,500**	**£912,900**
Option 7	**£27,468,000**	**55.76%**	**£9,039,400**	**£962,700**
Option 8	**£28,509,300**	**55.76%**	**£10,080,700**	**£1,073,600**

[5] The Kerbside Analysis Tool (KAT) is a publicly available model developed by WRAP for comparing the costs of different household waste collection systems. More information is Section provided in 2.1.

[6] Options 1 and 2 are not comparable against the other options and so is evaluated separately in the report.

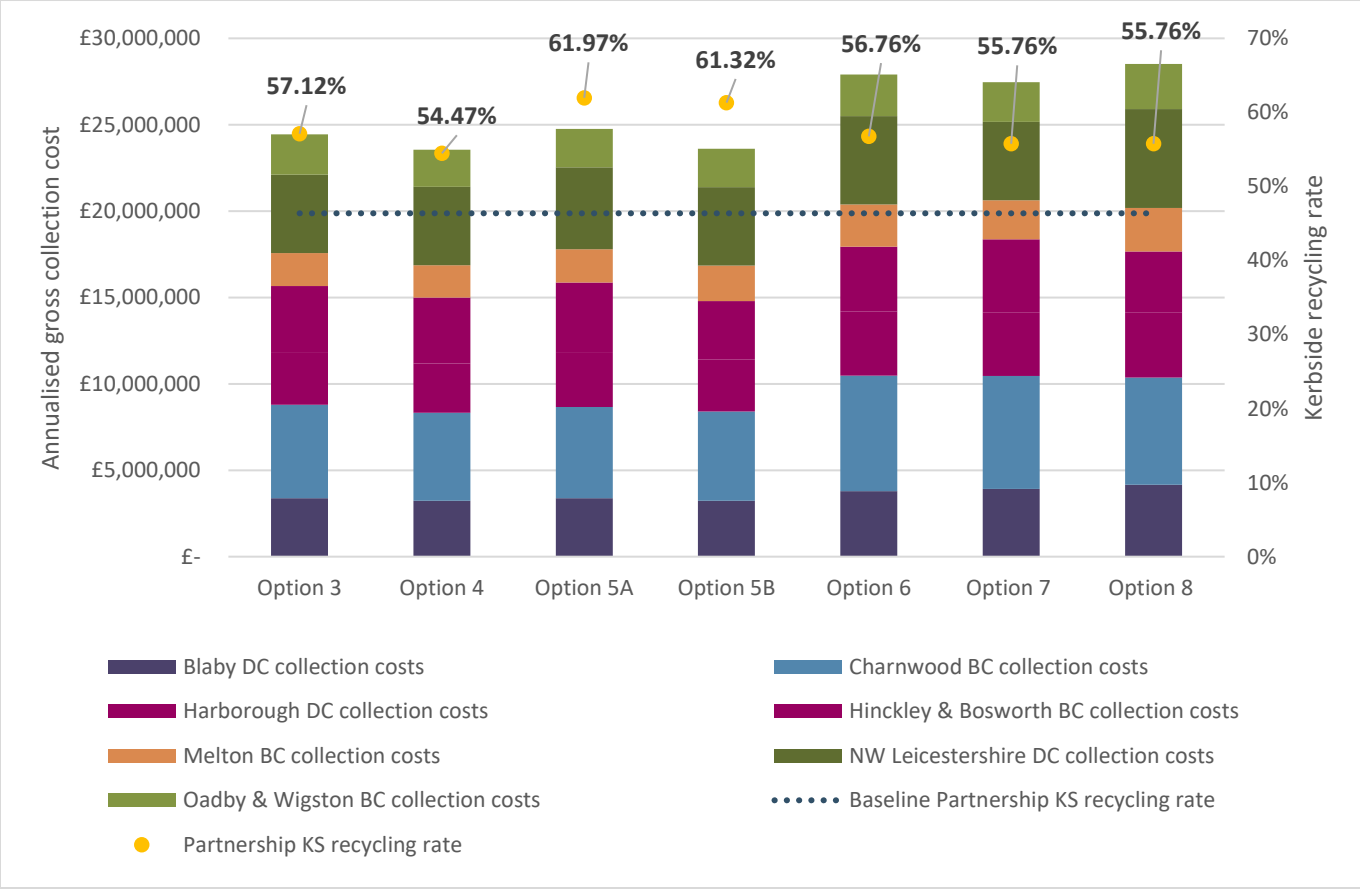
[7] There will be some variation from the actual budget costs, the KAT model is designed to compare systems on a 'like for like' basis, not account for every budget element, however they should be of a similar order to actual budget costs for these service elements, and are guided by cost data provided by the WCAs

[8] The total WCA recycling rate would also include the waste flows from the 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 WCA recycling rate (e.g. it could be +3 or +4% depending on other factors within the WCA). For 2019/20 the household waste recycling rate for Leicestershire was 45.5%.

9 An estimate of the cost increase for every 1% improvement in kerbside recycling, relative to the baseline cost and recycling performance

There will be some variation from the actual budget costs as the KAT model is designed to compare systems on a 'like for like' basis, not account for every budget element. However, they should be of a similar order to actual budget costs for these service elements and are guided by cost data provided by the WCAs.

All options result in an increase in kerbside recycling rate for the Partnership as shown in ES Figure 1. The annualised collection cost (left-axis, coloured bars) shows the combined gross annualised costs for the WCAs, to illustrate the total Partnership costs of each option. The Partnership kerbside recycling rate is presented on the right-axis (yellow marker) in comparison to the baseline kerbside recycling rate (dotted line). Option 5A provides the highest recycling rate for the Partnership (61.97%), with an increase of 15.6% from the baseline (46.4%). Option 5A models a residual waste restriction whereby all collection authorities use 140L wheeled bins, collected fortnightly. Dry recycling is collected as per the baseline i.e. commingled for all authorities except North West Leicestershire District Council (NWLDC) which operates a kerbside sort collection.



ES Figure 1: Modelled kerbside collection costs and performance

ES Table 3: Total Partnership costs

	Baseline	Option 3	Option 4	Option 5A	Option 5B	Option 6	Option 7	Option 8
Total Partnership cost	**£29.4 million**	**£38.3 million**	**£31.9 million**	**£37.9 million**	**£36.9 million**	**£39.9 million**	**£36.8 million**	**£37.9 million**

As shown in ES Table 3 above, all options incur an additional cost for the Partnership when considering the total net costs (including collection, treatment and disposal). Overall, the total net cost to the Partnership (including collection, treatment and disposal) of moving to a twin-stream collection system (option 6), with free garden waste collections results in the highest total cost of all options modelled (£39.9 million). Alignment of a twin-stream against the Resources and Waste Strategy for England is likely to be determined through a TEEP[10] (or equivalent) assessment. Option 5A results in the 2nd highest overall net cost to the Partnership (including collection, treatment and disposal) at £37.9 million, £8.5 million over the baseline (closely followed by option 8). This option does, however, result in the highest kerbside recycling rate. Option 5B (three-weekly residual) is considered in recycling terms the most cost effective, as it has the lowest additional cost per 1% improvement in kerbside recycling rate.

Each alternative option models the impact of DRS and EPR on the kerbside collection. Our analysis indicates that at the kerbside, the Partnership could see an average reduction of c.21% in dry recycling yields[11], and c.3% reduction on residual waste per annum, primarily driven by the DRS removing glass, plastic bottles and cans from the collection service. The changing composition as a result of DRS and EPR also has an impact on the carbon performance of the kerbside dry recycling collection service as there are less dry recyclable materials being collected (by the Local Authorities) and sent for reprocessing. However, the poorer carbon performance of each option as a result of DRS / EPR is often outweighed by savings from separate food and free garden waste collection. The aims of a DRS are to encourage recycling at a wider (national) level; therefore it is important to recognise that there will be additional carbon benefits when evaluating the environmental performance of these policy measures, outside of the Local Authority service.

Service changes are required to help Local Authorities work towards the national municipal solid waste (MSW) recycling target of 65% by 2035. Reaching these higher targets means more investment is required, and the Government has stated a commitment to covering the additional costs to Local Authorities for both capital and operational costs from new required measures. Furthermore, Government is also intent on introducing EPR on packaging materials, as modelled in all options in this appraisal. A requirement of EPR is that the producers would be accountable for 100% of the collection / recycling / disposal cost of the packaging handled by Local Authorities. The detail of this aspect is yet to be determined but could go some way to support Local Authorities with the additional cost burden of new policy measures (referred to as 'New Burdens'). Central Government has indicated that the net cost of other new collections burdens will be met through central government funding arrangements, and

[10] A Technical, Economic and Environmental assessment of Practicability (TEEP) for alternative collection approaches.
[11] So if a WCA recycled 100 tonnes of dry recycling prior to DRS / EPR, this would be 79tonnes afterwards.

there is also the potential for an income stream to local government via unredeemed DRS deposits, although both of these aspects are unclear at present.

The collection options have also been modelled using the Waste and Resources Assessment Tool for the Environment (WRATE) to determine the carbon impact as kg CO_2-eq savings. The WRATE modelling represents Life Cycle Assessment results, and so considers the impact of containers, vehicles, operations and infrastructure as a proportion of their use and their life.[12] The results of the WRATE modelling (carbon assessment) are presented for each option in ES Table 4 below in kg CO_2-eq savings.

ES Table 4 – Carbon assessment (WRATE) results

Carbon savings (kg CO_2-eq)	Baseline	Option 3	Option 4	Option 5A	Option 5B	Option 6	Option 7	Option 8
Blaby DC	42,623	210,112	283,576	-360,018	-549,009	324,246	542,482	544,794
Charnwood BC	-740,830	-734,457	-664,378	-2,193,429	-1,822,558	824,445	1,188,254	568,289
Harborough DC	18,538	-330,592	-226,508	-654,093	-799,191	-86,313	106,073	69,813
Hinckley & Bosworth BC	570,265	705,789	878,264	-341,969	-89,660	1,342,573	1,653,038	1,149,312
Melton BC	628,716	616,850	662,354	33,098	159,459	730,700	791,359	758,541
NW Leicestershire DC	1,342,287	1,122,455	1,122,455	888,465	752,707	1,446,303	1,122,455	1,327,255
Oadby & Wigston BC	-144,818	-163,561	-34,585	-370,884	-485,567	7,136	134,423	86,772
HWRC	-6,086,548	-6,011,223	-6,086,548	-6,011,223	-6,011,223	-6,011,223	-6,011,223	-6,011,223
Total	-4,369,767	-4,584,627	-4,065,370	-9,010,053	-8,845,042	-1,422,133	-473,139	-1,506,447

Option 5A results in the largest carbon saving of all collection options with c.9,000tonnes CO_2 equivalents per annum, over double the baseline emission savings. This is due to both increased carbon savings from enhanced dry recycling and food waste capture and a corresponding decrease in treatment and landfill emissions.

Option 7 results in the highest carbon emissions of all the options within this appraisal with only a modest saving in carbon emissions of c. 470 tonnes CO_2 eq. per annum. The lower performance is due to increased transport emissions associated with a kerbside sort option and decreased total recycling (although some recycling such as glass has higher carbon benefits per tonne as it has higher quality and so can be sent to remelt applications). There are also higher impacts from the residual waste treatment and disposal options when compared to the other options.

In all options the emissions from landfill and waste treatment are reduced due to the separate collection of food waste, and in the majority of options moving from a charged garden waste collection to a free service.

[12] Figures may not add up due to rounding.

As part of the Partnership's LRWS development, it is important to consider additional factors beyond cost and performance when assessing options for future waste management and recycling. For the purposes of this project, FRM have considered each option in turn and evaluated using criteria agreed by the Partnership namely: public acceptability; operational flexibility; alignment with regulations, and social value indicators. These are more qualitative judgements and are scored using a 1-5 scoring system. This score has then been applied to an agreed weighting for each option. The scoring method is included in Appendix A.

In terms of public acceptability, it is assumed that option 3 (baseline with separate food, free garden waste collection and expanded recycling) is the most widely accepted, as it requires no change to the household but also provides additional services. Although the baseline (business as usual) requires no change to the household, it does not have food waste collection and residents must subscribe to a garden waste collection (for 6 out of 7 of the WCAs) to have their garden waste collected. Options 5A and 5B require a smaller residual waste bin container or a change of collection frequency (to 3 weekly)[13] for all WCAs and as such are considered to score lowest in terms of public acceptability. Option 7 and 8 are considered moderate scoring as they require the most significant change from households in terms of dry recycling collection configuration (with the exception of NWLDC).

As regards alignment to regulations, option 7 and 8 are scored highest as it is anticipated that these options would be fully aligned to the Resources and Waste Strategy for England (free garden waste collection, consistent collections via a kerbside sort collection, food waste collection). Option 6 has been ranked below option 7 and 8 as this is technically aligned with the national RWS, however this is subject to a TEEP[14] (or equivalent) assessment, as would all other options that contain commingled recycling collections.

The creation (and retention) of jobs, community well-being and wider health benefits have all been considered when evaluating the social value of each option. Options 3, 6, 7 and 8 score most highly in terms of community well-being as these options provide collection of the greatest range of recyclables, enabling residents and businesses to contribute more. In terms of employment, all options require more staff than the baseline. However, the creation of a jobs is a trade-off for more general health impacts (e.g. air quality) as typically where those services provide a higher number of jobs this is due to more resource being required to operate the kerbside collection service (i.e. more vehicles require more drivers and crew, however this generally means more transport miles are required and higher levels of air pollution).

The results of this evaluation are presented below.

[13] It is understood that within some of the WCAs, there is some flexibility for larger households / different property types (e.g. student housing) which may require additional capacity.

[14] A Technical, Economic and Environmental assessment of Practicability (TEEP) for different recycling collection approaches.

ES Table 5: Options Appraisal

		Business as Usual	*Revised Baseline with Consistent Collection measures, EPR & DRS*	*As Option 3, with retained charged garden*	*As Option 3, plus restricted residual (140L WHB)*	*Option 3, plus restricted residual (3-weekly collection)*	*As Option 3, plus fortnightly twin stream collection of dry recycling*	*As Option 3, plus kerbside sort collection of dry recycling*	*As Option 3, plus three-stream recycling*
Criteria	**Weighting**	**Baseline**	**Option 3**	**Option 4**	**Option 5A**	**Option 5B**	**Option 6**	**Option 7**	**Option 8**
Carbon	4.7	*3*	*3*	*3*	*5*	*5*	*1*	*1*	*1*
Recycling performance	4.3	*1*	*4*	*3*	*5*	*5*	*4*	*4*	*4*
Cost	4.3	*5*	*1*	*4*	*2*	*2*	*1*	*2*	*2*
Residual waste arisings	4.1	*1*	*4*	*4*	*5*	*5*	*4*	*4*	*4*
Educational / Awareness Raising	4.1	*1*	*4*	*3*	*4*	*4*	*3*	*4*	*4*
Alignment with National Policy	4.0	*2*	*3*	*2*	*3*	*2*	*4*	*5*	*5*
Public Acceptability	3.9	*3*	*5*	*4*	*2*	*1*	*4*	*3*	*3*
Social Value	3.5	*2*	*4*	*3*	*3*	*3*	*4*	*4*	*4*
Operational Flexibility	3.4	*4*	*5*	*5*	*5*	*2*	*3*	*2*	*4*
Resource Use	3.2	*2*	*3*	*3*	*5*	*5*	*3*	*3*	*3*
Total Score (with weighting applied) Highest Number = Best Option		**94.8**	**140.5**	**133.6**	**153.8**	**135.7**	**120.3**	**125.4**	**132.2**

Key

1	2	3	4	5

Worst performing — Best performing

Sensitivity analysis has been carried out on a number of aspects within this Options Appraisal including replacing the kerbside collection vehicles with electric equivalent vehicles. Our high-level modelling estimates that replacing the current fleet of vehicles with electric equivalents could save c.6,800 tonnes of CO_2 per annum. Exploring the use of alternative fuels will be part of the Leicestershire Resources and Waste Strategy. Other sensitivity analysis includes assessing alternative residual waste treatment options; the estimated impact of potential funding mechanisms arisings from the reforms to EPR and new burdens funding.

Finally, the costs/savings and recycling figures estimated in this report are indicative and are based on a number of assumptions for modelling purposes only. They provide a reasonable guide to the magnitude of changes that might be expected and are subject to forthcoming legislation and future funding mechanisms. Therefore they should not be used directly to justify specific costs of service change. They are modelled in comparison to the Partnership's estimated baseline costs, on an annualised basis. If the Partnership is minded to pursue any of the above changes, they are advised to undertake a more bespoke assessment of any particular option, potentially including re-routing and asset reallocation, in order to satisfy themselves that any modelled improvements in recycling or efficiencies can be realised in practice.

Contents

Glossary of terms and abbreviations

Term	Abbreviation	Glossary term
Anaerobic Digestion	**AD**	*Anaerobic digestion is a process by which microorganisms break down biodegradable material in the absence of oxygen to produce biogas (consisting of methane and carbon dioxide) which can be used to generate energy. It is a common treatment method used for food waste collected by Local Authorities.*
Blaby District Council	**BDC**	
Capital expenditure	**CAPEX**	*Capital expenditure (CAPEX) is the money spent to purchase fixed assets relating to an organisation or corporate entity. For a Local Authority waste service this includes the purchase of vehicles and potentially containers.*
Charnwood Borough Council	**CBC**	
Circular Economy		*A circular economy aims to reach maximum efficiency in the use of resources and materials. This means moving away from an economic model of 'take-make-dispose' and ensuring the life of a product is extended by as much as reasonably possible. Examples of good circular economy practice include sharing, leasing, reusing, repairing, refurbishing and recycling existing materials and products for as long as possible to reduce and avoid waste.*
Deposit Return Scheme	**DRS**	*A Deposit Return Scheme involves paying a deposit for an item (added to the retail price at point of purchase) which is then redeemed when it is returned to a designated point. Through the National Resources and Waste Strategy for England, the Government has announced that a DRS for England, Wales and Northern Ireland will be introduced from 2025 for drinks containers.[15] The aim of the scheme is to boost recycling rates, reduce littering and improve the quality of material collected for recycling.*
Equality and Human Rights Impact Assessment	**EHRIA**	*An Equality and Human Rights Impact Assessment is a process designed to ensure that a policy, project or scheme does not unlawfully discriminate against any protected characteristic. These are as follows:* - *Age* - *Disability* - *Gender reassignment* - *Marriage and civil partnership* - *Pregnancy and maternity* - *Race* - *Religion or belief* - *Sex* - *Sexual orientation*
Extended Producer Responsibility	**EPR**	*Extended Producer Responsibility (EPR) is a policy tool which requires producers to be responsible for the packaging they place on the market at the end of its life. It is intended to*

[15] Introducing a Deposit Return Scheme (DRS) in England, Wales and Northern Ireland: Executive summary and next steps - GOV.UK (www.gov.uk)

		promote packaging design which considers resource inputs and easier end of life recovery (e.g. reuse or recycling) of the resources within the products. The new EPR system announced in the National Resources and Waste Strategy for England (which is intended to be implemented from 2024) will require packaging producers to pay for the full net costs of collecting, handling, recycling and disposing of packaging waste.
Harborough District Council	**HDC**	
Hinckley and Bosworth Borough Council	**HBBC**	
Household Waste recycling Centre	**HWRC**	*Household Waste Recycling Centres are facilities operated by Local Authorities to provide a site for residents wanting to dispose of and recycle a wide range of materials, further to the service provided at the kerbside. Commonly referred to as 'tips'.*
Kerbside Analysis Tool	**KAT**	*A modelling tool which provides a comparative assessment of cost and operational requirements of the kerbside collection service.*
Leicestershire County Council	**LCC**	
Leicestershire Resources and Waste Strategy	**LRWS**	*Describes the recycling and waste management services which will be delivered by LWP.*
Leicestershire Waste Partnership	**LWP**	*Referred to as 'the Partnership', LWP comprises Leicestershire County Council (the Waste Disposal Authority) and the seven Leicestershire Waste Collection Authorities (the District and Borough Councils – Blaby District Council, Charnwood Borough Council, Harborough District Council, Hinckley & Bosworth Borough Council, Melton Borough Council, North West Leicestershire District Council and Oadby & Wigston Borough Council). Leicester City Council is an associate member and manages its waste via separate arrangements as a Unitary Authority.*
Melton Borough Council	**MBC**	
Materials Recycling Facility	**MRF**	*A facility which receives mixed recyclate and separates it into recyclable materials.*
Municipal Solid Waste	**MSW**	*Consists of waste from households and similar waste from businesses.*
Net Zero		*Net Zero means achieving a balance between the total greenhouse gas emissions released into the atmosphere, and the total emissions removed from the environment (for example through natural carbon sinks such as forest and oceans).*

		The net zero target for the UK is defined as the total greenhouse gas emissions released into the atmosphere being equal to or less than the emissions removed from the environment.[16]
North West Leicestershire District Council	**NWLDC**	
Operating expenditure	**OPEX**	*An operating expenditure (OPEX) relates to an ongoing cost for running a service, system or business. For Local Authority waste collection services this includes maintenance costs for vehicles, staffing (driver, loader and supervision roles) and fuel.*
Oadby and Wigston Borough Council	**OWBC**	
Participation rate		*Participation rate is the number of households (or percentage) that set out their waste or recycling at least once in three consecutive collection opportunities.*
Residual Waste		*The waste remaining after the separation of materials for reuse, recycling, composting and/or anaerobic digestion.*
Strategic Environmental Assessment	**SEA**	*A Strategic Environmental Assessment is a systematic decision support process, aiming to ensure that environmental and possibly other sustainability aspects are considered effectively in policy, plan and program making.*[17]
Set out rate		*The set out rate is the percentage of households which set out their waste or recycling on collection days (a percentage of the total number of households served during that day).*
Technical, Economic and Environmental assessment of Practicability	**TEEP**	*A method applied to determine compliance with separate collection requirements set out under statute, and currently being redefined.*
Waste Hierarchy		*The waste hierarchy indicates an order of preference for action to reduce and manage waste.* *It suggests how waste should be managed with the primary goal to prevent and minimise waste, followed in turn by reuse, recycling and composting, disposal with energy recovery and ending with disposal without energy recovery (i.e. landfill) as the least preferred option.*
Waste Collection Authority	**WCA**	*A Waste Collection Authority is a local authority responsible for the collection of municipal waste. The WCA passes on the waste and recycling to the Waste Disposal Authority (WDA) that is tasked with the ultimate treatment and disposal of that waste. The Leicestershire County Council have a 'two-tier' administration whereby the WCAs are Blaby District Council, Charnwood Borough Council, Harborough District Council, Hinckley & Bosworth Borough Council, Melton Borough Council, North West Leicestershire District Council and Oadby & Wigston Borough Council and Leicestershire County Council is the Waste Disposal Authority.*
Waste Disposal Authority	**WDA**	*A Waste Disposal Authority is responsible for the management and treatment of municipal waste in its area.*

[16] Net zero and the different official measures of the UK's greenhouse gas emissions - Office for National Statistics

[17] Strategic environmental assessment and sustainability appraisal - GOV.UK (www.gov.uk)

		Leicestershire County Council is the Waste Disposal Authority for Leicestershire.
WasteDataFlow	**WDF**	*A web based system for municipal waste data reporting by UK local authorities to government. Information can be downloaded by the public.*
Waste Electrical and Electronic Equipment	**WEEE**	*Waste Electrical and Electronic Equipment is end of life Electrical and Electronic Equipment, i.e. items that require electric currents of electromagnetic fields in order to operate. This includes (but is not limited to) small household appliances (irons, toasters, vacuum cleaners), large household appliances (fridges, cookers, washing machines), IT equipment (computers, telephones), TVs, lighting, electronic tools, medical devices, monitoring equipment.*
	WRAP Ready Reckoner	*A tool used to estimate projected food waste tonnages. The formula is based on indices of deprivation and is the most accurate data set available.*
Waste and Resources Assessment Tool for the Environment	**WRATE**	*A tool used to determine the carbon impact as kg CO_2-eq savings. The WRATE modelling represents Life Cycle Assessment results, and so considers the impact of containers, vehicles, operations and infrastructure as a proportion of their use and their life.*

1 Introduction

1.1 Project Brief

Leicestershire County Council (LCC or the County Council) are working in partnership with the 7 Leicestershire Waste Collection Authorities (WCAs) through the Leicestershire Waste Partnership (LWP) to review the current Leicestershire Municipal Waste Management Strategy (LMWMS)[18] and develop the Leicestershire Resources and Waste Strategy (LRWS). The WCAs are:

- Blaby District Council (BDC)
- Charnwood Borough Council (CBC)
- Harborough District Council (HDC)
- Hinckley and Bosworth Borough Council (HBBC)
- Melton Borough Council (MBC)
- North West Leicestershire District Council (NWLDC)
- Oadby and Wigston Borough Council (OWBC)

A Municipal Waste Management Strategy requires an Options Appraisal to prioritise between alternative options for the purposes of service delivery, procurement and planning. The methodology for the Options Appraisal was discussed at a workshop with representatives from each council and was held on 9th June 2021. Nine options were agreed covering the span of the waste hierarchy. Six of the options address different kerbside collection configurations.

1.2 Summary of the current waste collection system

The current waste collection systems across the WCAs are outlined in Table 1 below. All WCAs have a kerbside collection service in place for dry recycling, residual and garden waste. The majority of WCAs have implemented a commingled collection method for dry recycling (collecting cans, plastics, cartons, paper, card and glass in a single wheeled bin) and a subscription-based garden waste collection service. The exception is NWLDC who operate a kerbside sort system (recyclable materials are collected in several boxes / bags and separated into different compartments on a specialised vehicle) and collect garden waste free of charge. Residual waste (mixed rubbish, usually presented in a black bin) is collected from all WCAs using a range of bin sizes, including 140L, 180L and 240L wheeled household bins (WHB). All WCAs collect residual waste fortnightly, except for OWBC who collect it weekly.

Table 1: Current waste collection system for the seven WCAs within Leicestershire

District	Collection	Frequency	Container	Comments
Blaby DC	Residual	Fortnightly	140/240L WHB	- In-house - Batteries bagged separately - Textiles and electrical items separately collected by Mind Charity
	Dry Recycling (commingled)	Fortnightly	140/240L WHB	
	Garden (charged)	Fortnightly	140/240L WHB	
Charnwood BC	Residual	Fortnightly	180L/240L WHB	- Operated by Serco (Outsourced)
	Dry Recycling (commingled)	Fortnightly	240L WHB	
	Garden waste (charged)	Fortnightly	240L WHB	

[18] Leicester City Council are an associate member of the LWP and have their own waste management. arrangements As a Unitary Authority they are responsible for their own collection and disposal services.

District	Collection	Frequency	Container	Comments
Harborough DC	Residual	Fortnightly	180L/240L WHB	- Operated by FCC (Outsourced)
	Dry Recycling (commingled)	Fortnightly	240L WHB	
	Garden waste (charged)	Fortnightly	240L WHB	
Hinckley & Bosworth BC	Residual	Fortnightly	240L WHB	- Operated in-house - Textiles bagged separately
	Dry Recycling (commingled)	Fortnightly	240L WHB	
	Garden waste (charged)	Fortnightly	240L WHB	
Melton BC	Residual	Fortnightly	240L WHB	- Operated by Biffa (Outsourced) - Textiles and electricals bagged separately
	Dry Recycling (commingled)	Fortnightly	240L WHB	
	Garden waste (charged)	Fortnightly	240L WHB	
North West Leicestershire DC	Residual	Fortnightly	180L/240L WHB	- Operated in-house - Currently trialling separate food waste collections with 4,000 households
	Dry Recycling (kerbside sort)	Fortnightly	2 x boxes 3 x bags	
	Garden waste (free)	Fortnightly	240L WHB	
Oadby & Wigston BC	Residual	Weekly	140L WHB	- Operated in-house
	Dry Recycling (commingled)	Weekly	240L WHB	
	Garden waste (charged)	Fortnightly	2 x 140L or 240L WHB	

As outlined in Table 2 below, the recycling rates of all the authorities within LWP have decreased between 2010/11 and 2019/20, with the exception of NWLDC who have stayed relatively static.

Table 2: Household waste recycling performance (2010/11 - 2019/20)[19]

District	Household waste recycling (%)									
	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
Blaby DC	45.7%	51.3%	49.9%	50.6%	48.8%	49.1%	47.9%	42.4%	42.0%	42.3%
Charnwood BC	46.1%	49.0%	48.7%	49.1%	48.8%	48.4%	48.4%	45.5%	44.9%	43.7%
Harborough DC	58.1%	61.6%	56.7%	57.3%	57.5%	57.5%	53.6%	47.3%	45.7%	47.3%
Hinckley & Bosworth BC	50.6%	53.9%	55.5%	56.1%	52.7%	51.6%	49.4%	43.9%	42.2%	43.9%
Melton BC	50.3%	49.9%	44.7%	46.6%	46.6%	47.6%	47.7%	46.0%	44.0%	44.7%
North West Leicestershire DC	45.7%	46.1%	46.5%	46.4%	46.6%	46.5%	46.7%	45.9%	45.0%	46.2%
Oadby & Wigston BC	45.3%	51.1%	52.7%	50.3%	48.8%	48.6%	48.3%	45.1%	43.4%	44.3%

[19] Defra Municipal Solid Waste Statistics

2 Collection modelling

2.1 KAT modelling methodology

The Kerbside Analysis Tool (KAT) was utilised to provide a comparative assessment of cost and operational requirements for the baseline (current) service and will be used to model the agreed alternative collection scenarios. KAT data proformas were originally completed by council officers and further clarifications were provided on request.

