WASTE STRATEGY FOR ESSEX

Final Report

Report for: Essex County Council

Ricardo ref. ED15623100 Issue: 5 10/05/24

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Essex County Council

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Ricardo reference:
ED15623100

Date:
10/05/24

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Abbreviations list

Abbreviation	Meaning
AD	Anaerobic Digestion
ATT	Advanced Thermal Treatment
BPES	Best Practicable Environmental Scenario
CC	County Council
CCUS	Carbon Capture, Utilisation and Storage
CHP	Combined Heat and Power
CO2	Carbon Dioxide
DIY	Do it Yourself
DMR	Dry Mixed Recycling
DRS	Deposit Return Scheme
ECC	Essex County Council
EfW	Energy from Waste
EPR	Extended Producer Responsibility
ESO	Electricity System Operator
EWP	Essex Waste Partnership
FW	Food Waste
FY	Financial Year
GGW	Green & Garden Waste
GHG	Greenhouse Gases
GVW	Gross Vehicle Weight
ICP	Indicative Cost and Performance (Tool)
IVC	In Vessel Composting
JMWMS	Joint Municipal Waste Management Strategy
KAT	KAT Modelling Tool (Ricardo)
KPI	Key Performance Indicator
LA	Local Authority
LACW	Local Authority Collected Waste
LE	Love Essex
LF	Landfill
MBT	Mechanical and Biological Treatment
MRF	Materials Recovery Facility
OAW	Open Air Windrow
OECD	Organization for Economic Cooperation and Development

Abbreviation	Meaning
ONS	Office for National Statistics
PO4	Phosphate
PTT	Pots, Tubs and Trays
RAG	Red, Amber, Green
RCHW	Recycling Centre for Household Waste
RCV	Refuse Collection Vehicle
RDF	Refuse Derived Fuel
REE	Ricardo Energy and Environment
SA	Scheme Administrator (EPR Funding)
SO2	Sulphur Dioxide
TEEP	Technically, Environmentally and Economically Practical
TEPSEB	Technically or Economically Practicable, Significant Environmental Benefit
TRAID	Textile Recycling for Aid and International Development
UK	United Kingdom
WCA	Waste Collections Authority
WDA	Waste Disposal Authority
WDF	Waste Data Flow
WDM	Waste Data Model
WEEE	Waste Electrical and Electronic Equipment
WFM	Waste Flow Model
WPS	Waste Prevention Strategy
WRAP	Waste and Resources Action Programme
WRATE	Waste and Resources Assessment Tool for the Environment
WSCM	Whole Systems Cost Model
WTS	Waste Transfer Station

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1. INTRODUCTION

1.1 PROJECT BACKGROUND

Essex County Council (ECC) is the statutory Waste Disposal Authority (WDA) for Essex and is obligated under the Environmental Protection Act (EPA) 1990 to provide a range of waste services for the treatment and disposal of Local Authority Collected Waste (LACW). The twelve Borough, City and District Councils in Essex[1] are all Waste Collection Authorities and are obligated under the EPA to provide a range of waste collection services.

To optimise the delivery of statutory waste functions ECC and the twelve Essex Waste Collection Authorities (WCAs) work in partnership, collectively known as the Essex Waste Partnership (EWP). There is a stated ambition that effective partnership working as the EWP will ensure that:

- appropriate infrastructure can be provided and utilised.
- complimentary systems and services can be implemented to deliver effective waste operations.
- resources can be used in a manner which maximises beneficial impacts.

The council's, working together as the EWP, are obliged to maintain a Joint Strategy setting out how household and similar wastes are to be managed. The current Joint Municipal Waste Management Strategy (JMWMS) was adopted in 2008 and was expected to be in place until 2032. The development of new legislative and policy drivers by government have resulted in the current JMWMS becoming outdated; the EWP have thus taken the decision to review, update and develop the Strategy to ensure it better reflects current needs and legislative requirements. The project is being carried out in partnership with EWP members with wider stakeholders facilitating "buy in" at all levels of the partnership.

This report details and summarises the work carried out so far to explore the current activities across the EWP in terms of waste collection and to investigate scenario opportunities for the future.

1.2 PURPOSE

The draft Waste Strategy for Essex provides a framework for the strategic management of waste in Essex. To successfully deliver the targets and ambitions of this draft strategy, Councils will need to review how they currently deal with the waste generated in their area and identify any changes that may be needed in the future. To support these considerations some modelling of different approaches and alternative collection and disposal systems has been undertaken to help inform future decision making. This includes comparing different ways of doing things, looking at the experiences of others and understanding the potential impacts of how things could be done differently in the future.

The following report was commissioned by Essex County Council on behalf of the EWP. Its purpose is to provide information to help the EWP develop a new Waste Strategy for Essex by,

1. providing contextual data and insight to identify priority areas of focus
2. Understanding some of the different ways of managing waste and their potential impacts, costs and performance
3. Gaining insight into the possible effects of upcoming legislation, demographic changes and behaviour

The high-level systems modelling undertaken has examined waste collection and disposal methods, the possible environmental impacts and the cost implications of different waste management systems. This is a research based study only and does not consider every variable, or cover a comprehensive range of waste management approaches or combination of approaches. However, this has enabled the EWP to identify some key strategic themes, exclude some waste management approaches and identify targets and ambitions for inclusion in the draft Waste Strategy for Essex.

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[1] Basildon Borough Council, Braintree District Council, Brentwood Borough Council, Castle Point Borough Council, Chelmsford City Council, Colchester City Council, Epping Forest Borough Council, Harlow District Council, Maldon District Council, Rochford District Council, Tendring District Council, Uttlesford District Council

The findings of the study have been considered as part of the range of research addressed in section 3 of the draft strategy. However, the study is not designed to and will not be used to identify a single preferred approach for the collection of waste in Essex. More detailed bespoke modelling and evaluation will be required in the future as individual councils consider the best way to deliver the ambition of the Waste Strategy for Essex.

1.3 CURRENT JOINT MUNICIPAL WASTE MANAGEMENT STRATEGY

The councils that make up the EWP are obliged to maintain a Joint Strategy setting out how household and similar wastes are to be managed. In 2008 the WDA and WCAs adopted a JMWMS for Essex. The strategy was developed in partnership, and in consultation with residents, businesses, industry, and partner organisations. The JMWMS covered the period from 2007 to 2032. The main objectives of this strategy are:

- Essex Authorities will work hard to reduce the amount of waste produced in the first place and re-use more of the waste that is produced.
- Essex will achieve high levels of recycling, with an aspiration to achieve collectively 60% recycling of household waste by 2020. This could be achieved through a combination of further improvement in the performance of recycling and composting kerbside collection schemes and the Recycling Centres for Household Waste, and the recovery of recyclable materials through new treatment plants.
- Essex favours composting technologies such as anaerobic digestion (AD), for multi-stream organic waste. (Note that AD is a form of biotreatment and produces a gas which can be used to generate 100% renewable electricity).
- Essex proposes to introduce new treatment plants using Mechanical Biological Treatment (MBT). MBT processes any 'black bag' waste and recovers further material for recycling. Part of the remaining material can either be manufactured into a fuel for energy production or can be sent to landfill.

The current JMWMS is thus a 25-year strategic plan for recycling and waste management in Essex. It provides a performance and policy framework for the development and delivery of LACW services, and the preferred approaches and technical solutions to achieve outcomes. It also considers local authority controlled and contracted infrastructure and its role in delivering strategic aims, and thus includes the Recycling Centres for Household Waste (RCHW), bulking facilities and depots.). However, the JMWMS has been subject to no further substantive review or refresh since its adoption in 2008.During this period there have been significant changes to national policy, legislative changes and shifts in behaviours and attitudes to waste.

1.4 GOVERNMENT TARGETS AND POLICIES

During the update of the JMWMS it will be important to ensure it is aligned with the appropriate elements of current and forthcoming policy and legislation. The way waste is managed has evolved significantly since 2008, with greater focus on reducing the amount of waste produced and managing the remainder in a more sustainable manner. The UK government has introduced the Environment Act 2021 which is designed to have far-reaching consequences for environmental protection, and the government intends the bill to be a framework to:

- allow policies to be implemented at every stage of the product lifecycle.
- set product design and related requirements to ensure products are more durable, repairable and recyclable.
- introduce new extended producer responsibility schemes to make producers responsible for the full net costs of managing their products and packaging when they are ready to be disposed of.
- implement charges on single-use plastics, following the successful introduction of the carrier bag charge, and will enable the introduction of a deposit return scheme for drinks containers.
- deliver consistent and frequent recycling collections across England, ending the current postcode lottery.
- ensure councils operate weekly separate food waste collections, preventing food waste from going to landfill or being incinerated.
- support tackling rogue operators that illegally dump or export waste, undermining legitimate businesses.

Within the waste landscape, these policies will impact on the way the EWP members will manage waste.

These headline policies and the methodology for their introduction, are provided in more detail in the Government's Resources and Waste Strategy for England[2]. This policy framework sets out how the government will "*preserve material resources by minimising waste, promoting resource efficiency and moving towards a circular economy in England*". It includes the following strategies and targets:

- UK Plastics Pact - all plastic packaging to be recyclable, reusable or compostable by 2025.
- eliminate food waste to landfill by 2030.
- eliminate avoidable plastic waste by 2042.
- double resource productivity by 2050.
- eliminate avoidable waste of all kinds by 2050.
- all households and appropriate businesses to have separate food waste collections by 2023.
- consistent set of dry recyclable materials collected from households and businesses.
- at least 65% of municipal waste to be recycled by 2035.
- no more than 10% of Municipal Solid Waste to be sent to landfill.

1.5 RESOURCE & WASTE STRATEGY - DEFRA WASTE CONSULTATIONS:

Defra launched a set of consultations in 2021 exploring their preferred scenarios on the implementation of the following initiatives:

- a Deposit Return Scheme (DRS) for drinks containers, where consumers will be incentivised to take their empty drinks containers to return points hosted by retailers.
- Extended Producer Responsibility for packaging, where manufacturers will pay the full costs of managing and recycling their packaging waste, with higher fees being levied if packaging is harder to reuse or recycle.
- consistency in household and business waste recycling, which includes the proposal of free garden waste collections, a preference for more frequent than fortnightly collections in urban areas, weekly food waste collections for all and restrictions on the collection of co-mingled dry recyclate.

These proposals have significant implications for all EWP members and have the potential to require significant changes to the current methodologies for the collection, management and disposal of all municipal waste streams across Essex.

The government response to the Extended Producer Responsibility consultation was published earlier in 2022; Defra were planning to release the Consistency and DRS responses by the end of 2022, but recent government announcements (as of 1st August 2023) suggest this will be postponed until late 2023. The government also intends to issue a consultation exercise regarding the Statutory Guidance which will confirm limitations of some elements of waste collection methodology for example, the minimum frequency for the collection of residual waste.

For a full summary of the waste initiatives included in the Environment Act 2021 and the Resource & Waste Strategy, see Chapter 9 of this report.

Further to the factors outlined above and in Chapter 9, the Committee for Climate Change's Sixth Carbon Budget sets a carbon budget order (tonnes of CO2 emissions) and a net zero target for the UK. The Government's Net Zero ambition is to "*reduce emissions by 78% by 2035 compared to 1990 levels, taking the UK more than three-quarters of the way to reaching net zero by 2050*"[3]. Measuring waste management activities using the generation of carbon emissions as a key metric will be required to monitor performance against this target.

1.6 OVERALL SCOPE OF THE PROJECT

As demonstrated, the current JMWMS needs to be refreshed to take account of new targets for waste management that go beyond 2020 and to reflect the greater ambition of the EWP. This project is designed to assist the EWP in producing a refreshed Joint Strategy, the "Waste Strategy for Essex" which will provide a

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[2] Resources and Waste Strategy for England
[3] UK Government Announcement

clear, concise and target-driven guide on how waste is to be managed for the next 30 years and the strategic approaches needed. The refreshed Joint Strategy will consider national waste policy, the latest legislation, performance targets and define a collective EWP ambition. The Joint Strategy will be based on a good understanding of current waste flows and how these may change over the lifetime of the plan to ensure that a sustainable resource management solution is delivered. To assist with this, this report outlines the extensive analysis which has been carried out on the current waste management landscape across the EWP area. This includes the development of baseline (current) models of the collection services for each of the EWP members. Models have been developed outlining a series of deliverable waste collection, treatment and disposal scenarios for the management of all LACW in Essex. These were developed in collaboration with EWP members through a series of Workshops where the scenarios to be considered, the assumptions to be made, and the evaluation criteria to be used were agreed. Each of the scenarios are illustrated by accompanying waste-flow models and financial models (driven by the waste-flow models) to estimate both the cost and likely performance of each waste collection methodology. The models are combined to illustrate a Whole System Cost across the EWP, including collection, reprocessing and disposal costs to show the net cost of each scenario to the county.

A Best Practicable Environmental scenario (BPES) lifecycle assessment has been carried out for each scenario to enable them to be considered in terms of:

- emissions to air (including climate change impacts), water and land.
- deliverability.
- performance against national targets.
- performance against EWP vision; and
- financial cost.

The purpose of the BPES assessment is to assist the EWP with understanding the possible implications of different approaches to waste management. It is not the intention of the BPES assessment to provide an answer to how waste needs to be managed but provide high level insight for the EWP on areas of focus for the delivery of waste management in the future and to help shape the strategic vision. The modelling of the scenarios provides an indication of the financial, operational and environmental impacts of each scenario, providing a basis for considering service change where appropriate.

1.7 STAKEHOLDER ENGAGEMENT

The EWP recognises that it is essential that all stakeholders are fully involved in the journey to decide the eventual Joint Strategy aims and objectives and the preferred services resulting from the Strategy. A series of workshops were held with senior officers, directors and elected members from all thirteen councils of the EWP to explore the levels of aspiration and vision for the Joint Strategy, develop the Vision Statement for the strategy, explore the priorities and develop the waste collection, treatment and disposal scenarios for modelling. These workshops resulted in the agreement of a long list of potential waste management methodologies and a set of evaluation criteria (including criteria weightings) to be used to assess each scenario approach. These were then refined to the current shortlist of six scenarios to model.

Subsequent meetings with officers, directors and elected members have been held to provide updates on the progress of the project and seek feedback and direction to ensure ‘buy-in’ at all levels of the partnership.

1.8 PARTNERSHIP WORKING

EWP officers have worked closely with the project team and Ricardo to provide the data required to inform the modelling in an intensive process requiring commitment from all partners The process has also identified local strategic and service objectives and constraints across within the partnership.

Regular meetings of the EWP have ensured the project has remained focussed on the collective vision while maintaining engagement and input across the EWP.

1.9 SUMMARY

The information gathered as part of the vision setting, baseline and scenario modelling, and the methodology and outputs of the BPES appraisal are included in this report. The report also includes the outputs of the benchmarking of the current services across the EWP, identifies the agreed criteria and weightings used to develop the alternative waste management scenarios, and demonstrates how the selected scenario(s) fit with the set Vision Statement for the EWP and the current and future legislative/policy framework for waste management. This identifies how the project has been developed to incorporate the rationale for why the strategy is needed, the current performance, the future vision and proposed priorities in terms of waste management.

2. VISION

2.1 OVERVIEW

A Vision is a simple statement declaring what the strategy aims are and what it will deliver. This will dictate the level of ambition and priorities for the EWP. At the early stages of the joint strategy development, a series of three workshops were held, to gain insight and direction from key stakeholders on the vision, understanding the level of ambition and setting the boundaries for the Waste Strategy for Essex. The three workshops took place between September and October 2021 and were aimed at targeting different groups of participants from within the EWP. Table 1 below summarises the dates and duration for each session, as well as the targeted groups of stakeholders.

Table 1: Scheduled Workshops for Waste Strategy for Essex development

Workshop	Stakeholders	Date	Duration
1	EWP Project Team	20 September 2021	4 hours
2	EWP Directors/Senior Leaders	04 October 2021	2 hours
3	Elected Members	11 October 2021	4 hours

Prior to each workshop, invitees were provided with a concise briefing note on the key issues to be considered during each session. These briefing notes informed stakeholders of the key aspects for consideration in the Waste Strategy for Essex development, to help them develop their thinking in advance of the workshops and to aid greater interaction during the sessions.

The list of participants during each workshop is provided in Appendix 1. It should be noted that for Workshop 3, some elected Members were unable to join due to other commitments; as a result, views were taken from directors and officers of those authorities. Subsequently, feedback was sought from Members at all subsequent EWP meetings, with officers asked to ensure they had support for their views from their members.

This section collates the outcomes of the three workshops and highlights areas of consensus and areas where views on priorities differed. It also highlights where more work will be required to develop the strategy and understand what boundaries need to be considered when choosing the scenarios to be modelled during the next stages of the project. The key areas discussed during the workshops are presented in the sections below, including setting the vision for the joint strategy and identifying priorities, key collaboration areas and red lines. The conclusions from the three sessions and how these will impact the next stages of the strategy development are also presented in the sections below.

2.2 AIMS AND OBJECTIVES

The aim of the series of workshops was to shape and guide the vision, objectives and priorities for the Waste Strategy for Essex, with the goal of understanding and capturing the diverse views across the EWP and to identify areas where there is consensus already within and across the groups.

During the workshops, the following points were discussed to identify areas of agreement and areas of divergence, to enable progress with the development of the Waste Strategy for Essex:

- priorities and objectives.
- vision and target setting.
- scenario boundaries.
- positioning of Essex nationally.
- extent of compliance with the national waste strategy, whether to meet or exceed the national strategy and potentially be a national leader.
- attitude to conformity within Waste Collection Authorities (WCAs).

- political limitations on scenarios (for example frequency of collections, technology types, import/export of waste).
- environmental performance, the extent that waste management is required to meet key environmental indicators such as carbon footprint, greenhouse gas (GHG) emissions, circular economy, other water and air quality compromising emissions.
- attitude to risk, especially in relation to novel or emerging approaches and technologies.
- attitude to the potential import/export of waste from the county, as a means of waste management and/or business opportunity.
- technology aversion, such as what technologies would be completely excluded based on political preference or pre-conceived opinions, deliverability, rick or acceptability.
- attitude to decentralised, local or centralised treatment operations.
- cost of changes to collection and treatment scenarios.

2.3 VISION SETTING

2.3.1 Level of Leadership

Establishing a collective vision for the EWP was an essential step at the early stages of the development of the project. A Vision is a simple statement declaring what the strategy aims are and what it will deliver. This will dictate the level of ambition and priorities for the EWP as a whole and individual Councils. Therefore, during the workshops, it was essential to understand what the stakeholders wanted the Strategy to achieve.

During the first Workshop, officers were invited to share their views on the current level of leadership of the EWP against other waste authorities and partnerships across the United Kingdom. Using the online tool Menti.com and by ‘dropping a pin’ on the image shown in Figure 1 below, stakeholders could express their views on where they believe the EWP’s collective performance is now, such as if it is legally compliant with the national waste management, in line with similar authorities, exceeding the benchmark through good practice, top of the table or thought leaders.

During both officer and member workshops, the average of the responses suggest that the stakeholders believe EWP’s waste management practices are exceeding the benchmark and represent good practice. Despite this, there was a divergence as some believed Essex to be in line with similar authorities or doing the minimum to remain legally compliant, as shown in Figure 1 and Figure 2. This could indicate that the partnership is not currently ‘moving as one’.

Figure 1: Level of Leadership Now – Officers

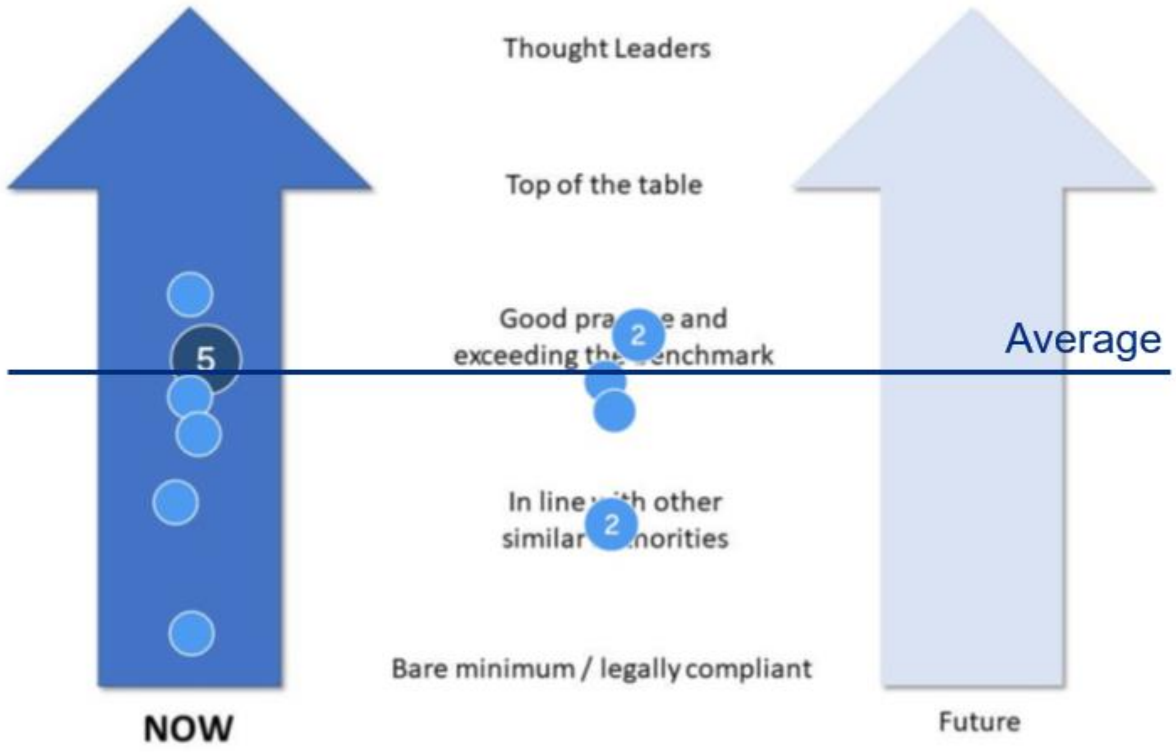
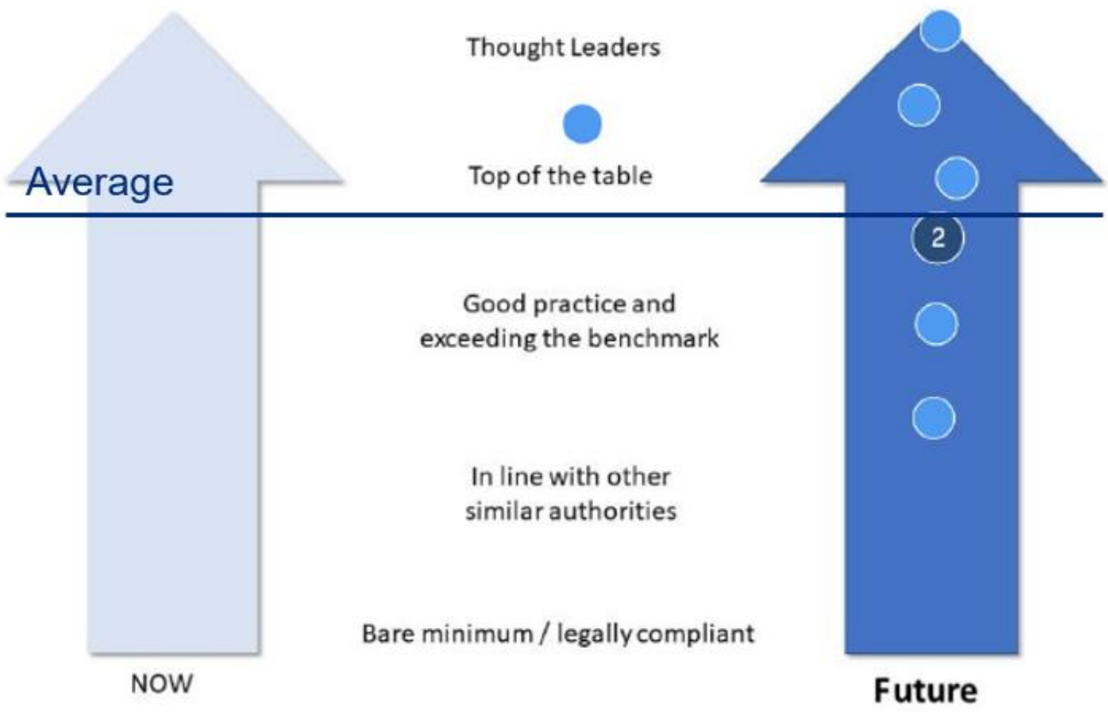


Figure 2: Level of Leadership Now – Members



Consistency in responses was also shown when consulting the stakeholders about what level of leadership they want EWP to have in the future. As shown by Figure 3 and Figure 4 representing the views gathered during the officer and member workshops respectively, stakeholders would like EWP performance to take a step forward compared to the current levels and to be closer to the best performing authorities in the country.

When questioned about future level of leadership, the responses given by the stakeholders showed a greater spread compared to those given in terms of current level of leadership, indicating that authorities could be on slightly different paths with respect to what they need from the EWP. This could be a consequence of the fact that the EWP has been relatively inactive recently and all members of the Partnership would benefit from a reinvigorated focus.

Figure 3: Level of Leadership Future – Officers

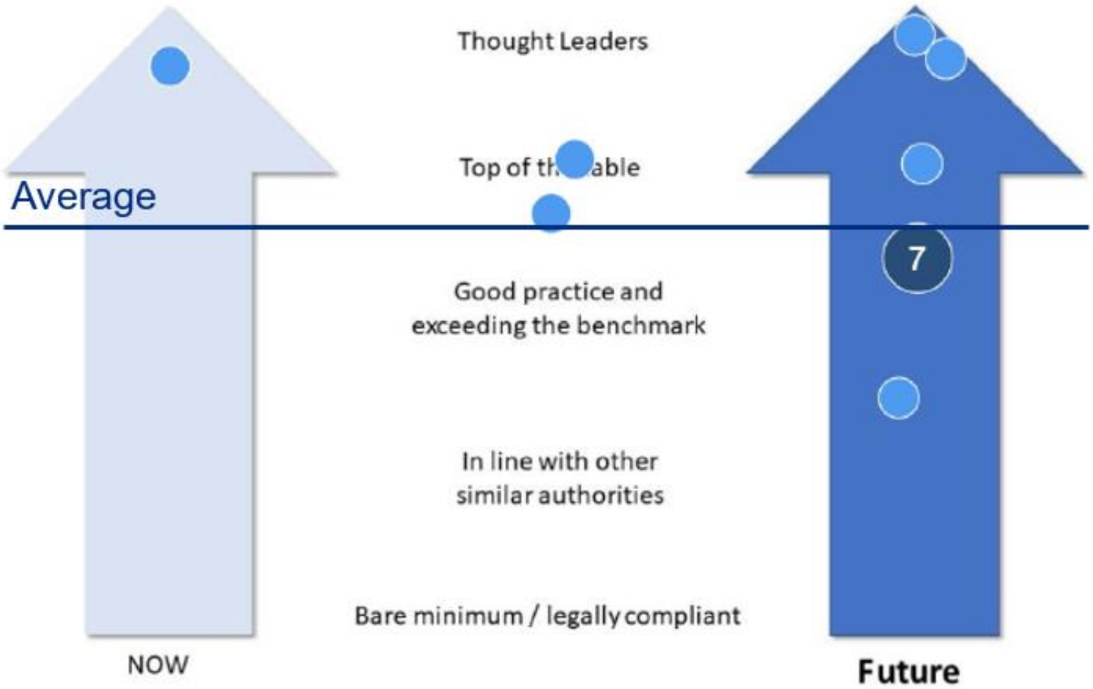
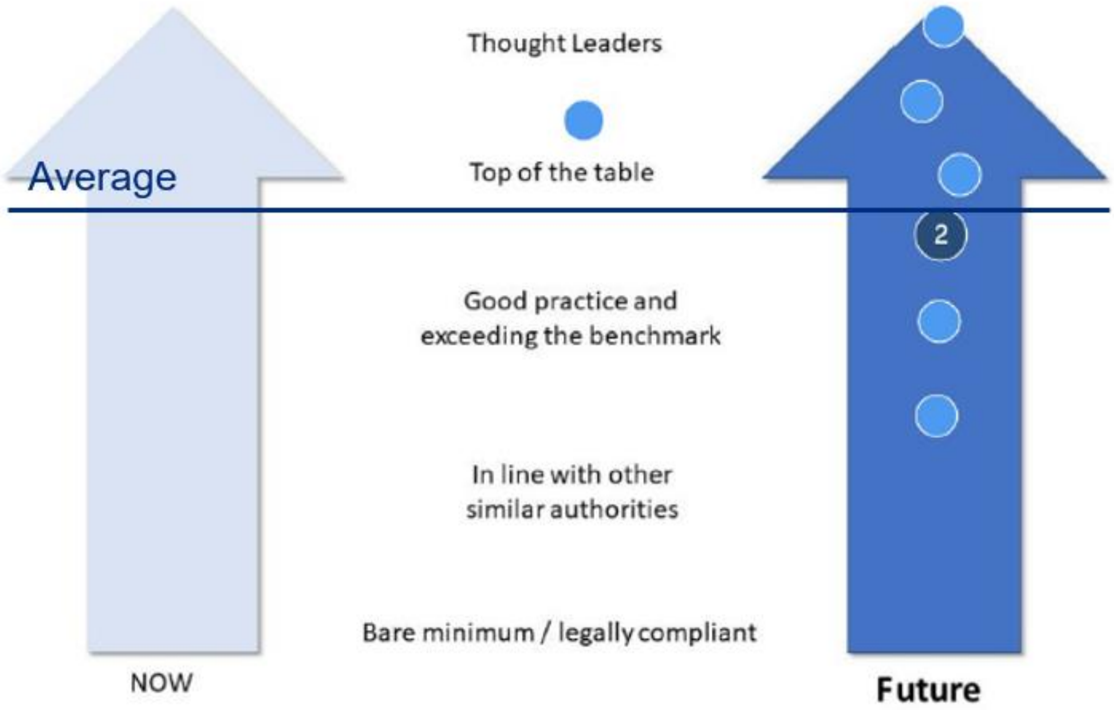


Figure 4: Level of Leadership Future – Members



2.3.2 Level of ambition

During the Officer Workshop, stakeholders were asked for their views about how they perceive EWP's current level of ambition in terms of waste management and what they think the level of ambition should be in the future. The gathered views are represented in Figure 5 and Figure 6 respectively. Stakeholders believe that Essex is currently performing well, being in the top quartile against their peers. This is consistent with their views around leadership. When looking at future levels, most stakeholders expressed their wish for EWP to be the highest performing in England, whereas some others would like EWP to go beyond that, being the highest performing in the UK and internationally.

The responses provided by the stakeholders showed a spread of views regarding the future level of ambition across three performance levels. During the workshop, the affordability of achieving these ambitions was discussed and it is possible that different views around costs may have been an influential factor on stakeholders' responses.

Please note that this question was only asked during the officer workshop and therefore the results for the member workshop are not presented.

Figure 5: Level of Ambition Now – Officers

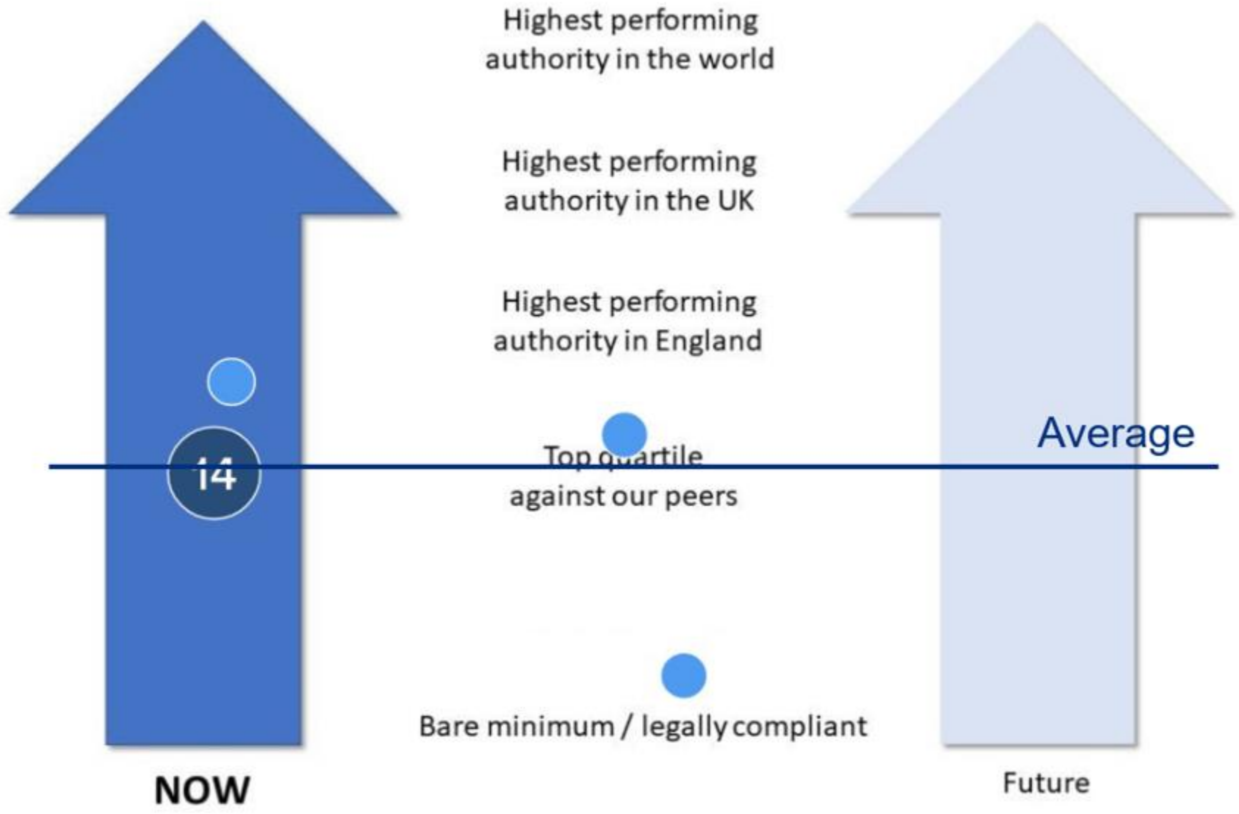


Figure 6: Level of Ambition Future – Officers

As part of setting the level of ambition for the Waste Strategy for Essex, stakeholders were invited to express their views on the recycling target goals that the strategy should aim to achieve. As shown by Figure 7, most stakeholders expressed an ambition to achieve a recycling performance that exceeds 70%, in line with the future ambition of being one of the best performing authorities in the UK. Achieving this would place Essex as national leaders for recycling and composting rates and would exceed the legislative requirements.

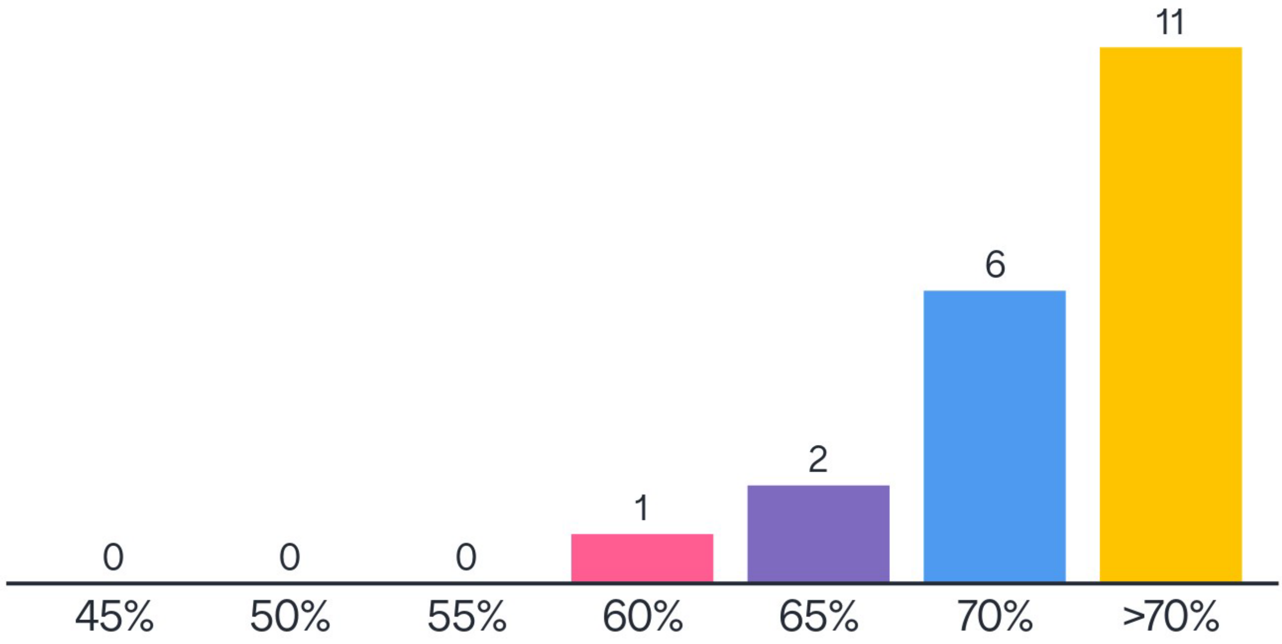
In 2020/21, EWP collectively achieved an overall reuse, recycling and composting rate of 51.8%. The EWP WCA's reuse, recycling and composting rates varied between 40.3% and 58.2%. This key information was included in the briefing notes circulated to stakeholders in preparation for the workshops.