The baseline models are designed to reflect the current service operation, at the time of modelling, and are therefore a good representation of the service. All cost elements are **annualised**, including existing bins, vehicles etc and consist of a mixture of actual and standardised costs so should be considered to be indicative (only). 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 year 2019/20 has been chosen as the baseline year[20], and tonnage input data has been provided by LCC, as per information required for input into WasteDataFlow, a national online data reporting system accessible to the public. Small WEEE and textiles have been included within the kerbside modelling, however any additional materials such as bulky, or large domestic WEEE are not accounted for within KAT.

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 core[21] service rather than the total recycling rate of the council[22].

[20] This year was chosen for the purposes of a representative set of waste arisings and operational performance data, without the distorted effects of Covid-19 and the impacts of lockdowns on municipal waste arisings.

[21] 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.

[22] The total WCA recycling rate would also include the waste flows from bring banks and other household waste streams not collected via the standard kerbside collection service.

2.2 Alternative Options

The alternative options which have been modelled as part of the Options Appraisal are outlined in Table 3 below. These options have been agreed by the Partnership.

Table 3: Alternative Options to be modelled for all WCAs

Option	Description
Baseline	Current Service
Option 1 *Waste minimisation*	Focus on waste awareness / education / waste reduction / recycling and prevention initiatives.
Option 2 *Reuse and repair*	Focus on facilitating or promoting reuse / repair activities in both Waste Collection Authorities (WCAs) and Waste Disposal Authority (WDA).
Option 3 *Revised Baseline[23] with Consistent Collection measures, EPR and DRS*	As Baseline, except: • Recycling collection to include materials indicated in Consistent Collections consultation (e.g. plastic film etc.) where not currently collected by the WCA. • 'Free' garden waste collection implemented for all WCAs. • Separate weekly food waste collection introduced across the Partnership (with food waste sent to Anaerobic Digestion, AD). • A national Extended Producer Responsibility[24] and Deposit Return Scheme[25] come into effect as set out in Government consultation. • Sensitivity on recycling to include batteries, textiles and small waste electrical and electronic equipment (WEEE).
Option 4 *Retained charged garden*	As Option 3, except: • Garden waste collection is retained as the current service for all WCAs (subscription based for all except NW Leicestershire).
Option 5A *Restricted residual waste by container size*	As Option 3, except: • Residual waste collected fortnightly in 140L WHB.
Option 5B *Restricted residual waste by frequency*	As Option 3, except: • Residual waste collected three-weekly in 180L / 240L WHB.

[23] The 'Baseline' is the current collection service as delivered in Leicestershire, the dry recycling collection configuration and residual waste collection frequency as per current service, see Table 1

[24] EPR is a policy approach which places responsibility (financial or physical) for the treatment of post-consumer products on producers. EPR incentivises producers (typically through the fees they pay) to ensure the products placed on the market are recyclable and that any unnecessary packaging material is reduced.

[25] A recycling system whereby consumers pay a small deposit on packaging items which can be refunded once returned via a designated recycling deposit site. At the time of writing this Options Appraisal it was understood that the DRS for England would mirror that of the system proposed in Scotland which includes plastic and glass bottles and cans. In March 2022, Defra announced that the DRS for England and Northern Ireland will exclude glass bottles.

Option	Description
Option 6 *Twin stream recycling, fibre out (this means the card and paper are kept separate from the remaining recyclables, collected in a box and put in a separate compartment on the vehicle[26]).*	As Option 3, except: • Fortnightly twin stream collection of dry recycling. Paper and card in one box, and plastics, glass and cans in a WHB.
Option 7 *Kerbside sort recycling collection (each household has several boxes and bags for putting different recyclables in, and they are sorted by collection crew into different compartments on a specialist vehicle)*	As Option 3, except: • Fortnightly kerbside sort collection of dry recycling.
Option 8 *Three-stream recycling (households have three containers for dry recycling, which are collected in separate compartments on a vehicle or in a separate vehicle)*	As Option 3, except: • Fortnightly three-steam collection of dry recycling. Paper and card in box 1, glass in box 2, and plastic and cans in box 3.

2.2.1 Alternative Options assumptions

When undertaking the modelling of different options within KAT, both common assumptions and specific option assumptions were applied, as agreed with the Partnership.

The WRAP[27] 'ready reckoner' for food waste yields was applied as a basis to consider tonnages of food waste that could potentially be 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. The yield selected in each option is influenced by the average weekly residual waste capacity for each WCA, and the level of set out and participation are based on evidence from WRAP food waste collection trials. The specific assumptions made for each option are defined in the option descriptions.

In the current food waste trial in NLWDC, initial results indicate that the 4000 households offered the scheme are currently presenting approx. 55kg of food waste, per household, per year. However it's worth noting that currently 1 in 3 present their container so the amount collected from participating households is much higher at approx. 160 kg of food waste, per household, per year.

[26] This preserves the quality of the paper and card which can be affected if mixed with glass in particular.

[27] The Waste and Resources Action Programme (WRAP) was set up by Government initially and is now a Charity providing guidance on waste and recycling issues.

2.2.2 DRS/EPR assumptions

It was agreed that the potential impact of the introduction of a Deposit Return Scheme (DRS) and Extended Producer Responsibility (EPR), as per the Resources and Waste Strategy for England, will be modelled in all options. The implications of EPR and DRS were both modelled using the 'Resource and Waste Policy Impact Calculator' (RAWPIC)[28].

The RAWPIC tool uses a series of assumptions to model the impact of a DRS and EPR, some inbuilt within the model and others which are 'user defined'. For the purposes of this project, the RAWPIC tool was used to calculate the percentage tonnage change on each WCA's kerbside dry recycling (by material) and residual collection services. These new tonnages were then run through the KAT model to determine the impact on collection operations.

Reforming the UK packaging producer responsibility (EPR) system aims to achieve better design of packaging (e.g. through increasing recycled material content, improving recyclability of packaging products, light weighting of material or producing refillable packaging). It is therefore assumed that more packaging items are able to be recycled and/or diverted from the residual waste stream.

A Deposit Return Scheme (DRS) aims to improve overall recycling and resource recovery by placing a redeemable deposit on 'in scope' materials. For the purposes of this report, it has been assumed that the DRS system implemented for England will mirror the proposed DRS system for Scotland. This DRS model is classified as an 'all in' system which means it applies to all single use drinks containers (excepting HDPE plastics, primarily milk bottles). The deposit is modelled as a 20p value added to plastic, glass and metal beverage containers.

Note. At the time of writing this Options Appraisal it was understood that the DRS for England, Wales and Northern Ireland would mirror that of the system proposed in Scotland which includes plastic and glass bottles and cans. In March 2022, Defra announced that the DRS for England and Northern Ireland will exclude glass bottles. At this present time Government has not released the outcomes from two of the secondary consultations, therefore there remains uncertainly in regards to forthcoming legislation and future funding mechanisms. As such, it was agreed that the modelling in this appraisal would not be updated to reflect the change in DRS scope. Waste growth projections within the LRWS document have been updated to provide a high-level assessment of future waste arisings during the Strategy period based on our current understanding (November 2022).

2.3 Carbon (WRATE) assessment

The results of the WRATE modelling are presented for each option within this report. The WRATE modelling represents the Life Cycle Assessment results, and so considers the impact of containers, vehicles, operations and infrastructure as a proportion of their use and their life.

As a waste management model, one of the key outcomes is the avoided environmental impact as a result of effective management of resources. For example, emissions from extracting / processing of virgin materials are avoided by effective secondary materials recovery for recycling, often providing a negative figure in the results (meaning a beneficial impact on the environment from the recycling activity).

[28] This is a product developed by Suez and Anthesis with support from LARAC and Kent Waste Partnership

It should be noted that, **the lower the emissions figure, the lower the impact** (in the case of negative numbers, a -1000 is better than a -800). Negative numbers arise where recycling and energy recovery, as noted above, has offset more damaging, carbon intensive processes, such as primary resource extraction and burning of fossil fuels. This therefore represents a carbon 'saving' as a result of the resource management activity.

3 Options Appraisal results

This section summarises the total annual gross collection costs and recycling performance for the Partnership for the current service and the seven alternative options. The costs are presented as indicative annualised gross costs, and don't reflect the changes from the current system (which in some cases would be substantial and others negligible).

3.1 Baseline service

As outlined in Table 4 below, the total annualised collection cost for the WCAs within Leicestershire for the current core collection service (baseline) is c. £18.4 million. For LWP, the current kerbside recycling rate is 46.4%. The kerbside recycling rate for each WCA is shown, relative to the LWP rate, in Figure 1.

Table 4: Baseline annualised collection costs for each of the seven WCAs

	Local Authority	Annualised gross collection cost	Kerbside recycling rate[29]
	Blaby DC	£2,332,700	44.4%
	Charnwood BC	£4,425,500	47.8%
	Harborough DC	£2,290,800	49.2%
	Hinckley & Bosworth BC	£3,136,700	44.9%
	Melton BC	£1,400,900	46.2%
	North West Leicestershire DC	£3,138,700	45.4%
	Oadby & Wigston BC	£1,703,100	46.1%
Total	**Leicestershire (all WCAs)**	**£18,428,500**	**46.4%**

[29] Note that this is not the total Local Authority Recycling rate which also includes the performance of Bring Banks, bulky waste and other collection activity, but is purely the performance of the core kerbside collection systems from households.

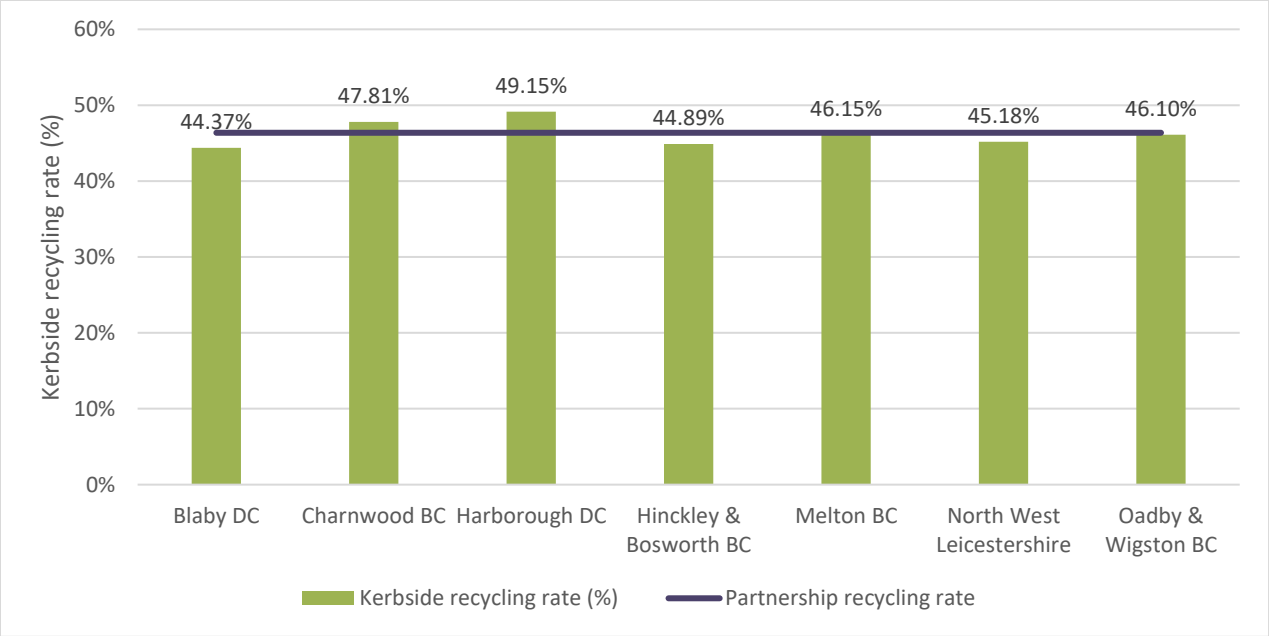


Figure 1: Baseline kerbside recycling rates for each WCA, relative to the LWP recycling rate

Table 5 outlines the annual kerbside collected tonnages, as per the Baseline service. These tonnages provide the basis for which all the alternative options have been modelled against.

Table 5: Baseline total kerbside collected tonnage

Baseline	Blaby DC	Charnwood BC	Harborough DC	Hinckley & Bosworth BC	Melton BC	NW Leicestershire DC	Oadby & Wigston BC	WCA total
Residual	18,789	30,085	16,804	23,047	10,506	21,307	8,915	129,453
Dry recycling[30]	8,614	16,649	9,285	9,646	5,358	7,033	4,556	61,141
Food	0	0	0	0	0	0	0	0
Garden	6,373	10,915	6,954	9,127	3,647	10,702	3,068	50,787
Kerbside recycling rate	**44.37%**	**47.81%**	**49.15%**	**44.89%**	**46.15%**	**45.43%**	**46.10%**	**46.37%**

The total annualised gross collection cost per household is illustrated in Table 6. The gross collection costs include the annualised operational and capital costs of vehicles, crew and containers, including fuel and maintenance. It excludes any revenues accrued from garden waste charges and recyclates sales. These are accounted for separately in the treatment and disposal costs. It also excludes any costs associated with trade waste or tipping away fees. Annual costs per household range from £55.32 in BDC to £72.94 in OWBC which could be attributed to a number of factors including the weekly residual and recycling collections (OWBC) and household numbers.

[30] This includes contamination (e.g. incorrect material collected within the recycling collections, that is not sent for recycling)

Table 6: Total annual gross collection cost per household - baseline

	Blaby DC	Charnwood BC	Harborough DC	Hinckley & Bosworth BC	Melton BC	North West Leicestershire DC	Oadby & Wigston BC
Baseline	£55.32	£58.03	£57.11	£62.35	£59.46	£66.31	£72.94

LCC are responsible for all the dry recycling collected across the County, in which they direct the majority of the WCAs to a MRF in Leicester. This is with the exception of NWLDC who have a contractual arrangement in place where LCC directs them to their own transfer / bulking facility, and where NWLDC process their own recycling. This provides an income to NWLDC as the materials are separated on the vehicle so require limited additional sorting costs. £6 million of revenue is accrued across the WCAs per annum; £5.5 million of this is from the charged garden service, and c.£500K from material revenues achieved by NWLDC for their kerbside sort dry recycling collection.

It is estimated to cost LCC c. £17 million to manage the treatment and disposal of the waste and recycling collected from the kerbside across the Partnership. This represents the cost for the treatment of kerbside collected material based on gate fees for the processing of dry recycling, garden and residual waste streams. It excludes any additional haulage or transfer costs.

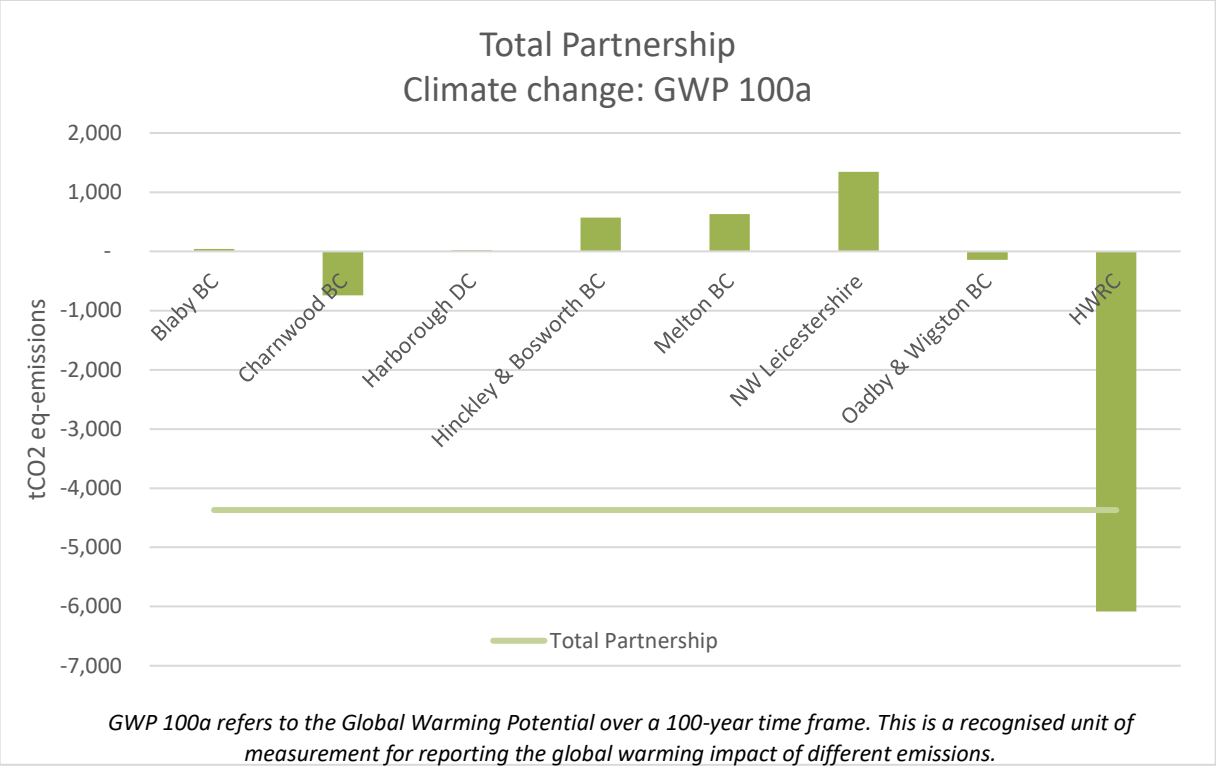
The total combined collection, with associated treatment and disposal costs for managing dry recycling, garden and residual waste from the kerbside, is estimated at just below £30 million, as shown in Table 7.

Table 7: Total Partnership costs (2019/20)

	Baseline
Gross Collection Cost (KAT) (WCA)	£18,428,600
WCA revenues	-£6,012,000
Treatment and Disposal Cost (WDA)	£16,987,700
Whole System Cost	**£29,404,300**

As shown in Figure 2, the baseline waste management services across LWP, including the operation of the Household Waste Recycling Centres (HWRCs, previously Recycling and Household Waste Sites) is modelled to result in a carbon saving of c. 4,427t CO_2-equivalent[31] emissions per annum. This suggests that the recycling activity within the Partnership currently more than offsets the detrimental emissions from collection, transport, infrastructure development and the residual waste treatment process. This was considered on a 'per authority' basis and CBC and OWBC in the baseline scenario more than offset their emissions through recycling activity. However, all other WCAs within the Partnership emit more emissions than they offset, with the value of this ranging from c.18.5t of CO_2-eq to c.1,342t of CO_2-eq per annum. The variation is as a result of the amount of recycling activity within respective council areas and the detrimental impacts of vehicle emissions and residual waste management.

[31] Climate change impacts are typically measured in carbon dioxide equivalents (CO_2 eq). For example methane has an impact on climate change (over a 100 year timeframe) of c. 28 times that of carbon dioxide, so 1 tonne of methane is 28 tonnes of CO_2 equivalent.



GWP 100a refers to the Global Warming Potential over a 100-year time frame. This is a recognised unit of measurement for reporting the global warming impact of different emissions.

Figure 2: Baseline carbon emissions per WCA (and the HWRCs)

3.2 Option 1 – Waste minimisation (prevention)

Option 1 focuses on the highest priority of the waste hierarchy[32]; waste prevention. For the purposes of this Options Appraisal, waste prevention encompasses all actions that prevent materials (items, products, substances) from becoming waste. This can be achieved, for example, by:

1) Reducing the quantity of materials used in products
2) Increasing efficiency with which products are used (i.e. leasing instead of purchases)
3) Extending the lifespan of products

As such, this option considers the value of raising awareness and education on resource and waste management and delivering waste prevention, reduction and recycling initiatives, with the overall aim of reducing total waste arisings across the County.

Waste prevention and recycling initiatives are prevalent at both a District and County level across Leicestershire. Over the last ten years, the following waste prevention projects have been initiated across Leicestershire:

[32] Article 4 of the Waste Framework Directive (WFD; Directive 2008/98/EC on waste and repealing certain Directives) established the waste hierarchy as the overarching principle of waste policies in the EU and EU Member States. In order of priority, waste prevention has the highest priority, followed by reuse, recycling and other recovery, with disposal as the least desirable option.

- Food waste prevention campaign including classes, Community Kitchens (see case study below) and competitions.
- Campaign to reduce contamination in recycling collections, aiming to reduce the amount that is spoiled and thus cannot be recycled by advising on what materials are recyclable, how to present recycling at the kerbside, and informing residents of what happens to materials after they're collected.
- Encouraging home composting via compost bin subsidies and training from skilled composters (Master Composters)
- Love Your Clothes campaign providing advice on purchasing, care and disposal options for clothing and textiles
- Grant scheme to enable community groups to conduct their own waste prevention activities.
- Presence at local events e.g. Loughborough Market (Charnwood), 'Recycle More…the tour' (NWLDC), citizens' forums plus around 75 roadshows delivered annually (pre-Covid-19) by LCC and volunteers
- Production and distribution of resources and tools for residents to support the above
- Seasonal campaigns targeting times waste arisings can increase e.g. Christmas and Halloween
- Reusable nappy lending scheme
- Social media presence across several platforms
- Visits to schools and community groups
- A large group of expert volunteers to provide advice and guidance to residents

LWP also manage the 'Less Waste' website[33] which serves as an online platform for the Partnership to provide information on recycling and waste management to its residents, focusing on themes of 'reduce', 'reuse' and 'recycle'. The website includes links and information on many of the initiatives quoted above.

Case Study - 'Recycle More…The Tour'

NWLDC adopted their 'Recycle More…' plan in April 2019. As part of its launch for a week the Council ran 'Recycle More…The Tour' which included eight roadshows across the district engaging with over 700 people regarding recycling advice, initiatives and tips.

21 recycling tours, talks and visits were carried out within the first year. Other initiatives included running a competition to name six recycling vehicles, trialling a food waste collection and introducing a battery and mobile phone recycling collection.

[33] https://www.lesswaste.org.uk/

Case Study – Subsidised compost bins

Since 2008, nearly 20,000 subsidised compost bins have been sold to Leicestershire residents through the partnership with Straight Recycling Ltd. These bins can accept a wide range of uncooked fruit and vegetable waste, garden waste and other household waste such as paper and cardboard to break down into compost that can then be added straight into the garden.

In addition to a saving of approximately 150Kg/year of waste per bin that would have either required collection and treatment as residual waste, garden waste or recycling, home composting produces a significant reduction in greenhouse gas emissions by diverting food waste from landfill where it would break down anaerobically, releasing methane.

Case Study – Leicestershire Community Kitchens

Leicestershire Community Kitchens provide spaces for residents to learn and practice practical food waste prevention skills in a friendly, supportive environment. The community kitchens are run by volunteers who deliver free or low-cost cooking classes and courses that, when possible, make use of surplus food that would otherwise go to waste. A cascade training model is used, and attendees are empowered to go on to volunteer and deliver their own household food waste prevention themed cooking classes at the community kitchens. Attendees typically reduce the amount of food they waste at home by about a third (by weight) after six weeks of involvement. Their food shopping bills reduce by 10% or more on average.

Figure 3: Community kitchen volunteers in training

Attendees and volunteers also report a range of personal benefits such as a growth in skills and confidence, making friends and a reduction in feelings of social isolation. Some also said they saw improvements in their diet, fitness levels and general wellbeing.

There are currently nine Leicestershire community kitchens in a growing network. In a typical year the community kitchens collectively deliver over 250 household food waste prevention themed cooking classes and engage around 800 residents in the 6-week waste prevention courses. Leicestershire County Council has made a grant fund available to help establish more community kitchens in Leicestershire. Funding is also available to provide support for existing community kitchens in the county looking to expand their reach.

Figure 4: Community kitchen attendees

3.3 Option 2 – Reuse and repair

Option 2 focuses on the 2nd highest priority of the waste hierarchy, preparing for reuse. As such, this option aims to highlight the impact of facilitating and promoting reuse and repair activities across Leicestershire. The aim of repair and reuse is to extend the useful life a product or service with wide ranging benefits from cost savings, enhancing resource efficiency, improving security of critical material supply, enhancing the local economy, less material consumption and fewer carbon emissions. This can be achieved by:

- Repairing
- Refurbishing
- Reusing
- Remanufacturing (or other related intervention measures)

Recent examples of reuse activity across Leicestershire include:

- **Furniture repair** – Furniture reuse workshops are available to all Leicestershire residents, , through the Adult Learning Service. These workshops take place regularly and teach individuals how to fix and upcycle items of furniture. Classes in crafting waste wood have also recently become available.
- **Textiles repair** – Classes are available through the Adult Learning Service for residents to learn sewing basics, as well as how to make new items out of existing fabric at home. An online guide is also available on the Less Waste website giving advice about how to care for and repair clothes, how items can be upcycled and where clothing can be donated/sold.
- **Give or Take Day toolkit** – A Give or Take Day is an event where people can exchange unwanted goods for items which they may need. A toolkit is available on the Less Waste website to help individuals set up their own event. Similar events have also been held for LCC staff at offices.
- **Reusable nappies** – Leicestershire residents can borrow a washable (reusable) nappy trial kit free of charge for a period of 4 weeks. A selection of different nappies in a range of sizes are available, and volunteer Nappy Advisors are available to give advice throughout the trial.
- **Fixer groups** - Support has been given through the Shire Environment Grant Scheme to help establish and support local groups that perform repairs on domestic appliances that would otherwise be thrown away (see case study below for more detail).

Leicestershire residents are also able to engage in reuse activities at the Household Waste and Recycling Centres (HWRCs) across the County. Across all HWRCs, c.300 tonnes of material was collected for reuse (bicycles and bric-a-brac) in 2019/20. Since 2020, there have been dedicated reuse collections, known as ReHome Zones, at four of the HWRCs. The main aim of these collection points is to encourage additional donations for reuse. One of the key aspects of the ReHome Zones is to retain items coming into the HWRCs as products, avoiding them from being classified as 'waste' items. This means that items must meet quality checks.

Figure 5: The ReHomeZone at Loughborough HWRC

It is noted that a number of the WCAs promote reuse activities through the bulky waste section of their websites. Many of them encourage residents to re-sell the items on second hand websites or to donate unwanted items to local charity-run reuse shops. Some WCAs have also engaged with the third sector to promote reuse and repair activity. One example of this is NWLDC, who promote the Marlene Reid Centre, Coalville which is a charity selling reusable items (furniture). Any proceeds from the sale of donated items helps to support the charity's work in the local community. Future projects include wood reuse classes from 2021.

LCC are trialling a paint reuse scheme from their Whetstone HWRC as part of a 'Community Paint Reuse Scheme.' Through the scheme, residents are able to deposit useable paint at the site. This ensures that leftover paint can be reused by community groups in need and prevents it from going to waste.

Figure 6: The paint storage area at Whetstone HWRC

Case Study - 'Fixers'

The SHIRE Environment Grant scheme has funded three 'Fixers' group projects since the scheme was launched. The first grant was awarded to the Leicester Fixers during 2018/19.

The group consists of amateur and professional repairers and non-repairers that work together to mend broken items and learn more about repairs. The grant has supported the Leicester Fixers to run a Leicestershire Outreach Programme to enable communities across the county to run their own Restart Parties. These parties are organised by volunteers to inspire people to mend their broken gadgets, buy for longevity and prevent electronics waste.

The aim of the project is to enable groups to self-organise and bring Restart Parties to their own community. This is done by providing support, insurance and toolkits to enable new groups to run these events throughout the year. Following the successful completion of the project, repair events have taken place and groups set up in Lutterworth, Hinckley, Loughborough, Melton Mowbray, Market Harborough and Coalville.

Following the success of this, funding has since been awarded to the Market Harborough and Hinckley Fixers groups.

3.4 Option 3 – Revised baseline with Consistent Collection measures, EPR and DRS

3.4.1 Kerbside Collection

Option 3 models the current service but with additional measures which are outlined in the EPR[34], DRS[35] and Consistent Collection[36] Government consultations. This includes the potential introduction of a free garden waste service and a separate weekly food waste collection to all households.

In Table 8 below, *blue italics* are used to signify changes from the current collection in types of containers used and *green italics* are used to show where the frequency of collections have changed. Where both the containers and the frequency have changed, *black italics* are used.

A sensitivity analysis is also applied in this option to include small WEEE, batteries and textiles within the dry recycling collection. Note that BDC currently work with the charity MIND to collect textiles and small WEEE. It has been assumed that this arrangement would continue, as such it has not been modelled as collected at the kerbside.

Table 8: Option 3 container requirements and collection frequency

	Dry recycling	Food waste	Garden waste	Residual
Frequency	As per current service	Weekly	Fortnightly	As per current service
Blaby DC	140L/240L WHB	*Small kerbside food waste bin + kitchen caddy*	240L WHB **(free)**	140L/240L WHB
Charnwood BC	240L WHB			180L/240L WHB
Harborough DC	240L WHB			180L/240L WHB[37]
Hinckley & Bosworth BC	240L WHB			240L WHB
Melton BC	240L WHB			240L WHB
NW Leicestershire DC	2 x box, 2 x bag[38]			180L/240L WHB
Oadby & Wigston BC	240L WHB			140L WHB

This option is in line with the proposed introduction of Consistent Collections, which would mean that the collection of materials such as plastic film and cartons would now be mandatory. All WCAs, with the exception of NWLDC, currently collect both of these materials. For NWLDC, it has been assumed that 215 tonnes of plastic film will be captured annually[39], and that 0.7% of dry recycling will comprise cartons[40]. For the introduction of the free garden waste service, it is assumed that the service will result

[34] Consultation on reforming the UK packaging producer responsibility system - Defra - Citizen Space
[35] Introducing a Deposit Return Scheme (DRS) in England, Wales and Northern Ireland - Defra - Citizen Space
[36] Consultation on Consistency in Household and Business Recycling Collections in England - Defra - Citizen Space
[37] There are some 360L wheeled bins, however these are historical and the number of bins still in circulation is unknown
[38] Includes the collection of plastic film and cartons.
[39] This is based on the average % plastic film captured at Casepak (the current MRF) through commingled collection.
[40] This is based on average dry recycling composition data from 9 benchmark authorities.

in a set out[41] rate of 60% and participation rate[42] of 65%. The modelling of a free garden waste service is based on a fortnightly collection which operates for 40 weeks of the year.