These results from the officer workshop, were presented to directors during workshop 2. There was a cross-section of opinion within the stakeholder group around the level of challenge that such a target would pose, which could reflect the different rates being achieved across EWP currently, whereby some stakeholders believed the proposed target to be very challenging and others believed it was not ambitious enough. However, all stakeholders agreed that extensive investments in the waste infrastructure will be required to achieve high reuse, recycling and composting rates.

The responses on this question are in line with what was previously presented with regards to future levels of leadership and ambition. The stakeholders believe EWP should exceed the benchmark and be one of the best performing authorities in the country, in line with the ambition to exceed 70% recycling levels.

During the member workshop, views were expressed about the importance of achieving high recycling levels as well as the need to set specific targets to measure the success of the strategy.

Figure 7: Reuse, Recycling and Composting rate targets – Officers' Workshop



Please note that this question regarding views on the recycling target goals that the strategy should aim to achieve was only asked during the officer workshop and therefore the results for the member workshop have not been presented.

2.3.3 Vision statement

As mentioned in section 2.3.1, the vision should be a simple statement of what the Waste Strategy for Essex aims to achieve. During the officer workshop, stakeholders were invited to express what three words they wanted to be included in the Vision Statement, by means of the 'word cloud' tool on Menti.com. The results of this exercise are shown in Figure 8.

The word cloud presents all the inputs given by the stakeholders and words that have been entered multiple times will appear with a bigger font, indicating their relative importance. As shown by the figure, the words put forward the most were "sustainable" and "environment", followed by "enable"; other popular contributions were "innovative", "sustainability" and "carbon".

Figure 8: Word cloud: 3 words to be included in the Vision Statement – Officers (workshop 1)

Following the workshop, the most popular entries in the word cloud were organised and summarised in the Vision Statement shown in Figure 9. This was presented to directors and members during subsequent workshops to gain insight and view from the other stakeholders, to firm up the proposed vision and gain consensus.

During the director's workshop, a proposed Vision Statement headline, "Less Waste, Less Carbon, Less Impact" was developed. Some stakeholders expressed the view that this was not ambitious enough. It was highlighted that the goal of the JMWMS is to have *more and a better* impact on the environment, and it was suggested to replace "Less Waste, Less Carbon" with "Zero Waste, Zero Carbon". The revised Vision Statement headline (shown in blue in the figure below) was presented to directors and members, receiving positive feedback.

Figure 9: Vision Statement Development – Directors and Members (Workshops 2 and 3)

~~Less Waste, Less Carbon, Less Impact~~

Zero Waste, Zero Carbon, More Impact

Vision Statement Example

"Through leadership and innovation, enable a sustainable environment that reduces the amount of waste and carbon generated across Essex"

2.4 PRIORITIES

2.4.1 Relative priorities

Following the discussion around establishing a vision, it was essential to understand what stakeholders envisaged as priorities for the development of the Waste Strategy for Essex, and to understand the relative importance of each identified priority. During the officer workshop, stakeholders were asked to type what issues the strategy should prioritise by means of a Menti.com word cloud. The outcome, provided in Figure 10, shows strong emphasis on reducing the current levels of generated waste, together with having a good value for money in the provided services and decreasing carbon emissions. Complying with government policy for waste management, such as the policies and targets in the Resources and Waste Strategy (such as consistency in collections and introduction of a Deposit Return Scheme) was also highly emphasised.

These priorities were presented to directors during workshop 2. Comments were raised by stakeholders over the level of investment and the timeframes required for changes to be implemented. It was agreed that considerable investments are needed for the identified priorities to be met.

Figure 10: Priorities Word Cloud – Officers (Workshop 1)

The same word cloud exercise was proposed to elected members. The outcomes, presented in Figure 11, differ slightly from those discussed with officers and directors, however, waste reduction, carbon reduction and value for money were still identified as high priorities. Other priorities expected to play an important role in the Joint Strategy include simplicity of waste management system for users and efficiency, although it was not specified whether it was intended as material efficiency or cost efficiency.

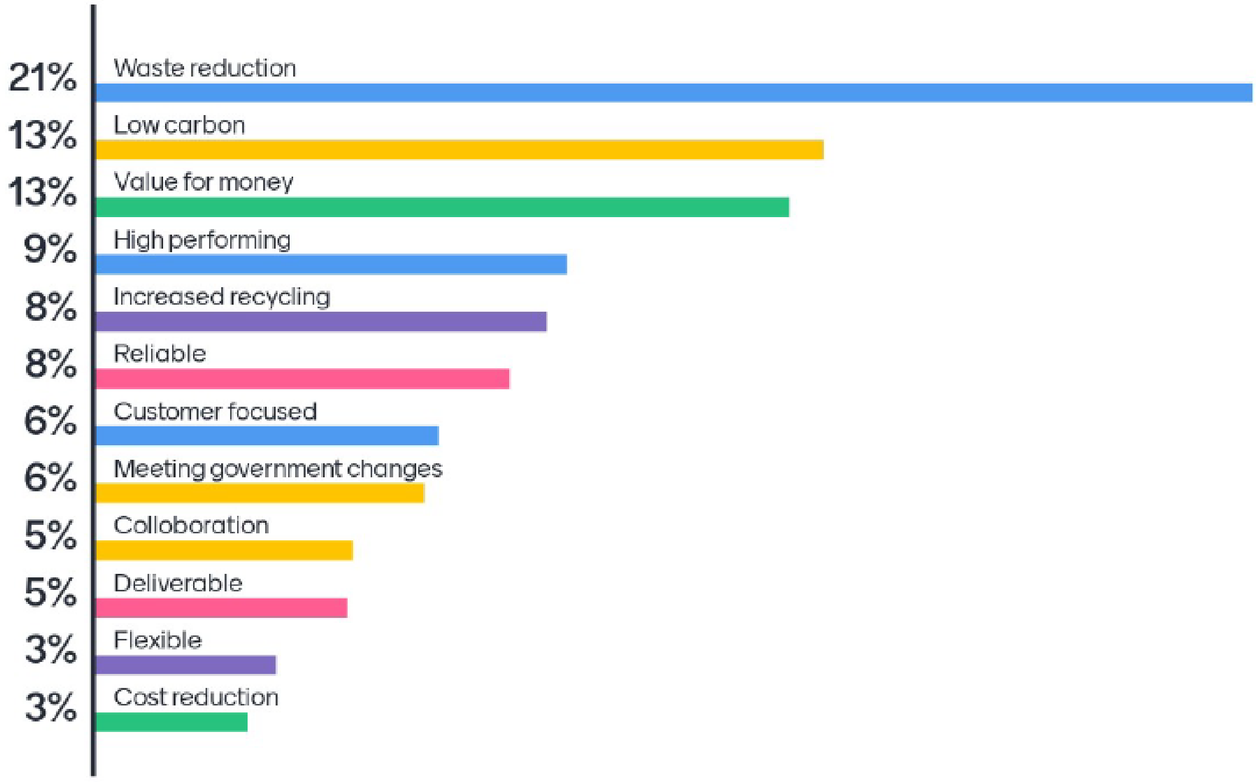
Figure 11: Priorities Word Cloud – Members (Workshop 3)

Stakeholders were asked to rank the priorities identified in the word clouds by assigning them a total of 100 points to be shared across the various priorities. The results for the officer workshop are shown in Figure 12.

This exercise identified that the top three priorities for officers are:

1. waste reduction - top priority (21% of the total 100 points).
2. low carbon services (13%).
3. value for money (13%).

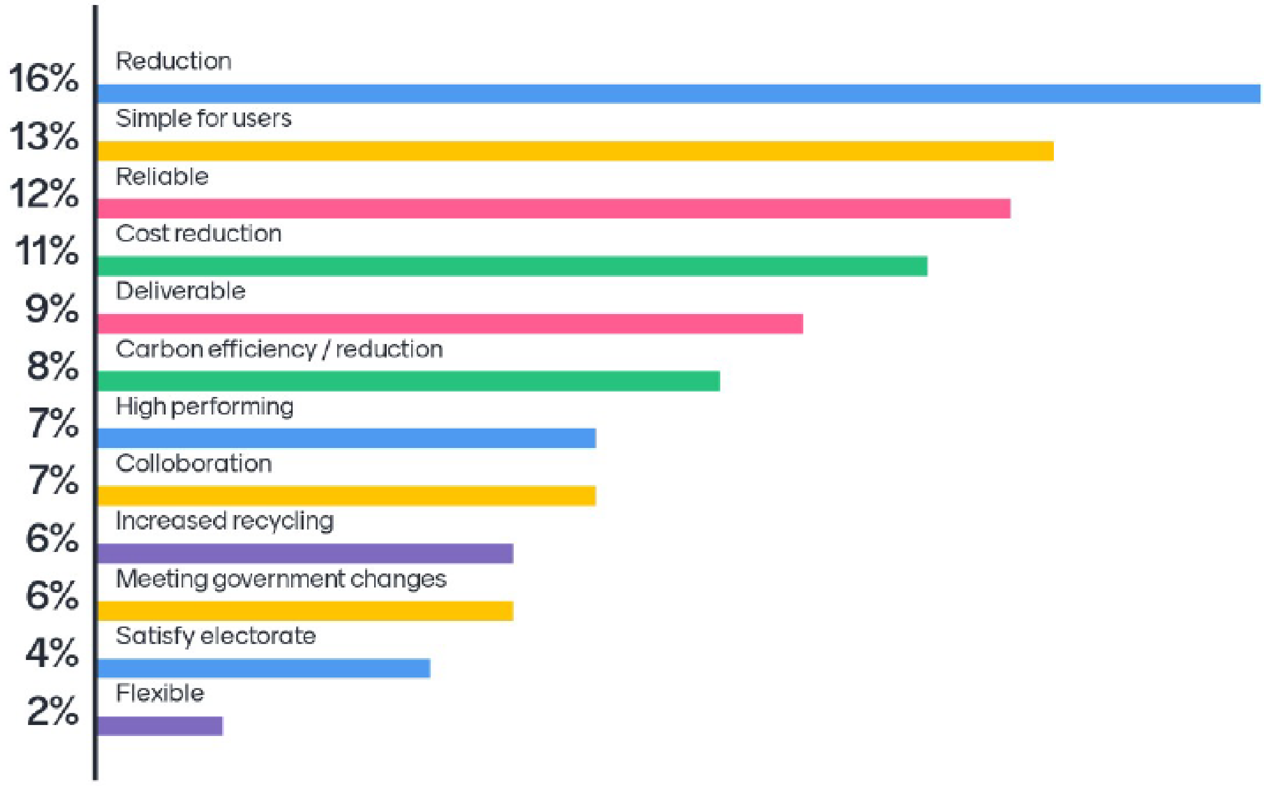
Figure 12: Relative Priorities – Officers (Workshop 1)



Having high performing, customer-focussed and simple waste management systems for users was also ranked highly in the relative priorities, with measures to increase recycling ranking within the same range (9-6%). For officers, costs related to waste management were not as important a consideration as the priorities already mentioned and this priority received the least points (3%). This outcome could be because officers might have considered waste reduction as a proxy indicator for cost reduction and have therefore focused more on value for money.

This exercise was repeated during the members workshop with the outcomes shown in Figure 13.

Figure 13: Relative Priorities – Officers (Workshop 3)



It was identified by Members that reducing waste generation should be the top priority in the Joint Strategy. Having a simple waste management system for the users was also ranked high in the relative priorities (13%), followed by having a reliable system (12%) and the reduction of the costs related to waste management (11%). The priority that received the least points is having a flexible system (2%).

Overall, waste reduction, carbon reduction, high performance and costs reduction/value for money were identified as broad areas of consensus between officers and members.

2.4.2 Driving issues and areas of focus

Stakeholders were invited to provide their insight about what issues should be driving the development of the strategy. For this task, stakeholders in workshops 1 and 3 were requested to assign a number between zero and ten to a list of issues, where zero meant that the issue was not very important and ten meant that it was very important. The results are shown in Figure 14 and Figure 15 for Workshops 1 and 3, respectively.

Figure 14: Driving issues – officers (workshop 1)

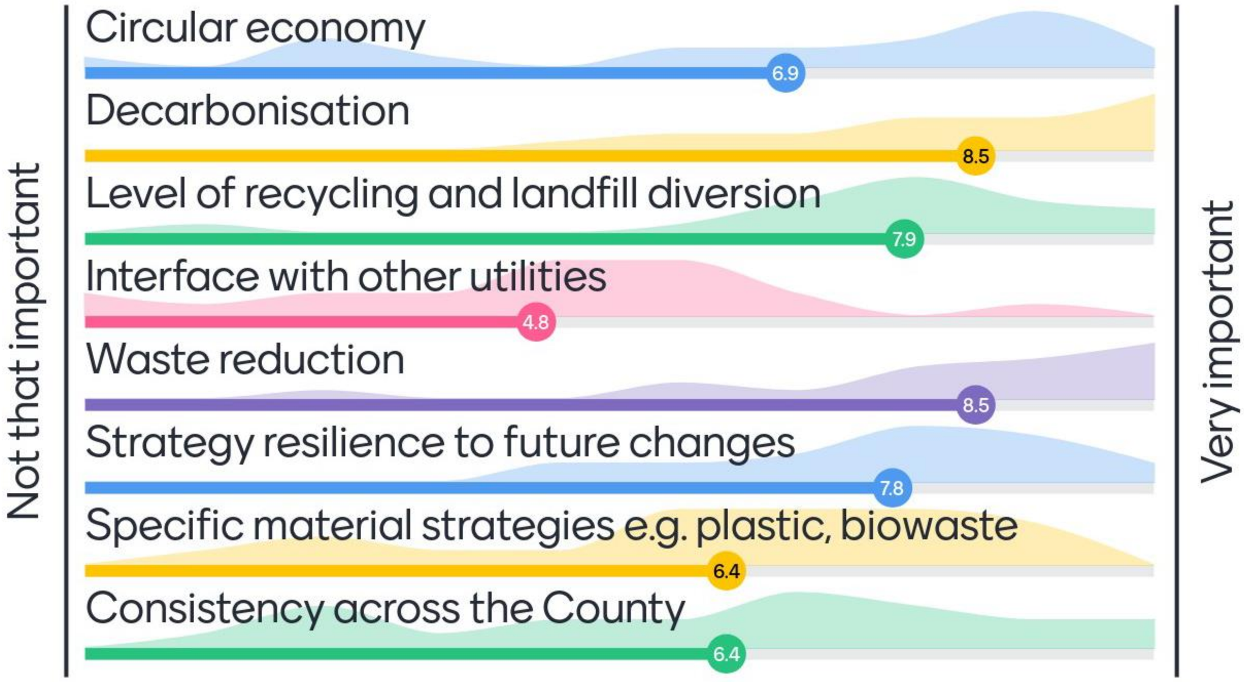
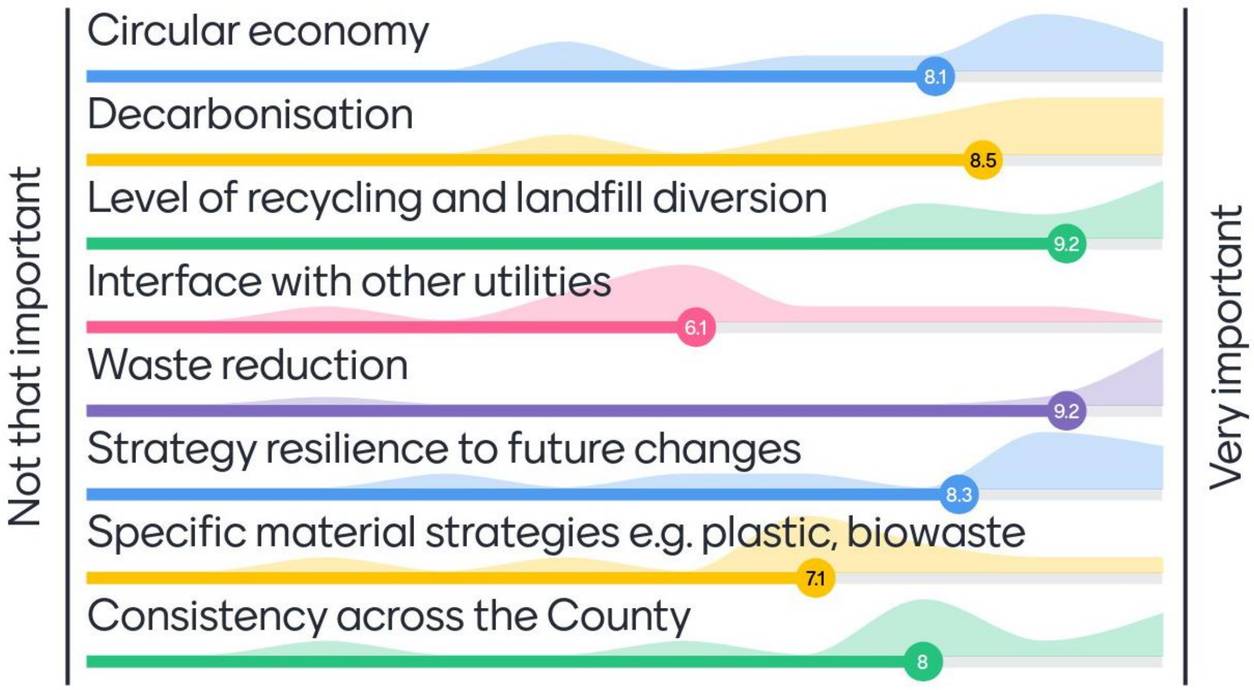


Figure 15: Driving Issues – Members (Workshop 3)



During the first session, decarbonisation of waste management practices and waste reduction were the most important driving issues identified, in line with the relative priorities assessment. During workshop 3, waste reduction was also identified as the main driving issue for the strategy, together with recycling and landfill diversion rates. Other key issues identified during the workshops were ensuring resilience to future changes and circular economy.

Similar trends were brought out through consultation with stakeholders about the main areas the Waste Strategy for Essex should focus on, as shown by Figure 16 and Figure 17 below. Key areas from workshop 1 include waste minimisation, decarbonisation and diversion from landfill, whereas members allocated more importance to recycling over decarbonisation. Landfill diversion and waste minimisation were also identified as main areas of focus during Workshop 3.

Figure 16: Areas of Focus – Officers (Workshop 1)

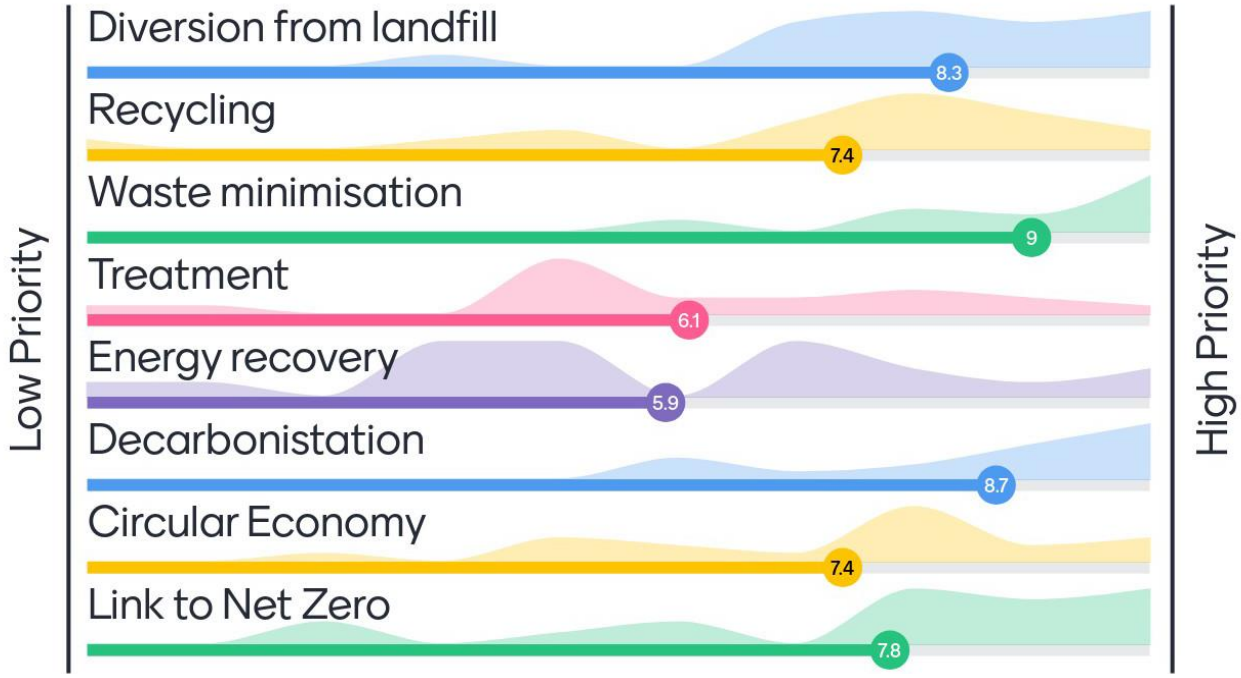
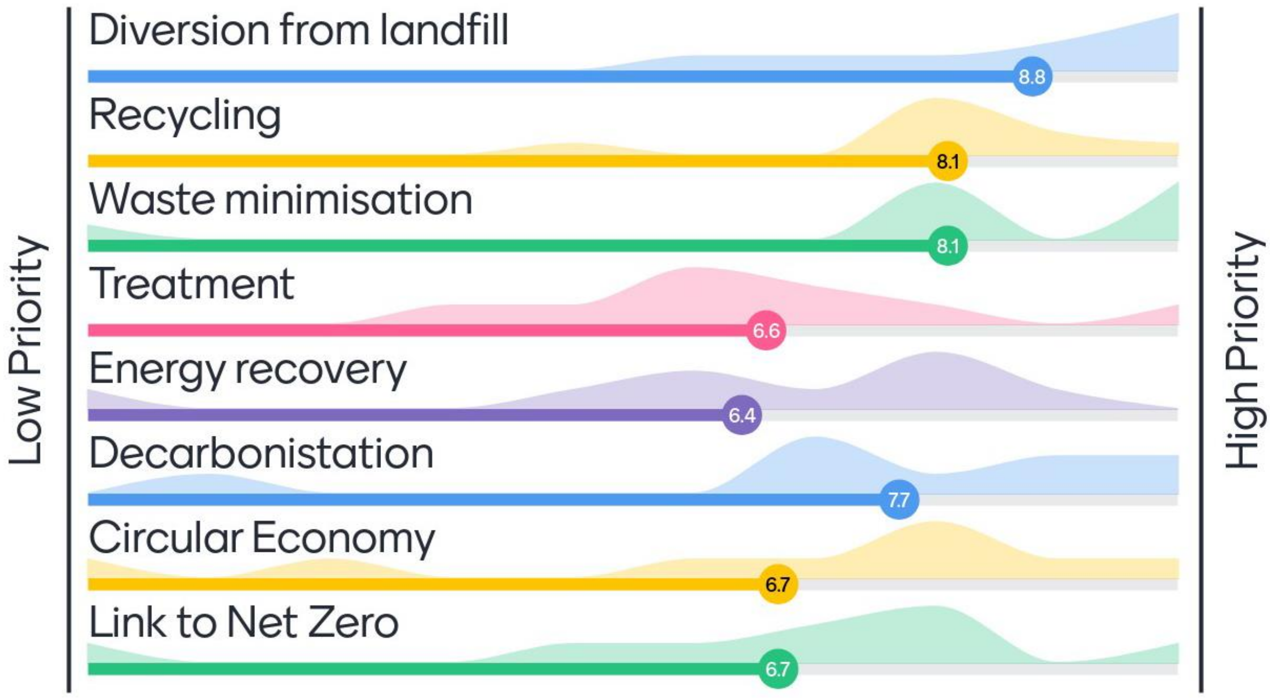


Figure 17: Areas of Focus – Members (Workshop 3)



2.5 KEY COLLABORATION AREAS

Enhanced collaboration across the EWP authorities has the potential to provide opportunities to both the WCAs, WDA and Essex residents and businesses. During workshop 1, stakeholders expressed their views on what benefits could be achieved from collaboration. The benefits raised included procurement benefits, better value for money, consistent outcomes, greater efficiencies, better customer experience as well as sharing of resources, experience and knowledge.

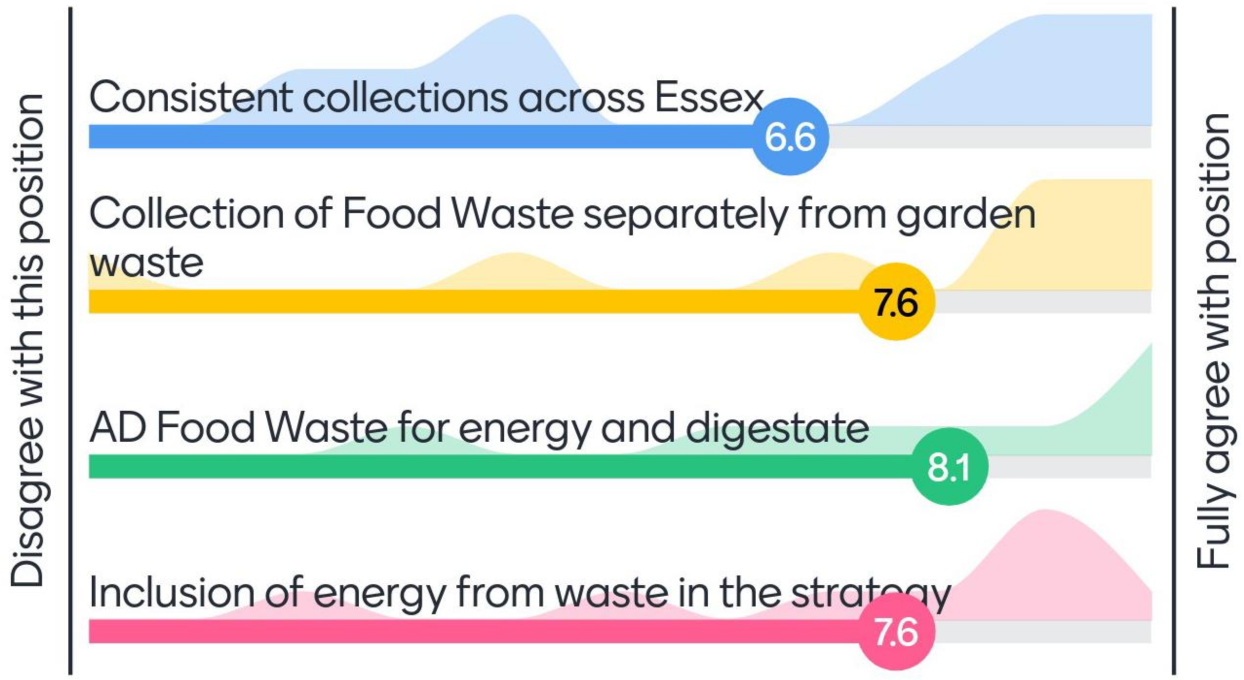
During the workshops, stakeholders were asked to express their views on key collaboration areas, such as:

- the standardisation of collection systems
- the preferred approach to food waste collections
- their views on residual waste treatment

These topics are key in the current national Resources and Waste Strategy[4] and have recently been the subject of government consultations. These proposed the introduction of a weekly separate food waste collection for all households and appropriate businesses with the goal of reducing GHG emissions and the introduction of consistent collections in England.

Figure 18 shows the strength of Members' views on the appetite for these key collaboration areas. Additional details will be provided in the following sections.

Figure 18: Appetite for Key Collaboration Areas across Essex – Members (Workshop 3)



2.5.1 Standardisation of collection systems

Waste collections across EWP WCAs differ from one council to another, as presented in Table 2.

Table 2: Summary of Waste Collection Schemes across EWP Authorities

Authority	Residual Scheme	Dry Recycling Scheme	Food Waste Scheme
Basildon[5]	Weekly	2-stream (glass out)	Mixed food and garden waste
Tendring	Fortnightly	2-stream (paper and card out)	Separate food waste
Castle Point, Maldon	Fortnightly	2-stream (glass out)	Separate food waste

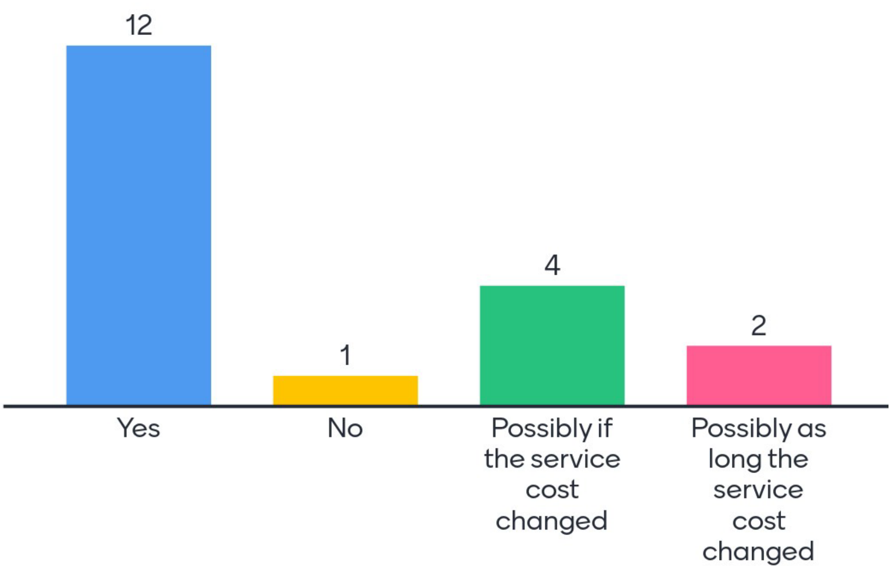
[4] HM Government, "Our Waste, Our Resources: A Strategy for England", 2018 See Chapter 8.8 for a detailed summary.

[5] The waste collection scheme is the one that was in place during the modelling activity. In October 2022 Basildon BC changed to a fortnightly residual waste service with a separate food waste service.

Authority	Residual Scheme	Dry Recycling Scheme	Food Waste Scheme
Epping Forest	Fortnightly	2-stream (glass out)	Mixed food and garden waste
Brentwood	Weekly	Multi-stream	Separate food waste
Chelmsford, Colchester	Fortnightly	Multi-stream	Separate food waste
Braintree, Harlow, Uttlesford	Fortnightly	Comingled	Separate food waste
Rochford	Fortnightly	Comingled	Mixed food and garden waste

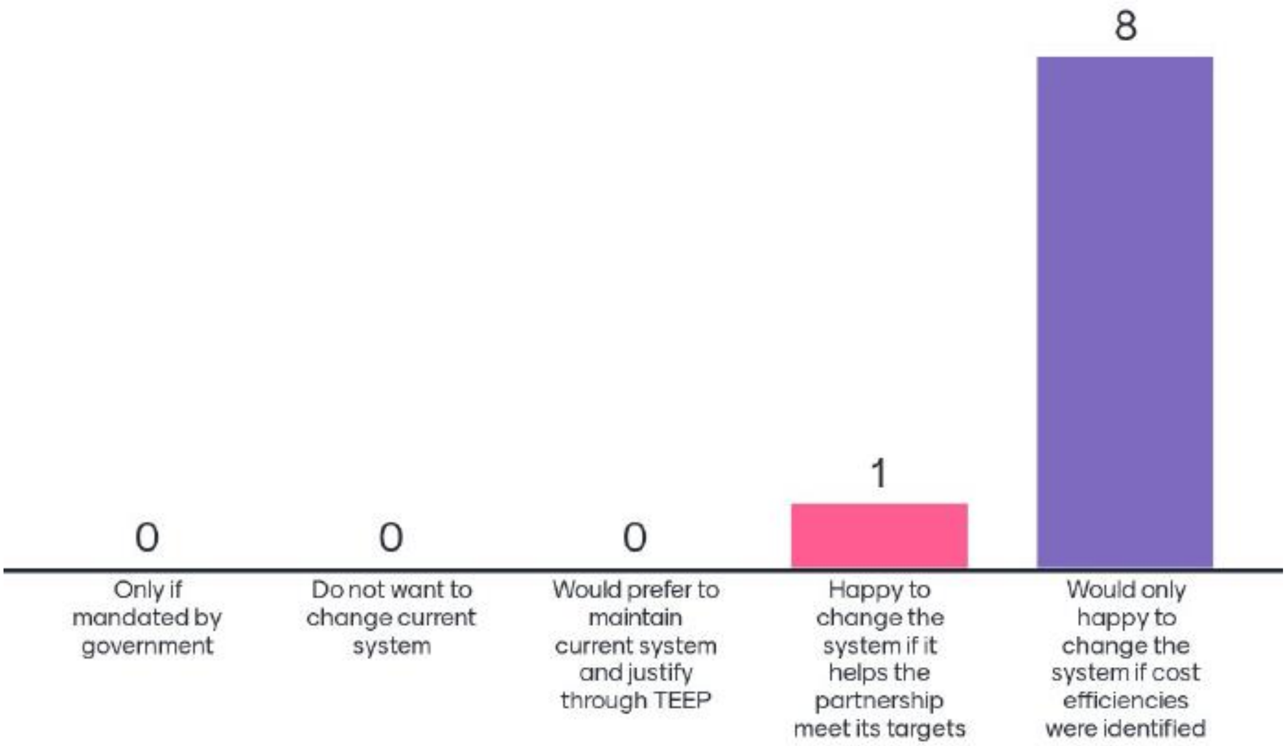
As previously seen, stakeholders expressed their views on what benefits could be achieved by increasing collaboration across the partnership. They were also specifically asked about their appetite for the standardisation of the collection systems (see Figure 19 and Figure 20). The outcomes show a general openness to change regarding current collection systems, particularly if it helps with improving recycling, landfill diversion rates and cost-efficiency of the provided services; however, members strongly think that this would only happen if it was demonstrably more cost efficient.

Figure 19: Appetite for consistent collections across Essex – Officers (Workshop 1)



Please note that the second to last scenario indicates a possibility to change the service even if it translates into changes in the costs associated with it. The last scenario indicates a possibility to change collection systems under the condition of costs changing as well.

Figure 20: Appetite for consistent collections across Essex – Members (Workshop 3)



2.5.2 Approach to the management of organic waste

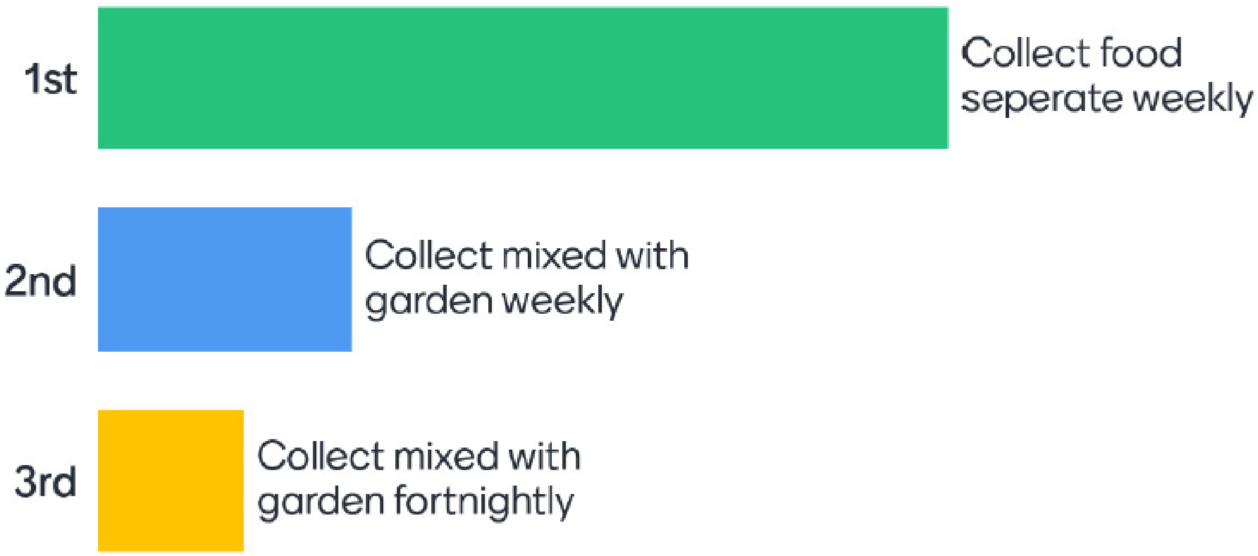
As part of the government consultation on consistent collections across England, a weekly separate collection of food waste has been proposed, and has subsequently become a requirement under the Environment Act. As previously shown in Table 2, only 3 WCAs out of 12 were collecting food waste mixed with garden waste weekly, whereas the remaining 9 were collecting food separately on a weekly basis.