The implications of EPR and DRS were modelled using the 'Resource and Waste Policy Impact Calculator' (RAWPIC)[43]. Reforming the UK packaging producer responsibility system (EPR) aims to achieve better design of packaging (e.g. through increasing recycled material content or improving recyclability of packaging products). It is therefore assumed that more packaging items are able to be recycled and diverted from the residual waste stream.

A DRS aims to improve overall recycling and resource recovery by placing a redeemable deposit on 'in scope' materials. The assumptions are described in section 2.3.

For this option, we have assumed either a 'low' or 'medium' yield from the WRAP ready reckoner. This is determined based on the average weekly residual waste capacity for each WCA (i.e. if the Authority has 120 litres of residual waste capacity it has been given a low yield, if it is 90 litres a medium yield has been applied). Based on evidence from WRAP food waste collection trials, a set out rate of between 45% and 55% and a participation rate of between 55% and 65% was applied. For all WCAs, it is assumed food waste is collected by dedicated 7.5t food waste vehicles[44].

The impact of the introduction of additional measures in line with EPR, DRS and Consistent Collections, which includes a weekly food waste service and free garden waste collection, is estimated to cost (collectively) approximately £6 million per annum in addition to the baseline. This results in a total indicative annual kerbside collection cost of approximately £24.4 million, as shown in Table 9 below.

Table 9: Option 3 annualised collection costs and recycling performance

Total gross collection cost for Option 3	**£24,441,700**
Baseline gross collection cost	**£18,428,500**
Difference in collection costs compared to baseline	**+£6,013,200**
Kerbside recycling rate[45]	57.1% **(+10.7%)**
Cost per 1% increase in kerbside recycling performance	£559,400

Through all WCAs introducing a weekly food waste collection and six of the WCAs moving to a free garden waste service, LWP's 'kerbside' recycling rate is modelled to increase by 10.7% to 57.1%, although a significant improvement, this is short of the national target of 65% by 2035[46]. A breakdown

[41] The set-out rate is the percentage of households which set out their waste or recycling on collection days (a percentage of the total number of households served during that day).
[42] Participation rate is the number of households (or percentage) that set out their waste or recycling at least once in three consecutive collection opportunities.
[43] This is a product developed by Suez and Anthesis with support from LARAC and Kent Waste Partnership
[44] It has been assumed that these vehicles will be used, however, more cost-effective ways of collecting this may be available for some WCAs.
[45] Note that this is not the total Local Authority Household Recycling rate which also includes the performance of Bring Banks, secondary recycling (e.g. from treatment) and other collection activity, but is purely the performance of the main collection systems from households
[46] This is a national municipal waste target; however it is recognised that improving kerbside recycling rate will play an important role in achieving the national target.

of the kerbside recycling rates (blue dot, axis on right) for each WCA is provided in Figure 7, alongside the annualised gross collection cost (green bar, axis on left).

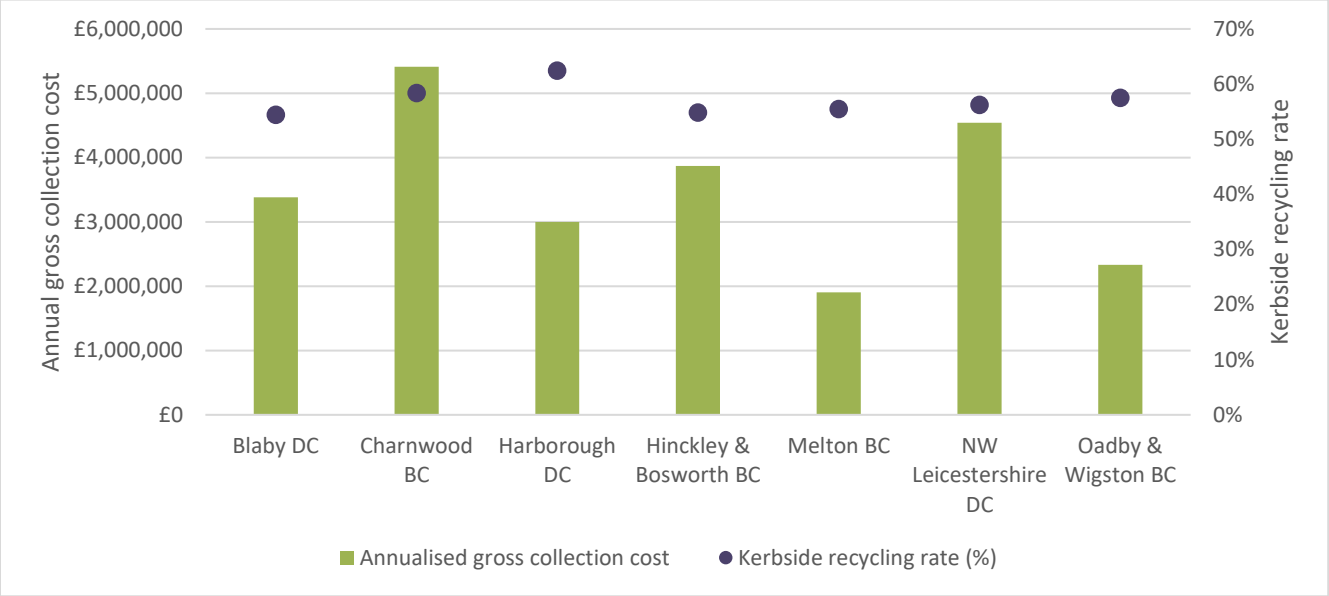


Figure 7: Option 3 annualised gross collection cost vs recycling performance

Table 10: Option 3 total kerbside collected tonnage

Option 3	Blaby DC	Charnwood BC	Harborough DC	Hinckley & Bosworth BC	Melton BC	NW Leicestershire DC	Oadby & Wigston BC	WCA total
Residual	13,475	20,155	10,655	17,444	7,741	15,152	6,160	90,783
Dry recycling	6,645	13,322	7,219	7,365	4,242	5,920	3,758	48,471
Food	2,960	5,144	3,783	3,318	1,530	4,003	1,556	22,294
Garden	7,967	13,644	8,692	11,409	4,559	10,702	3,835	60,809
Contamination[47]	1,244	2,751	1,194	744	552	904	597	7,986
Kerbside recycling rate	**54.42%**	**58.37%**	**62.44%**	**54.85%**	**55.47%**	**56.23%**	**57.52%**	**57.12%**

Table 10 summarises the estimated collection tonnage and kerbside recycling rate for each of the WCA for option 3. This illustrates the combined impact of expanding the breadth of material collected at the kerbside and the introduction of DRS and EPR measures. Based on our modelling, it is estimated that introducing a DRS and EPR measure could reduce the amount of dry recycling collected at the kerbside by c.21%, and the amount of residual waste by 4%.

[47] This tonnage relates to the contamination collected across the dry recycling, food and garden collections.

The capture of food waste and increased capture of garden waste results in the requirement of additional vehicles for the WCAs within LWP, including a fleet of dedicated 7.5t food waste collection vehicles[48].

The cost per household is presented in Table 11, where all WCAs see an increase in cost per household from the baseline. This is in part driven by the introduction of a food waste service, as well as higher collection costs for garden waste, as a result of this being free[49] and as such provided for all households, instead of only those subscribed to the service.

Table 11: Total annual gross collection and cost per household - Option 3

	Blaby DC	Charnwood BC	Harborough DC	Hinckley & Bosworth BC	Melton BC	NW Leicestershire DC	Oadby & Wigston BC
Option 3 total annualised gross collection cost	£3,380,800	£5,413,300	£3,001,200	£3,867,700	£1,906,300	£4,541,500	£2,330,900
Option 3 cost per HH	£80.18	£70.98	£74.82	£76.88	£80.91	£95.95	£99.83
Baseline cost per HH	*£55.32*	*£58.03*	*£57.11*	*£62.35*	*£59.46*	*£66.31*	*£72.94*

3.4.2 Treatment and Disposal

LCC are responsible for allocating the treatment / disposal point for the dry recycling, garden and residual waste collected. Under the current arrangement, the commingled dry recycling is processed at a Materials Recycling Facility (MRF) for sorting into individual materials for onward sale to third parties. The exception to this is NWLDC who operate under a direction from LCC but process their own recycling. Through their current arrangement, NWLDC go out to the market every two months for materials collected at the kerbside (commonly referred to as 'spot pricing'). In this option, there are no changes to these arrangements for dry recycling assumed. Garden waste collected across the WCAs and from the HWRCs is sent for composting. Residual waste is currently treated by a combination of energy recovery (mainly incineration with some refuse derived fuel (RDF) processing) and landfill, this assumption is applied to all options in this appraisal[50]. It is assumed that the separately collected food waste will be sent for processing at an Anaerobic Digestion facility[51].

Table 12 shows a breakdown of the total costs to the Partnership. In this option, garden waste is collected free of charge; as such the annual revenue received by each of the WCAs charging for garden

[48] It has been assumed that these vehicles will be used, however, more cost-effective ways of collecting this may be available for some WCAs.

[49] The free garden waste service is based on a fortnightly collection which operates for 40 weeks of the year.

[50] There is also a sensitivity analysis undertaken which is used to determine the impacts of moving to a higher level of energy recovery

[51] Not site specific. Anaerobic Digestion is the breakdown of organic material (e.g., food waste, farm waste, sewage sludge) in the absence of oxygen to produce biogas or biofertiliser. The biogas is used as a fuel to generate renewable electricity and heat in a combined heat and power (CHP) unit.

waste is lost, collectively equivalent to £5.5 million per annum. NWLDC retain their kerbside sort collection with its estimated annual income of £465K from sale of recyclable materials.

The total treatment and disposal costs are reduced from nearly £17 million in the baseline to £14.5 million per annum. The introduction of a DRS is estimated to reduce the amount of dry recycling collected at the kerbside by c.21%. Based on a gate fee per tonne arrangement with the MRF, this in turn results in lower MRF costs for LCC. However, in the case of NWLDC this results in a lower revenue for their kerbside sort system. In this option it is assumed that the gate fee for processing the commingled recycling is paid by LCC and is included within the WDA treatment and disposal costs presented below.

There are also savings on disposal costs achieved through the introduction of a food waste collection on account of lower gate fees associated with anaerobic digestion (AD) treatment of the separately collected food waste than this tonnage going for residual waste disposal (a combination of landfill and EfW). However, savings on waste treatment and disposal do not outweigh the increase in collection costs across LWP in this option. As a total cost to LWP, this option is estimated to cost c. £38.3 million per annum to operate a service which accommodates the majority of the national policy reforms (assuming the current recycling collection schemes can be retained).

Table 12: Option 3 total net costs (Partnership)

	Baseline	Option 3
Gross Collection Cost	£18,428,500	£24,441,700
Garden Waste Income	-£5,528,500	£0
Dry Recycling Income	-£483,500	-£465,000
Treatment and Disposal Cost	£16,987,700	£14,367,500
Whole System Cost	**£29,404,300**	**£38,345,000**

Within the latest round of consultations on the Resources and Waste Strategy for England was a commitment from Government to cover the net cost of any 'new burden' faced by Local Authorities as a result of any proposed (and implemented) reforms to recycling and waste management services. Sensitivity analysis has been undertaken to estimate the potential cost to the LWP of meeting the requirements of the national RWS where packaging producers contribute to the cost of managing packaging waste and central Government covers the costs of free garden waste collections and separate food waste collections. See Section 3.11.3 for more detail.

3.4.3 Carbon (WRATE) analysis

The Baseline waste management services across LWP, including the operation of the HWRCs, is modelled to result in a carbon saving of c. 4,370t CO2-eq emissions per annum. This suggests that the recycling activity within the Partnership currently more than offsets the detrimental emissions from collection, transport, operations, infrastructure development and the residual waste treatment and disposal process.

The model uses life cycle assessment to consider the impact of all elements of the service including provision of containers, vehicles, transport movement and the emissions / offsets from recycling and disposal. The lower the score the more beneficial (or less detrimental) the impacts.

Option 3 incurs a small additional carbon saving in comparison to the baseline, saving c. 4,585t CO_2-eq emissions per annum. This additional saving is the equivalent of taking 100 average cars off the road each year[52], in emission terms. This demonstrates the impact of DRS and EPR and including the collection of small WEEE, batteries and textiles at the kerbside combined with a move to a free garden waste collection service. The removal of dry recycling from the kerbside (on account of implementing a DRS) reduces the amount of emissions savings associated with the Partnerships recycling activity[53], however free garden waste collection is also introduced in this option which results in reduced treatment emissions (i.e. there is a better carbon performance from garden waste moving from the residual streams to composting). The results of the WRATE modelling for each WCA and the HWRCs for option 3 are shown in Figure 8.

There is also a slight reduction in carbon performance from the HWRCs in this scenario as some of the increased garden waste is assumed diverted from the HHWRCs into the kerbside collection scheme.

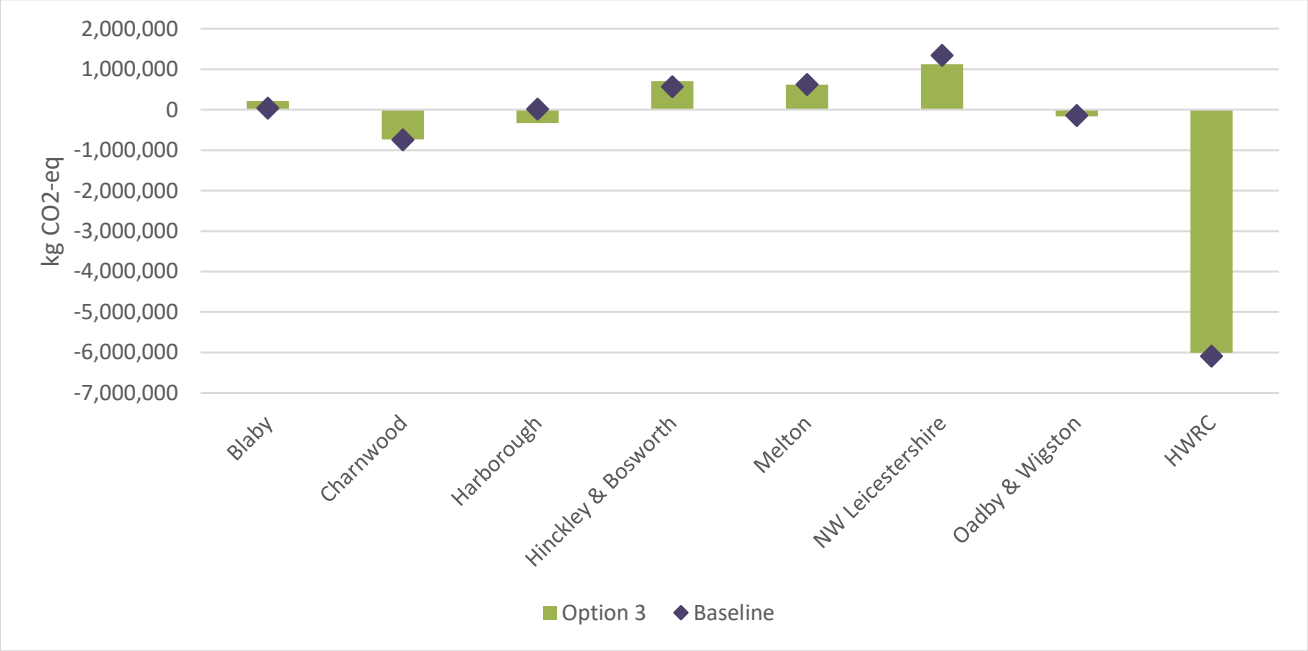


Figure 8: Option 3 carbon emissions by WCA and the HWRC service

[52] carbonfootprint.com - Carbon Footprint Calculator

[53] It should be noted that although material is removed from the kerbside, recyclable materials will be sent for recycling and reprocessing through the DRS supply chain and so although this reduces the WCA's carbon emission savings, the environmental benefit will be captured at a wider level.

3.5 Option 4 – As Option 3, with garden waste collected as per baseline

3.5.1 Kerbside Collection

Option 4 is the same model as option 3, however in this case, the garden waste is retained in a subscription arrangement as per the Baseline. For NWLDC, who currently provide garden waste collections free of charge, it is assumed that this will continue within their existing arrangement.

Within Table 13, *blue italics* are used to signify changes from the current collection in types of containers used and *green italics* are used to show where the frequency of collections have changed. Where both the containers and the frequency have changed, *black italics* are used.

Table 13: Option 4 container requirements and collection frequency

	Dry recycling	Food waste	Garden waste	Residual
Frequency	As per current service	Weekly	As per current service	As per current service
Blaby DC	140L/240L WHB	*Small kerbside food waste bin + kitchen caddy*	140L/240L WHB **(charged)**	140L/240L WHB
Charnwood BC	240L WHB		240L WHB **(charged)**	180L/240L WHB
Harborough DC	240L WHB		240L WHB **(charged)**	180L/240L WHB
Hinckley & Bosworth BC	240L WHB		240L WHB **(charged)**	240L WHB
Melton BC	240L WHB		240L WHB **(charged)**	240L WHB
NW Leicestershire DC	2 x box, 2 x bag[54]		240L WHB **(free)**	180L/240L WHB
Oadby & Wigston BC	240L WHB		240L WHB **(charged)**	140L WHB

This option is broadly in line with the proposed introduction of Consistent Collections and would introduce the mandatory collection of dry recycling materials such as plastic film and cartons. All WCAs, with the exception of NWLDC, currently collect both of these materials. For NWLDC, it has been assumed that 215 tonnes of plastic film will be captured annually[55], and that 0.7% of dry recycling will comprise cartons[56]. Unlike option 3, it is not assumed that the garden waste service for all WCAs will be free as described above. It is assumed that the WCAs will keep their current service.

Separate food waste collection is introduced across the Partnership. As per option 3, for this option, we have assumed either a 'low' or 'medium' yield from the WRAP ready reckoner. This is determined based on the average weekly residual waste capacity for each WCA (i.e. if the Authority has 120 litres of residual waste capacity it has been given a low yield, if it is 90 litres a medium yield has been applied). Based on evidence from WRAP food waste collection trials, a set out rate of between 45% and 55% and a participation rate of between 55% and 65% was applied. For all WCAs, it is assumed food waste is collected by dedicated 7.5t food waste vehicles[57].

[54] Includes the collection of plastic film and cartons.

[55] This is based on the average % plastic film captured at the current MRF through commingled collection.

[56] This is based on average dry recycling composition data from 9 benchmark authorities.

[57] It has been assumed that these vehicles will be used, however, more cost-effective ways of collecting this may be available for some WCAs.

The estimated total annualised cost of collection for all of the WCAs for option 4 is £23.5 million (Table 14), an additional c.£5.1 million per annum compared to the cost of the current service. This is largely due to the number of food waste vehicles required to operate this service.

Table 14: Option 4 annualised collection costs and recycling performance

Total gross collection cost for Option 4	**£23,549,900**
Baseline gross collection cost	**£18,428,500**
Difference in collection costs compared to baseline	**+ £5,121,300**
Kerbside recycling rate[58]	54.5% **(+ 8.1%)**
Cost per 1% increase in kerbside recycling performance	£632,300

The kerbside recycling rate increases to 54.5% in option 4. This is an 8.1% uplift in comparison to the baseline (46.4%), approximately £632k per 1% increase in kerbside recycling performance. This increase is largely driven by the separate collection of food waste at the kerbside, as this material is now recycled rather than going into the residual waste stream.

A breakdown of the predicted kerbside recycling rates (right axis) for each WCA is provided in Figure 9, alongside the modelled annualised gross collection cost (left axis). The tonnages of waste and recyclables for each WCA are included in Table 15.

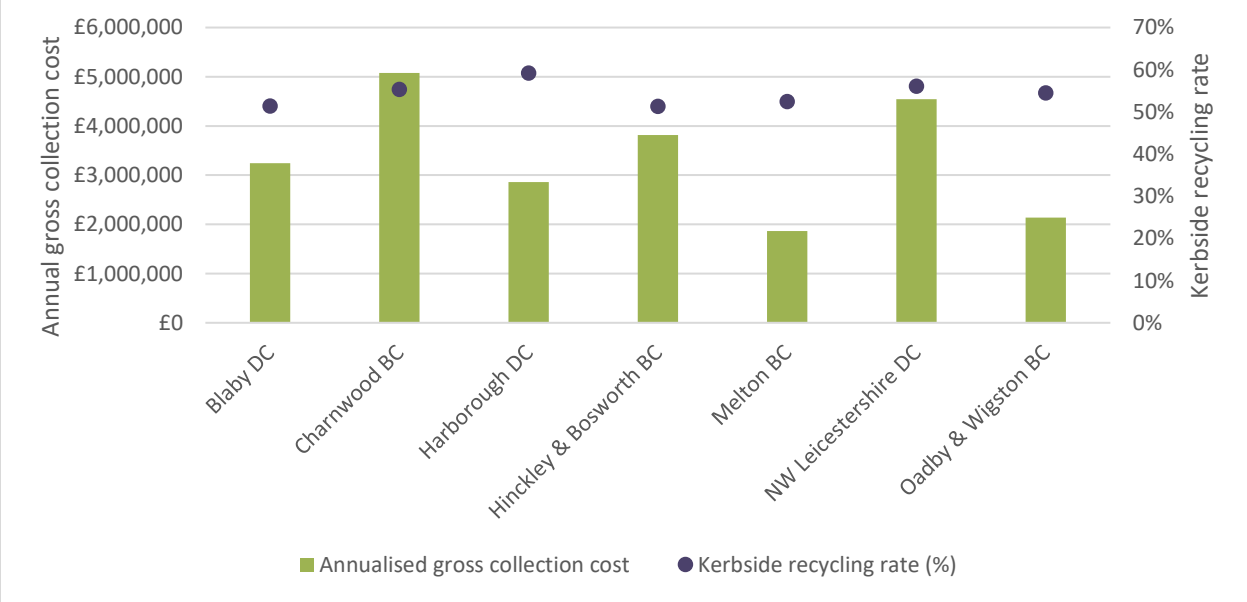


Figure 9: Option 4 annualised gross collection cost vs recycling performance

[58] 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 15: Option 4 total kerbside collected tonnage

Option 4	Blaby DC	Charnwood BC	Harborough DC	Hinckley & Bosworth BC	Melton BC	NW Leicestershire DC	Oadby & Wigston BC	WCA total
Residual	13,953	21,051	11,216	18,048	7,972	15,187	6,412	93,839
Dry recycling	6,646	13,254	7,181	7,354	4,240	5,879	3,738	48,292
Food	2,960	5,144	3,783	3,318	1,530	4,003	1,556	22,294
Garden	6,373	10,915	6,954	9,127	3,647	10,702	3,068	50,786
Contamination[59]	1,164	2,606	1,104	720	551	903	556	7,606
Kerbside recycling rate	**51.38%**	**55.34%**	**59.26%**	**51.34%**	**52.49%**	**56.13%**	**54.54%**	**54.47%**

The total tonnage collected at the kerbside in option 4 is shown in Table 15 . In this option, the garden waste tonnage is lower than option 3 (but same as the baseline) due to the majority of WCAs retaining the charged garden waste collections. As with all options, the impact of DRS and EPR has also been taken into account. This reduces the total dry recycling yield by c. 21 % and the residual waste yield by c.4%.

Table 16 illustrates the total annualised gross collection cost per household for option 4, relative to the baseline. The cost per household increases for all WCAs due primarily to the requirement to separately collect food. For all WCAs this requires a dedicated fleet of vehicles and operators. KAT modelling calculates an annualised capital cost of containers and does not consider the additional cost burden of purchasing small kerbside food waste bins and kitchen caddies for all households.

Table 16: Total annual gross collection and cost per household - Option 4

	Blaby DC	Charnwood BC	Harborough DC	Hinckley & Bosworth BC	Melton BC	NW Leicestershire DC	Oadby & Wigston BC
Option 4 total annualised gross collection cost	£3,244,000	£5,079,700	£2,857,900	£3,818,300	£1,867,400	£4,541,000	£2,141,000
Option 4 cost per HH	£76.93	£66.60	£71.25	£75.90	£79.26	£95.95	£91.69
Baseline cost per HH	*£55.32*	*£58.03*	*£57.11*	*£62.35*	*£59.46*	*£66.31*	*£72.94*

3.5.2 Treatment and Disposal

It is estimated that option 4 will cost LWP an additional £5.1 million per annum on collection costs, primarily as a result of introducing a separate food waste collection. However, there are treatment and disposal savings of approximately £2 million. There are a variety of influencing factors here. As with all

[59] This tonnage relates to the contamination collected across the dry recycling, food and garden collections.

options in this appraisal it is assumed that DRS and EPR measures are introduced. This removes approximately 21% of dry recycling from the kerbside (consisting of packaging items such as plastic and glass bottles and cans) and approximately 4% from residual waste. EPR measures support in this reduction of residual waste tonnages as packaging producers are incentivised to produce readily recyclable packaging, moving material from residual streams into the recycling stream.[60]

The introduction of a dedicated food waste collection also incurs a lower gate fee than the current residual waste disposal route reducing the overall treatment and disposal costs. In this option as the charged garden service is retained by the majority of authorities, each WCA with a charged garden service retains the annual revenue from subscription charges. This equates to c£5.5m. In this option NWLDC retain their kerbside sort collection of dry recycling and as such gain revenue from the sale of recyclable material. This is estimated at £461K per annum.

It is assumed that food waste will be sent for processing at an Anaerobic Digestion facility[61]. All other treatment and disposal processes are as per the current arrangements. The total net cost for the Partnership is c. £32 million per annum, indicating that whilst there are savings of c. £2.4 million on treatment and disposal estimated, these do not outweigh additional collection costs.

Table 17: Option 4 total net costs (Partnership)

	Baseline	Option 4
Gross Collection Cost	£18,428,500	£23,549,900
Garden Waste Income	-£5,528,500	-£5,528,500
Dry Recycling Income	-£483,500	-£460,200
Treatment and Disposal Cost	£16,987,700	£14,381,800
Whole System Cost	**£29,404,300**	**£31,943,000**

Within the latest round of consultation on the Resources and Waste Strategy for England was a commitment from government to cover the net cost of any 'new burden' faced by Local Authorities as a result of any proposed (and implemented) reforms to recycling and waste management services. Sensitivity analysis has been undertaken to estimate the potential cost to LWP of meeting the requirements of the national RWS where packaging producers contribute to the cost of managing packaging waste and central Government covers the costs of free garden waste collections and separate food waste collections. See Section 3.11.3 for more detail.

3.5.3 Carbon (WRATE) analysis

The results of the WRATE modelling for option 4 are shown in Figure 10. This option results in a smaller carbon emission saving than the baseline, saving 4,065t of CO_2 equivalent emissions (300 tonnes less the baseline, an equivalent addition of c.106 average petrol cars on the road). Although there are decreased emissions from the treatment and landfill primarily driven by the separate food waste collection, this is outweighed by increased emissions on recycling, containers and transport. Recycling emissions benefits are reduced due to DRS materials being captured outside of the kerbside system. The charged garden

[60] This impact is subtle when combined with DRS impacts.
[61] Not site specific

service is retained for authorities in this option. As will all other options, there are increased transport emissions associated with the introduction of a dedicated food waste collection service.