Since the workshops, an additional council has segregated their food and garden waste streams, and another has indicated this is likely to happen within the next 12 months.

During the officer workshop, stakeholders were invited to rank three collection scenarios for food waste:

- separate food collection, on a weekly basis.
- mixed garden and food waste collection, on a weekly basis.
- mixed garden and food waste collection, on a fortnightly basis
- The preference of officers is shown in Figure 21: Weekly, separate food waste collections is the preferred scenario. As most of the WCAs in EWP are currently operating food waste collections under this scheme and it has been included as a requirement in the Environment Act (2021), this was the anticipated outcome.

Figure 21: Ranked Scenarios for Food Waste Collections



During Workshop 2, questions were raised by directors around the anaerobic digestion capacity in the county, as it was understood that treatment infrastructure capacity might be at risk following the introduction of nation-wide mandatory food waste collections. It was highlighted that the current strategy was built to allow flexibility around the scenario of mixing garden and food waste and that, should this scenario be technically, environmentally and economically practicable, it should not be discounted when agreeing the scenarios to be modelled in the Waste Strategy for Essex, as it has potential to divert more material from landfill and generate power from green waste. Other stakeholders, however, showed hesitation in including the scenario in the revised strategy, as most districts and boroughs have already invested in implementing separate food waste collection services. Moreover, this scenario would not be compliant with national policy direction.

2.5.3 Boundaries for the management of residual waste

Stakeholders were invited to provide their views on what scenarios should be included in the Joint Strategy in terms of residual waste management. Across all workshops, there was unanimous agreement of the need to avoid landfill disposal as a main residual waste treatment scenario. Energy from Waste (EfW) was discussed in detail and the conclusion was that it has a role to play and should be considered as part of the strategy, where combined heat and power (CHP) is included in the solution. As such, both officers and members agreed that it should be a key technology to be considered in the development of a new strategy for waste that is not reused, recycled or composted.

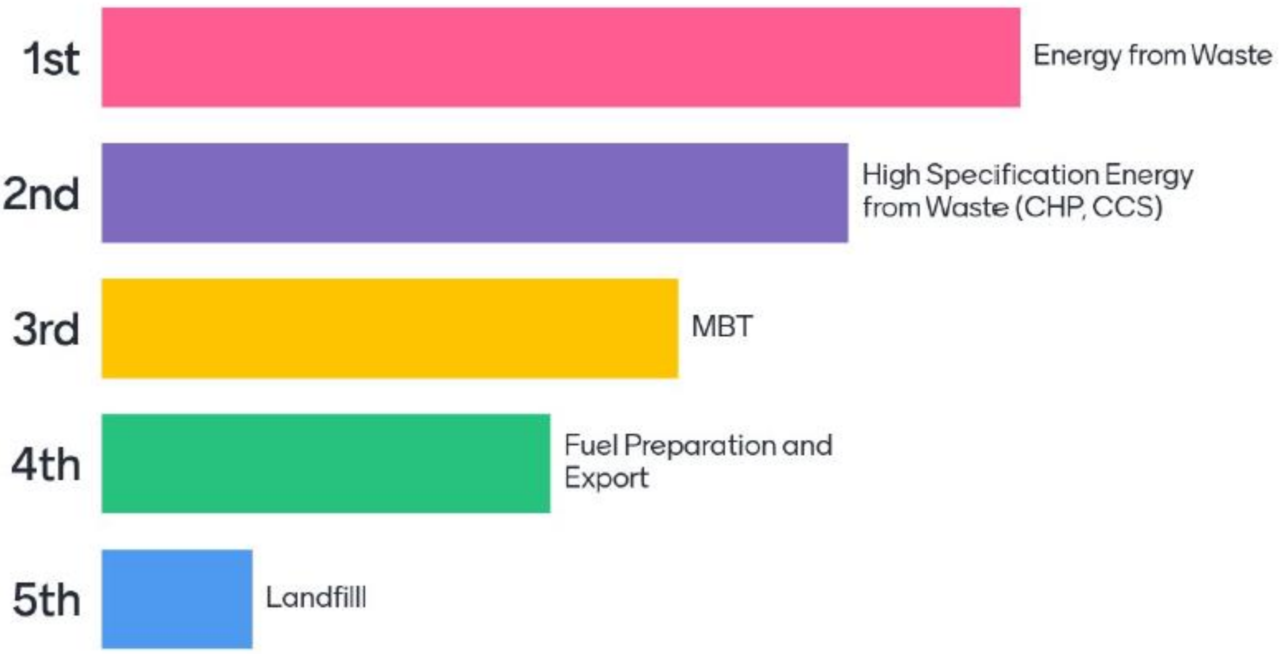
During workshop 2, directors and officers expressed their view that any use of EfW as part of the treatment technologies should not jeopardise recycling rates and the environmental and carbon impacts of the technology should be considered. Questions were raised about the role of mechanical biological treatment (MBT) in the upcoming Waste Strategy for Essex. At the time, it was understood that the current MBT plant was unavailable for the treatment of waste, and this is not expected to change (note: the MBT plant has subsequently been scheduled for complete decommissioning, with this process currently ongoing. "*The waste treatment contract for the mechanical and biological waste treatment facility (MBT), otherwise known as the Tovi Eco Park, in Basildon, Essex is to be terminated as part of a mutual agreement between Essex County Council (ECC) and UBB Waste (Essex) Limited (UBB).The parties have agreed to amend the PFI contract relating to the MBT facility to include an obligation on UBB to demolish the MBT facility, hand back the Environmental Permit to the Environment Agency and return the empty site to ECC, following which the PFI contract will be terminated*[6]"). MBT technology remains a valid consideration for residual waste and if this is chosen as a treatment scenario, a new facility may be required.

[6] Essex.gov.uk News Release

Figure 22 shows how Members ranked possible technologies for the treatment of residual waste. EfW was selected as the preferred scenario, with CHP and a preference for carbon capture, utilisation, and storage (CCUS) to be enabled. MBT ranked at third place out of five.

Through these workshops, it was recognised that residual waste will require treatment/disposal and, despite EfW being identified as a possible solution, some concerns remain about its use and acceptability. The relative ranking of MBT here may reflect the experience with this technology in Essex.

Figure 22: Ranked Residual Waste Management Scenarios – Members (Workshop 3)



2.6 RED LINES

2.6.1 Treatment technologies

After having identified the key areas for collaboration and having discussed the possibility of changing the current collection schemes, organic waste collections and residual waste treatment scenarios, stakeholders were asked what technologies and collection systems should be excluded in developing a future Waste Strategy for Essex.

During the Workshops, officers and members expressed their opinion on the subject by means of a Menti.com word cloud. The outcomes of the two sessions are presented in Figure 23 and Figure 24 below. During Workshop 1, officers strongly objected to the inclusion of landfilling scenarios in the development of the Waste Strategy for Essex.

Other practices to be excluded from the Waste Strategy for Essex included exporting waste, unproven/novel technologies and incineration without recovering energy. When the same question was asked of members, the use of EfW as a technology without energy recovery was a red line, followed by landfill and overseas exports. Members also considered unproven technologies to be a red line, due to the potential risks involved. EfW as a technology with energy recovery was not ruled out, but there was a preference for efficient technologies that produce heat as well as power and provide for carbon capture, utilisation, and storage (CCUS).

Consequently, landfilling and incineration without energy recovery will not be considered as residual waste treatment scenarios during the next stages of the strategy development. There was no suggestion from directors that any specific treatment technology or collection system should be excluded by the Waste Strategy for Essex, although a preference for tried and tested technologies was clearly expressed. The role of EfW was discussed and it was understood that some opposition to this solution could be related to the location/siting of a possible facility, rather than to the technology itself.

Figure 23: Technologies and collection systems that should not be included – Officers (Workshop 1)

Figure 24: Technologies and collection systems that should not be included – Members (Workshop 3)

2.6.2 Strategic framework

The conversations raised during the three workshops have supported the shape of the proposed strategic framework for the Waste Strategy for Essex, as presented in Figure 25 below.

The Vision Statement *"Zero waste, zero carbon, more impact"* has been broken down into five main themes:

- Decarbonisation.
- cost-effective resource use.
- management of residual waste.
- management of organic waste.

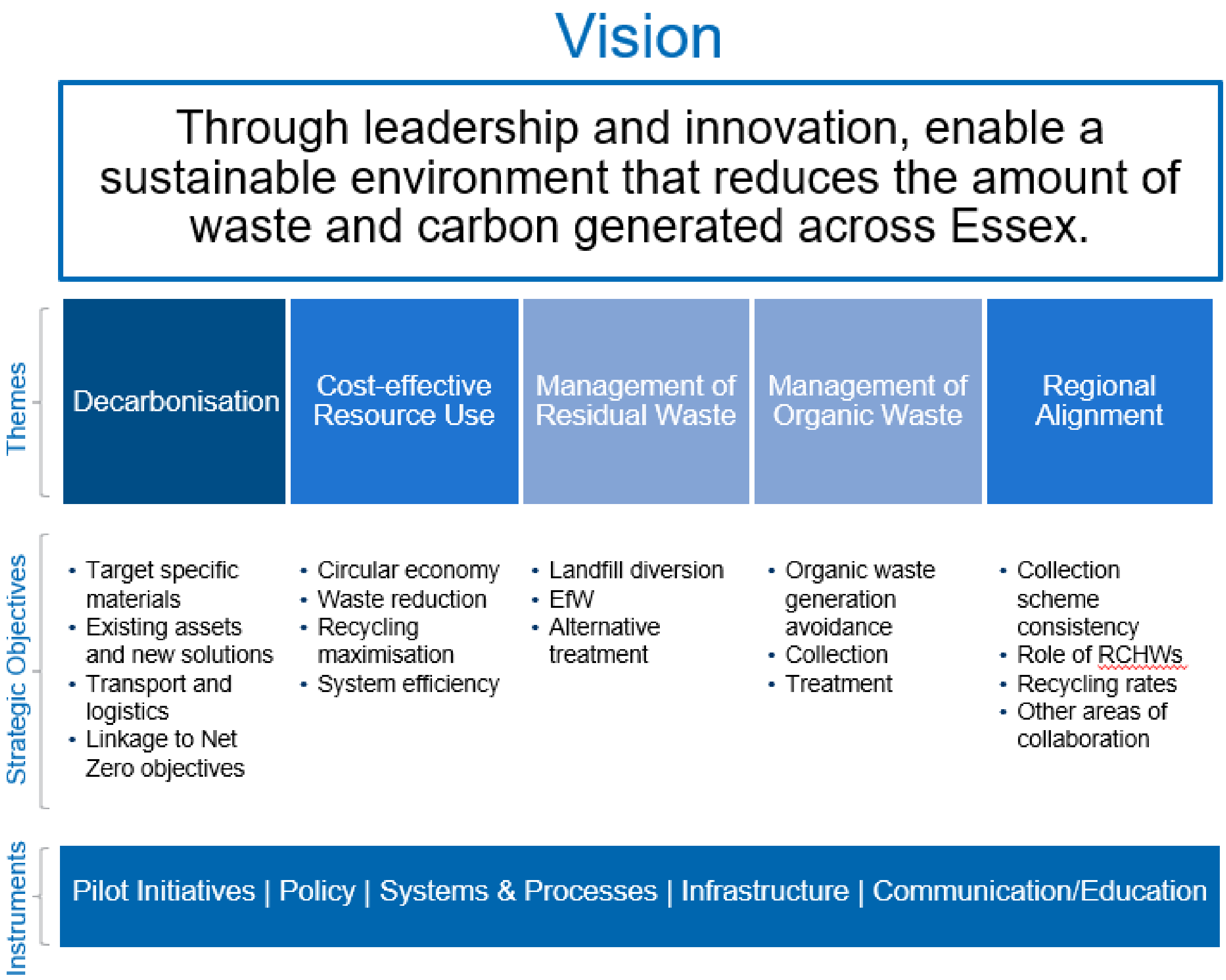
- regional alignment.

For each theme, strategic objective areas are identified and listed below each relevant box. The strategy should explain how the role of these and any targets or objectives to be achieved.

Finally, the box in blue at the bottom of the chart, represents the instruments and tools that will enable the implementation of the Waste Strategy for Essex.

It should be noted that the elements presented as part of the Strategic Framework in Figure 25: summarise what was discussed during the workshops and are not an exhaustive list of the themes and objectives that will be included in the Strategy. It is expected that further conversations will take place during the development of the Waste Strategy for Essex, and these will also be encompassed within the project.

Figure 25: Strategic framework



3. BENCHMARKING

3.1 DISTRICT COUNCIL BENCHMARKING

To establish each Council's current performance in comparison to the rest of the UK, a benchmarking exercise was performed using the local authority data in the WRAP LA portal.

The following section presents the analysis using quartiles; These are used to rank local authorities into four groups based on the performance data for each element of their service. Quartile 1 is the lowest quartile and represents the 25% of local authorities with the worst relative performance, whilst Quartile 4 represents the 25% of local authorities with the best relative performance. Quartiles 2 and 3 represent the remaining categories. It should be noted that the higher the tonnage of recycling collected, the higher the Quartile performance, whereas the opposite applies for residual waste, where the lower the weight of residual waste collected, the higher the Quartile performance.

The description of the quartiles is given in Table 3 below. The results of the recycling and residual waste benchmarking are presented using quartiles. For recycling, the higher the tonnage of the recycling collected, the higher the quartile performance, but for residual waste, the reverse is true.

Table 3: Benchmarking quartiles

Q1 Upper Limit	Performance places authority in bottom 25% of authorities
Q2 Upper Limit	Performance places authority in lower half (26%-50%) of authorities
Q3 Upper Limit	Performance places authority in upper half (51%-75%) of authorities
Q4 Upper Limit	Performance places authority in top 25% of authorities

Table 4 presents the yields for recyclables and residual waste for each council according to 2018-19 data from WRAP (which was the most up-to-date data available at the time of modelling). The colour coding for each cell represents the Quartile in which the outputs fit.

The WRAP benchmarking data used has a few limitations that are important to note:

- **Kerbside Waste Only**: WRAP's benchmarking data only looks at kerbside collected waste, which means that it does not consider recycling collected via bring banks or RCHWs. This puts local authorities that rely on bring banks or RCHWs at a disadvantage.
- **Yield Focus**: Since the benchmarking exercise focuses on recycling and residual waste *yields*, rather than *capture rates*, it highlights authorities that generate greater quantities of recycling as higher performers than those that generate lower quantities of recycling, even if the latter have higher capture rates. Ideally, benchmarking would look at performance in terms of capture rates as well, however this would require compositional data for the residual waste of all authorities, and this is not readily available.
- **Reliant on composition assumptions**: WRAP's benchmarking data relies on composition assumptions that WRAP has not published. There could be inaccuracies in these assumptions.

Table 4: WRAP LA portal benchmarking for each Council (based WRAP's data from 2018/19)

Yields (kg/hh/year)	Paper	Card	Cans	*Glass	Plastic Bottles	Mixed plastics	Plastic film	Textiles	Total Dry Recycling*	Residual waste	Yield as % of Total Waste
Basildon	93.7	32.7	10.0	54.6	14.4	5.7	5.0	0.4	211.0	476.6	30.7%
Braintree	88.0	30.7	9.4	0.0	13.5	5.3	2.3	0.0	146.9	464.3	24.0%
Brentwood	85.8	29.9	9.2	54.3	13.1	5.2	0.0	0.0	197.4	439.5	31.0%
Castle Point	91.8	32.0	9.8	55.5	14.1	5.6	0.0	1.1	208.8	407.3	33.9%
Chelmsford	48.8	40.2	7.4	62.2	16.2	8.3	6.4	0.3	183.0	431.2	29.8%
Colchester	63.0	29.7	11.5	53.0	17.3	8.8	6.8	4.1	183.3	264.1	41.0%
Epping Forest	92.8	34.4	11.3	58.4	15.3	6.0	2.5	0.1	218.1	386.3	36.1%
Harlow	96.3	31.5	8.6	56.9	13.0	0.0	0.0	0.0	206.3	374.7	35.5%
Maldon	87.4	30.5	9.3	63.2	13.4	5.3	0.0	0.0	209.1	295.4	41.4%
Rochford	95.6	35.4	11.6	60.1	15.7	6.2	0.0	1.3	224.7	329.3	40.6%
Tendring	43.3	20.4	7.3	0.0	10.2	0.0	0.0	0.0	81.1	504.6	13.8%
Uttlesford	109.7	40.6	13.3	69.0	18.1	7.1	3.0	0.0	257.8	445.9	36.6%

** Plastic film and textiles are excluded from this column as they are not commonly collected and would thus distort the benchmarking exercise*

The summary outputs from this exercise are:

- Uttlesford is the best performing council in Essex, according to the WRAP portal, with a total of 257.8 kg of recycling waste produced by each household each week. Rochford, Epping Forest and Basildon follow behind with 224 kg/hh/year, 218.1 kg/hh/year and 211.0 kg/hh/year recycling produced, respectively. Uttlesford and Rochford both have comingled recycling schemes, and Epping Forest and Basildon have twin-stream recycling schemes with just glass separated from a dry mixed recyclables collection. This supports the WRAP conclusion that the less the recyclable segregation required from residents, the greater the recycling yields residents will produce (see 4.3.1). However, when considering yield as a percentage of total waste, Colchester, Maldon and Rochford demonstrate higher performance than otherwise indicated when considering the yields alone.
- However, Tendring, which collects dry recyclables fortnightly, has the lowest total recycling yield of all councils in Essex, with 81.1 kg/hh/yr produced. It should be noted that the WRAP benchmarking data only considers the waste from kerbside collection, and since household glass recycling is collected at bring bank sites and not included in this benchmarking, Tendring is expected to perform better than that stated in Table 4.

- The next councils with lowest recycling yields are Chelmsford, Colchester and Brentwood at 183.0 kg/hh/yr, 183.3 kg/hh/yr, and 197.4 kg/hh/yr, respectively. These three councils collect recyclables in a multi-stream collection system. It can be concluded from the WRAP research 4.3.1 that the added responsibility of residents to separate recycling materials will produce lower recycling yields. However, this should be caveated with the possibility of recyclable materials being of higher quality due to the segregation and reduced contamination from this.
- Tendring produces the highest residual waste yield of all councils, according to WRAP with 504.6 kg/hh/yr, so hence are the worst performing council in Essex for residual waste collections. Basildon and Braintree follow behind Tendring with 476.6 kg/hh/yr and 464.3 kg/hh/yr of residual waste produced, respectively. Conclusions can be drawn from Basildon collecting residual waste weekly for all properties and Tendring and Braintree collecting residual waste weekly from flats. This supports the WRAP conclusion that more frequent collections of residual waste will produce higher waste yields.
- Colchester is the best performing council in terms of residual waste collection as the district has the lowest residual waste yield according to WRAP with 264.1 kg/hh/wk residual waste produced. Colchester's collection of dry recycling is a multi-stream collection system, so it can be said that the incentivisation of residents to recycle more diligently can also encourage residents to produce less residual waste.