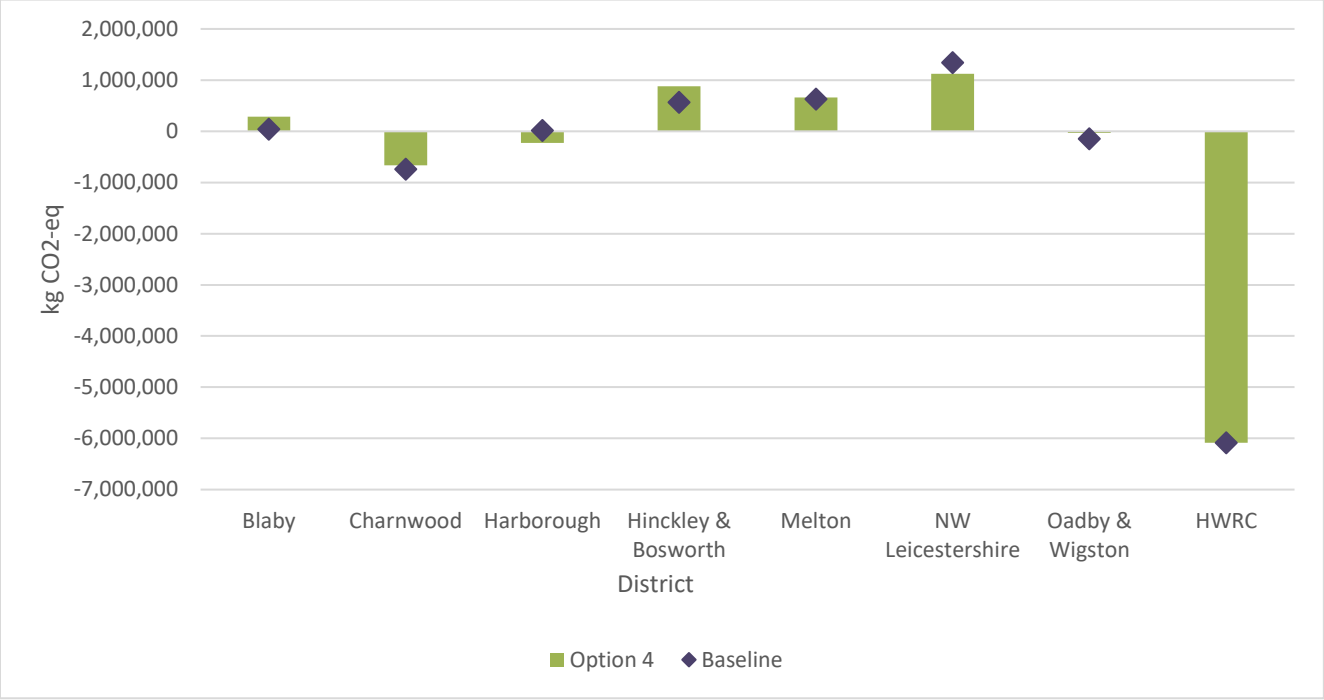


Figure 10: Option 4 carbon emissions by WCA and the HWRC service

3.6 Option 5A – 140L residual collected fortnightly

3.6.1 Kerbside Collection

Option 5A is one of two options within this appraisal which model a restricted residual waste collection for the WCAs within the LWP. In this option, the residual waste is collected fortnightly, via a 140L WHB as shown in Table 18. This equates to c.70L weekly capacity available for households, less than all residents have available at present, however it will be combined with increased capacity for recycling through a new weekly food waste collection and incentivise greater separation of materials from residual waste into other streams. The waste composition for Leicestershire (see Headline Strategy) shows that over 70% of the contents of the typical household bin could be recycled through the schemes proposed. Dry recycling is collected as per the baseline, however with the expanded breadth of recyclables. The garden waste is collected free of charge (operating fortnightly over 40 weeks of the year).

Blue italics are used to signify changes from the current collection in types of containers used and *green italics* are used to show where the frequency of collections have changed. Where both the containers and the frequency have changed, *black italics* are used.

Table 18: Option 5A container requirements and collection frequency

	Dry recycling	Food waste	Garden waste	Residual
Frequency	As per current service	Weekly	Fortnightly	Fortnightly
Blaby DC	140L/240L WHB	*Small kerbside food waste bin + kitchen caddy*	240L WHB **(free)**	140L WHB
Charnwood BC	240L WHB			*140L WHB*
Harborough DC	240L WHB			*140L WHB*
Hinckley & Bosworth BC	240L WHB			*140L WHB*
Melton BC	240L WHB			*140L WHB*
NW Leicestershire DC	2 x boxes, 2 x bag[62]			*140L WHB*
Oadby & Wigston BC	240L WHB			*140L WHB*

As noted above, restricting the residual waste container sizes decreases the total available weekly capacity for household residual waste. OWBC already have 140L WHB in place for residual waste and this is collected on a weekly basis, however within this option they move to a fortnightly collection, which halves the capacity available for its residents. BDC currently have 140L WHB for their residual waste[63] and this is collected fortnightly, so the configuration of their residual waste service does not change; all other WCAs will experience a reduction in their residual waste capacity. As a result of this, a 2% increase was applied to the participation rate and a 5% increase to the capture rate[64] from the baseline for the dry recycling streams of those WCAs. This is because it is assumed that householders will more effectively use their recycling containers when presented with restricted capacity in the residual bin.

[62] To include the collection of plastic film and cartons.

[63] It is noted that BDC has a split of 140L and 240L WHB for residual, however for the purposes of the modelling, 140L WHB have been assumed.

[64] Capture rate refers to the amount of material that households are putting out for collection.

As per other options with a free garden waste service, it is assumed that all households within the County will be covered, and the service will result in a set out rate of 60% and participation rate of 65%.

For this option, due to the residual waste restriction we have assumed a midpoint between the medium and high yield from the WRAP ready reckoner. This is determined based on the average weekly residual waste capacity, which is in this option is 70L per week. A set out rate of 60% and a participation rate of 70% was applied. For all WCAs, it is assumed food waste is collected by dedicated 7.5t food waste vehicles[65].

The total gross collection cost of this option is approximately £6.3 million per annum more than the baseline, resulting in a total indicative annual collection cost of £24.7 million, as shown in Table 19 below. This is slightly higher in kerbside collection cost terms than option 5B which restricts residual collection by waste frequency (3-weekly).

Table 19: Option 5A annualised collection costs and recycling performance

Total gross collection cost for Option 5A	**£24,758,800**
Baseline gross collection cost	**£18,428,500**
Difference in collection costs compared to baseline	**+£6,330,200**
Kerbside recycling rate[66]	62.0% **(+15.9%)**
Cost per 1% increase in kerbside recycling performance	£405,800

Reducing the residual waste capacity to 140L is modelled to increase LWP's 'kerbside' recycling rate by 15.9% to 62%. This is the highest kerbside recycling rate of all options modelled and approaching the 2035 national target of 65%. The increased capture of dry recyclables and food waste results in the requirement of additional vehicles for the Partnership. Any collection savings associated with reducing the residual waste capacity restriction does not offset the additional cost to operate the dry recycling and food waste collection services.

A breakdown of the kerbside recycling rates (right axis) for each WCA is provided in Figure 11, alongside the annualised gross collection cost (left axis). The tonnages of waste and recyclables for each WCA are included in Table 20.

[65] It has been assumed that these vehicles will be used, however, more cost-effective ways of collecting this may be available for some WCAs.

[66] 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

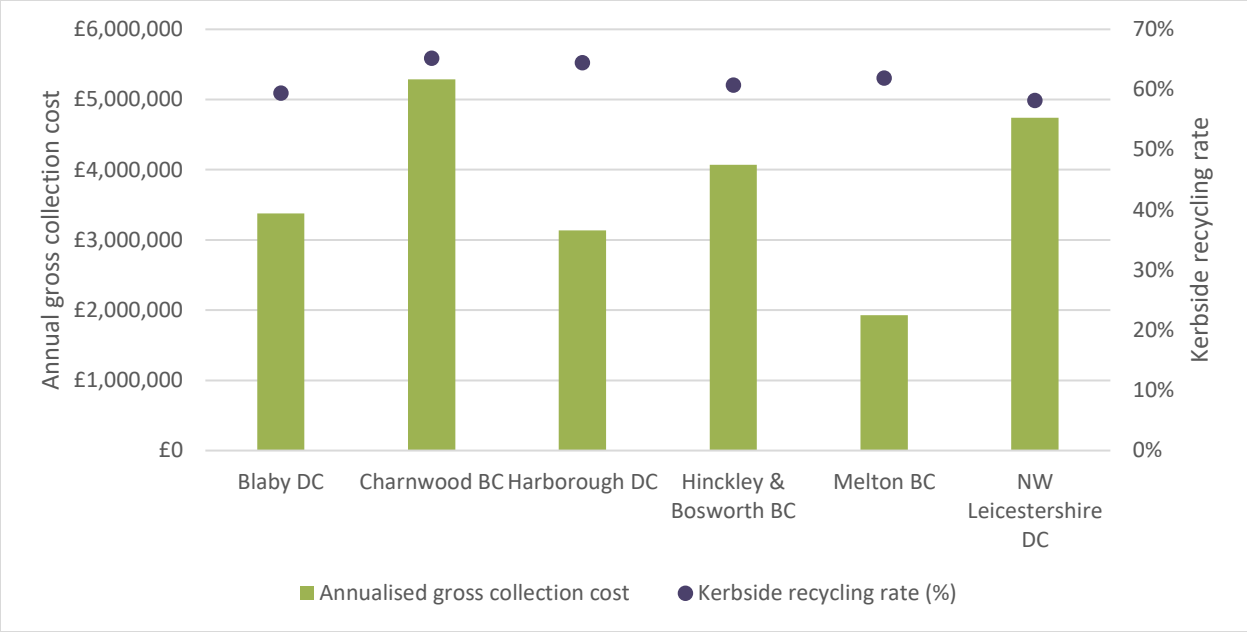


Figure 11: Option 5A annualised gross collection cost vs recycling performance

Table 20: Option 5A total kerbside collected tonnage

Option 5A	Blaby DC	Charnwood BC	Harborough DC	Hinckley & Bosworth BC	Melton BC	NW Leicestershire DC	Oadby & Wigston BC	WCA total
Residual	11,769	16,075	9,988	14,944	6,451	14,405	5,238	78,870
Dry recycling	6,939	14,715	7,497	8,166	4,709	6,137	3,902	52,064
Food	4,275	7,524	4,133	4,888	2,265	4,496	2,285	29,865
Garden	7,967	13,644	8,692	11,409	4,559	10,702	3,835	60,809
Contamination [67]	1,341	3,060	1,234	873	641	935	645	8,728
Kerbside recycling rate	**59.40%**	**65.22%**	**64.43%**	**60.73%**	**61.92%**	**58.17%**	**63.01%**	**61.97%**

The total tonnage collected at the kerbside in option 5A is shown in Table 20. The amount of food waste and dry recycling collected is increased in comparison to the option 3 and 4 due to the restriction on residual waste capacity. The total tonnage of contamination reported includes contamination arising in the dry recycling, food and garden waste streams.

The total gross collection cost per household for option 5A is presented in Table 21. For all authorities, restricting the residual capacity, introducing a weekly food waste collection and moving garden waste to a free service increases the cost per household (ranging from approximately £11 to £34)[68].

[67] This tonnage relates to the contamination collected across the dry recycling, food and garden collections.
[68] The free garden waste service is based on a fortnightly collection which operates for 40 weeks of the year.

Table 21: Total annual gross collection cost per household - Option 5A

	Blaby DC	Charnwood BC	Harborough DC	Hinckley & Bosworth BC	Melton BC	NW Leicestershire DC	Oadby & Wigston BC
Option 5A total annualised gross collection cost	£3,379,400	£3,930,100	£3,134,500	£4,071,700	£1,925,900	£5,357,000	£2,221,300
Option 5A cost per HH	£80.14	£69.31	£78.15	£80.93	£81.75	£100.14	£95.13
Baseline cost per HH	*£55.32*	*£58.03*	*£57.11*	*£62.35*	*£59.46*	*£66.31*	*£72.94*

3.6.2 Treatment and Disposal

LCC are responsible for allocating the treatment / disposal point for the dry recycling, garden and residual waste collected. Under the current arrangement, the commingled dry recycling is processed at a MRF in Leicester for sorting into individual materials for onward sale to third parties. The exception to this is NWLDC who operate under a direction from LCC but process their own recycling. Through their current arrangement NWLDC go out to the market every two months for materials collected at the kerbside (commonly referred to as 'spot pricing'). In this option, there are no changes to this arrangement assumed. Garden waste collected across the WCA is sent for composting. Residual waste is currently treated by a combination of energy recovery (mainly incineration with some refuse derived fuel (RDF) processing) and landfill, this assumption is applied to all options in this appraisal[69]. It is assumed that the separately collected food waste will be sent for processing at an Anaerobic Digestion facility[70].

Table 22 shows a breakdown of the total costs to LWP in option 5A. More restriction on the residual waste capacity incentivises householders to use alternative collections, increasing participation (and yield) of dry recycling and food waste. This in turn results in lower disposal costs as processing dry recycling through the MRF and separately collected food waste through AD facilities incurs lower gate fees than the residual waste disposal arrangements. In this scenario garden waste is modelled as a free service, as such the annual revenue received by the WCAs of the Partnership is reduced by c.£5.5 million due to the loss of income from subscription fees. There is an estimated £480K revenue for the sale of NWLDC's kerbside sort dry recycling.

[69] There is also a sensitivity analysis undertaken which is used to determine the impacts of moving to a higher level of energy recovery

[70] Not site specific.

Table 22: Option 5A total net costs (Partnership)

	Baseline	Option 5A
Gross Collection Cost	£18,428,500	£24,758,800
Garden Waste Income	-£5,528,500	£0
Dry Recycling Income	-£483,500	-£479,900
Treatment and Disposal Cost	£16,987,700	£13,652,100
Whole System Cost	**£29,404,300**	**£37,931,000**

Within the latest round of consultation on the Resources and Waste Strategy for England was a commitment from government to cover the net cost of any 'new burden' faced by Local Authorities as a result of any proposed (and implemented) reforms to recycling and waste management services. Sensitivity analysis has been undertaken to estimate the potential cost to LWP of meeting the requirements of the national R&WS where Packaging producers contribute to the cost of managing Packaging waste and central Government covers the costs of free garden waste collections and separate food waste collections. See Section 3.11.3 for more detail.

3.6.3 Carbon (WRATE) analysis

The results of the WRATE modelling for option 5A is shown in Figure 12. This option has the highest carbon saving of all the options modelled in this appraisal with c.9,000t CO_2 equivalents per annum, over double the baseline emission savings. This saving of 4,640 t CO_2 eq emissions is equivalent to taking a further 1,600 average petrol cars off the road. There is a combination of factors attributed to this reduction. As previously mentioned, there are reduced treatment and landfill emissions on account of additional garden waste diverted from the residual waste to composting. Additionally, the restriction on

residual capacity incentivises households to recycle more which has a significant carbon benefit where this material is diverted from energy recovery or landfill.

There is also a slight reduction in carbon performance from the HWRCs in this scenario as some of the increased garden waste is assumed diverted from the Household Waste Recycling Centres into the kerbside collection scheme.

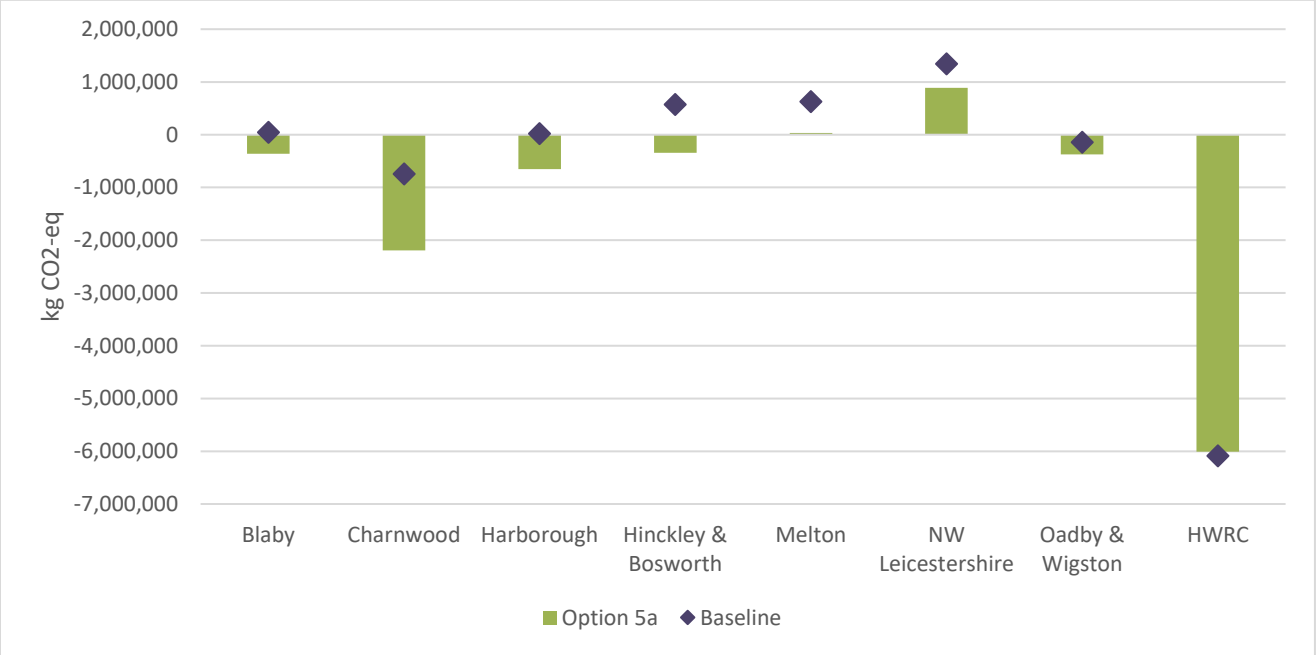


Figure 12: Option 5A carbon emissions by WCA and the HWRC service

3.7 Option 5B – 180L/240L residual waste collected three-weekly

3.7.1 Kerbside Collection

Option 5B is the second of the options which restrict the capacity of the residual waste stream. As opposed to option 5A which restricts the container size, option 5B maintains current residual waste containers but restricts the average weekly capacity of residual waste by reducing the collection frequency. The weekly capacity for residual waste will therefore be less than all residents have at present, however it will be combined with increased capacity for recycling through a new weekly food waste collection and incentivise greater separation of materials from residual waste into other streams. The waste composition for Leicestershire (see Headline Strategy) shows that over 70% of the contents of all household bins (residual, recycling and garden) could be recycled through the schemes proposed. More information regarding the required containers and collection frequency can be seen in Table 23.

The weekly capacity of each bin varies depending on whether the WCA uses a 180L or 240L WHB (or a combination of both[71]), and therefore the WCAs have a range of between 60L and 80L weekly kerbside capacity.

Blue italics are used to signify changes from the current collection in types of containers used and *green italics* are used to show where the frequency of collections have changed. Where both the containers and the frequency have changed, *black italics* are used.

Table 23: Option 5B container requirements and collection frequency

	Dry recycling	Food waste	Garden waste	Residual
Frequency	As per current service	Weekly	Fortnightly	3- weekly
Blaby DC	140L/240L WHB	*Small kerbside food waste bin + kitchen caddy*	240L WHB **(free)**	*180L WHB*
Charnwood BC	240L WHB			*240L WHB*
Harborough DC	240L WHB			*180L WHB*
Hinckley & Bosworth BC	240L WHB			*240L WHB*
Melton BC	240L WHB			*240L WHB*
NW Leicestershire DC	2 x boxes, 2 x bag[72]			*180L WHB*
Oadby & Wigston BC	240L WHB			*180L WHB*

Option 5B is similar to 5A in principle, however instead of restricting the residual waste stream through container size, in this option it is restricted through the three-weekly collection frequency. With the exception of BDC and OWBC who move to 180L WHB, all other WCAs keep their current residual bin size and only experience changes to the frequency in which this is collected. As a result of this, a 2% increase was applied to the participation rate and a 5% increase to the capture rate from the baseline for the dry recycling streams for appropriate WCAs. This is because it assumed that householders will more effectively use their recycling containers when presented with a reduced collection frequency for the residual bin.

[71] Some WCAs have a policy of replacing 240L WHB with 180L WHB

[72] To include the collection of plastic film and cartons.

For the free garden waste service, it is assumed that all households within the WCA will be covered, and the service will result in a set out rate of 60% and participation rate of 65%. The free garden waste service is based on a fortnightly collection which operates for 40 weeks of the year.

For this option, the assumed food waste yield from the WRAP ready reckoner varies based on the size of the container used for the three-weekly residual waste collection. We have assumed between a 'medium' and 'medium-high' yield from the WRAP ready reckoner. This is determined based on the average weekly residual waste capacity, whether that be 60L or 80L per week. A set out rate of 55-60% and a participation rate of 65-70% was applied. For all WCAs, it is assumed food waste is collected by dedicated 7.5t food waste vehicles[73].

Reducing the frequency of residual collections to three-weekly, as well as introducing a weekly food waste service and moving to a free garden waste service is estimated to cost LWP an additional c. £5.2 million to the baseline, as seen in Table 24. This is a slightly lower collection cost than the alternative restricted residual option (option 5A) which restricts by container size rather than frequency.

Table 24: Option 5B annualised collection costs and recycling performance

Total gross collection cost for Option 5B	**£23,604,300**
Baseline gross collection cost	**£18,428,500**
Difference in collection costs compared to baseline	**+ £5,175,700**
Kerbside recycling rate[74]	61.3% (+15.2%)
Cost per 1% increase in kerbside recycling performance	£346,200

The KAT modelling suggests that this option would increase the kerbside recycling rate by c. 15.2%, costing LWP approximately £346k per 1% increase in kerbside recycling performance, making this the most cost effective of all the alternative options. This increase is driven by a restriction in the residual collection frequency which encourages better use of the recycling service, as well as a food and garden waste service which is available to all residents. This is the second highest kerbside recycling performance of all options modelled, after option 5A.

A breakdown of the kerbside recycling rates (right axis) for each WCA is provided in Figure 13: Option 5B annualised gross collection cost vs recycling performance, alongside the annualised gross collection cost (left axis). The tonnages of waste and recyclables for each WCA are included in Table 25.

[73] It has been assumed that these vehicles will be used, however, more cost-effective ways of collecting this may be available for some WCAs.

[74] 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

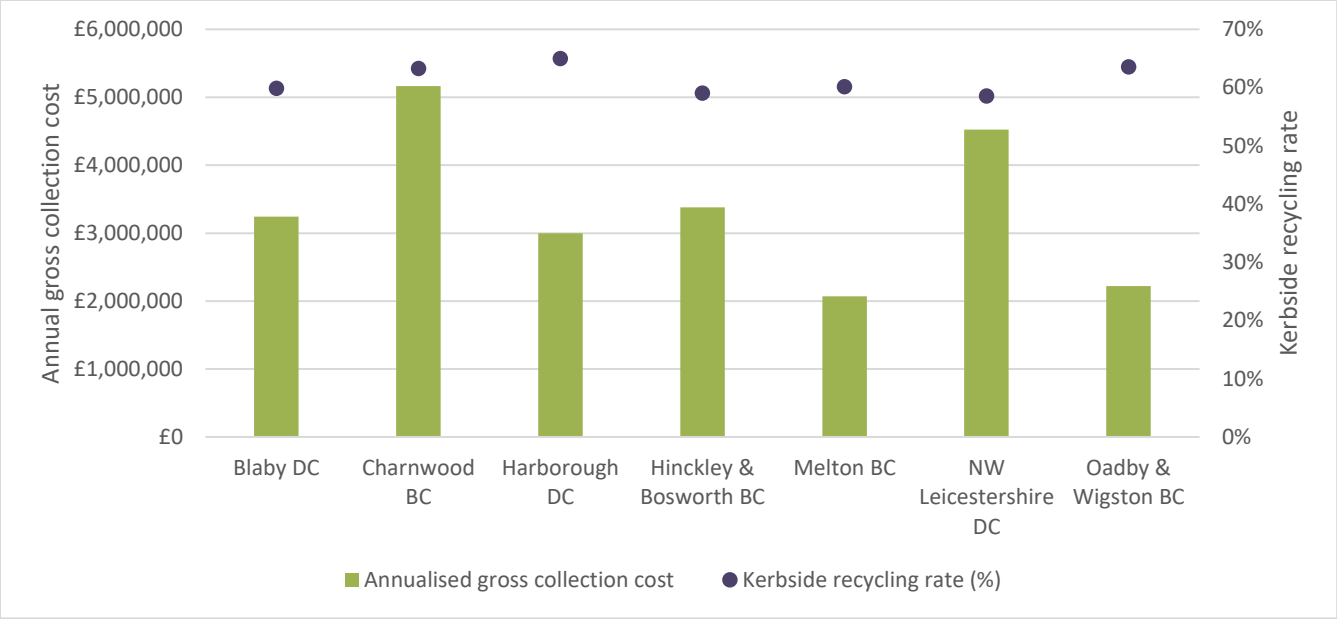


Figure 13: Option 5B annualised gross collection cost vs recycling performance

Table 25: Option 5B total kerbside collected tonnage

Option 5B	Blaby DC	Charnwood BC	Harborough DC	Hinckley & Bosworth BC	Melton BC	NW Leicestershire DC	Oadby & Wigston BC	WCA total
Residual	11,592	17,213	9,800	15,651	6,805	14,259	5,144	80,464
Dry recycling	7,100	14,447	7,671	8,018	4,622	6,278	3,989	52,124
Food	4,275	6,730	4,133	4,365	2,020	4,496	2,285	28,302
Garden	7,967	13,644	8,692	11,409	4,559	10,702	3,835	60,809
Contamination[75]	1,358	2,983	1,247	837	619	939	653	8,637
Kerbside recycling rate	**59.90%**	**63.29%**	**64.98%**	**59.06%**	**60.14%**	**58.56%**	**63.56%**	**61.32%**

Table 26 illustrates the total annualised gross collection cost per household for option 5B, relative to the baseline. The cost per household increases for all WCAs, by between £5 and £29.

Table 26: Total annual gross collection cost per household - Option 5B

	Blaby DC	Charnwood BC	Harborough DC	Hinckley & Bosworth BC	Melton BC	NW Leicestershire DC	Oadby & Wigston BC
Option 5B total annualised	£3,243,100	£5,164,500	£2,998,900	£3,381,100	£2,070,100	£4,525,300	£2,221,300

[75] This tonnage relates to the contamination collected across the dry recycling, food and garden collections.

gross collection cost							
Option 5B cost per HH	£76.91	£67.71	£74.77	£67.21	£87.86	£95.61	£95.13
Baseline cost per HH	*£55.32*	*£58.03*	*£57.11*	*£62.35*	*£59.46*	*£66.31*	*£72.94*

KAT modelling calculates an annualised capital cost of containers and does not consider the additional cost burden of purchasing new 140L bins.

3.7.2 Treatment and Disposal

As per option 5A, more restriction on the residual waste capacity incentivises householders to use alternative services, increasing participation (and yield) of dry recycling and food waste. This in turn results in lower disposal costs as the MRF and AD gate fees are lower than the residual waste disposal arrangements. This option has slightly more restriction (overall, not uniform across each WCA) and as such has marginally lower WDA costs than option 5A.

Similarly, there is a loss of the garden waste income on account of free garden waste collection. Revenues shown below illustrate the material revenue for NWLDC's dry recycling.

Table 27: Option 5B total net costs (Partnership)

	Baseline	Option 5B
Gross Collection Cost	£18,428,500	£23,604,300
Garden Waste Income	-£5,528,500	£0
Dry Recycling Income	-£483,500	-£491,100
Treatment and Disposal Cost	£16,987,700	£13,747,000
Whole System Cost	**£29,404,300**	**£36,860,000**

Within the latest round of consultation on the Resources and Waste Strategy for England was a commitment from Government to cover the net cost of any 'new burden' faced by Local Authorities as a result of any proposed (and implemented) reforms to recycling and waste management services. Sensitivity analysis has been undertaken to estimate the potential cost to LWP of meeting the requirements of the national R&WS where Packaging producers contribute to the cost of managing Packaging waste and central Government covers the costs of free garden waste collections and separate food waste collections. See Section 3.11.3 for more detail.

3.7.3 Carbon (WRATE) analysis

The results of the WRATE modelling for option 5B is shown in Figure 14. This option has the second highest carbon saving of all the options modelled in this appraisal with c.8,800 CO_2 equivalents saved per annum, equivalent to double the baseline emission savings (i.e. a further saving of 1,600 cars). As with option 5A, there is a combination of factors attributed to this reduction, including the dedicated food waste collection, free garden waste collection and enhanced recycling performance that all also

reduced treatment and landfill / EfW emissions. The average weekly capacity to household is slightly higher in option 5B than option 5A hence the slight difference in carbon emission savings between the two restricted residual options.

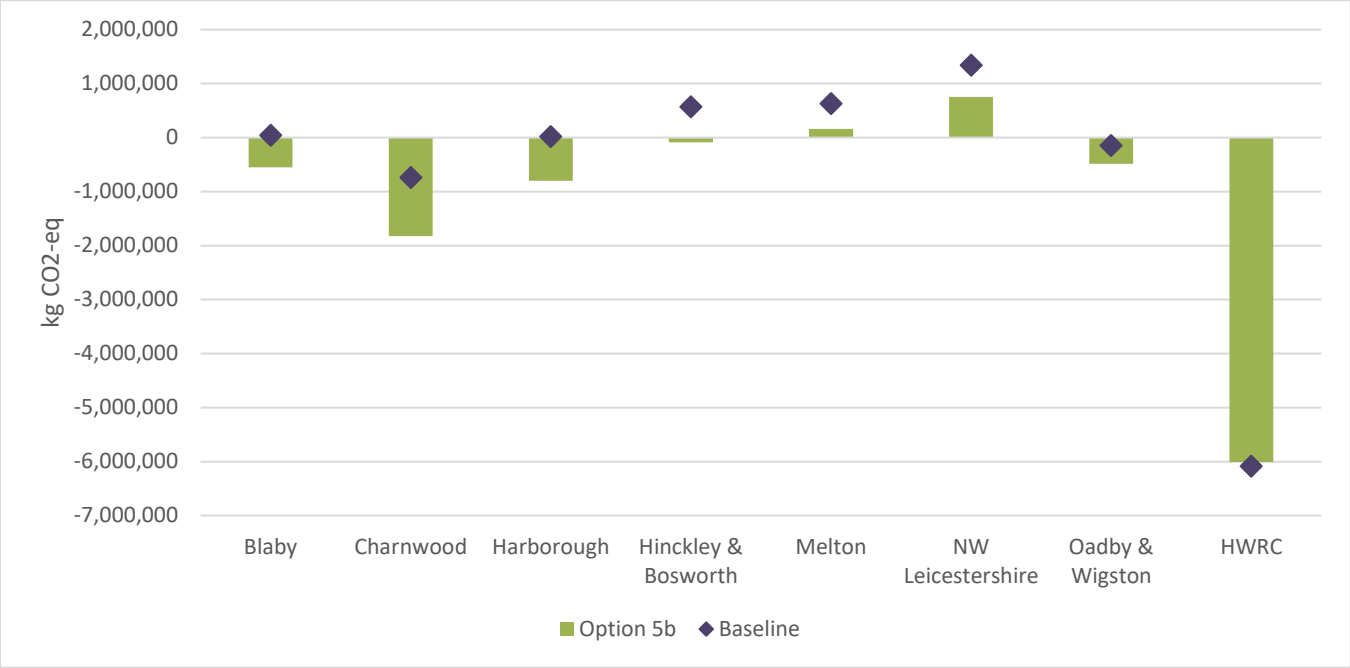


Figure 14: Option 5B carbon emissions by WCA and the HWRC service

3.8 Option 6 – Twin stream recycling, fibre out

3.8.1 Kerbside Collection

Option 6 is the first of the alternative collection options to change the collection service for dry recycling. In this option all WCAs move to a twin stream collection system, with paper and card forming the separated fraction from the other dry recyclables, both of which are collected on a fortnightly basis. More details of this can be seen in Table 28.