As part of the Baseline benchmarking exercise, each Council's performance was measured against a set of comparator councils with similar waste collection schemes and similar demographics to the given council. The waste yields for the comparators were then used to benchmark each of the Councils' performances. The waste collection systems of comparators for each council are presented in Table 5.

Table 5: Characteristics of LA comparators for each Council

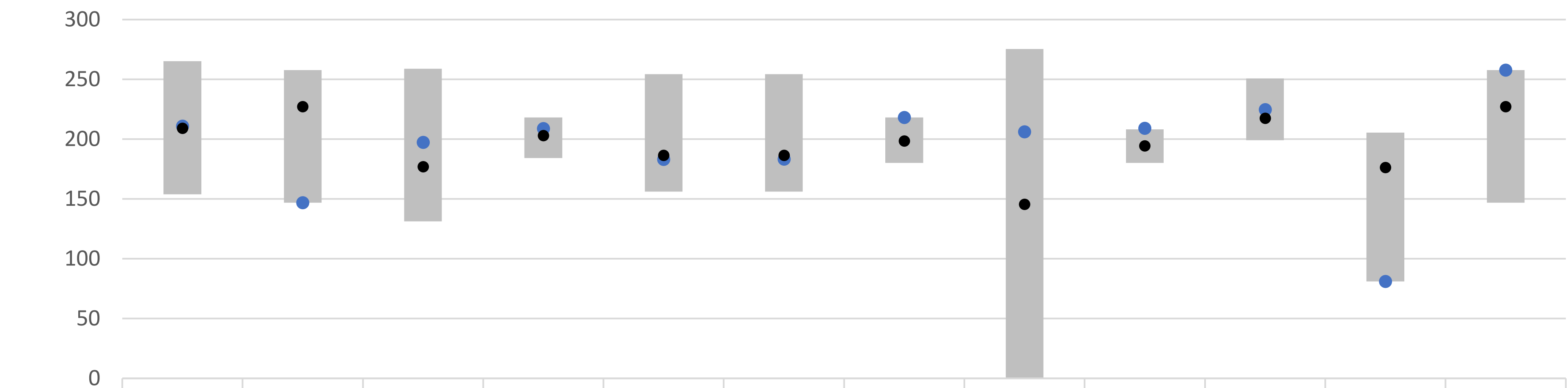
Authority	WRAP rurality	Residual	Dry recycling	Food waste	Garden waste	Number of comparators
Basildon	3 (mixed urban/rural, higher deprivation) Las categorised as rurality 4 (mixed urban/rural, lower deprivation) have been included in the list of comparators, since not enough rurality 3 comparators had been identified.	Weekly collections	Weekly collections	Weekly collections	N/A	5
Braintree	6 (predominantly rural, lower deprivation)	Fortnightly collections	Comingled, fortnightly collections	Weekly, separate collections	N/A	8
Brentwood	6 (predominantly rural, lower deprivation) Ruralities 2 (predominantly urban, lower deprivation) and 4 have been added to increase the number of comparators.	N/A	Weekly collections	Weekly, separate collections	N/A	6

Authority	WRAP rurality	Residual	Dry recycling	Food waste	Garden waste	Number of comparators
Castle Point	4 (mixed urban/rural, lower deprivation) Ruralities 6 have also been included in the list of comparators, since not enough rurality 4 comparators were identified.	N/A	Twin-stream, fortnightly collections	Weekly collections	N/A	4
Chelmsford	4 (mixed urban/rural, lower deprivation) Las categorised as rurality 5 (predominantly rural, higher deprivation) and 6 have been included in the list of comparators, since not enough rurality 4 comparators had been identified.	Weekly collections	N/A	Weekly, separate collections	N/A	7
Colchester	4 (mixed urban/rural, lower deprivation) Ruralities 2 and 6 have also been included in the list of comparators, since not enough rurality 4 comparators were identified.	Fortnightly collections	Multi-stream, fortnightly collections	Weekly, separate collections	N/A	6
Epping Forest	6 (predominantly rural, lower deprivation)	Fortnightly collections	Twin-stream, fortnightly collections	N/A	N/A	5
Harlow	3 (mixed urban/rural, higher deprivation) Rurality 1 (predominantly urban, higher deprivation) has been added to increase the number of comparators.	Fortnightly collections	Fortnightly collections	Weekly, separate collections	N/A	8
Maldon	6 (predominantly rural, lower deprivation)	Fortnightly collections	N/A	Weekly, separate collections	N/A	24
Rochford	4 (mixed urban/rural, lower deprivation)	Fortnightly collections	Comingled, fortnightly collections	Weekly mixed collections	Weekly mixed collections	5
Tendring	5 (predominantly rural, higher deprivation)	Fortnightly collections	Fortnightly collections	Weekly, separate collections	N/A	5

Authority	WRAP rurality	Residual	Dry recycling	Food waste	Garden waste	Number of comparators
Uttlesford	6 (predominantly rural, lower deprivation)	Fortnightly collections	N/A	Weekly, separate collections	N/A	25

Figure 26 shows each Councils' performance in dry recycling collection when benchmarked against their comparators.

Figure 26: Total dry recycling yield (kg/hh/yr) – Local Authority comparators against each Council

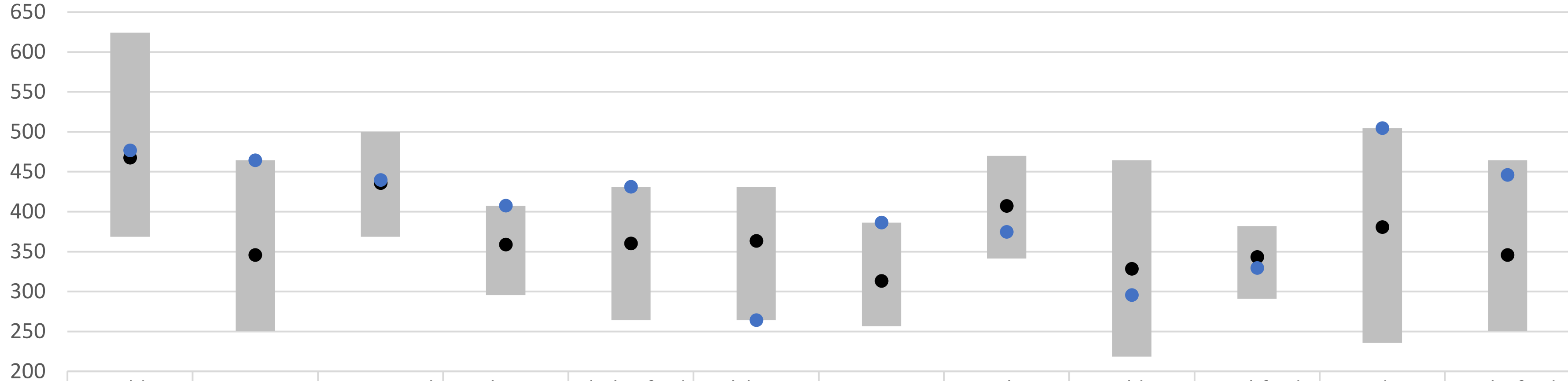


	Basildon	Braintree	Brentwood	Castle Point	Chelmsford	Colchester	Epping	Harlow	Maldon	Rochford	Tendring	Uttlesford
Range	111.3	110.9	127.5	33.8	98.2	98.3	38.0	275.3	28.1	51.6	124.5	110.9
Minimum	153.9	146.9	131.3	184.3	156.2	156.2	180.1	0.0	180.1	199.1	81.1	146.9
Council	211.0	146.9	197.4	208.8	183.0	183.3	218.1	206.3	209.1	224.7	81.1	257.8
Average	209.2	227.2	177.0	203.1	186.5	186.5	198.4	145.6	194.4	217.5	176.2	227.2

Note that both Tendring and Braintree do not collect glass at the kerbside. This is likely to be why their performance is at the bottom of the comparator range and, as detailed previously, this is a limitation of the WRAP tool.

Figure 27 shows each Councils' performance in terms of residual waste yields when benchmarked against their comparators.

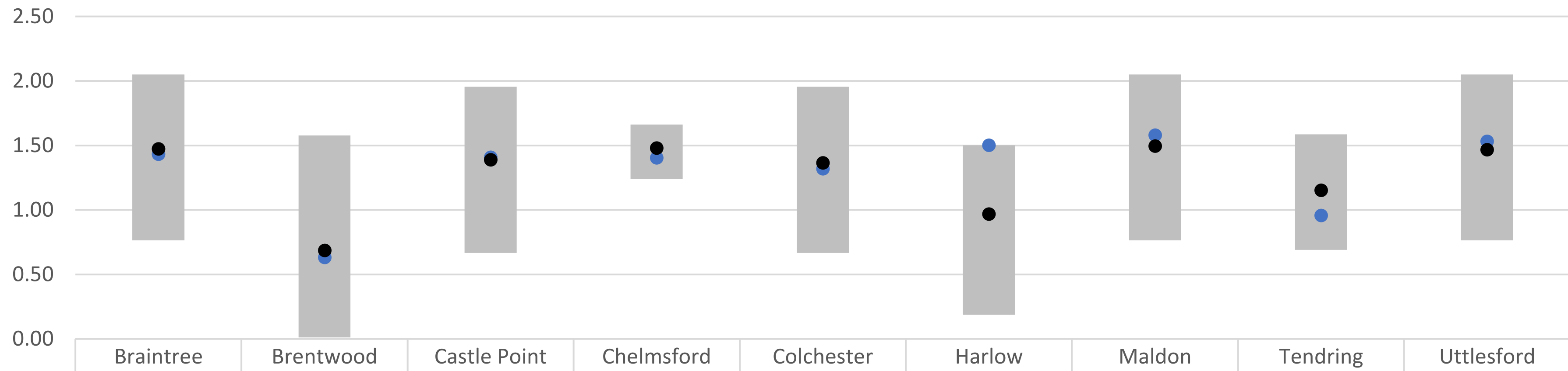
Figure 27: Total residual waste yield (kg/hh/yr) – Local Authority comparators against councils



	Basildon	Braintree	Brentwood	Castle Point	Chelmsford	Colchester	Epping	Harlow	Maldon	Rochford	Tendring	Uttlesford
Range	255.5	213.6	131.1	111.9	167.1	167.1	129.7	128.7	245.9	91.1	268.7	213.6
Minimum	368.7	250.7	368.7	295.4	264.1	264.1	256.6	341.3	218.3	290.8	235.9	250.7
Average	467.5	345.5	435.6	358.6	360.1	363.5	313.1	407.1	328.2	343.0	380.7	345.5
Council	476.6	464.3	439.5	407.3	431.2	264.1	386.3	374.7	295.4	329.3	504.6	445.9

Food waste benchmarking data has also been provided by WRAP and has been used to benchmark each Councils' food waste yields against other local authorities with similar characteristics This is shown in depth in Appendix 4. Figure 28 shows a summary of the food waste benchmarking results. Note that Basildon, Epping Forest and Rochford are not included in this figure as these Councils have a mixed organics collection, so individual food waste yields are not available from the WRAP data.

Figure 28: Food waste yield (kg/hh/wk) – Local Authority comparators against Councils



	Braintree	Brentwood	Castle Point	Chelmsford	Colchester	Harlow	Maldon	Tendring	Uttlesford
Range	1.29	1.57	1.29	0.42	1.29	1.31	1.29	0.90	1.29
Minimum	0.76	0.01	0.67	1.24	0.67	0.19	0.76	0.69	0.76
Council	1.43	0.63	1.41	1.40	1.32	1.50	1.58	0.96	1.53
Average	1.47	0.69	1.39	1.48	1.36	0.97	1.50	1.15	1.47

Noting the limitations of this method, the conclusions from the benchmarking exercise using WRAP's data (from 2018-19) are as follows:

- Basildon is performing well relative to its baseline comparators in terms of dry mixed recycling and residual waste.
- Braintree's dry recycling performance is lower than average compared with similar authorities operating similar schemes. This is partly because Braintree's glass is collected via bring banks, and so the benefits of glass recycling are not accounted for in the benchmarking data. The other reason for Braintree's below-average performance is low capture rates in general for dry recyclables. It is worth noting that the quartiles are very close together, so it would not take a significant amount of effort for Braintree to improve its relative performance. Braintree's residual waste arisings are very high; however, whilst Braintree's food waste performance is around average.
- Brentwood is performing well relative to its baseline comparators, with dry recycling in the upper half of comparators. The residual yields are also in the upper half. Brentwood is performing well in some dry recyclables, paper, cans, glass, and plastic bottles, with its overall performance within the top quartile. Brentwood's food yields are slightly lower than the average of the Las it was benchmarked against, accounting for 0.63 kg/hh/week.
- Castle Point's performance is lower than the average of its comparators. Moreover, Castle Point has higher residual yields than its comparators, indicating that the lower dry recycling yields are not due to lower overall waste generation. Food waste yields are just above average.

- Similar to Castle Point, Chelmsford's recycling performance is below the average of its comparators. Chelmsford also has higher residual waste yields than its comparators, indicating that the lower dry recycling yields are not due to lower overall waste generation.
- Colchester is performing very well in some dry recyclables, collecting more paper, cans, plastic film, glass and textiles than the average of its comparators. Its overall performance is slightly below average; this is due to poorer performance in card. However, Colchester performs very well in residual waste yields, generating less residual waste than all the authorities it was benchmarked against.
- Epping Forest is performing very well relative to its baseline comparators. However, Epping Forest's residual arisings are higher than the average of its comparators, indicating high engagement with the recycling scheme but also high levels of waste generation.
- Harlow is performing well relative to its baseline comparators. Harlow's food yields are above the average of the Las it was benchmarked against, accounting for 1.5 kg/hh/wk.
- Maldon is performing well relative to its baseline comparators. Maldon's food yield is slightly higher than the average of the Las it was benchmarked against, accounting for 1.6 kg/hh/wk.
- Rochford performs better than the average of the comparators it was benchmarked against, both in terms of recycling performance and residual waste arisings. Rochford's residual waste yield is lower than the average of the analysed authorities.
- Tendring's recycling collection performance via the kerbside is lower than the average of the local authorities it was benchmarked against. This is affected by the fact that some recyclables such as glass, plastic film and textiles are not collected by the council via this route. Tendring is also performing worse than its comparators in terms of residual waste arisings, with a higher generation than the average of its comparators. Tendring's food yields are above the average of the Las it was benchmarked against, accounting for 0.96 kg/hh/wk.
- Uttlesford's dry recycling yields are higher than all the local authorities it was benchmarked against, with the exclusion of textiles which are not collected by kerbside collections however, Uttlesford generates more residual waste than its comparators. Uttlesford's food yields are slightly above average of the Las it was benchmarked against, accounting for 1.53 kg/hh/wk.

3.2 RCHW BENCHMARKING

ECC's RCHW performance has also been benchmarked against their nearest geographical neighbours using FY 2020/21 data from Waste Data Flow[7]. Table 6 presents the total recycling/reuse rate of ECC's RCHW sites and those of its neighbours.

Table 6: RCHW site benchmarking against close neighbours

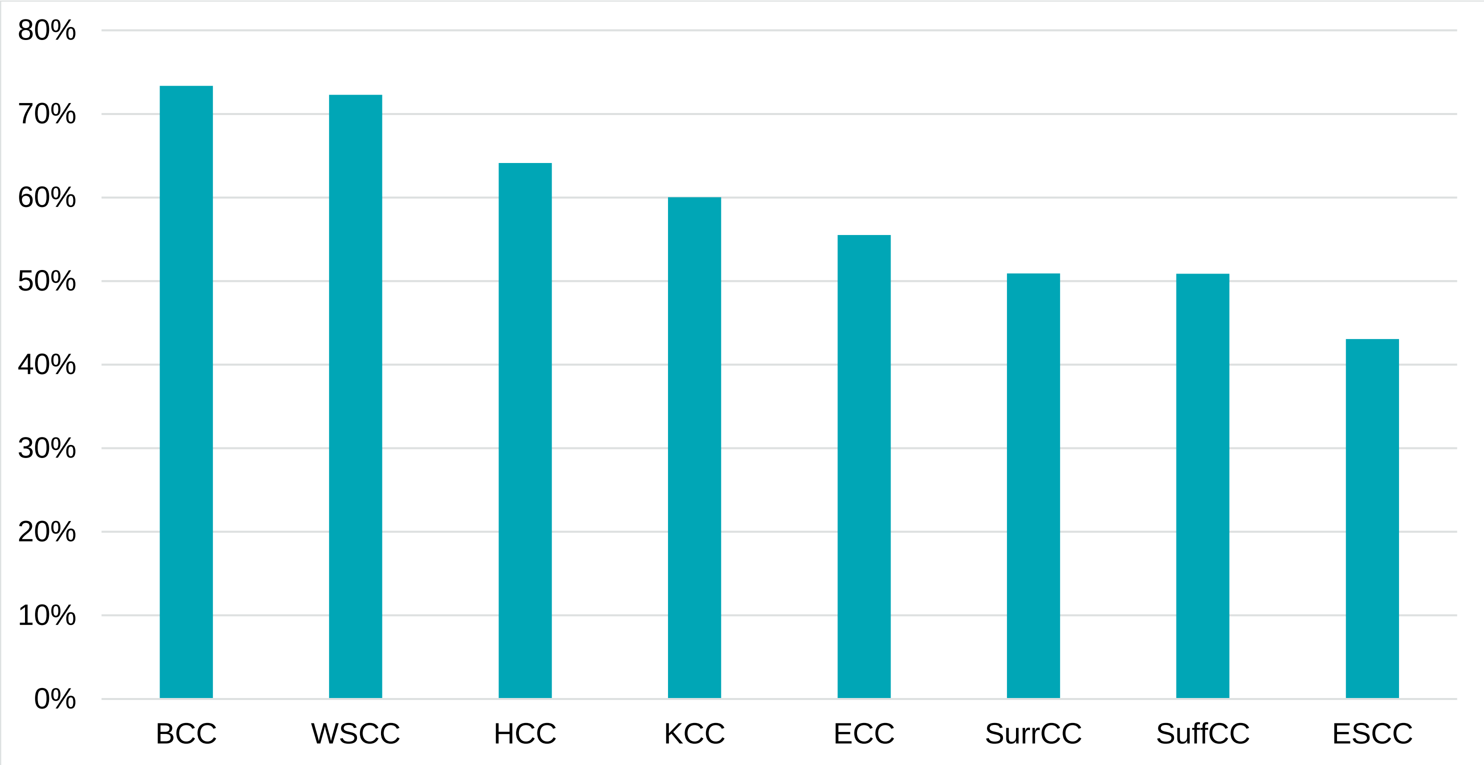
Authority	Abbreviation	Recyc/Reuse %	Total Recyc/Reuse (tonnes)	Total Disposed (tonnes)	Total Waste (tonnes)
Buckinghamshire Council	BCC	73%	29,440	10,684	40,125
West Sussex County Council	WSCC	72%	62,055	23,775	85,830
Hertfordshire County Council	HCC	64%	44,072	24,643	68,715
Kent County Council	KCC	60%	43,656	29,064	72,720
Essex County Council	ECC	55%	50,320	40,352	90,672
Surrey County Council	SurrCC	51%	36,937	35,586	72,523
Suffolk County Council	SuffCC	51%	20,317	19,614	39,931
East Sussex County Council	ESCC	43%	16,975	22,456	39,430

Buckinghamshire council has the highest recycling rate of 73%. East Sussex County Council has the lowest recycling rate of 43%. Compared with its neighbours, Essex's RCHW performance is around average. It is possible that in areas where collection authorities (i.e., districts and boroughs) are high performers, the RCHWs in the area (whose performance counts towards the respective county or waste disposal authority), may not perform as well.

Figure 29: presents the comparison of recycling/reuse rates of ECC and its comparators graphically.

[7] WasteDataFlow Waste Management

Figure 29: RCHW Recycling Rate Comparison (FY20-21)



4. BASELINE OUTCOMES

The Baseline model represents each WCA's current service. This acts as a representation of each Council's core waste collection services (but excludes non-core elements such as bulky waste, clinical waste, fly-tipping or street cleansing collections). The Baseline is calibrated to represent, as closely as possible, the resources utilised by each of the WCA's (vehicles, staff, containers), the tonnages of each material stream collected, the collection methodology and the costs, capital and revenue, incurred by the service.

While care was taken to attempt to build an accurate picture of each WCA's gross collection costs in a bottom-up manner, the modelled baseline costs will not necessarily reflect the budgeted expenditure contained within each authority's financial accounts. This is due to a number of reasons, including:

1. This study has focussed on part of the service portfolio (kerbside) only which means that proportions of shared costs across waste services have been estimated and allocated.
2. Each authority has a different approach to the application and accounting of central support costs, and for modelling purposes a uniform estimation approach has been used.
3. For modelling purposes, the capital costs associated with vehicle and container purchasing have been annualised and depreciated in a simple manner and in reality, this could look different for each authority.
4. Authorities' services investment spending cycles vary.
5. Operations have been simplified in order to model them in a bottom-up manner.

For these reasons, baseline modelled costs may look different from actual accounted costs. However, since the purpose of modelling baseline costs is purely to provide a comparison for the scenario modelling results and indicate the direction and scale of change in costs, these differences are not deemed to be material.

The agreed waste composition data[8] for both the recycling and residual streams is utilised to determine the tonnage of recyclates collected and, importantly, the tonnage of recyclates left in the residual stream. The tonnage of recyclates left in the residual waste stream is used along with the outcomes of the benchmarking exercise, coupled with an analysis of yields presented by WRAP's Indicative Cost and Performance (ICP) tool, to estimate the potential yields of dry recyclate and food waste to be modelled. This ensures that the modelling of increased yields is based on material which is available to capture and checked against the reality of current performance for each WCA.

Producing Baseline models that try to reflect each Councils' current collection service and their specific operations acts to calibrate the models used so that the scenario modelling will be more useful. Secondly, presenting the baseline models' outputs to the councils and agreeing that these adequately reflect their current services provides great value and confidence in these models' outputs.

The current Baseline is shown as a comparator against which each of the scenarios modelled can be compared. However, the scenario models will also show the projected performance and costs of the current services for the financial year (FY) in 2027-2028: this is included in the scenario modelling as scenario 0+. This mirrors the modelling of each of the scenarios, which are also based on the assumptions of service provision for FY 2027/28.

Accurate baseline models that reflect the Councils' realities in FY 2020-2021 need to provide confidence in the reliability of the outputs; to this end, extensive research and analysis was carried out with each of the WCAs to obtain, analyse check and validate the operational data provided as much as possible. However, it should be recognised that there will be limitations and the modelling is not intended to provide a precise costing of each service.

Six separate models are used in the baseline modelling process. The process models the waste flow calculations, waste collection resources, collection and treatment costs for each Council's current collection system in the baseline year – FY 2020-2021. After modelling each WCA separately, the results were combined to examine the overall costs experienced by the EWP in delivering waste services. The Baseline modelling stage is important as the results will reflect the current state of play for each council. This modelling will focus on the core household collections (household residual, dry recycling and organics) only.

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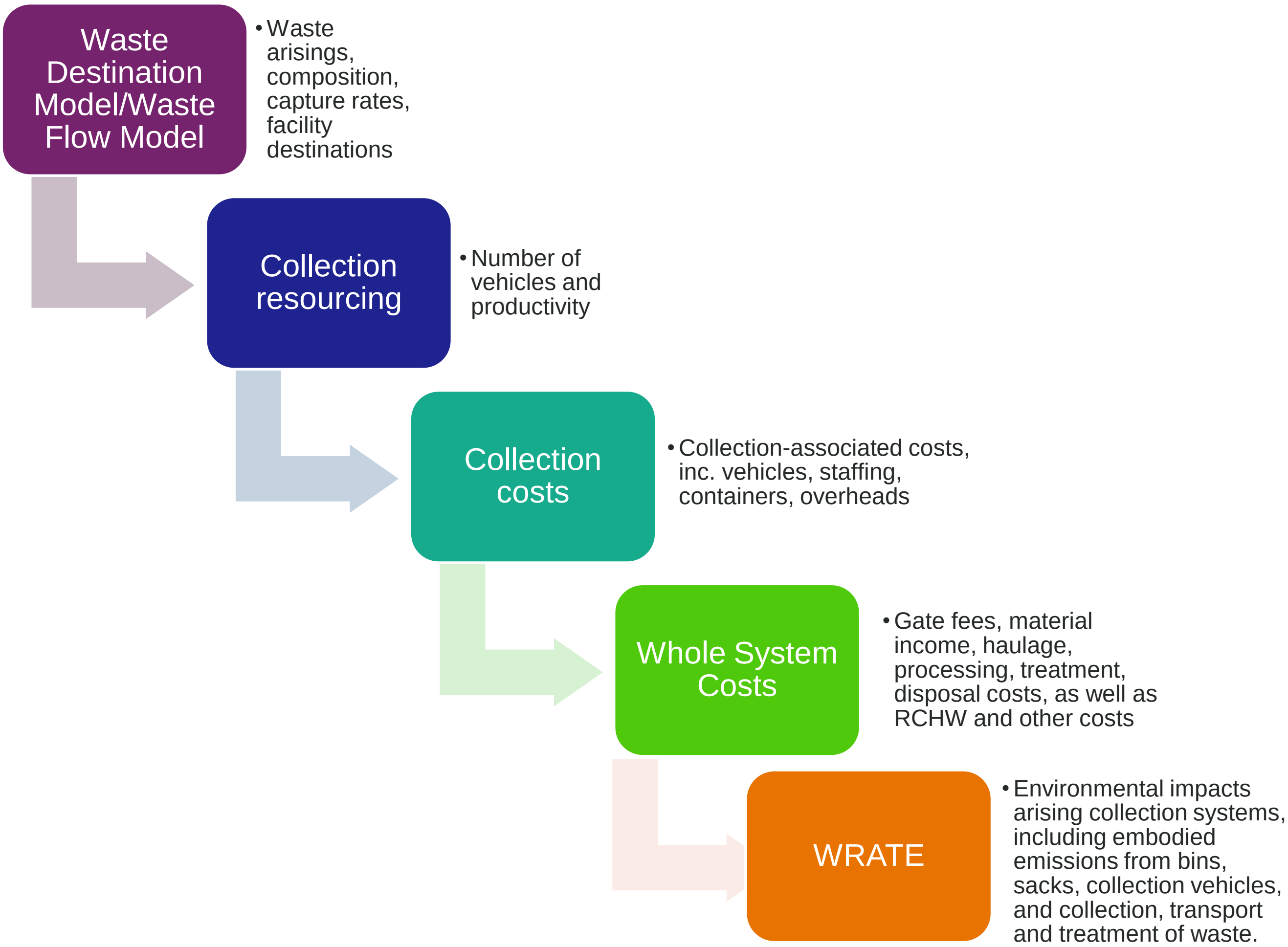
[8] Data from ECC's waste sampling project.

Figure 30 demonstrates the different models used for the baseline modelling, with an explanation of each element below.

Figure 30: Modelling Method



A brief outline of the development and purpose of each stage identifies the overall methodology:

- **Waste Destination Model (WDM)** – This model calculates Key Performance Indicators and maps the waste flow of a Local Authority. The model calculates the total tonnes moving from generation to each transfer point, to each processing point and finally to end destinations (i.e., landfill, recycling, energy from waste). It also allows forecasting up to 2055 based on household growth, tonnages growth for other reasons, compositional changes and the introduction of a Deposit Return Scheme (DRS). The WDM examines all waste and recycling collected by local authorities, also known as Local Authority Collected Waste (LACW). This includes the core household collections (refuse, dry recycling, garden, food), as well as other streams such as street cleansing waste, litter bins, fly-tipped waste, bulky waste, local authority commercial collections and others. The waste streams that are not core household collections have been included in the WDMs to examine overall performance as accurately as possible, but they have been excluded in the examination of resources and cost modelling for simplicity and practicality.
- **Waste Flow Model (WFM)** – Provides the waste flow calculations for kerbside collected waste for each WCA for the baseline year and each of the agreed scenarios. This model focuses on only the core collections (household refuse, dry recycling, garden and food), for the purpose of examining changes to resources required and the associated costs.

- **Collection Resourcing Model (Collection Resources)** – Calculates the number of vehicles and productivity for a collection system for a specific WCA for the baseline year and each of the agreed scenarios.
- **Gross Collection Costs Model (Collection Costs)** – This model calculates the collection costs for a kerbside collection system based on the number and type of vehicles, staffing levels, number and type of containers and other assumptions relating to overheads for a specific WCA for the Baseline year and each of the agreed scenarios.
- **Whole System Costs Model (WSCM)** – Provides the total costs of collection, processing, treatment and disposal of waste for the baseline year and each of the agreed scenarios. This includes costs associated with haulage, transfer, RCHW operations, as well as other management costs and inter-authority costs.
- **Waste and Resource Assessment Tool for the Environment (WRATE)** – originally developed on behalf of the Environment Agency. It has been regularly utilised since its' development to estimate the environmental impacts arising from waste management systems, including embodied emissions from bins, sacks, collection vehicles, and collection, transport and treatment of waste.

The input for each model is based on information provided by the councils. Once the baseline models were completed and results agreed with each of the councils, the modelling process was repeated, but to model the agreed set of scenarios for FY 2027-2028.

4.1 CURRENT COLLECTION SYSTEMS

For the reference of each council, a summary of the number of households and waste collection systems currently utilised by each WCA (as at the baseline year of 2020/21) are presented in Table 7 below. Note that, since the study was completed, some councils (e.g. Basildon) have made significant changes to their services, whilst others have confirmed some service changes. The collection vehicles utilised by each of the WCAs are presented in Table 8. Note that the vehicle specifications inputted into the Collection Resources model use the specification provided by the Councils. In cases where a Council has not provided vehicle specifications, Ricardo's vehicle specification database has been used.

Table 7: High-level summary of each Council's current waste collection systems

Authority	Households	Residual	Dry Recycling	Food waste	Garden waste
Basildon	78,000	Weekly collection in black sacks	Twin-stream: Weekly collection of dry mixed recycling in sacks Fortnightly collection of glass in boxes	Weekly collections of mixed organics in wheeled bins	
Braintree	65,910	Standard properties – fortnightly collection Flats – weekly collection Wheeled bins	Comingled: Dry mixed recycling excluding glass collected in clear sacks Standard properties – fortnightly collection Flats – weekly collection	Weekly collections in food waste caddies	Fortnightly collection in wheeled bins
Brentwood	39,510	Weekly collection in sacks	Multi-stream: Alternate weekly collections of cans and plastics in sacks, and paper and card in sacks Fortnightly collection of glass in boxes	Weekly collections in food waste caddies	Fortnightly collection in wheeled bins or single use biodegradable sacks
Castle Point	36,824	Fortnightly collection in sacks	Twin-stream: Fortnightly collections of dry mixed recycling in sacks and glass in boxes	Weekly collections in food waste caddies	Weekly collection in wheeled bins
Chelmsford	77,768	Standard properties – fortnightly collection Flats – weekly collection Wheeled bins	Multi-stream: Fortnightly collections of plastics in non-reusable bags, paper in sacks, cardboard	Weekly collections in food waste caddies	Fortnightly collection in wheeled bins

Authority	Households	Residual	Dry Recycling	Food waste	Garden waste
			in sacks, and dry mixed recyclables (metal, glass, WEEE, textiles) in boxes		
Colchester	85,298	Standard properties – fortnightly collection Flats – weekly collection Sacks and wheeled bins	Multi-stream: Metals, paper and card, glass, and plastics separated out. Standard properties – fortnightly collections of each recyclable. Metals and glass in boxes, and paper and card, and plastics in clear sacks Flats – weekly collections of each recyclable in wheeled bins.	Weekly collections in food waste caddies	Fortnightly collection in wheeled bins
Epping Forest	57,089	Fortnightly collection in wheeled bins	Twin-stream: Fortnightly collections of dry mixed recycling in sacks and glass in boxes	Weekly collections of mixed organics in wheeled bins	
Harlow	39,326	Standard properties – fortnightly collection Flats – weekly collection Wheeled bins	Comingled: Fortnightly collections of dry mixed recycling in wheeled bins or boxes	Weekly collections in food waste caddies	Fortnightly collection in wheeled bins or sacks
Maldon	28,784	Fortnightly collection in wheeled bins	Twin-stream: Fortnightly collections of dry mixed recycling in sacks and glass in boxes	Fortnightly collections in food waste caddies	Weekly collection in wheeled bins
Rochford	36,286	Fortnightly collection in wheeled bins	Comingled: Fortnightly collections of dry mixed recycling in wheeled bins	Weekly collections of mixed organics in wheeled bins	
Tendring	72,200	Standard properties – fortnightly collection Flats – weekly collection Sacks and wheeled bins	Twin stream: Alternate weekly collection of plastics and metals in boxes, and paper and card in boxes	Weekly collections in food waste caddies	Fortnightly collection in wheeled bins
Uttlesford	38,000	Fortnightly collection in wheeled bins	Comingled:	Weekly collections in food waste caddies	Fortnightly collection in wheeled bins

Authority	Households	Residual	Dry Recycling	Food waste	Garden waste
			Fortnightly collection of dry mixed recycling in wheeled bins		

Table 8 shows the vehicle resources currently utilised by each of the WCAs for waste collection.

Table 8: Current collection vehicles utilised by each Council

Authority	Residual	Dry Recycling	Food waste	Garden waste
Basildon	26T RCV open back	26T RCV open back	26T RCV open back	
Braintree	26T RCV open back	26T RCV open back	7.5T Plastic bodied utility vehicle	26T RCV open back
Brentwood	26T RCV open back	26T RCV open back	7.5T Plastic bodied utility vehicle	26T RCV open back
Castle Point	26T RCV open back	26T RCV open back – Comingled DMR 18T Toploader – Glass	12T small RCV	26T RCV open back
Chelmsford	26T RCV open back	Plastics and paper waste – 26T Twin Pack (70:30) Cardboard – 26T RCV open back DMR – 12T Toploader	12T small RCV	26T RCV open back
Colchester	26T RCV open back	Standard properties – 26T 50:50 open splitter Flats – 26T 70:30 triple lift	*11T side pod FW vehicle 7.5T side pod FW vehicle	26T RCV open back
Epping Forest	Standard properties and flats – 26T RCV open back Rural properties – 15T small twin pack	Comingled DMR and Glass: Standard properties and flats – 26T Twin Pack Rural properties – 15T Twin Pack	26T RCV open back	
Harlow	26T RCV open back	26T RCV open back	12.5T food waste vehicle	26T RCV open back
Maldon	26T RCV open back	26T RCV + pod	7.5T food waste vehicle	26T RCV open back

Authority	Residual	Dry Recycling	Food waste	Garden waste
Rochford	*Combination of: 26T RCV open back 18T RCV open back 14T RCV open back	*Combination of: 26T RCV open back 18T RCV open back 14T RCV open back	*26T RCV open back 14T RCV open back	
Tendring	26T RCV open back	Splitback 26T 70:30	Co-collected with dry recyclables	26T RCV open back
Uttlesford	32T Large Twin Pack	32T Large Twin Pack	Co-collected with dry recyclables and residual waste	26T RCV open back

**For collections with different vehicle types used on the same rounds, a modelled vehicle is used with the vehicle specification averaged across the different vehicle types.*

4.2 BASELINE MODELLING ASSUMPTIONS

Where operational data (residual waste composition, vehicle payloads, distances to and from depot/tipping points, speeds, times etc) was not available from councils, industry averages and/or Ricardo's database were used to calibrate the model to best represent the specific Council's current operations.

High level assumptions were also required, covering household growth and type, the impact of Covid, the impact of the introduction of the requirements of the Resource & Waste Strategy and Environment Act (DRS, Extended Producer Responsibility, the collection of plastic films, textiles and small WEEE from 2027), the introduction of free, universal garden waste collections and cost inflation.

Details of all assumptions made for the modelling have been collated and listed in section 6.2 – Scenario Modelling Assumptions.

4.3 BASELINE OUTCOMES

4.3.1 Capture rates

Based on experience and data from Ricardo's previous modelling scenarios, and utilising trend data from WRAP, the dry recycling collection scenarios available to WCAs are effectively, co-mingled, twin-stream and multi-stream collections. Each scenario has benefits and disadvantages, which are largely related to the ease of use for residents, quantity and the quality of the material collected.

The capture rate for each material stream is the proportion of the available material which is collected by the recycling collection. It is the proportion of the total amount of material available. The total amount of each material stream is the total of the quantity captured for recycling added to the volume of the material remaining in the residual stream (based on the composition of the residual stream). Each collection methodology achieves differing capture rates.

Co-Mingled: From the perspective of the resident, a co-mingled collection represents the most convenient recycling methodology, with all dry recyclate simply placed in a single container, maximising participation and yield. This is often the least expensive collection methodology, as a standard RCV can be utilised for collections, and transfer, storage and transport of the recyclate is straightforward. However, this methodology tends to attract the highest level of contamination, as there is no requirement for residents to consider what they are putting in the container.