Blue italics are used to signify changes from the current collection in types of containers used and *green italics* are used to show where the frequency of collections have changed. Where both the containers and the frequency have changed, *black italics* are used.

Table 28: Option 6 container requirements and collection frequency

	Dry recycling	Food waste	Garden waste	Residual
Frequency	Fortnightly	Weekly	Fortnightly	As per current service
Blaby DC	*240L WHB and box*	*Small kerbside food waste bin + kitchen caddy*	240L WHB **(free)**	140L/240L WHB
Charnwood BC	*240L WHB and box*			180L/240L WHB
Harborough DC	*240L WHB and box*			180L/240L WHB
Hinckley & Bosworth BC	*240L WHB and box*			240L WHB
Melton BC	*240L WHB and box*			240L WHB
NW Leicestershire DC	*240L WHB and box*[76]			180L/240L WHB
Oadby & Wigston BC	*240L WHB and box*			140L WHB

Split-back (70:30) collection vehicles will be used to operate the twin stream dry recycling. Mixed dry recycling will be collected via the 240L WHB and emptied into the larger compartment on the vehicle and a box will be used to collect paper and card, emptied into the smaller compartment. For all WCAs, the dry recycling contamination rate for this option decreases by a third in comparison to their baseline position. For all WCAs, with the exception of NWLDC, dry recycling yields decrease by 2% as a result of the move from a commingled to a twin-stream recycling service. For NWLDC, the yield of dry mixed recycling increases by 7%.

For the free garden waste service, it is assumed that all households within the WCA will be covered, and the service will result in a set out rate of 60% and participation rate of 65%. The free garden waste service is based on a fortnightly collection which operates for 40 weeks of the year.

As per option 3, for this option, we have assumed either a 'low' or 'medium' yield from the WRAP ready reckoner. This is determined based on the average weekly residual waste capacity for each WCA. Based on evidence from WRAP food waste collection trials, a set out rate of between 45% and 55% and a participation rate of between 55% and 65% was applied. For all WCAs, it is assumed food waste is collected by dedicated 7.5t food waste vehicles[77].

[76] Includes the collection of plastic film and cartons.

[77] It has been assumed that these vehicles will be used, however, more cost-effective ways of collecting this may be available for some WCAs.

The gross collection cost of operating a twin-stream service is modelled to cost, in total, approximately £27.9 million per annum in collection costs. This is an increase of £9 million to the baseline, as shown in Table 29.

Table 29: Option 6 annualised collection costs and recycling performance

Total gross collection cost for Option 6	**£27,941,100**
Baseline gross collection cost	**£18,428,500**
Difference in collection costs compared to baseline	**+£9,485,500**
Kerbside recycling rate[78]	56.8% **(+10.7%)**
Cost per 1% increase in kerbside recycling performance	£912,900

The kerbside recycling rate increases by approximately 10.7%, bringing the overall 'kerbside' recycling rate for LWP to 56.8%. This equates to c. £913k per 1% increase in kerbside recycling performance to the baseline. A summary of the kerbside recycling rate (right axis) for each WCA in this option is shown in Figure 15, alongside the annualised gross collection cost (left axis).

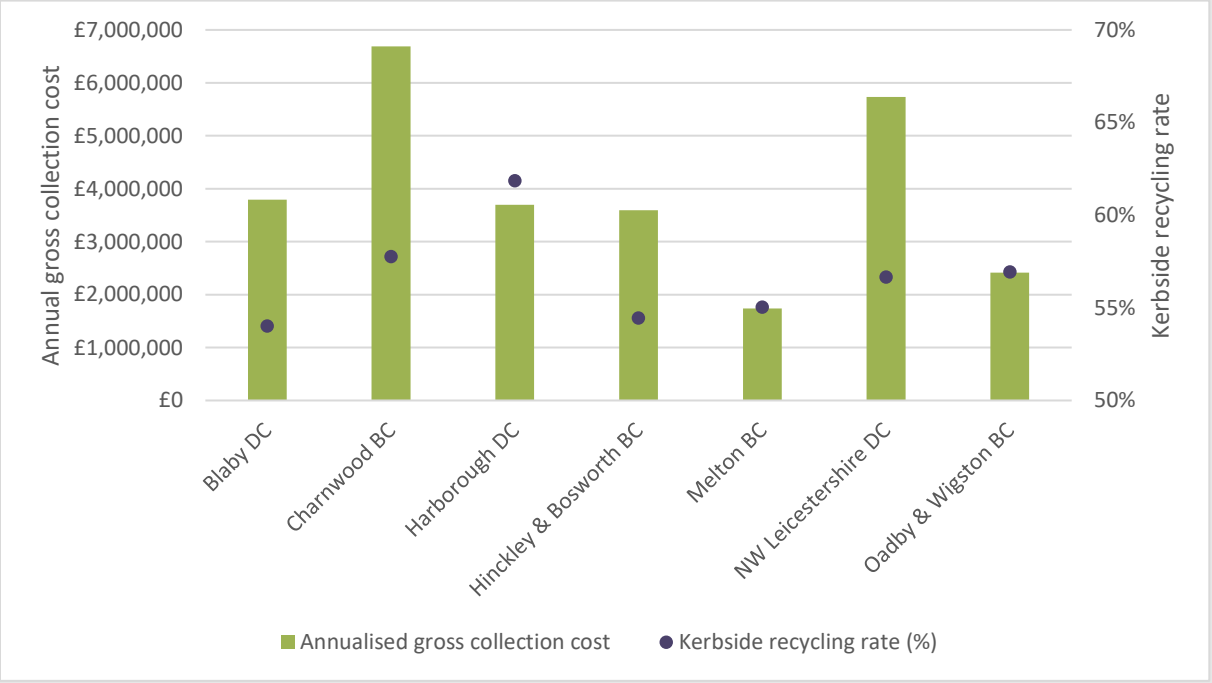


Figure 15: Option 6 annualised gross collection cost vs recycling performance

[78] 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 30: Option 6 total kerbside collected tonnage

Option 6	Blaby DC	Charnwood BC	Harborough DC	Hinckley & Bosworth BC	Melton BC	NW Leicestershire DC	Oadby & Wigston BC	WCA total
Residual	13,848	21,171	11,055	17,777	8,008	14,797	6,376	93,032
Dry recycling	6,514	12,989	7,038	7,208	4,159	6,073	3,664	47,644
Food	2,960	5,144	3,783	3,318	1,530	4,003	1,556	22,294
Garden	7,967	13,644	8,692	11,409	4,559	10,702	3,835	60,808
Contamination[79]	1,002	2,069	976	568	368	1,100	475	6,558
Kerbside recycling rate	**54.01%**	**57.76%**	**61.86%**	**54.46%**	**55.03%**	**56.65%**	**56.93%**	**56.76%**

The total tonnage collected at the kerbside in option 6 is shown in Table 30. The amount of contamination collected in this option is reduced in comparison to the previous option where the majority of households have a commingled collection.

The gross annualised collection cost per household is presented in Table 31. For option 6, all WCAs see an increase in the cost per household in comparison to the baseline. For the majority of WCAs this increase is in the region of £40 per household. This is primarily driven by increased costs associated with operating a twin-stream dry recycling service (both in terms of CAPEX of split-back vehicles, and an increase in the number of recycling vehicles required), alongside elevated garden collection costs and dedicated food waste collections. The exception to this is HBBC which sees a smaller increase in cost of £12 per household. Our modelling indicates HBBC would be able to deliver a twin-stream service with a similar no. of split-back vehicles to their current recycling fleet.

Table 31: Total annual gross collection cost per household - Option 6

	Blaby DC	Charnwood BC	Harborough DC	Hinckley & Bosworth BC	Melton BC	NW Leicestershire DC	Oadby & Wigston BC
Option 6 total annualised gross collection cost	£3,793,500	£6,688,700	£3,697,800	£3,760,500	£2,444,800	£5,111,800	£2,414,800
Option 6 cost per HH	£89.96	£87.70	£92.19	£74.75	£103.77	£108.04	£103.42
Baseline cost per HH	*£55.32*	*£58.03*	*£57.11*	*£62.35*	*£59.46*	*£66.31*	*£72.94*

3.8.2 Treatment and Disposal

In this option dry recycling is collected via a twin-stream collection, with paper and card presented separately from the remaining recyclable material (e.g. metals, plastics, cartons, glass; also referred to

[79] This tonnage relates to the contamination collected across the dry recycling, food and garden collections.

as dry mixed recycling 'DMR'). As such, there is the potential to receive an income from the onward sale of the paper/card. Based on current arrangements, it is assumed that the LCC will receive any income associated with this, whilst also bearing the cost of the gate fee for sorting the remaining DMR collected.

Table 32 shows a breakdown of the total costs to LWP in option 6. For the purposes of this Options Appraisal it is assumed that LCC would receive the revenue (income) for the separately collected paper and card[80]. This is based on the assumption that WCAs would tip both the commingled recyclates (glass, metals, plastics) and the separated paper and card fraction at a County Council facility, where LCC receive the revenue. As NWLDC will also change their collection service in this scenario, it is assumed that this would also be the case. As a result, there are no direct revenues for the WCAs in this option. LCC would still pay a MRF gate for the commingled material.

On balance, between paying for the MRF gate fee and receiving revenue for the paper and card fraction, LCC could receive c. £600k of revenue. This option is modelled to reduce LCC's treatment and disposal cost to c. £12.6 million. The revenue would also offset higher transfer costs which are not modelled.

Table 32: Option 6 total net costs (Partnership)

	Baseline	Option 6
Gross Collection Cost	£18,428,500	£27,914,100
Garden Waste Income	-£5,528,500	£0
Dry Recycling Income	-£483,500	-£602,500
Treatment and Disposal Cost	£16,987,700	£12,614,800
Whole System Cost	**£29,404,300**	**£39,926,300**

Within the latest round of consultation on the Resources and Waste Strategy for England was a commitment from Government to cover the net cost of any 'new burden' faced by Local Authorities as a result of any proposed (and implemented) reforms to recycling and waste management services. Sensitivity analysis has been undertaken to estimate the potential cost to LWP of meeting the requirements of the national RWS where packaging producers contribute to the cost of managing packaging waste and central Government covers the costs of free garden waste collections and separate food waste collections. See Section 3.11.3 for more detail.

3.8.3 Carbon (WRATE) analysis

The results of the WRATE modelling for the twin-stream collection option is shown in Figure 16. Our WRATE modelling suggests that this option has an overall net saving of c.1,422 tonnes of CO_2-eq emissions. This is however, approximately 2,950 t CO_2-eq emissions worse than the baseline; the 3rd highest Partnership carbon emissions.

There is a slight reduction in carbon performance from the HWRCs in this scenario as some of the increased garden waste is assumed diverted from the HWRCs into the kerbside collection scheme. However, there is increased transport emissions and the option has the 2nd lowest saving from recycling emissions.

[80] This assumption has been made for the purposes of this options appraisal and would be subject to forthcoming legislation and funding mechanisms.

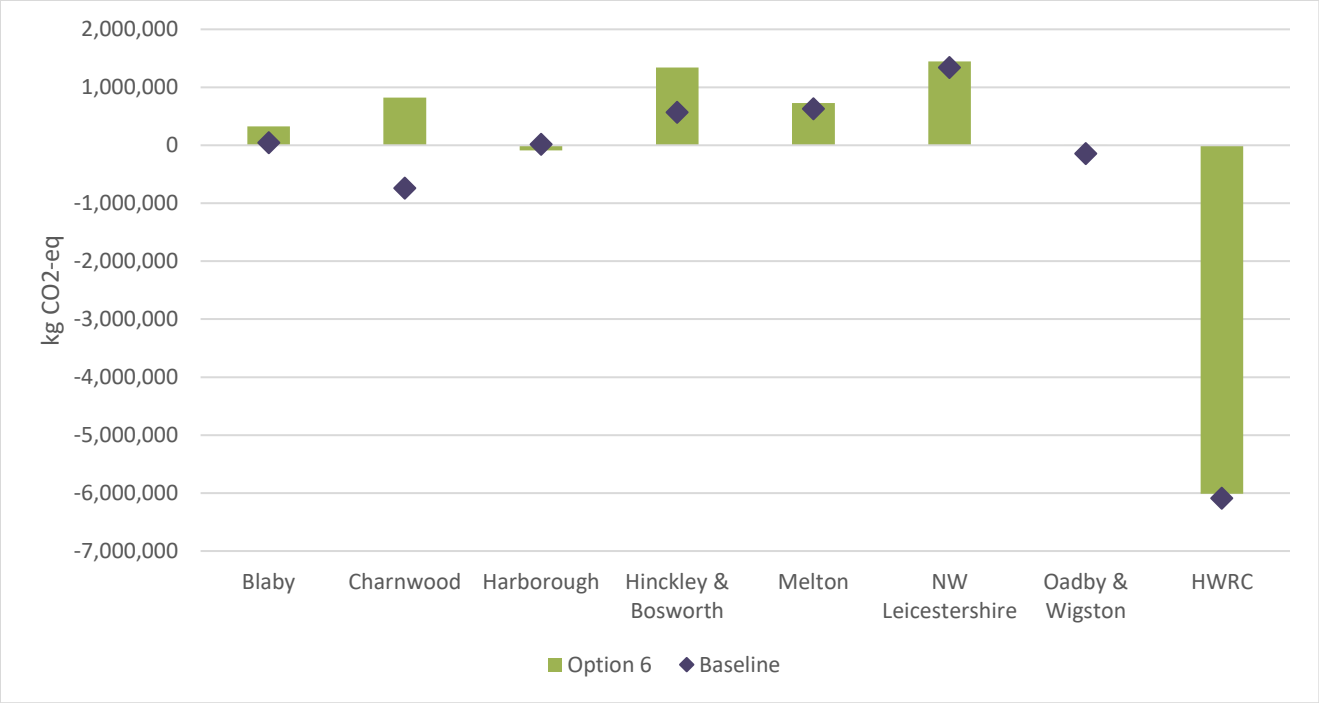


Figure 16: Option 6 carbon emissions by WCA and the HWRC service

3.9 Option 7 – Kerbside sort

3.9.1 Kerbside Collection

In option 7, all WCAs move to a kerbside sort system which requires the resident to sort recyclables into two boxes and a bag, this is collected on a fortnightly basis as shown in Table 33. The exception to this is NWLDC, where it is assumed that the current containers (3 boxes and 2 bags are retained). The materials are collected as follows:

- Box 1 – Plastics (bottles, PTT and film), cartons and metals
- Box 2 – Glass
- Bag 1 – Paper and Card

Blue italics are used to signify changes from the current collection in types of containers used and *green italics* are used to show where the frequency of collections have changed. Where both the containers and the frequency have changed, *black italics* are used.

Table 33: Option 7 container requirements and collection frequency

	Dry recycling	Food waste	Garden waste	Residual
Frequency	Fortnightly	Weekly	Fortnightly	As per current service
Blaby DC	*2 x boxes, 1 x bag*	*Small kerbside food waste bin + kitchen caddy*	240L WHB **(free)**	140L/240L WHB
Charnwood BC	*2 x boxes, 1 x bag*			180L/240L WHB
Harborough DC	*2 x boxes, 1 x bag*			180L/240L WHB
Hinckley & Bosworth BC	*2 x boxes, 1 x bag*			240L WHB
Melton BC	*2 x boxes, 1 x bag*			240L WHB
NW Leicestershire DC	3 x boxes, 2 x bag[81]			180L/240L WHB
Oadby & Wigston BC	*2 x boxes, 1 x bag*			140L WHB

Within option 7, all WCAs move to a kerbside sort collection, which is assumed to be collected via a large, compartmentalised vehicle[82], and therefore all WCAs implement a change in the required containers. The WCAs implement a change of service from commingled to kerbside sort, with the exception of NWLDC who are retaining their current collection configuration. As well as having a change of service, OWBC also change the frequency of their dry recycling collection from weekly to fortnightly. A common contamination rate is assumed for all WCAs at 2% (a significant drop for all except NW Leicestershire) and yields of dry recycling decrease by 7% for all WCAs, except for NWLDC where this remains the same.

For the free garden waste service, it is assumed that all households within the WCA will be covered, and the service will result in a set out rate of 60% and participation rate of 65%. The free garden waste service is based on a fortnightly collection which operates for 40 weeks of the year.

As per option 3, for this option, we have assumed either a 'low' or 'medium' yield from the WRAP ready reckoner. This is determined based on the average weekly residual waste capacity. Based on evidence from WRAP food waste collection trials, a set out rate of between 45% and 55% and a participation rate

[81] To include the collection of plastic film and cartons.
[82] Also referred to as a kerbsider, or Romaquip vehicle

of between 55% and 65% was applied. For all WCAs, it is assumed food waste is collected by dedicated 7.5t food waste vehicles[83].

Moving to a common, weekly kerbside sort collection system is estimated to cost LWP (in collection terms) an additional £9 million to the baseline, as shown in Table 34, resulting in a total gross collection cost of approximately £27.5 million.

Table 34: Option 7 annualised collection costs and recycling performance

Total gross collection cost for Option 7	**£27,468,000**
Baseline gross collection cost	**£18,428,500**
Difference in collection costs compared to baseline	**+£9,039,500**
Kerbside recycling rate[84]	55.8% (+9.7%)
Cost per 1% increase in kerbside recycling performance	£962,700

KAT modelling suggests that the kerbside recycling rate increases by 9.7% when a kerbside sort system, free garden waste service and separate food waste collection is introduced across the Partnership, costing approximately £963k for every 1% increase in recycling performance that is achieved. A breakdown of the kerbside recycling rates (right axis) for each WCA is provided in Figure 17, alongside the annualised gross collection cost (left axis). The total tonnage collected at the kerbside in option 7 is shown in Table 35.

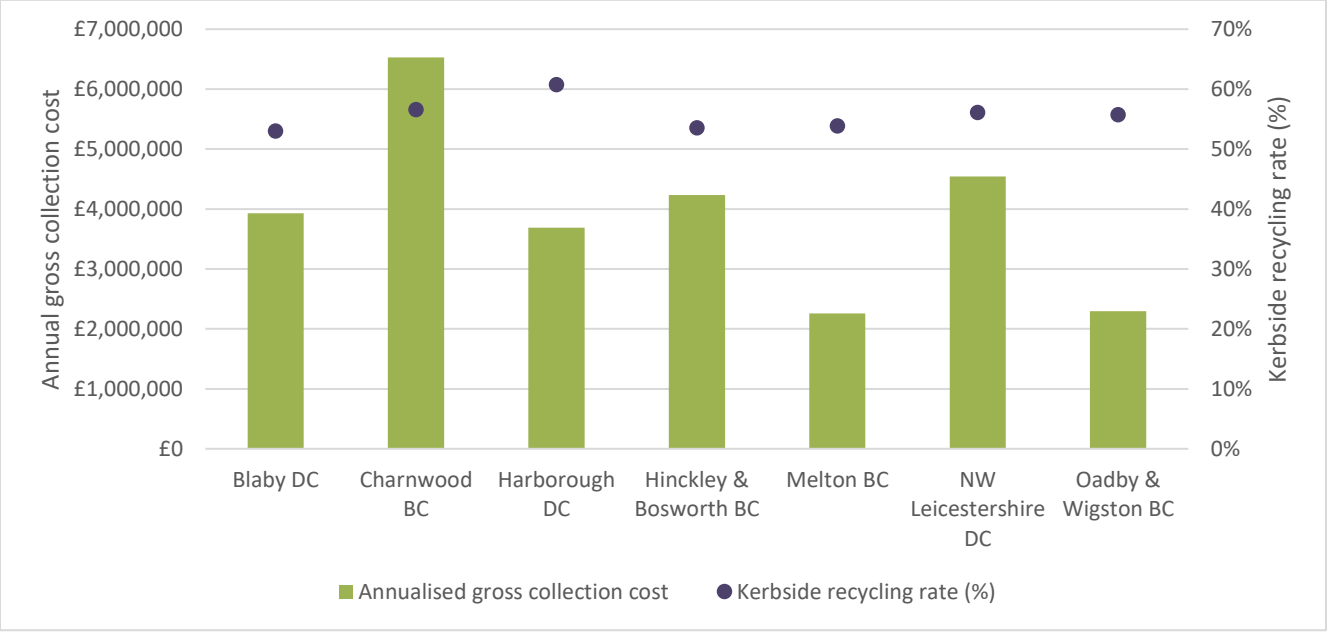


Figure 17: Option 7 annualised gross collection cost vs recycling performance

[83] It has been assumed that these vehicles will be used, however, more cost-effective ways of collecting this may be available for some WCAs.

[84] 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 35: Option 7 kerbside collected tonnage

Option 7	Blaby DC	Charnwood BC	Harborough DC	Hinckley & Bosworth BC	Melton BC	NW Leicestershire DC	Oadby & Wigston BC	WCA total
Residual	14,511	22,714	11,626	18,296	8,435	15,187	6,700	97,470
Dry recycling	6,183	12,329	6,684	6,840	3,944	5,879	3,475	45,335
Food	2,960	5,144	3,783	3,318	1,530	4,003	1,556	22,294
Garden	7,967	13,644	8,692	11,409	4,559	10,702	3,835	60,809
Contamination[85]	670	1,186	757	417	155	903	339	4,428
Kerbside recycling rate	**52.99%**	**56.56%**	**60.74%**	**53.54%**	**53.88%**	**56.13%**	**55.75%**	**55.76%**

It is noted that the total dry recycling yields are lowest in this option in comparison to the baseline and alternative collection options. However, the levels of contamination are lowest where material is sorted at the kerbside.

The total gross collection cost per household for option 7 is presented in Table 36. The gross cost per household is higher for all WCAs and increases by between £22 and £37.

Table 36: Total annual gross collection cost per household - Option 7

	Blaby DC	Charnwood BC	Harborough DC	Hinckley & Bosworth BC	Melton BC	NW Leicestershire DC	Oadby & Wigston BC
Option 7 total annualised gross collection cost	£3,793,500	£6,527,100	£3,687,000	£4,233,400	£2,257,00	£4,541,500	£2,294,700
Option 7 cost per HH	£93.13	£85.58	£91.92	£84.15	£95.80	£95.95	£98.28
Baseline cost per HH	*£55.32*	*£58.03*	*£57.11*	*£62.35*	*£59.46*	*£66.31*	*£72.94*

3.9.2 Treatment and Disposal

LCC are responsible for allocating the treatment / disposal point for the dry recycling, garden and residual waste collected. Under the current arrangement, the commingled dry recycling is processed at a MRF in Leicester for sorting into individual materials for onward sale to third parties. The exception to this is NWLDC who operate under a direction from LCC but process their own recycling. Through their current arrangement NWLDC go out to the market every two months for materials collected at the kerbside (commonly referred to as 'spot pricing').

[85] This tonnage relates to the contamination collected across the dry recycling, food and garden collections.

In this option, there are no changes to this arrangement assumed for NWLDC. However, in this option it is assumed that all WCAs within the Partnership will go out to market to sell the separately collected dry recycling in the same way that NWLDC currently do. As per the other options, residual waste is treated by a combination of energy recovery (mainly incineration with some refuse derived fuel (RDF) processing) and landfill, this assumption is applied to all options in this appraisal[86]. It is assumed that the separately collected food waste will be sent for processing at an Anaerobic Digestion facility.

For the purposes of the Options Appraisal, it is assumed that WCAs will gain revenue for the kerbside sort dry recycling, much as is the case with NWLDC at present.[87] It is assumed that no material will be processed at the MRF. Material revenues for the kerbside sort material is based on 3-year averages market prices[88].

Table 37 shows a breakdown on the total costs to LWP in option 7. In this scenario, it is estimated that the sale of dry recyclables could provide a combined income of nearly £3.5 million. Should this income go to the WCAs, this could offset over a third of the increase in gross collection costs, which are modelled at nearly £9 million above the baseline. The treatment and disposal costs are estimated at approximately £12.8 million, a £4.4 million saving compared to the baseline.

Table 37: Option 7 total net costs (Partnership)

	Baseline	Option 7
Gross Collection Cost	£18,428,500	£27,468,000
Garden Waste Income	-£5,528,500	£0
Dry Recycling Income	-£483,500	-£3,472,200
Treatment and Disposal Cost	£16,987,700	£12,843,000
Whole System Cost	**£29,404,300**	**£36,838,800**

Within the latest round of consultation on the Resources and Waste Strategy for England was a commitment from Government to cover the net cost of any 'new burden' faced by Local Authorities as a result of any proposed (and implemented) reforms to recycling and waste management services. Sensitivity analysis has been undertaken to estimate the potential cost to LWP of meeting the requirements of the national RWS where packaging producers contribute to the cost of managing packaging waste and central Government covers the costs of free garden waste collections and separate food waste collections. See Section 3.11.3 for more detail.

3.9.3 Carbon (WRATE) analysis

The results of the WRATE modelling for option 7 is shown in Figure 18. This option results in the highest carbon emissions of all the options within this appraisal. This option has an increase in emissions of nearly 4,000t CO_2-eq when compared to the baseline. This is due to increased transport emissions

[86] There is also a sensitivity analysis undertaken which is used to determine the impacts of moving to a higher level of energy recovery

[87] This assumption has been made for the purposes of this options appraisal and would be subject to forthcoming legislation and funding mechanisms.

[88] As reported on Lets Recycle

associated with a kerbside sort option and decreased overall recycling. There are also more emissions from the residual and treatment options when compared to the other options.

Figure 18: Option 7 carbon emissions by WCA and the HWRC service

3.10 Option 8 – Three-steam recycling

3.10.1 Kerbside Collection

In Option 8, all WCAs move to a three-stream recycling service, which is collected on a fortnightly basis via 3 boxes. The materials are collected as follows:

- Box 1 – Plastics (bottles, PTT and film), cartons and metals
- Box 2 – Glass
- Box 3 – Paper and Card

Blue italics are used to signify changes from the current collection in types of containers used and *green italics* are used to show where the frequency of collections have changed. Where both the containers and the frequency have changed, *black italics* are used.

Table 38: Option 8 container requirements and collection frequency

	Dry recycling	Food waste	Garden waste	Residual
Frequency	Fortnightly	Weekly	Fortnightly	As per current service
Blaby DC	*3 x boxes*	*Small kerbside food waste bin + kitchen caddy*	240L WHB **(free)**	140L/240L WHB
Charnwood BC	*3 x boxes*			180L/240L WHB
Harborough DC	*3 x boxes*			180L/240L WHB
Hinckley & Bosworth BC	*3 x boxes*			240L WHB
Melton BC	*3 x boxes*			240L WHB
NW Leicestershire DC	*3 x boxes*			180L/240L WHB
Oadby & Wigston BC	*3 x boxes*			140L WHB

It is assumed that dry recycling will be collected by two types of vehicles; a Rear End Loader (REL) with a pod, and a standard Refuse Collection Vehicle (RCV). It is modelled that the REL with pod will collect paper and card in the rear compartment and glass will be collected in the pod. A dedicated RCV will operate fortnightly to collect mixed plastics, cartons and cans. Residents will be provided with 3 containers to separate out their dry recycling into these three streams. In addition, food waste will be collected weekly via dedicated collection vehicles and garden waste is collected free of charge. Residual waste is assumed to be collected as per the current collection service. As noted previously for other options with a free garden waste service, it is assumed that all households within the WCA will be covered, and the service will result in a set out rate of 60% and participation rate of 65%. The free garden waste service is based on a fortnightly collection which operates for 40 weeks of the year.

We have assumed either a 'low' or 'medium' food waste yield from the WRAP ready reckoner, consistent with option 3. This is determined based on the average weekly residual waste capacity. Based on evidence from WRAP food waste collection trials, a set out rate of between 45% and 55% and a participation rate of between 55% and 65% was applied. For all WCAs, it is assumed food waste is collected by dedicated 7.5t food waste vehicles[89].

[89] It has been assumed that these vehicles will be used, however, more cost-effective ways of collecting this may be available for some WCAs.

Collecting dry recycling via a three-stream collection (two vehicles) is estimated to cost (collectively) approximately £10 million per annum more than the baseline, resulting in a total indicative annual gross collection cost of £28.5 million, as shown in Table 39.

Table 39: Option 8 annualised collection costs and recycling performance

Total gross collection cost for Option 8	**£28,509,300**
Baseline gross collection cost	**£18,428,500**
Difference in collection costs compared to baseline	**+£10,080,700**
Kerbside recycling rate[90]	55.8% (+9.4%)
Cost per 1% increase in kerbside recycling performance	£1,073,600

Option 8 is modelled to increase LWP's kerbside recycling rate by 9.4% to 55.8%. This equates to the highest cost per 1% increase in kerbside recycling performance of all options modelled. A breakdown of the kerbside recycling rates (right axis) for each WCA is provided in Figure 19, alongside the annualised gross collection cost (left axis).

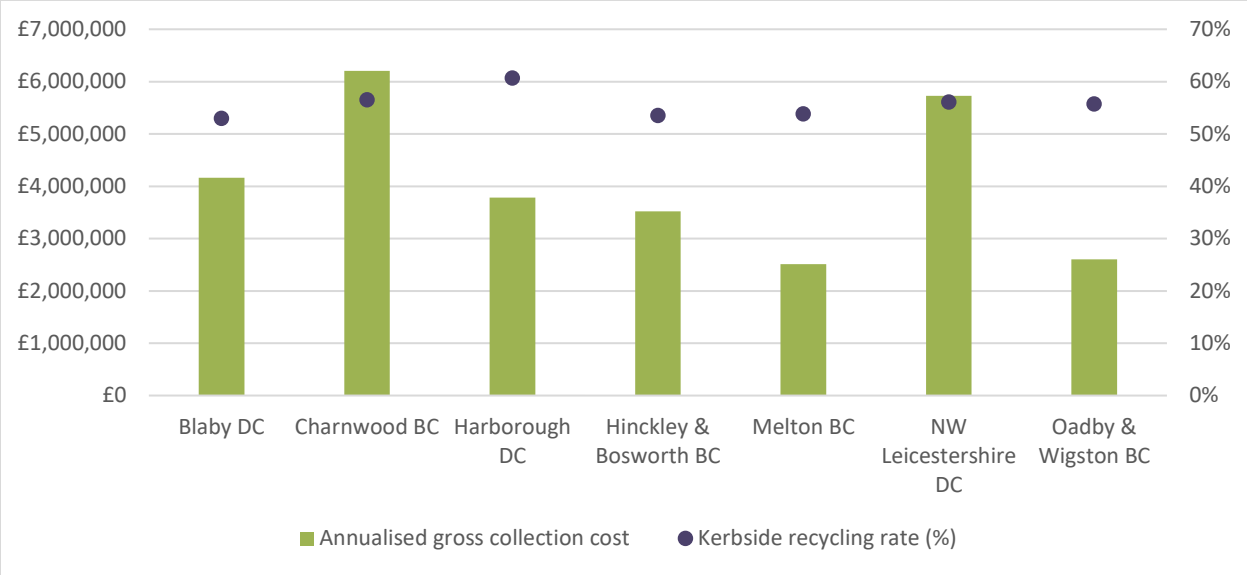


Figure 19: Option 8 annualised gross collection cost vs recycling performance

Table 40: Option 8 kerbside collected tonnage

Option 8	Blaby DC	Charnwood BC	Harborough DC	Hinckley & Bosworth BC	Melton BC	NW Leicestershire DC	Oadby & Wigston BC	WCA total
Residual	14,511	22,715	11,629	18,296	8,433	15,187	6,699	97,471
Dry recycling	6,183	12,328	6,682	6,840	3,946	5,880	3,476	45,335
Food	2,960	5,144	3,783	3,318	1,530	4,003	1,556	22,294

[90] 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

Garden	7,967	13,644	8,692	11,409	4,559	10,702	3,835	60,808
Contamination[91]	670	1,186	757	417	155	903	339	4,428
Kerbside recycling rate	**52.99%**	**56.56%**	**60.73%**	**53.54%**	**53.88%**	**56.13%**	**55.75%**	**55.76%**

The total tonnage collected at the kerbside in option 8 is shown in Table 40. The total amount of dry recycling collected per WCA is joint lowest, with option 7. This is because the more complex a recycling system is (e.g. the greater separation the householder is required to undertake) will generally yield lower levels of recycling. It does, however, have a positive impact on the contamination rate, with this option showing the equal (with option 7) lowest amount of contamination of recyclables of all options modelled.

The total gross collection cost per household for option 8 is presented in Table 41. All WCAs see a significant increase in the cost of the service per household, with option 8 having the highest average cost per household of all options modelled in this appraisal up to £54.64 per household above the baseline. HBBC is the exception here with a much smaller increase of c.£8 per household. This is because HBBC achieve savings made on the residual waste collection service in this option which helps to offset cost increases on other areas of the collection service. This effect is not seen across all WCAs in this option.

Table 41: Total annual gross collection cost per household - Option 8

	Blaby DC	Charnwood BC	Harborough DC	Hinckley & Bosworth BC	Melton BC	NW Leicestershire DC	Oadby & Wigston BC
Option 8 total annualised gross collection cost	£4,160,000	£6,202,500	£3,783,000	£3,522,300	£2,513,400	£6,342,000	£2,600,100
Option 8 cost per HH	£98.65	£81.32	£94.32	£70.01	£106.68	£120.95	£111.49
Baseline cost per HH	*£55.32*	*£58.03*	*£57.11*	*£62.35*	*£59.46*	*£66.31*	*£72.94*

3.10.2 Treatment and Disposal

LCC are responsible for allocating the treatment / disposal point for the dry recycling, garden and residual waste collected. Under the current arrangement, the commingled dry recycling is processed at a MRF. The exception to this is NWLDC who operate under a direction from LCC but process their own recycling. Through their current arrangement NWLDC go out to the market every two months for materials collected at the kerbside (commonly referred to as 'spot pricing'). In this option, there are no changes to this arrangement assumed. However, in this option it is assumed that the WCAs within the Partnership will go out to market to sell the separately collected dry recycling. As per the other options, residual waste is treated by a combination of energy recovery (mainly incineration with some refuse

[91] This tonnage relates to the contamination collected across the dry recycling, food and garden collections.

derived fuel (RDF) processing) and landfill, this assumption is applied to all options in this appraisal[92]. It is assumed that the separately collected food waste will be sent for processing at an Anaerobic Digestion facility.

For the purposes of the Options Appraisal, it is assumed that WCAs will gain revenue for the kerbside sort dry recycling, much as is the case with NWLDC at present[93]. It is assumed that no material will be processed at the MRF. Material revenues for the kerbside sort material is based on 3-year averages market prices[94].

Table 42: Option 8 total net costs (Partnership)

	Baseline	Option 8
Gross Collection Cost	£18,428,500	£28,509,300
Garden Waste Income	-£5,528,500	£0
Dry Recycling Income	-£483,500	-£3,471,500
Treatment and Disposal Cost	£16,987,700	£12,843,000
Whole System Cost	**£29,404,300**	**£37,880,800**

Within the latest round of consultation on the Resources and Waste Strategy for England was a commitment from Government to cover the net cost of any 'new burden' faced by Local Authorities as a result of any proposed (and implemented) reforms to recycling and waste management services. Sensitivity analysis has been undertaken to estimate the potential cost to LWP of meeting the requirements of the national RWS where packaging producers contribute to the cost of managing packaging waste and central Government covers the costs of free garden waste collections and separate food waste collections. See Section 3.11.3 for more detail.

3.10.3 Carbon (WRATE) analysis

The results of the WRATE modelling for option 8 is shown in Figure 20. This option is the 2nd worst performing (in terms of carbon emissions) of the Options Appraisal, at 2,900 tonnes CO_2-eq emissions - higher emissions than the baseline.

There are increased transport emissions due to operating two rounds on the dry recycling. This combined with decreased recycling emissions savings and more emissions on the residual and treatment options when compared to the other options. This option has the joint lowest carbon saving from recycling activity.

[92] There is also a sensitivity analysis undertaken which is used to determine the impacts of moving to a higher level of energy recovery

[93] This assumption has been made for the purposes of this options appraisal and would be subject to forthcoming legislation and funding mechanisms.

[94] As reported on Lets Recycle

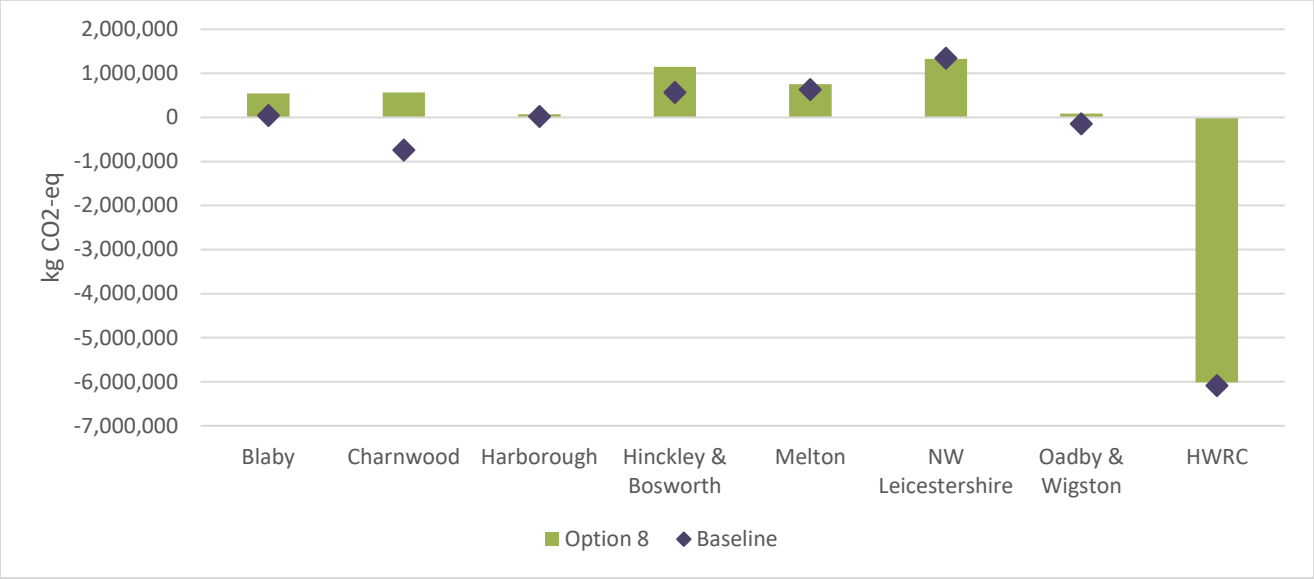


Figure 20: Option 8 carbon emissions by WCA and the HWRC service

3.11 Sensitivity Analysis

This section sits outside of the main Options Appraisal process but explores some sub-options or sensitivities in the LRWS or how operations may be delivered, to have some understanding of impacts. Aspects of this have also informed the Environmental Assessment, which is a separate process running in parallel to the Options Appraisal and supporting the development of the LRWS.

3.11.1 Residual waste treatment sensitivity

Residual waste collected across Leicestershire is currently sent to a combination of Energy Recovery, via Energy from Waste Facilities (c.40%) and the remainder to landfill (c.60%)[95]. The County Council intends to move away from landfill as a disposal option and therefore this sensitivity analysis considers the carbon performance of option 3 for all the WCAs, under different residual waste treatment arrangements. Two sensitivities have been modelled through WRATE; these are as follows:

a) Reducing the amount of residual waste sent to landfill to 10%. The remaining 90% is sent to conventional EfW with a gross electrical efficiency of 25%.
b) Reducing the amount of residual waste sent to landfill to 10%. The remaining 90% is sent to EfW with Combined Heat and Power (CHP) at a ratio of 25% gross electrical efficiency and 10% heat recovery. The amount of heat recovery is modest; however it reflects the relatively low use of heat[96] from EfW in the UK.

Energy from waste is a more preferred option than landfill according to the waste hierarchy, which is one of the guiding themes of this LRWS. It is preferred because it conserves resources and increases material productivity - in the form of supplying energy and recovering aggregate and metals from the ash for recycling. It has also been a higher performer than landfill in carbon terms. More recently, as the electricity grid has become 'cleaner', i.e. a larger proportion of the electricity comes from renewables or nuclear (low carbon sources), then electricity from EfW facilities becomes less attractive in carbon terms. This is because (depending on the residual waste composition) a significant proportion of the heat generated in an EfW plant is derived from burning plastics ('fossil' carbon, which is equivalent to burning oil) with the remainder from burning biogenic carbon (paper, card, wood, garden waste etc.). Energy from biogenic carbon is considered renewable and low carbon. The balance of the electricity grid is now such that energy from a typical EfW plant is a net emitter of carbon, whereas in the past (when the electricity grid was more dominated by fossil fuels) it was a net saver of carbon. The sensitivity analysis below confirms this. In Table 43 the amount of carbon emissions increases when 90% of the residual waste is sent to standard EfW. However, when a proportion of the heat is recovered (in the CHP sensitivity), there is a substantial carbon improvement against the current disposal arrangement, similar to that achieved by the best recycling scenarios. The reason for this is that heat is generally supplied by gas or oil, both of which are 100% fossil sources and damaging for climate change. The heat supplied by CHP facilities will be part renewable and therefore offsets (reduces) carbon emissions.

[95] Based on total residual waste, not just kerbside waste

[96] It should be noted that one of the current facilities used by Leicestershire County Council has a CHP enabled system, the Coventry Energy from Waste plant.

Table 43: Residual treatment carbon sensitivity

tCO_2-Eq	Baseline	Option 3[97]	Option 3 (increased EfW)	Option 3 (EfW with CHP)
Blaby DC	43	210	358	-735
Charnwood BC	-741	-734	-448	-2,156
Harborough DC	19	-331	26	-922
Hinckley & Bosworth BC	570	706	908	-436
Melton BC	571	499	631	-76
North West Leicestershire DC	1,342	1,122	1,426	199
Oadby & Wigston BC	-145	-164	-75	-581
Total (WCA only)	**1,659**	**1,308**	**2,707**	**-4,823**

These results indicate that Leicestershire, where seeking EfW for residual waste will create the best carbon performance if they do one or all of the following:-

- Reduce the amount of plastics in residual waste to improve the carbon intensity[98] of the energy produced
- Recover heat wherever possible and a secure demand is available
- Seek facilities with a higher electrical energy efficiency, at around 27% it is similar to the landfill impact and >27% it would be notably better than landfill (using 2021 electricity grid mixes)
- When commercially available and logistically suitable, seek to use facilities with Carbon Capture and Storage technology (see below) as this effectively removes emissions making it a low carbon energy source.

Carbon capture, utilisation and storage (CCUS) or carbon capture and sequestration (CCS) technology is an area of increasing interest as a method of reducing emissions and mitigating climate change. It is the process of capturing carbon dioxide (CO_2) that would otherwise be emitted into the atmosphere. The process of CCUS has potential applications for any process that produces large amounts of carbon dioxide, e.g. natural gas in power stations. CO_2 is captured, liquified and prepared for storage (i.e. underground injection) or for secondary use. Storage takes place in suitable geological formations, for example, in exhausted oil and gas fields or reservoirs, deep saline formations and coal fields. The use of CCS process requires a considerable amount of heat and also electricity to operate, but this could be supplied by the facility itself.

[97] The difference in carbon impacts between the baseline and option 3 are subtle and vary between small beneficial impacts to small detrimental impacts primarily as a result of the relative balance between recycling benefits and collection/transport emissions. This can vary based on local circumstance.

[98] This is a measure of the amount of carbon considered to be added to the atmosphere per kilowatt hour of electricity produced. A lower number for an EfW process, reflects more biogenic carbon and less fossil carbon sourced energy = cleaner emissions in climate terms

There are wider reasons to avoid landfilling of municipal waste. There are policy drivers (e.g. the Resources and Waste Strategy for England and the Circular Economy Package[99]) with targets for reducing waste to landfill. Furthermore, there are potential environmental impacts arising from leachate from landfills and finally the landfilling of waste passes on the responsibility for managing environmental impacts of the landfills onto future generations which is contrary to sustainable development.

Table 44 provides a comparison of the typical average gate fees for landfill and energy from waste. There are significant variations in the treatment cost per tonne for each treatment method as shown by the reported low and high gate fees. However, based on the median reported figure, the cost of landfill (for the treatment of non-hazardous municipal waste) is generally more expensive than sending for energy recovery via an EfW facility.

Table 44: Residual waste treatment gate fee comparison, 2019/20[100]

Treatment method	Gate Fee 2019/20		
	Low	High	Median
Energy from Waste *(post-2000 facilities)*	£48	£150	£93
Landfill *(Non-hazardous waste including landfill tax at 2019/20 rate of £91.35/tonne)*	£93	£187	£116

3.11.2 Electric vehicles fleet sensitivity

Several refuse collection vehicle (RCV) manufacturers are rolling out electric RCVs to local authorities across the UK. Blaby District Council conducted a trial in October 2021. Performance trials by Dennis Eagle on power consumption suggest that their fleet of eRCVs are consuming c.150 kW per day, travelling c.154km. It is expected that the battery will last the life of the vehicle.[101]

A cost-benefit analysis exercise was undertaken by Eunomia in 2020 to look at the environmental and cost differential between diesel and electric RCVs[102]. The research shows that replacing all diesel RCVs in the UK with electric equivalents could provide a carbon saving of 290 kilotonnes of carbon-dioxide-equivalent per annum ($ktCO_2e/yr$). From a cost perspective, the results indicate that the higher initial capital costs of an eRCV are largely offset by cheaper operational costs (but not fully), however once the impact of emissions is included (monetised as 'externalities'), the eRCVs result in a saving of over £12,000 per vehicle.

The focus of waste vehicle electrification has predominantly been on RCVs. It is understood that manufacturers are developing and trialling spilt body system vehicles, however the total range will likely be adversely impacted based on the system requirements for operating twin-bodies. Kerbside Sort

[99] Targets set out within the Resources and Waste Strategy for England and Circular Economy Package include recycling 65% of municipal waste by 2035 and to have no more than 10% municipal waste going to landfill by 2035.
[100] Source: WRAP Gate Fees Report (2021). Available here: https://wrap.org.uk/resources/report/gate-fees-report-2020 exl.VAT
[101] Source: Webinar (2021) Freight in the City – Electrification of waste and recycling vehicles. Presentation by Dennis Eagle
[102] Source: Eunomia (2020) Ditching Diesel – A cost-benefit analysis of electric refuse collection vehicles

vehicles are also becoming available in electric only options, and food waste vehicles are currently available as hybrids.

Table 45: Cost benefit analysis – eRCV vs diesel RCV. Source: Eunomia (2020) Ditching Diesel

Category	Electric RCV	Diesel RCV	Net Cost / Impact of eRCV compared to diesel RCV
Environmental Impact ($ktCO_2e/yr$)	40	330	-290
Capital Cost (£)	365,374	163,791	+201,583
Operational Cost (£)	237,331	409,306	-171,975
Total (exc. Externalities) (£)	**602,705**	**573,097**	**29,608**
Externalities (£)	7,979	49,952	-41,973
Total (£)	**610,684**	**623,049**	**-12,365**

The capital costs indicated in Table 45 are consistent with market intelligence recently gathered by Frith Resource Management (FRM) which shows the following anticipated costs for the types of vehicles used in the Options Appraisal for LWP:

- Standard ($24m^3$) RCV – c.2.5-3 times the cost for an electric equivalent compared to diesel
- A multi-compartment (also known as kerbside sort) vehicle (i.e., Romaquip) – c.2-2.5 times the cost for an electric equivalent
- 7.5t food waste vehicle – c.1.75 times the cost for a hybrid equivalent

As technology develops, the capital cost of electric vehicles is likely to reduce. FRM has noted that waste management contractors are reluctant to propose a whole fleet of electric vehicles to service a contract unless the procuring authority is explicit in its requirement. This is a reflection of the evolving technology, the current perceived concerns over limitations in vehicle range (driving distance between charging)[103] and the high capital cost.

In addition to the increased capital cost of the vehicles, investment is likely to be required for charging capacity at depots. The cost of this is dependent on local circumstances, the size of the fleet and the charging type required. However, as an indication, the City of London Council[104] has reported a cost of £250k for the installation of a new electrical substation at the depot to handle the charging of its full fleet of seven electric RCVs. This figure could easily double depend on the specific requirements. The electrical charging infrastructure is considered likely to last for several vehicle lifespans, so should not need replacing alongside the vehicle fleet, however care needs to be taken to match the charging infrastructure to the vehicle type in order to conserve battery life.

The operational cost of electric vehicles is lower than for diesel equivalents, as shown in Table 45. This covers not only the cost of the fuel (or electricity) but also that electric powered vehicles are exempt from Vehicle Excise Duty, which is reported to save over £600 per vehicle per year. A presentation by

[103] It should be noted that Dennis Eagle, who manufacture the E-Collect electric RCV have tested the vehicle on several authorities and examples we have seen showed a full collection round completed with >20% battery life remaining. This will vary by transport distance, however.

[104] http://www.transportengineer.org.uk/transport-engineer-features/municipal-vehicles-juice-for-refuse/227649

Dennis Eagle[105] highlighted the importance of the electricity tariff in calculating opex[106] relative to diesel vehicles; at current rates there would need to be a tariff of c.5p / kWh to match overall diesel equivalent costs after 8 years. Any higher and it is likely to be more expensive (subject to diesel prices).

There is limited information in the public domain regarding the lifespan of electric RCVs. Traditionally, a lifespan of 7 years has been used as the working assumption for diesel RCVs; this is now being extended to 8-9 years, and in some cases 10 years, as a result of smoother driving from reduced landfill activity. There is a discussion that the life of electric batteries may be the limiting factor, and currently likely have a shorter life than the vehicle body. However, there is also the argument that electric vehicles offer a smoother drive and simpler motor than their diesel counterparts, which prolongs the life of the chassis. The Ditching the Diesel report[107] mentions that manufacturers are estimating a 10-year lifespan for electric vehicles, while in Denmark, operators are working on the assumption that the vehicles will last for 10-12 years. If this is the case, the 20% increase in vehicle life will serve to offset a proportion of the initial capital cost.

At present, the industry is experiencing increased lead times for waste collection vehicles of all types. Anecdotally, FRM is hearing that lead times for electric vehicles are typically longer than diesel, which is likely to be due to reduced production volume as well as a reported shortage of semiconductor computer chips.

Electric vehicles have the direct benefit of eliminating localised air pollution from waste operations, i.e. there are no tail pipe emissions from eRCV as no fuel is burned. Furthermore, Dennis Eagle has reported that its eRCVs are half as noisy when compacting waste in comparison to the diesel equivalents. There is also reduced noise pollution from electric engines when driving, improving the working conditions for collection crews and householders during collection rounds.

From an operational perspective, there are a number of key considerations. These include, but are not limited to:

- Space for parking and charging infrastructure
- Charging capability (i.e. grid capacity, potential requirement for substation or local upgrades to the electricity grid)
- Increased torque for vehicle movements / operations
- Size and geography of the collection round
- Recharging time
- Load / bay management
- Skills and training for drivers and maintenance staff
- Supply chain for eRCVs

Other alternatives to diesel and electric vehicles are also being developed, including hydrogen and hydrotreated vegetable oil. Regarding hydrogen, it is important to know where hydrogen is coming from when considering GHG emissions. There is a growing market for hydrotreated vegetable oil fuelled

[105] Let's Recycle Live event, 2021
[106] Operating costs
[107] Ditching Diesel – A cost-benefit analysis of electric refuse collection vehicles. Eunomia (2020).

RCVs, this fuel can be a direct 'drop in' fuel replacement for RCVs, with 90-92% reduction in GHG emissions[108].

3.11.2.1 Sensitivity Results

A sensitivity analysis was undertaken to estimate the carbon performance of using electric vehicles instead of the current diesel counterpart. This sensitivity has been applied to option 3. The operational aspects of option are as discussed in Section 3.4 in terms of the service provided and resource requirements.

The impact of electric vehicles was applied using a generalised assumption from the Eunomia Cost Benefit Analysis 'Ditching the Diesel' report[109]. This report states that switching to electric RCVs would yield around 12.1% of the carbon impact of using diesel RCVs (across the UK). This benefit is only indicative as limited detail of the methodology applied within the study is published. It would also be dependent on the source of electricity used. Discussion with electric RCV suppliers reports significant variation in performance by local dynamics (number of bin lifts versus travel time, loads collected, hills and general travel conditions). Therefore, the approach adopted to deliver indicative carbon savings was to separate out the carbon impacts of transport from diesel collection vehicles (from the WRATE outputs) and reduce their carbon impact to 12.1% of that figure to estimate the carbon impacts associated with operating electric vehicles. This is therefore a high-level estimate.

These assumptions have been applied to all vehicle types used in option 3. The findings of the WRATE modelling are shown in Figure 21 and Table 46.

[108] Source: Webinar (2021) Freight in the City – Electrification of waste and recycling vehicles. Presentation by Zemo Partnership

[109] January 2020

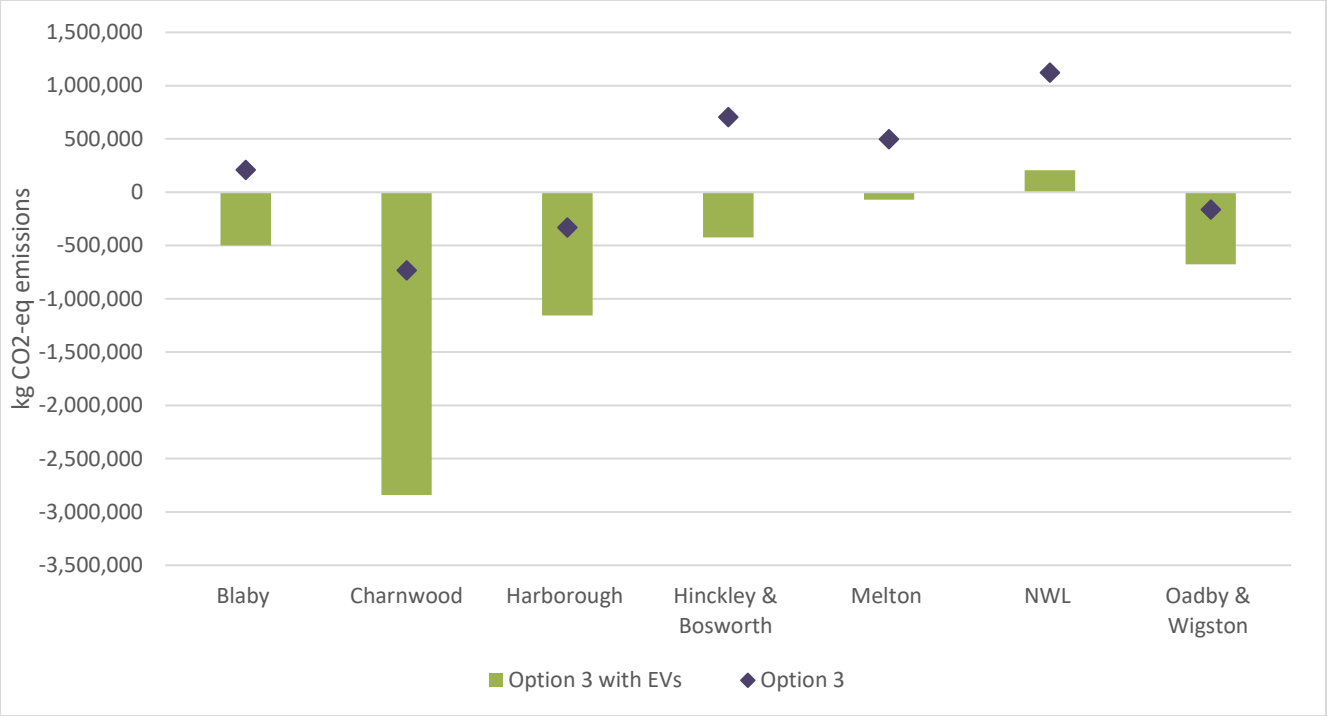


Figure 21: Electric vehicle sensitivity modelling (WRATE) – Option 3

If LWP were to replace all the vehicles collecting recyclables and waste from the kerbside modelled in option 3, with electric equivalents, but otherwise maintain the other elements of the waste management service, the carbon impact from the service could improve by c.6,800 tonnes. This is equivalent to taking 2,400 cars off the road in comparison to option 3. This would result in a total modelled carbon performance of 11,471 tonnes of CO_2 equivalent emissions saved. This is a product of the total vehicles and miles travelled in each option and avoided equivalent diesel emissions. The transport aspect (mileage) in option 3 is significantly further than the Baseline in order to provide a dedicated weekly food waste collection and the free garden waste service, and therefore, the avoided emissions (savings) of moving to electric vehicles are higher than the baseline, the results of which are provided below for comparison. This performance improvement is a high-level estimate and should be treated as such, some vehicle types used in the options have not yet been demonstrated in a battery powered form. This is an area of intense development across the industry at this time.

Table 46: Electric vehicle sensitivity results

Emissions (tCO_2-Eq)	Baseline	Option 3
Total emissions with Current vehicles (tCO_2-Eq)	-4,370	-4,585
Total emissions with eRCVs (tCO_2-Eq)	-9,937	-11,456
Difference on transport emissions[110] (tCO_2-Eq)	***5,567***	***6,872***
Approximate distance travelled (km)	*2,974,835*	*4,093,617*

[110] Increased CO_2-Eq savings

3.11.3 Estimated impacts of Policy Reforms

The requirements within the Environment Act and Resources and Waste Strategy for England pose some of the most significant reforms to the management of waste and recycling that the industry has experienced over the last 50 years. Although much of the detail of these reforms is yet to be confirmed, the impact of the reforms proposed for Local Authority costs and operations is considerable. As such, as part of our analysis of the Options Appraisal we have applied a sensitivity analysis comprising some high-level cost modelling to estimate how collection and disposal costs might look for the Partnership, based on some of the proposals within the national Strategy. This includes consideration of:

1. Full net cost recovery of obligated packaging material through the Extended Producer Responsibility (EPR) producer pays principle
2. Proposed Government commitment to cover any net new burdens placed on local government as a result of strategy obligations
3. Potential income from the capture of unredeemed deposits from the Deposit Return Scheme (DRS), within the kerbside collected waste.

The potential cost implications of each are presented as follows:

EPR

As part of the proposals for reforming Extended Producer Responsibility (EPR), Government are proposing that from the beginning of 2024[111], packaging producers will be responsible for covering the full net recovery costs of packaging items placed on the market. For Local Authorities, it is assumed that this includes the cost of collecting, transporting, recycling and treating/disposing of materials obligated within the reformed EPR schemes. Although the detail on how the financing arrangements will ultimately be determined is yet to be known, high-level cost modelling has been applied to all options to estimate the potential proportion of Local Authority costs (both at a WCA and WDA level) that could be covered by producers through the EPR schemes.

The potential collection costs covered by EPR has been estimated based the proportion of dry recycling and residual waste which is classed as 'obligated EPR material'. On disposal and treatment, it is assumed that any revenue accrued from the onward sale of obligated EPR materials is provided to producers to reflect their net costs.

Our modelling is based on a series of assumptions derived from information within the latest round of consultation documents on the Resources and Waste Strategy for England. Any figures quoted are based on assumptions which may require update following the publication of the 2nd round of consultation responses (expected early 2022). These cost estimates have been applied and are indicative only.

New Burdens

As part of the reforms to the waste and recycling industry, the Government has also committed to fully fund all net new burdens placed on local authorities arising from the Environment Act. This is in recognition of the financial pressures on local authorities and to ensure that any additional costs arising

[111] Subject to consultation. This timeline is as per latest proposals from the Resources and Waste Strategy

from new statutory duties will be covered. It includes changes that may necessitate additional equipment or resourcing, covering capital and operating costs.

This analysis includes a high-level assessment of the potential costs covered by the new burdens' doctrine, focusing on impacts on food waste and garden waste collection. The duration of how long these costs will be covered, remains to be seen, however Defra have confirmed that government will be funding local authorities for the operation of a separate food waste collection, even where there are existing food waste collections.

The detail regarding the calculation of a net burden for local authorities has not yet been published by government. Therefore, for the purposes of this modelling, we have presented two potential methods in which new burdens may be calculated for operating a free garden waste service:

- Option A – where Government pays the additional collection (operational) costs. This means covering the additional cost for an authority to move from a charged service to a free service. This includes any additional resourcing, containers, vehicles required over and above a charged garden service. In this scenario the new burden cost covered by government also reimburses the loss of garden waste income.
- Option B – where Government covers the total collection cost of a free garden waste collection (i.e., any previous subscription costs would not be reimbursed).

Our modelling indicates that in option A, a new burdens doctrine could cover up to £8.4m per annum for the WCAs across the partnership, based on the purchase of additional containers, any new vehicles or operating costs and by reimbursing each WCA (except NWLDC) for any lost subscription revenue. Should the Government choose to cover the whole collection cost of the service, but not any lost revenue (option B) instead, this could equate to c.£6m per annum. This is c.£2.4m cheaper than option A, including the cost of NWLDC service, which is already free and so is not included in option A as there are no 'new' changes associated to that service. It is possible, due to the emphasis on 'net' costs that Government may reduce the payment to Waste Collection Authorities based on an assumption that some of the garden waste was diverted out of residual waste (yielding a disposal cost saving as green waste composting is significantly cheaper than residual waste disposal), however there is limited information on this and the saving would be to the WDA whilst the costs incurred by the WCAs. This has not been included in the assessment here.

Table 47: New burdens calculations –garden waste collections

Cost Element	Garden waste collection costs covered by new burdens (all Options moving to free garden waste service)	
	Option A	*Option B*
Additional cost of free garden	£2,863,370	Not covered in this circumstance
Loss of garden waste income	£5,528,500	
Gross collection Cost		£5,980,546
Total	**£8,391,870**	**£5,980,546**

To estimate the 'new burdens' cost of a food waste service, we have assumed that all authorities will implement a dedicated food waste collection, and the annualised collection cost from KAT has been

used. The total new burdens covered by the Government for the new food waste service is shown in Table 48. However, it should be noted that the collection costs for food waste can vary significantly depending on the collection arrangement, i.e. separate dedicated food waste or co-collected with other materials such as a split-back vehicle with a pod, or via a kerbside sort vehicle (e.g. Terberg or Romaquip).

Table 48: New burdens calculations – food waste collections

Partnership Summary	Option 3	Option 4	Option 5A	Option 5B	Option 6	Option 7	Option 8
Total cost of food waste collection	£4.9 million	£4.9 million	£5.2 million	£5.2 million	£4.9 million	£4.9 million	£4.9 million

As mentioned, Defra have confirmed that government funding for local authorities will cover the total collection cost and total **net**[112] disposal cost of a separate food waste collection, even where there are existing food waste collections at present. The disposal of organics is cheaper than the alternative treatment method (residual waste disposal). Furthermore, it is unclear from the definition of 'net costs' whether any savings would be deducted from additional collection costs or not and how this will work in two-tier authority areas. As such we have excluded this element of the costings and are these not included as part of this modelling.

Net impact of EPR payments and New Burdens

A summary of the potential net impacts of EPR and New Burdens payments is provided in Table 49 and Table 50. The costs are presented after the impacts of EPR payment have been applied, detailing the cost for the collection authorities (WCA cost), treatment and disposal cost (WDA cost) and the net cost for the Partnership. Revenues to the collection authorities have been separately identified. In the baseline and option 3 to 6, it is assumed that the County Council would incur the cost of processing material at the MRF (and the revenue for separately collected paper and card in option 6). This is included in the treatment and disposal cost identified. The exception to this is NWLDC where the revenue for their kerbside sort option is presented. In option 7 and 8, it is assumed for the purpose of the modelling that all WCAs will receive an income from the onward sale of the recyclables collected through the modelled kerbside sort variation. The revenue received is presented as a Partnership total.

It is estimated that on collection, EPR payments from producers could reduce the WCAs kerbside gross collection costs by c.£5m across the Partnership in the baseline scenario. This is based on producers covering the cost of obligated materials within the kerbside collection scheme (packaging within the dry recycling and residual waste streams). In alternative collection options this ranges from £4.65m to £6.8m.

[112] Our interpretation of 'net costs' covers the total difference in net disposal costs between sending food for Anaerobic Digestion and sending to EfW (as if food waste remains in the residual waste stream) – equivalent to £58/t.

Where free garden waste collections are introduced, under the new burdens' doctrine, it is assumed that the government will cover the total kerbside collection costs[113]. This cost covers the cost of vehicles (capital expenditure, operational expenditure and maintenance costs), collection crew and container provision. The cost to the Partnership is just under £6m in all options. Similarly, on the same basis, it is also assumed that government will cover the total kerbside collection cost of a separate food waste collection service. Our modelling estimates this could cost in between £4.9m and £5.2m per annum.

Combined with the additional savings that could be achieved through the new burdens' payments for garden waste (in all alternative options except option 4) and food waste (all alternative options), the total annual gross collection costs for the WCAs could reduce by between £10m and £17.8m, depending on the alternative collection arrangement.

Our sensitivity analysis estimates that the total treatment costs could reduce by between £3.4 million and £6.4 million per annum, on account of EPR. As a total net (Partnership) cost, savings of approximately £5.3 million per annum have been estimated against the current baseline service. In the alternative option this range increases significantly on account of the government proposals to cover food and garden waste collection with savings ranging from £9 million (option 4) to £20.4 million (option 5A).

Any revenue or disposal costs of items not covered by EPR (i.e., small WEEE or textiles) are not considered as part of this modelling.

[113] A sensitivity has also been applied to explore an alternate option which was also considered as discussed under New Burdens, (previously in this section) whereby subscription monies were reimbursed and the cost of changing from a charged garden waste collection to a free service was paid by Central Government instead. This delivered a higher payment from Government (by c. £2.2m per annum) according to the modelling.

Table 49: EPR sensitivity – Total Partnership costs

	Baseline	Option 3	Option 4	Option 5A	Option 5B	Option 6	Option 7	Option 8
Total Net Partnership cost *(as per collection modelling)*	**£29.4 million**	**£38.3 million**	**£31.9 million**	**£37.9 million**	**£36.9 million**	**£39.9 million**	**£36.8 million**	**£37.9 million**
Total Net Partnership cost *(If EPR and new burdens payments are received)*	**£23.9 million**	**£17.9 million**	**£22.9 million**	**£17.4 million**	**£16.7 million**	**£18.8 million**	**£19.2 million**	**£19.8 million**
Difference	*-£5.4 million*	*-£20.4 million*	*-£9 million*	*-£20.5 million*	*-£20.2 million*	*-£21.1 million*	*-£17.6 million*	*-£18 million*

The light purple rows in Table 50 provide a detailed breakdown of where cost difference arises from (i.e. which costs will be covered by EPR or new burdens payments).[114]

Table 50: Breakdown of EPR Sensitivity

		Baseline	Option 3	Option 4	Option 5A	Option 5B	Option 6	Option 7	Option 8
Gross Collection Costs after EPR and new burdens (WCA cost)		***£13.4 million***	***£8.3 million***	***£13.4 million***	***£8.2 million***	***£7.5 million***	***£10.2 million***	***£10 million***	***£10.7 million***
		-£5 million	*-£16.1 million*	*-£10.1 million*	*-£16.5 million*	*-£16 million*	*-£17.7 million*	*-£17.4 million*	*-£17.8 million*
Saving arising	*Kerbside dry and residual collection cost covered by EPR*	*£5 million*	*£5 million*	*£5 million*	*£5 million*	*£4.7 million*	*£6.6 million*	*£6.4 million*	*£6.8 million*
	Garden cost covered by new burdens (total cost)	-	*£6 million*	-	*£6 million*	*£6 million*	*£6 million*	*£6 million*	*£6 million*

114 This table is to show the potential impacts EPR and the new burdens doctrine could have on the modelled costs in each option (the differences are highlighted in green). There are additional revenues which are not impacted by EPR and the new burdens doctrine which are not presented in this table but are taken into account in the total net Partnership costs presented in Table 49.

	Food cost covered by new burdens (total cost)	-	*£4.9 million*	*£4.8 million*	*£5.2 million*	*£5.2 million*	*£4.9 million*	*£4.9 million*	*£4.9 million*
	Dry Recycling Revenue (NWLDC only)	*-£90,000*	*-£97,000*	*-£93,000*	*-£97,000*	*-£99,500*	*£0*	*-£937,000*	*-£937,800*
	Dry Recycling Revenue (all WCAs)								
Total treatment and disposal (WDA cost)[115]		***£10.6 million***	***£9.6 million***	***£9.5 million***	***£9.2 million***	***£9.2 million***	***£8.5 million***	***£9.2 million***	***£9.2 million***
		-£6.4 million	***-£5 million***	***-£5 million***	***-£4.7 million***	***-£4.7 million***	***-£3.4 million***	***-£3.4 million***	***-£3.4 million***

[115] This includes MRF costs in the baseline and options 3 – 6. In option 7 and 8 it is assumed there are no MRF costs and WCAs will receive any revenue from the onward sale of recyclables. Note that some of the savings to the WDA (for example from diverting organics from the residual waste stream) could in theory be offset against monies given to the WCAs for organics collections. This has not been included here as it is unclear how and if Government would apply these to new burdens calculations.

In option 7 and 8 the WCAs get the benefit of the material revenue, so as such would see the impact of EPR effects here.

DRS – Value of unredeemed deposits

The Government are also currently consulting on what will happen to unredeemed deposits i.e., those packaging items that are covered by the Deposit Return Scheme but that are not returned by a Reverse Vending Machine (RVM) or similar mechanism, and as such fall into the management of Local Authorities (either through kerbside collection or street cleansing of litter). Within the latest round of consultation on the Resources and Waste Strategy for England, it is proposed that unredeemed deposits will form one of the funding mechanisms for the Deposit Management Organisation (for example through the value of unredeemed deposits, revenue from the sale of materials and a producer fee). However, the Government are also considering a funding mechanism for Local Authorities to pay them for any material left within kerbside collections.

An estimation of the potential value of unredeemed deposits has been made for each WCA, assuming that Local Authorities can capture a third of the unredeemed DRS obligated materials (this is equivalent to c.5% of all in-scope DRS material). Based on this estimation, across the Partnership, the WCAs could receive in the region of £2.4 million by way of income from unredeemed deposits. It should be noted that this is a very high-level assessment.

Table 51: Estimated value of unredeemed deposits

	Blaby DC	Charnwood BC	Harborough DC	Hinckley & Bosworth BC	Melton BC	North West Leicestershire DC	Oadby & Wigston BC
Value of unredeemed deposits[116]	£354,000	£609,000	£317,600	£423,300	£191,100	£356,300	£176,400
Total	£2,428,000						

[116] Assuming that each WCA could capture one third of all redeemed (c.5% of all DRS obligated materials) and are funded the full value of the deposit.

4 Comparison of headline results across all options

The summary table (Table 53) overleaf provides a comparison of the results across all options. Each option has been modelled to determine the collection cost, kerbside recycling performance, treatment and disposal costs (including material revenues) and its environmental performance (carbon equivalent savings). Cost information has been amalgamated to show the total Partnership costs; however it is important to note that the degree to which these costs are impacted varies across options (i.e. where any cost increases or savings sit across the service) and whether the cost or saving falls upon either the WCAs or County Council or is shared across the Partnership.

The criteria with which each of the options are assessed was agreed at the first Partnership workshop, which took place on 9th June 2021. The agreed criteria and their associated weighting are outlined in Table 52.

Table 52: Agreed criteria and associated weighting

Criteria	Weighting
Carbon	4.7
Recycling performance / reuse performance / waste prevention performance	4.3
Cost	4.3
Residual waste arisings	4.1
Educational / awareness raising	4.1
Alignment with National Policy	4.0
Public acceptability	3.9
Social value	3.5
Operational flexibility	3.4
Resource use	3.2

These appraisal criteria were applied to all collection options (Baseline and options 3 – 8). Options 1 and 2 (waste prevention and reuse) are activities that all should undertake and vary widely in terms of their outputs and impacts. We have explored different initiatives that the Partnership currently undertake and additional ideas that could be explored. The best reuse and prevention initiatives will be subject to the resource available and the need in a particular area or point in time. We have therefore not scored options 1 and 2 within the Options Appraisal report but have identified good practice and the types of initiative that LWP could deliver which are included in the Headline Strategy.

The first four criteria are quantitative (can be directly measured using models as part of this appraisal), and the remainder are qualitative, albeit that some aspects (e.g. the employment aspect of Social Value) may be informed by numbers. All results (including the qualitative criteria) are scored 1-5 (highest is best) against each criterion and then weighted to deliver the total option score. The total option score is used to apply a ranking of options.

A description of the criteria banding is provided in Appendix A.

Table 53: Evaluation of Options

		Business as Usual	*Revised Baseline with Consistent Collection measures, EPR & DRS*	*As Option 3, with retained charged garden*	*As Option 3, plus restricted residual (140L WHB)*	*Option 3, plus restricted residual (3-weekly collection)*	*As Option 3, plus fortnightly twin stream collection of dry recycling*	*As Option 3, plus kerbside sort collection of dry recycling*	*As Option 3, plus three-stream recycling*
Criteria	**Weighting**	**Baseline**	**Option 3**	**Option 4**	**Option 5A**	**Option 5B**	**Option 6**	**Option 7**	**Option 8**
Carbon	4.7	*3*	*3*	*3*	*5*	*5*	*1*	*1*	*1*
Recycling performance	4.3	*1*	*4*	*3*	*5*	*5*	*4*	*4*	*4*
Cost	4.3	*5*	*1*	*4*	*2*	*2*	*1*	*2*	*2*
Residual waste arisings	4.1	*1*	*4*	*4*	*5*	*5*	*4*	*4*	*4*
Educational / Awareness Raising	4.1	*1*	*4*	*3*	*4*	*4*	*3*	*4*	*4*
Alignment with National Policy	4.0	*2*	*3*	*2*	*3*	*2*	*4*	*5*	*5*
Public Acceptability	3.9	*3*	*5*	*4*	*2*	*1*	*4*	*3*	*3*
Social Value	3.5	*2*	*4*	*3*	*3*	*3*	*4*	*4*	*4*
Operational Flexibility	3.4	*4*	*5*	*5*	*5*	*2*	*3*	*2*	*4*
Resource Use	3.2	*2*	*3*	*3*	*5*	*5*	*3*	*3*	*3*
Total Score (with weighting applied) Highest Number = Best Option		**94.8**	**140.5**	**133.6**	**153.8**	**135.7**	**120.3**	**125.4**	**132.2**

Key

1	2	3	4	5

Worst performing Best performing

4.1 Carbon

The results of the WRATE modelling for each option are presented in Table 54. A key outcome of WRATE, as a waste management Life Cycle Assessment tool, is the avoided environmental impact as a result of recycling (in particular) offsetting carbon impacts that would have occurred through virgin material extraction, processing and logistics.

It should be noted that each Waste Collection Authority has a bespoke waste composition and baseline operating performance, this influences the relative changes for each option in carbon terms.

Table 54: Summary of WRATE modelled (carbon equivalent savings), Baseline – plus Options 3 – 8.

Carbon savings (kg CO_2-eq)	Baseline	Option 3	Option 4	Option 5A	Option 5B	Option 6	Option 7	Option 8
Blaby DC	42,623	210,112	283,576	-360,018	-549,009	324,246	542,482	544,794
Charnwood BC	-740,830	-734,457	-664,378	-2,193,429	-1,822,558	824,445	1,188,254	568,289
Harborough DC	18,538	-330,592	-226,508	-654,093	-799,191	-86,313	106,073	69,813
Hinckley & Bosworth BC	570,265	705,789	878,264	-341,969	-89,660	1,342,573	1,653,038	1,149,312
Melton BC	628,716	616,850	662,354	33,098	159,459	730,700	791,359	758,541
NW Leicestershire DC	1,342,287	1,122,455	1,122,455	888,465	752,707	1,446,303	1,122,455	1,327,255
Oadby & Wigston BC	-144,818	-163,561	-34,585	-370,884	-485,567	7,136	134,423	86,772
HWRC	-6,086,548	-6,011,223	-6,086,548	-6,011,223	-6,011,223	-6,011,223	-6,011,223	-6,011,223
Total	-4,369,767	-4,584,627	-4,065,370	-9,010,053	-8,845,042	-1,422,133	-473,139	-1,506,447

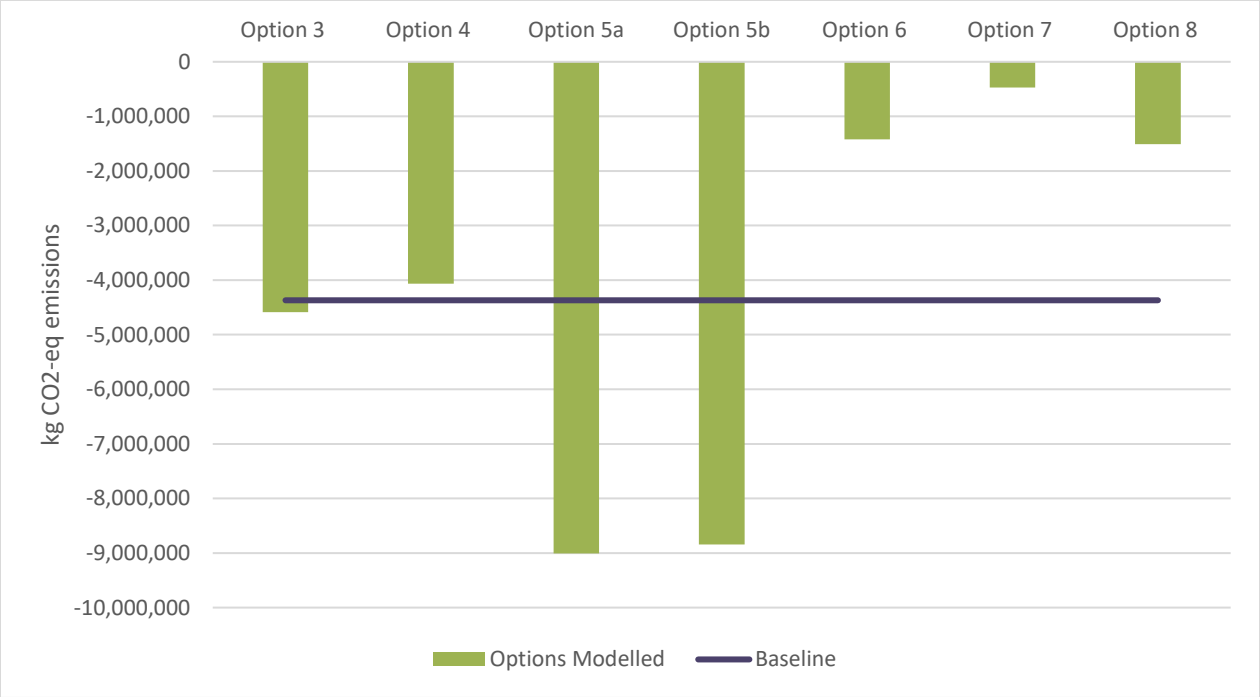


Figure 22: Summary of WRATE modelled (carbon equivalent savings), Baseline against Options 3 – 8

The carbon savings per option have been ranked from 1 – 5, based on their score relative to the lowest and highest score.

Option 3 results in marginally better environmental performance than the baseline (c.215 tonnes of CO_2-eq). This demonstrates the impact of DRS in particular (as a detrimental impact on the WCA carbon performance), balanced out by improved management of food waste, the collection of small WEEE, batteries and textiles at the kerbside combined with a move to a free garden waste collection service.

Option 5A results in the largest carbon saving of all collection options with c.9,010 CO_2 equivalents per annum, over double the baseline emission savings. There is a combination of factors attributed to this reduction. There are reduced treatment and landfill emissions on account of additional garden waste diverted from the residual waste to composting. More significantly, the restriction on residual capacity incentivises households to recycle more (both dry recycling and food waste) which has a significant carbon benefit where this material is diverted from energy recovery or landfill. There is also a slight reduction in carbon performance from the HWRCs in this scenario as some of the increased garden waste is assumed diverted from the Household Waste Recycling Centres into the kerbside collection scheme. Option 5B has comparable levels of carbon performance for similar reasons.

Option 7 results in the highest carbon emissions of all the options within this appraisal with only a modest saving in carbon emissions of c. 470tonnes CO_2 eq. per annum. The lower performance is due to increased transport emissions associated with a kerbside sort option and decreased total recycling (although some recycling such as glass has higher carbon benefits per tonne as it has higher quality and

so can be sent to remelt applications). There are also higher impacts from the residual and treatment options when compared to the other options. This is followed by option 6 and 8 which has carbon savings of c.1,400 and c.1,500 tonnes CO_2-eq, respectively.

In all options the emissions from landfill and waste treatment are reduced due to the separate collection of food waste, and in the majority of options moving from a charged to a free garden waste collection.

The overall carbon benefit from dry recycling decreases in all options in comparison to the baseline. The level of savings reduction is due in part to the removal of recycling material from the introduction of DRS, and in the cases of option 6, 7 and 8 which see the collection service change, decreasing the potential yield of dry recycling collected. However, the DRS scheme should result in greater carbon benefits overall, but the recycling is not taking place via the WCA services and so it falls outside of this appraisal.

4.2 Recycling performance

As shown in Table 55 and Figure 23, all options result in an increase in kerbside recycling rate for the collection authorities as a whole; ranging from an increase of 8.1% to 15.6% percentage points.

Option 5A results in the highest kerbside recycling rate at almost 62%. This is close to the national 65% municipal recycling target for 2035. In this option dry recycling is collected as per the current service with the addition of cartons and film for NWLDC. Food waste is separately collected (as per all other options), garden waste is collected free of charge and residual waste is restricted to a 140L WHB. This performance level is followed closely by option 5B which is estimated to have a 61.3% kerbside recycling. This option mirrors option 5A however option 5B models residual waste collected over three weeks.

Option 5A and 5B are also the most cost-effective option in terms of collection cost per 1% increase in kerbside recycling performance, however in this regard, option 5B is most cost effective at £336,500.

Option 4 results in the lowest kerbside recycling rate. This is primarily because it is the only alternative collection option which models the garden waste collection retaining a charged garden service (as per the baseline).

All other options model a free garden waste collection (alongside a separate food waste collection). Of those options that operate free garden waste collections, option 7 and 8 result in the (joint) lowest kerbside recycling performance. Option 7 and 8 model different variations a on a kerbside sort collection; whereby option 7 models the dry recycling material collected via a specialist vehicle with multiple compartments (e.g. a Romaquip) and option 8 models this collected via two vehicles (a Rear End Loader with a pod, and a standard Refuse Collection Vehicle). The small decrease in recycling performance is based on the assumption that providing households with more containers to separate recyclables into, results in lower capture rates. However, our modelling (and evidence from NWDLC) shows that separating materials generally provides higher quality recycling, as is seen in the level of contamination across the options. A standard box-based system has been applied in the modelling, other alternative collection systems are available (e.g. stackable box – trolley systems) which may yield householder benefits in terms of storage and mobility but would also entail additional capital costs. NWLDC are currently trialling two types of recycling trolleys (including the triplestack which is widely used in Wales).

Option 8 has the highest cost per 1% improvement at over £1million per 1% increase in kerbside recycling performance. This is due to a high kerbside collection cost to operate a three-stream dry recycling (requiring two dry recycling vehicle types) and also a lower kerbside recycling rate; which is common when moving from a fully commingled service (which is the case for 6 of the LWP members) to a kerbside sort arrangement.

Table 55: Comparison of recycling performance, Baseline and Option 3 – 8.

	Kerbside recycling rate[117]	Collection cost per 1% increase in kerbside recycling performance[118]
Baseline (current service)	**46.37%**	**-**
Option 3	**57.12%**	**£559,400**
Option 4	**54.47%**	**£632,300**
Option 5A	**61.97%**	**£405,800**
Option 5B	**61.32%**	**£346,200**
Option 6	**56.76%**	**£913,000**
Option 7	**55.76%**	**£962,700**
Option 8	**55.76%**	**£1,073,600**

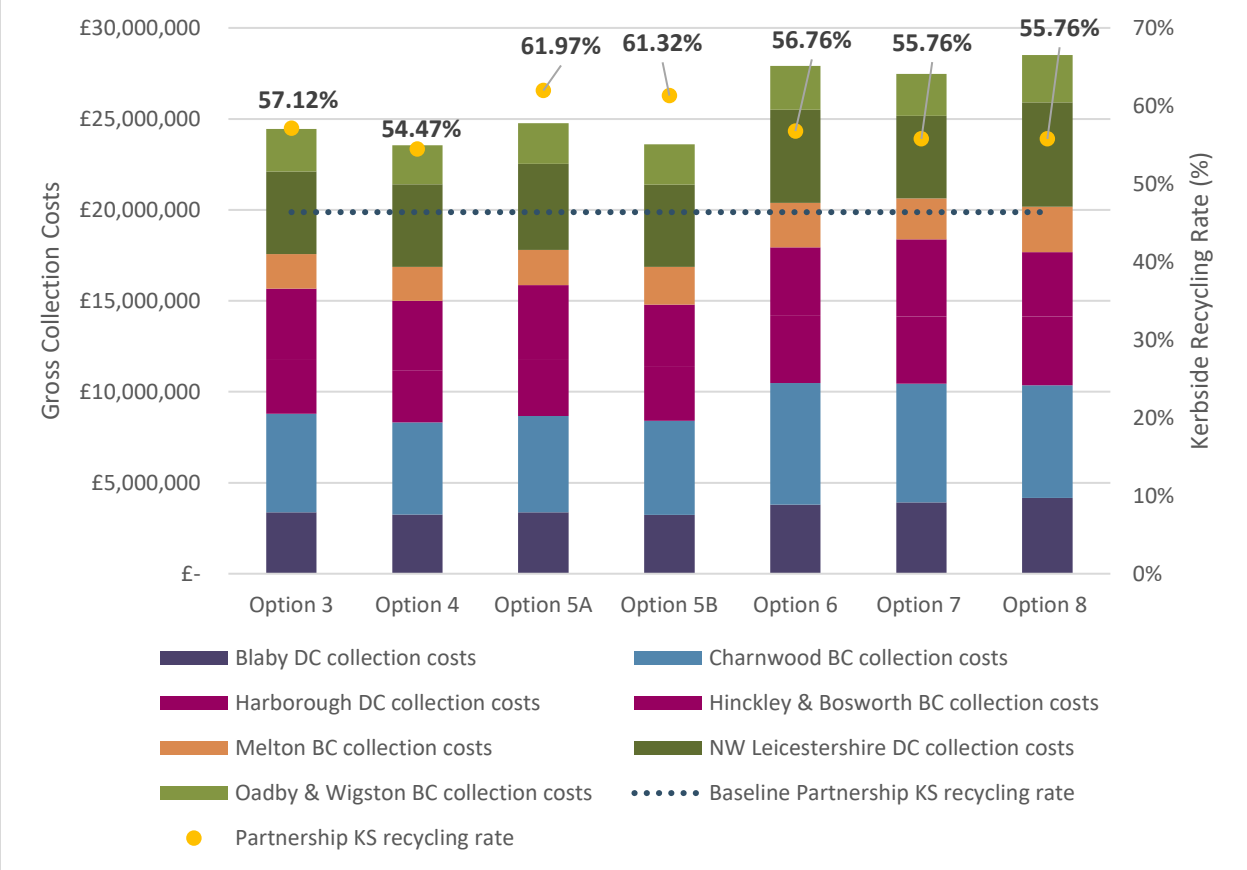


Figure 23: Comparison of headline results across all scenarios

[117] The total WCA recycling rate would also include the waste flows from the 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 WCA recycling rate (e.g. it could be +3 or +4% depending on other factors within the WCA).

In March 2022, Defra announced that the DRS for England and Northern Ireland will exclude glass bottles. At this present time Government has not released the outcomes from two of the secondary consultations, therefore there remains uncertainly in regards to forthcoming legislation and future funding mechanisms. As such, it was agreed that the modelling in this appraisal would not be updated to reflect the change in DRS scope. However, it is anticipated that the kerbside recycling performance could increase by between 1.5% and 2% above the recycling performance modelled in this Options Appraisal if glass is not collected as part of the DRS.

4.3 Costs

Table 56 provides a summary of the total collection, revenue and treatment and disposal costs for all options, compared against the baseline. A subtotal of 'revenues' is provided to show the total income generated by each of the WCAs, followed by a subtotal of the total treatment and disposal costs for the County Council. In this regard, it is assumed that LCC cover the cost of processing dry recycling in option 3 to 6 and as such is included in the treatment and disposal costs presented. However, in option 7 and 8 where material is sorted at the kerbside, it is assumed that WCAs will receive revenue from the sale of this material.

All options have a greater cost in collection terms than the baseline. This is driven, in part, by the introduction of a dedicated food waste collection service in all options, adding approximately £5 million (collectively) to the kerbside collection costs for the Partnership. In all options, except option 4, the garden waste service is delivered free and as such incurs slightly higher costs on account of providing containers and operating the service to all households.

Option 5B is the lowest cost alternative option (in collection terms) for the WCAs collectively. In this option, residual waste is collected three-weekly, reducing the residual waste collection costs for the Partnership.

The option with the greatest annual collection cost for the Waste Collection Authorities (collectively) is option 8. This option models a three-stream dry recycling collection, whereby a Rear End Loader (REL) vehicle with a pod is used to collect and paper and card in the main compartment and glass in the pod of the vehicle. A dedicated RCV is operated to collect plastic and metals. Option 8 is modelled to cost (collectively) an additional £10 million per annum in collection costs, this is due to the number of additional vehicles and crew required to operate this service

This is followed closely by option 6 (at c. £9.5 million) and option 7 (at c.£9 million above the baseline), respectively. Option 6 models a twin-stream collection service for all WCAs. Option 7 models a kerbside sort collection, which although is the same container configuration as option 8, requires only one vehicle (Romaquip) to collect the dry recycling. In this option, dedicated food waste vehicles are selected, however some optimisation may be achieved by co-collecting food with the dry recycling every other week, or by increasing the dry recycling collection frequency to weekly.

Option 4 is the only collection system (besides the baseline) which retains the charged garden waste service, therefore this option includes the revenue from garden waste subscriptions, as shown below. The revenues shown for option 5A and 5B relate to NWLDC material revenue from their kerbside sort system. There is no revenue for the WCAs in option 6 (twin-stream) as it is assumed the WCAs would likely deposit the DMR and paper and card at the same facility, and LCC would receive the revenue for the sale of paper and card. In option 7 and 8 however, where the WCAs operate variations of a kerbside

sort system, it is assumed the WCAs receive the revenue from material collection. These revenues therefore offset against the higher gross collection costs, making them more comparable to the other options which don't see a change to the dry recycling collection. In this case, option 6 would have the highest (collective) gross collection costs.

In terms of treatment and disposal costs for the County Council, all options provide a saving against the baseline. Option 6 is the most-cost effective option for LCC. This option models a twin-stream collection system. Part of the reason for this is it is assumed that the LCC will receive any income from the sale of paper and card and as such provides a small revenue to offset against the cost to process the remaining dry mixed recycling through a materials recycling facility.

Options 6, 7 and 8 reduce the total treatment costs for the WDA where material is separately collected, and as such does not require processing at a Materials Recycling Facility, thereby incurring a gate fee. In option 6, paper and card are collected separately, and so a smaller proportion of dry mixed recycling requires sorting and processing. In options 7 and 8 material is presented separately at the kerbside by residents and therefore not does require a MRF to process any of the material. In reality, some additional sorting may be required, for example at a depot or other site, however this would not require the same degree of separation and would therefore not incur the same level of costs for processing.[119]

The difference from the baseline for each option is presented in italics. *Green* indicates a cost saving, whilst *red* indicates an additional cost.

Table 56: Total Partnership costs

	Baseline	Option 3	Option 4	Option 5A	Option 5B	Option 6	Option 7	Option 8
Gross Collection Cost (KAT)	**£18.4 million**	**£24.4 million**	**£23.5 million**	**£24.7 million**	**£23.6 million**	**£27.9 million**	**£27.5 million**	**£28.5 million**
		£6 million	*£5.1 million*	*£6.3 million*	*£5.2 million*	*£9.5 million*	*£9 million*	*£10 million*
Revenues Total	**-£6 million**	**-£464K**	**-£5.98 million**	**-£480K**	**-£490K**	**-£602K**	**-£3.5 million**	**-£3.5 million**
		£5.5 million	*£23K*	*£5.5 million*	*£5.5 million*	*£6 million*	*£2.5 million*	*£2.5 million*
Treatment and Disposal Cost	**£17 million**	**£14.4 million**	**£14.4 million**	**£13.6 million**	**£13.9 million**	**£12.6 million**	**£12.8 million**	**£12.8 million**
		-£2.6 million	*-£2.6 million*	*-£3.4 million*	*-£3 million*	*-£4.4 million*	*-£4.2 million*	*-£4.2 million*
Net Partnership cost	**£29.4 million**	**£38.3 million**	**£31.9 million**	**£37.9 million**	**£36.9 million**	**£39.9 million**	**£36.8 million**	**£37.9 million**
		£8.9 million	*£2.5 million*	*£8.5 million*	*£7.5 million*	*£10.5 million*	*£7.4 million*	*£8.5 million*

The costs/savings and recycling figures estimated in this report are indicative and based on a number of assumptions for modelling purposes only and are subject to forthcoming legislation and future funding mechanisms. Therefore, they should not be used directly to justify specific cost of service change.

[119] This evaluation is based on assumptions which will be subject to forthcoming legislation and funding mechanisms.

4.4 Residual waste arisings

Table 57 shows the total tonnage of residual waste collected in each of the options modelled through KAT, and the evaluation score. The scores follow a similar pattern to the recycling performance, whereby the highest recycling options also result in the lower residual waste tonnages. In comparison to the baseline, all options result in a significant reduction in tonnage. The impacts of DRS and EPR are estimated to reduce the total residual waste yield by c. 3%, which is modelled in all of the alternative collection options. Broadly, options 3, 4, 6, 7 and 8 and result in similar levels of residual waste arisings. The most significant reductions are seen in options 5A and 5B where a restriction of the residual waste capacity (by bin size or collection frequency) is modelled. Restricting the size of the residual waste bin results in the lowest overall residual waste arisings, however it should be noted that the individual results for each WCA may vary depending on the size of container chosen by each authority for option 5B (three-weekly collection). For example, if BDC chose to collect residual waste via 180L WHB every three weeks, this equates to a lower average bin capacity than collecting a 140L WHB every two weeks; therefore it is likely for BDC that three-weekly collection would have a lower residual waste tonnage than option 5A.

Table 57: Comparison of results: Residual waste arisings

Criteria	Baseline	Option 3	Option 4	Option 5A	Option 5B	Option 6	Option 7	Option 8
Residual waste arisings (tonnes)[120]	129,454	98,768	101,445	87,598	89,101	99,589	101,897	101,899

An overview of the total waste arisings, for comparison purposes, is shown in Table 58.

Table 58: Total waste arisings

	Baseline	Option 3	Option 4	Option 5A	Option 5B	Option 6	Option 7	Option 8
Residual	129,454	98,768	101,445	87,598	89,101	99,589	101,897	101,899
Dry recycling	61,141	48,471	48,292	52,064	52,124	47,644	45,335	45,335
Food	0	22,294	22,294	29,865	28,302	22,294	22,294	22,294
Garden	50,787	60,809	50,786	60,809	60,809	60,808	60,809	60,808
Contamination [121]	7,689	7,986	7,606	8,728	8,637	6,558	4,428	4,428
Total	241,382	230,343	222,817	230,336	230,336	230,336	230,336	230,336

[120] Excluding contamination

[121] This includes dry recycling, garden and food waste.

4.5 Educational / awareness raising

The options within this appraisal are scored in Table 59 below based on how well they raise additional awareness of waste and recycling; ranging from 'no additional awareness raising' to 'strong additional awareness raising'. In this regard, the baseline has been ranked lowest, as this the business as usual case, with no changes to the service. The scoring system is included in Appendix A.

Option 3 is considered to bring strong awareness raising as in this option the breadth of recycling is expanded to the consistent collections agenda proposed by government, but also includes the kerbside collection of batteries, small WEEE and textiles. This is in addition to the introduction of a dedicated food waste collection and free garden waste collection.

Option 4 has limited additional awareness raising as although food waste collections are introduced, garden waste is retained as a charged service, and it is considered that this would have limited awareness raising. Options 5A, 5B, 7 and 8 also score high in this regard; option 5A and 5B as it is assumed that presented with smaller or lower frequency collection on residual waste, residents would think more carefully about the amount of waste generated in their household. Similarly, with option 7 and 8 where residents would be required to sort material at the household this would raise awareness of which materials can be recycled, more so than in a commingled option.

Table 59: Comparison of results: Educational / awareness raising

Criteria	Baseline	Option 3	Option 4	Option 5A	Option 5B	Option 6	Option 7	Option 8
Educational / Awareness Raising	1	4	3	4	4	3	4	4

4.6 Alignment with National Policy

As regards alignment, the options have been scored based on their anticipated alignment with the Resources and Waste Strategy for England. Although this is still under consultation, there are aspects of the national strategy which are highly likely to be introduced (mandatory food waste collections and consistent collections agenda) with other areas requiring further insight (such as providing free garden waste collections). The scoring system is included in Appendix A. Options 7 and 8 are ranked highest (green) as it is anticipated that these options would be fully aligned with the Resources and Waste Strategy for England (providing a free garden waste service, consistent collections via a kerbside sort collection, food waste collection).

Option 5B has been ranked lower than option 3 and 5A as although it meets the proposed requirements on providing a free garden waste service and food waste, the latest round of the national Resources Waste Strategy consultations document suggests that the preferred method for collection of residual waste should be 'at least fortnightly' and as dry recycling for this option is retained at its current configuration, predominantly commingled, this is the least preferable method (likely to be not aligned) for collecting dry recycling (based on the capture of high quality material).

The baseline and option 4 are ranked lowest, as it is considered that charged garden will not be aligned with the national Resources and Waste Strategy in the future; however further clarification on this may arise from the results of the latest round of consultations which are due in Spring 2022.

Option 6 has been ranked below option 7 and 8 as this is technically in alignment with the national RWS, however this is subject to a TEEP[122] (or equivalent) assessment. Option 3 is scored 'amber' as each WCA collects food, however garden waste collections are retained as a charged service and not all recyclables are collected, as per the consistent collections requirements.

Table 60: Comparison of results: Alignment with National Policy

Criteria	Baseline	Option 3	Option 4	Option 5A	Option 5B	Option 6	Option 7	Option 8
Alignment with National Policy	1	3	2	3	2	4	5	5

4.7 Public Acceptability

In terms of public acceptability, option 3 is ranked the equal highest as this requires the smallest amount of change; no change to configuration, only increased dry recycling materials collected at the kerbside, and the introduction of a free garden waste service and food waste collection. Although the baseline (business as usual) requires no change to the household, it does not have food waste collection and residents must subscribe to a garden waste collection (for 6 out of 7 of the WCAs) to have their garden waste collected.

The scoring system is included in Appendix A. Option 4 is ranked second highest as this provides households with the widest service with a minimum level of change. Garden waste is retained as charged service which ranks this lower than option 3, however no other significant behaviour changes are required.

Options 5A and 5B require a residual waste bin container or frequency change for all WCAs and as such are considered to score lowest in terms of public acceptability. Option 7 and 8 are considered amber as they require the most significant change from household in terms of dry recycling collection configuration (with the exception of NWLDC).

Table 61: Comparison of results: Public Acceptability

Criteria	Baseline	Option 3	Option 4	Option 5a	Option 5B	Option 6	Option 7	Option 8
Public Acceptability	3	5	4	2	3	4	3	3

[122] A Technical, Economic and Environmental assessment of Practicability (TEEP) for alternative collection approaches.

4.8 Social Value

Each option has been ranked based on its anticipated social value. The scoring system is included in Appendix A. The creation (and retention) of jobs, community well-being and wider health benefits have all been considered when evaluating the score of each option. Options 3, 6, 7 and 8 score most highly in terms of community well-being as these options provide collection for the greatest range of recyclables, enabling residents and business to contribute more. In terms of employment, all options require more staff than the baseline. However, the creation of a jobs is a trade-off for more general health impacts (e.g. air quality) as typically where those services provide a higher number of jobs this is due to more resource being required to operate the kerbside collection service (i.e. more vehicles require more drivers and crew, however this means more transport miles are required and higher levels of air pollution).

Table 62: Comparison of results: Social Value

Criteria	Baseline	Option 3	Option 4	Option 5A	Option 5B	Option 6	Option 7	Option 8
Social Value	2	5	3	3	3	4	4	4

4.9 Operational flexibility

Table 63 shows how the options have been scored for operational flexibility. This relates to how well the WCAs could deliver the service based on the resources required to deliver each option. For example option 3, 4 and 5A score well against this evaluation criteria, as all waste services (with the exception of NWLDC) are operated by standard Refuse Collection Vehicles (RCVs), therefore there is potential scope for flexibility should demands and waste tonnages require temporary shift in delivery.

Option 5B ranks lowest here, as a three weekly collection scheme can be inherently complex to co-operate with other service which operate on a fortnightly or weekly basis. Option 7 ranks joint lowest in this as all WCAs move to a kerbside collection system which sees the use of compartmentalised vehicles (e.g. Romaquips) which are designed for kerbside sort collections and could not be used for other services such as garden or residual waste. Option 6 and 8 rank slightly better as although there are different vehicle configurations in these options, there is some flexibility in these vehicles to be used for other services.

Table 63: Comparison of results: Operational flexibility

Criteria	Baseline	Option 3	Option 4	Option 5A	Option 5B	Option 6	Option 7	Option 8
Operational Flexibility	3	5	5	5	2	3	2	4

4.10 Resource Use

Resource use has been scored based a combination of the following:

- Amount of resource depletion of abiotic resources (kg antimony-Eq) – this relates to the extraction of raw materials and resources. An abiotic depletion factor is determined for each mineral or fossil fuel based on the rate of extraction and the available global resource reserves.
- Reduction / increase in kg of material recycled

The scoring system is included in Appendix A. Option 5A and 5B both see a substantial increase in the kg/hh/yr material recycled (dry recycling, food and garden combined), with a minor reduction in kg of antimony measure.

All of the alternative options have a reduction in the kg of antimony-eq compared to the baseline. This is due to the estimated effect of a DRS and enhanced EPR measures, whereby a proportion of the dry recycling and residual waste is removed from the kerbside service, either designed out of 'waste' by EPR, or collected through reverse vending machines in the case of DRS obligated material (plastic and glass bottles and cans). Options 4, 5A and 5B have the largest reduction in kg of antimony-eq, (at over 10% reduction) however option 4 ranks lower as the kg of recycling collected per HH is the lowest of all options as free garden waste collection is not offered. This scores option 4 in the same category of option 3, 6, 7 and 8, which each have higher kg/recycling/hh than option 4, but a lower reduction in kg of antimony-eq.

Table 64: Comparison of results: Resource Use

Criteria	Baseline	Option 3	Option 4	Option 5A	Option 5B	Option 6	Option 7	Option 8
Resource Use	2	2	2	5	5	3	3	3

5 Conclusions

This Options Appraisal applies criteria agreed with Councillors and Officers from across the LWP authorities[123]. These include quantitative assessments, using industry standard models and assumptions; it also applies judgements on more qualitative criteria which are discussed in the report. The appraisal informs the LRWS, and the ranking of options reflects the impact across the Partnership as a whole.

Options 1 and 2 (waste prevention and reuse) are activities that all local authorities should undertake and vary widely in terms of their outputs and impacts. We have explored different initiatives that the Partnership currently undertake and additional ideas that could be explored. The best reuse and prevention initiatives will be subject to the resource available and the need in a particular area or point in time. We have therefore not scored options 1 and 2 within the Options Appraisal report but have identified good practice and the types of initiative that the Partnership could deliver which are included in the Headline Strategy.

The alternative options (options 3 – 8) were selected to explore the collection cost implications and impacts upon performance of potential service changes (including disposal impacts), as agreed by the Partnership. Subject to consultation, key service changes could include mandatory separate food waste collections, free garden waste collections and a move towards a 'consistent collection' approach across all Local Authorities in England.

The key results and ranking for the Baseline and options 3 – 8 are shown in Table 65, and the scoring system is included in Appendix A.

[123] Leicester City is not a member of the partnership and has its own collection and disposal arrangements as a unitary authority, however the LWP do work with Leicester City on overlapping issues.

Table 65: Evaluation of Options

		Business as Usual	*Revised Baseline with Consistent Collection measures, EPR & DRS*	*As Option 3, with retained charged garden*	*As Option 3, plus restricted residual (140L WHB)*	*Option 3, plus restricted residual (3-weekly collection)*	*As Option 3, plus fortnightly twin stream collection of dry recycling*	*As Option 3, plus kerbside sort collection of dry recycling*	*As Option 3, plus three-stream recycling*
Criteria	**Weighting**	**Baseline**	**Option 3**	**Option 4**	**Option 5A**	**Option 5B**	**Option 6**	**Option 7**	**Option 8**
Carbon	4.7	*3*	*3*	*3*	*5*	*5*	*1*	*1*	*1*
Recycling performance	4.3	*1*	*4*	*3*	*5*	*5*	*4*	*4*	*4*
Cost	4.3	*5*	*1*	*4*	*2*	*2*	*1*	*2*	*2*
Residual waste arisings	4.1	*1*	*4*	*4*	*5*	*5*	*4*	*4*	*4*
Educational / Awareness Raising	4.1	*1*	*4*	*3*	*4*	*4*	*3*	*4*	*4*
Alignment with National Policy	4.0	*2*	*3*	*2*	*3*	*2*	*4*	*5*	*5*
Public Acceptability	3.9	*3*	*5*	*4*	*2*	*1*	*4*	*3*	*3*
Social Value	3.5	*2*	*4*	*3*	*3*	*3*	*4*	*4*	*4*
Operational Flexibility	3.4	*4*	*5*	*5*	*5*	*2*	*3*	*2*	*4*
Resource Use	3.2	*2*	*3*	*3*	*5*	*5*	*3*	*3*	*3*
Total Score (with weighting) Highest no. = Best Option		**94.8**	**140.5**	**133.6**	**153.8**	**135.7**	**120.3**	**125.4**	**132.2**

Key

1	2	3	4	5

Worst performing Best performing

None of the 7 alternative collection options provide a collection cost saving to the Partnership, incurring additional modelled costs ranging from £5.1 million (option 4) to £10 million (option 8). Option 4 is the lowest cost option (in collection terms) for the Partnership; however this is the only option where garden waste collection remains as a charged service. This option is similar to the Baseline with a dedicated food waste collection service added.

Option 5B is the lowest cost option (in collection terms) where garden waste is collected as a free service. In this option, along with the introduction of food waste and free garden waste collections, the frequency of residual waste collection is reduced to three-weekly. Dry recycling is collected in the same way as the baseline in this option.

All options result in an increase in the kerbside recycling rate for the Partnership. Option 5A provides the highest recycling rate for the Partnership (61.97%), with an increase of 15.6% from the baseline (46.4%). Option 5A models a residual waste restriction whereby all collection authorities use 140L WHB, collected fortnightly.

Options 7 and 8 model different variations a on a kerbside sort collection; option 7 models the dry recycling material collected via a specialist compartmentalised vehicle and option 8 models this collected via two vehicles (a Rear End Loader with a pod, and a standard Refuse Collection Vehicle). Excluding option 4, which does not include a free garden waste service, options 7 and 8 result in the (joint) lowest kerbside recycling performance. The small decrease in recycling performance is based on the assumption that households provided with more containers to separate into, results in lower capture rates. Moving to a kerbside sort system requires a significant increase in collection cost on account of the additional resource (vehicle capex and opex) that is required to ensure that all vehicles are serviced (option 7 and 8).

Retaining a commingled collection (along with other measures) helps to achieve the highest kerbside recycling rate however this should be evaluated in conjunction with other factors, including alignment with the Resources and Waste Strategy for England where the preferred method is kerbside sort collection (or similar).

In terms of treatment and disposal costs for the County Council, all options provide a saving against the baseline. Option 6 is the most-cost effective option for LCC. This option models a twin-stream collection system. It is assumed that LCC will receive any income from the sale of paper and card and as such provides a small revenue to offset against the cost to process the remaining dry mixed recycling through a materials recycling facility.

Options 6, 7 and 8 reduce the total treatment costs for the County Council (WDA) where material is separately collected, and as such does not require processing at a Materials Recycling Facility, thereby incurring a gate fee (as at present). In option 6, paper and card are collected separately from the remaining dry mixed recycling (DMR), and so a smaller proportion of DMR requires sorting and processing. In options 7 and 8 material is collected separately at the kerbside by residents and therefore it is assumed that this not does require a MRF to process any of the material.

All options incur an additional cost for the Partnership when considering the total net costs (including collection, recycling, treatment and disposal). Overall, the total net cost to the Partnership of moving to a twin-stream collection system, with free garden waste collections and food waste collections results in

the highest total cost of all options modelled (£39.9 million). Alignment of a twin-stream recycling service with the Resources and Waste Strategy for England is likely to be determined through a TEEP[124] (or equivalent) assessment. Option 5A results in the 3rd highest overall net cost to the Partnership (including collection, treatment and disposal) at £38.1 million, £8.7 million over the baseline. This does not however include the cost of rolling out the new service (i.e. purchase of new smaller bins plus any income or cost of disposing the old, redundant, large bins, plus the delivery and collection of the bins). This option does, however, result in the highest kerbside recycling rate. Option 5B (three-weekly residual) is considered the most cost effective with the lowest additional cost per 1% improvement in kerbside recycling rate.

Service changes are required to help Local Authorities work towards supporting England in achieving the national municipal solid waste (MSW) recycling target of 65% by 2035. Reaching these higher targets means more investment is required, and the Government has stated a commitment to covering the additional costs to Local Authorities for both capital and operational costs from new required measures. Furthermore, Government is also intending to mandate Extended Producer Responsibility (EPR) on packaging materials. A requirement of EPR is that the producers would be accountable for 100% of the collection / recycling / disposal costs of the packaging handled by local authorities. The detail of this aspect is yet to be determined but could go some way to support local authorities, as will the additional cost burden of new policy measures committed by central Government. A high-level estimate of these funding streams is included in the sensitivity analysis for this appraisal.

The introduction of a DRS is modelled to reduce the total kerbside recycling tonnage by an average of 21%[125], and an average of 3% from residual waste across the WCAs. The materials within the dry recycling most impacted by a DRS are glass, plastic and metals. The modelling suggests that EPR will improve the recyclability of packaging (predominantly plastic and metals), moving material from the residual waste stream to recycling.[126] The residual waste restriction also helps to drive up the kerbside recycling rate, but this does not compensate for the overall material lost to a DRS and as such all options result in a reduction in dry recycling tonnage, in comparison to the baseline. There are discussions regarding to the implementation of a digital DRS whereby obligated DRS material carry a barcode which would allow them to be put through the kerbside collection service. For the purposes of this report we have assumed that DRS material would be returned via designated return points (i.e. supermarkets / other shops).

The changing composition as a result of DRS and EPR also has an impact on the carbon performance of the kerbside dry recycling collection service as there are less dry recyclable materials being collected and sent for reprocessing. The reduction in carbon performance of each option as a result of DRS / EPR is often outweighed by savings from separate food and free garden waste collections. However, the aims of a DRS are to encourage recycling at a wider (national) level, therefore it is important to recognise that

[124] A Technical, Economic and Environmental assessment of Practicability (TEEP) for alternative collection approaches.

[125] So if a WCA recycled 100 tonnes of dry recycling prior to DRS / EPR, this would be 79tonnes afterwards.

[126] As of March 2022, it is understood that the DRS for England and Northern Ireland will exclude glass bottles. This will impact the amount of glass collected at the kerbside. Due to ongoing uncertainty from Government regarding forthcoming legislation it was agreed that the modelling would not be updated to reflect the change in DRS scope. However, it is anticipated the kerbside recycling performance and carbon performance would improve where more glass is presented for recycling at the kerbside. It is anticipated that the kerbside recycling performance could increase by between 1.5% and 2% above the recycling performance modelled in this Options Appraisal.

there will be greater carbon benefits when evaluating the environmental performance of these policy measures, outside of the Local Authority service.

Although there are aspects of the Resources and Waste Strategy for England that are yet to be determined, there are parts of the national strategy which are likely to be introduced. For example, mandatory food waste collections and the consistent collection requirements. Against the criteria of 'alignment with the national RWS', options 7 and 8 score highest as they include separate food collection, free garden waste collection and most closely follows the consistent collections guidance with a kerbside sort or three stream collection for dry recycling. Alignment of a twin-stream (option 6) with the Resources and Waste Strategy for England is likely to be determined through a TEEP[127] (or equivalent) assessment, as would all other options that contain commingled recycling collections.

Restricting residual waste capacity has a positive impact on a number of the criteria; carbon, recycling performance, residual waste arisings and awareness raising. However, we are awaiting further guidance as to the Government's position on residual waste collection. The latest round of consultation indicated a minimum collection frequency of fortnightly, which means that against the Alignment criteria option 5B ranks amongst the lowest of the options.

The results of this Options Appraisal score the baseline (current service) lowest against recycling performance, residual waste arisings, alignment with National Policy, social value criteria. When scored using the agreed weighting, the baseline results in the lowest ranked score. The highest ranked score is option 5A, which delivers the best recycling rate and carbon performance.

Finally, the costs/savings and recycling figures estimated in this report are indicative and are based on a number of assumptions for modelling purposes only. They provide a reasonable guide to the magnitude of changes that might be expected and are subject to forthcoming legislation and future funding mechanisms. Therefore, they should not be used directly to justify specific cost of service change. They are modelled in comparison to the Partnership's estimated baseline costs and on an annualised basis. If the Partnership is minded to pursue any of the above changes, they are advised to undertake a more bespoke assessment of any particular option, potentially including re-routing and asset reallocation, in order to satisfy themselves that any improvements in recycling or efficiencies can be realised in practice.

Appendix A – Scoring System

The following scoring approach has been applied to the Evaluation Criteria for the Options Appraisal. There is a 1-5 scoring system as follows:

Criteria Banding	Unit	1	2	3	4	5
Carbon	*kg CO2/eq*	-550t - -2,260t	-2,261t - -4,030t	-4,031t - -5,680t	-5,681t - -7,370t	-7,371t - -9,100t
Recycling performance	*Kerbside recycling rate*	46.36% - 49.49%	49.5% - 52.61%	52.62% - 55.73%	55.74% - 58.85%	58.86% - 61.97%
Cost	*£*	£37.8 - £40 million	£35.6 - £37.8 million	£33.4 - £35.6 million	£31.2 - £33.4 million	£29 - £31.2 million
Residual waste arisings	*tonnes*	121,001 - 129,500	112,501 - 121,000	104,001 - 112,500	95,501 - 104,000	87,000 - 95,500
Educational / Awareness Raising		No additional awareness raising	Limited additional awareness raising	Moderate additional awareness raising	Good additional awareness raising	Strong additional awareness raising
Alignment with National Policy	*RWS compliance*	No aspects align with RWS	2-3 aspects do not align with RWS	1 aspect does not align with RWS	Likely to align with RWS	Anticipated to fully align with RWS
Public Acceptability		Poor public acceptability	Potential for public acceptability concerns	Broadly neutral acceptability from the public	Positive public acceptability	Strong public acceptability
Social Value		Little or no anticipated social value	Potential for some social value benefits	Moderate social value benefits	Good social value benefits	Strong social value benefits
Operational Flexibility		Little or no operational flexibility	Some operational flexibility	Moderate operational flexibility	Good operational flexibility	Strong operational flexibility
Resource Use		Reduction in kg recycled and notable reduction (>10%) in kg of Antimony measure	Broadly neutral in kg recycled and notable reduction (>10%) in kg of Antimony measure	Notable increase in kg recycled and substantial reduction (>10%) in kg of Antimony measure	Significant increase in kg recycled and minor reduction (<10%) in kg of Antimony measure	Substantial increase in kg recycled and minor reduction (<10%) in kg of Antimony measure