Twin-Stream: Twin-stream collections (either paper out or glass out) require residents to segregate their recyclate and use two containers. This additional requirement leads to residents taking more care when recycling, lowering contamination; however, the extra effort can reduce participation and yield. Collection costs are higher, due to the need for split-bodied vehicles and/or additional staff. Transfer, storage and transport of the recyclate may be less straightforward, as two streams of material are involved.

Multi-stream; by requiring residents to fully segregate their recyclate into different containers, contamination levels are substantially reduced, as the contamination is far easier to observe. However, this additional effort tends to reduce participation. Collection costs are higher, due to the need for more complex vehicles with multiple compartments (which often have lower capacity) and/or additional staff. Transfer, storage and transport of the recyclate will be less straightforward, as multiple streams of material are involved.

From the perspective of the net value and marketability of the collected recyclate, each collection methodology will require a differing approach to delivering high quality recyclate to the market:

Co-Mingled: The mixed recyclate will need to be sent to a sorting facility (Materials Recycling Facility, or MRF). Through a mixture of mechanical, and manual sorting, each material stream will be separated out, including any contamination or non-target materials (materials which may be recyclable but for which there is no current market). Modern MRFs have the capability to sort recyclate to a high standard, which should ensure the marketability and value of the sorted materials is maintained. However, there will be a cost (a gate fee) for the sorting, and there will also be a cost for the disposal of the segregated contamination and non-target materials, which will be treated as residual waste. In terms of the cost of dealing with the collected material, this will be the most expensive option.

Twin-Stream: The material (paper or glass) collected as a single stream may require moderate sorting to ensure the quality is appropriate for the market, but this will be a simpler (and less expensive) operation than a full MRF option. The remaining materials from the second stream will need to be sent to a Materials Recycling Facility as above. However, as one of the main material streams (either glass or paper) has already been removed at source, this will be a simpler process, the gate fee should be lower. Again, there will also be a cost for the disposal of the segregated contamination and non-target materials, which will be treated as residual waste; however, as the level of contamination will be lower, this will be less expensive. In terms of the cost of dealing with the collected material, the cost will be lower than for a co-mingled collection.

Multi-stream; As each material stream is collected separately, and the majority of contamination is removed during the collection process, each material stream should only require very moderate sorting to ensure the quality is appropriate for the market. This approach ensures the quality of the material is maximised, whilst the cost of managing any contamination will be minimal. The cost of dealing with the collected material will thus be the lowest of the three options.

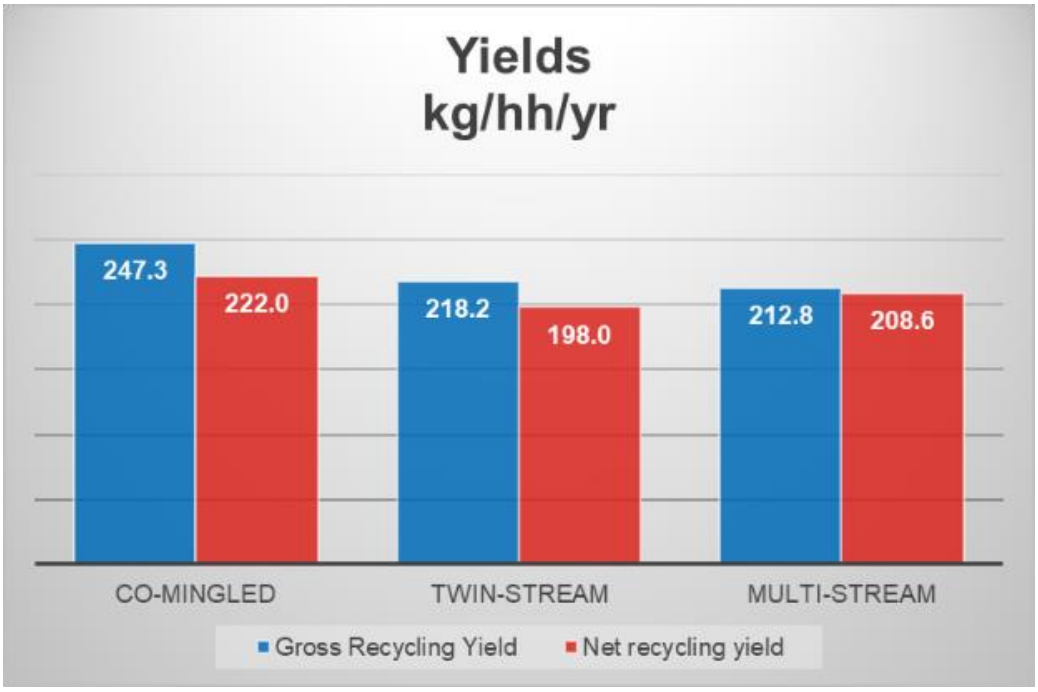
Table 9 summarises these trends, whilst Figure 31 illustrates data provided by WRAP which shows the indicative yields for each collection methodology, including gross yields (including contamination) and the net recycling yields once contamination has been removed.

From a modelling perspective, lower costs have been modelled for the sorting and processing of separately collected materials, compared with the costs of sorting and processing co-collected materials – this is in line with industry experience. It is possible that higher material incomes can also be achieved through separate collections, compared with co-collected materials. However, higher material incomes have not been modelled because there is limited evidence regarding differences in income levels from differing collection methodologies, perhaps due to the volatility of the markets.

Table 9: Summary of Indicative Cost & Performance

	Participation	Contamination	Cost	Net Recycling Yield (ex contamination)
Co-mingled	Highest	Highest	Lowest	Highest
Twin-stream	Medium	Medium	Medium	Lowest
Multi-stream	Lowest	Lowest	Highest	Medium

Figure 31: Summary Data from WRAP Indicative Cost & Performance Tool



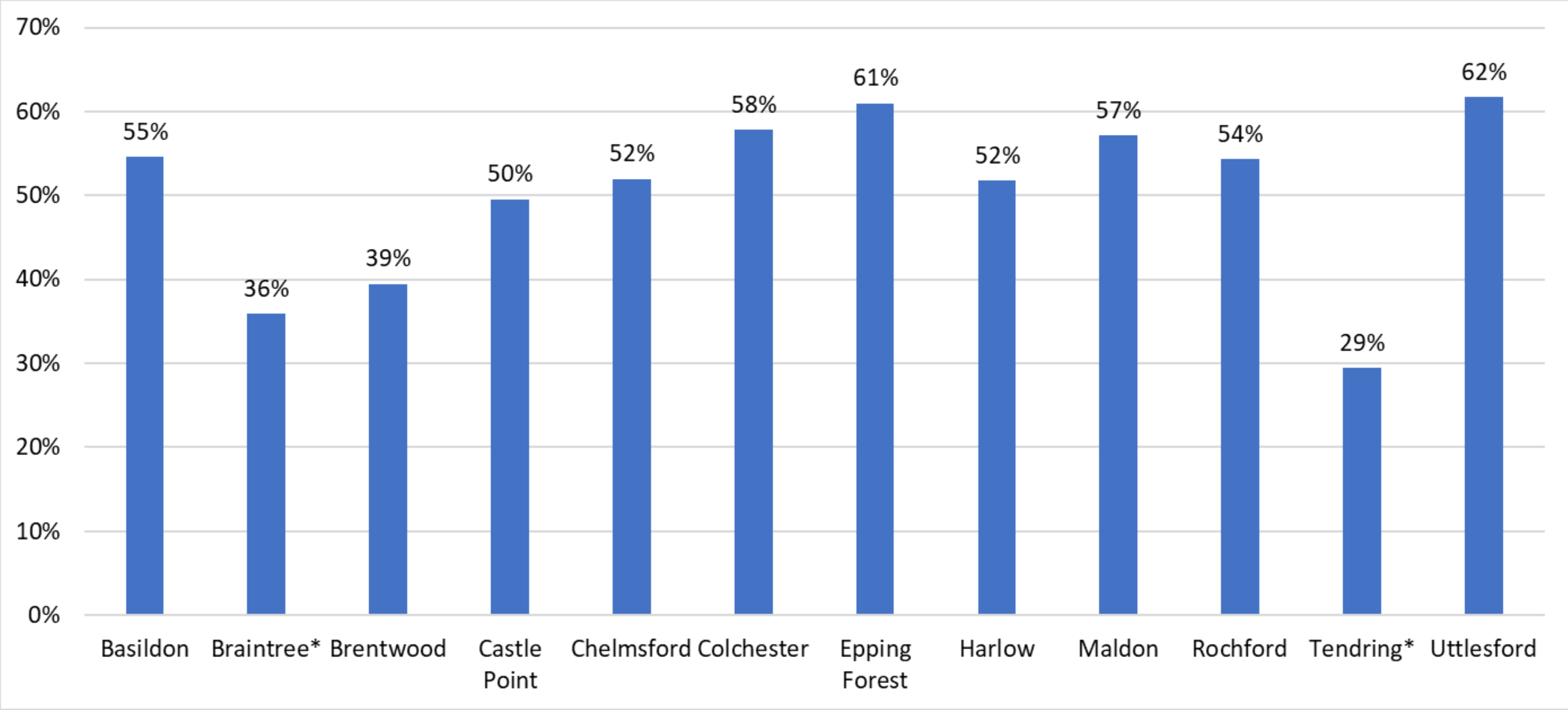
4.3.2 Capture Rates WFM

Using the household waste stream tonnage, waste composition and number of households provided by each council, the WFM outputs generate the capture rate for each recyclable material for each of the councils. Table 10 presents these figures for each council, along with the overall capture rate of the dry recyclables, which are also displayed in Figure 32.

Table 10: Baseline capture rates of recyclables for each council

Material	Basildon	Braintree	Brentwood	Castle Point	Chelmsford	Colchester	Epping Forest	Harlow	Maldon	Rochford	Tendring	Uttlesford
Recyclable paper	83%	78%	73%	79%	65%	84%	89%	74%	89%	83%	77%	90%
Recyclable card & cardboard	69%	58%	55%	66%	77%	70%	78%	84%	53%	72%	60%	82%
Cartons	0%	0%	0%	0%	84%	0%	0%	0%	0%	0%	0%	0%
Plastic films	0%	5%	0%	10%	4%	0%	0%	0%	5%	0%	0%	0%
Plastic bottles	79%	60%	48%	43%	76%	79%	81%	64%	79%	50%	65%	84%
PTTs	35%	55%	24%	33%	25%	40%	43%	16%	4%	25%	0%	36%
Other dense plastic	0%	0%	0%	23%	0%	0%	0%	0%	0%	59%	0%	0%
Recyclable glass	76%	0%	78%	83%	84%	86%	19%	79%	86%	82%	0%	68%
Ferrous	65%	43%	21%	40%	53%	61%	58%	44%	29%	51%	52%	61%
Non-ferrous	49%	43%	22%	55%	37%	45%	41%	28%	17%	46%	36%	44%
Textiles	0%	0%	3%	0%	3%	7%	5%	0%	0%	5%	0%	0%
WEEE	0%	0%	0%	0%	17%	0%	7%	0%	0%	0%	0%	0%
Garden waste	94%	91%	84%	88%	92%	89%	92%	52%	92%	93%	78%	85%
Food waste	24%	38%	24%	44%	46%	53%	45%	45%	51%	50%	41%	49%
Overall Capture Rate (excl organics)	**55%**	**36%**	**39%**	**50%**	**52%**	**58%**	**61%**	**52%**	**57%**	**54%**	**29%**	**62%**

Figure 32: Overall dry recycling capture rate (excluding organics) for each council (kerbside only; excludes materials collected at bring banks)



**Braintree and Tendring councils do not include glass in their kerbside collections. As glass is a heavy material, its exclusion will reduce their capture rate performance in comparison to other councils that do collect glass.*

Listed below are observations and conclusions drawn:

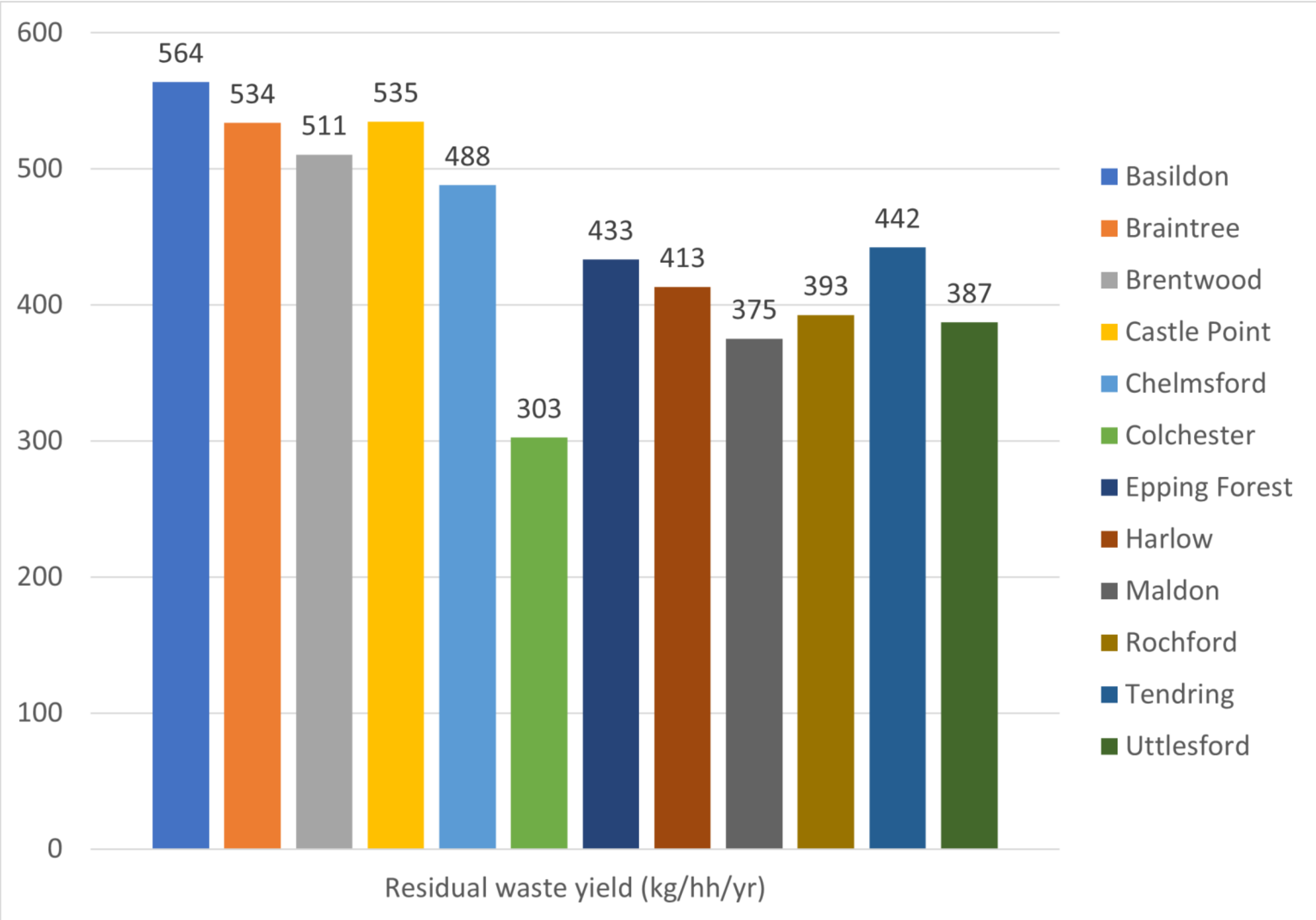
- Uttlesford and Epping Forest have the highest overall capture rates, with 62% and 61%, respectively. Uttlesford's high overall capture rate is down to its remarkable capture rates in paper, card, and plastic bottles. Paper and plastic bottles capture rate are the highest of all councils, 90% and 84%, respectively. Uttlesford operate a fortnightly comingled recycling collection and fortnightly residual waste collection both in wheeled bins. This reflects the WRAP trend data that the capacity restriction of residual waste in wheeled bins may be encouraging residents to recycle more due to the limited space available for residual waste. Similarly, Epping Forest has high capture rates for paper, card and plastics bottles relative to the other Councils at 89%, 78%, and 81%, respectively. Garden waste capture rate is also high at 92%, which is a factor of the weekly collection of mixed organics and the use of average yields (i.e. Epping Forest has very large gardens so the average garden waste yield is higher than in areas with smaller gardens). Epping Forest has a similar residual and dry recycling collection scheme to Uttlesford, however glass is separately collected in a box. Overall, this reflects the trend that fortnightly collections of residual waste and dry recycling with limited recycling segregation produces high capture rates of recyclables.

- Colchester has the third-highest overall capture rate of the councils and operates a multi-stream dry recycling collection system. Colchester has a high capture rate of glass with 86% which is separately collected in boxes with metals. Food waste capture rate at 53% is the highest for all the councils. Other recyclables – paper, plastic bottles, PTTs and ferrous metals have above average capture rates, relative to the other councils. Colchester's good performance shows that multi-stream recycling collections can produce a solid recycling performance as the extra responsibility on residents to segregate their recyclables can incentivise people to recycle more.
- Tendring is the worst performing council, in terms of overall capture rates of recyclables, with an overall rate of 29%. However, this conclusion is not so reliable as the results presented in Table 10 are from the WFM, which only models kerbside waste collections, so Tendring's glass tonnage from bring bank sites are not considered. The same can be said for Braintree, which is placed with the second-lowest overall capture rate at 36%.
- Brentwood has a worrying trend of low capture rates for most recyclables. With an overall capture rate of 39%, Brentwood is a poor performing district relative to the Councils in ECC, and with no bring bank sites for household waste, Brentwood may have the lowest overall capture rate of recyclables. Brentwood has low capture rates for ferrous and non-ferrous metals; 21% and 22%, respectively, and a low capture rate of 24% for food waste. A connection can be made from residual waste being collected weekly in sacks for Brentwood, which produces a high residual waste yield for each household and thus reduces any practical incentive for recycling. In addition, the lower participation rate of their multi-stream recycling collection may also contribute to the lower capture rate.
- It is noted that the residual yield (%) is based on a total amount of material that uses average yields and is therefore an estimate.

4.3.3 Residual waste yields – Waste Flow Model (WFM)

Figure 33: presents the total residual waste yield in terms of kilograms per household per year (kg/hh/yr) generated from the WFM for each council in Essex. This consists of household collected waste (kerbside and flats) and does not include waste deposited at RCHWs in each area.

Figure 33: Residual waste yield (kg/hh/yr) for councils based on arisings in 2020/21 (kerbside and flats collections)

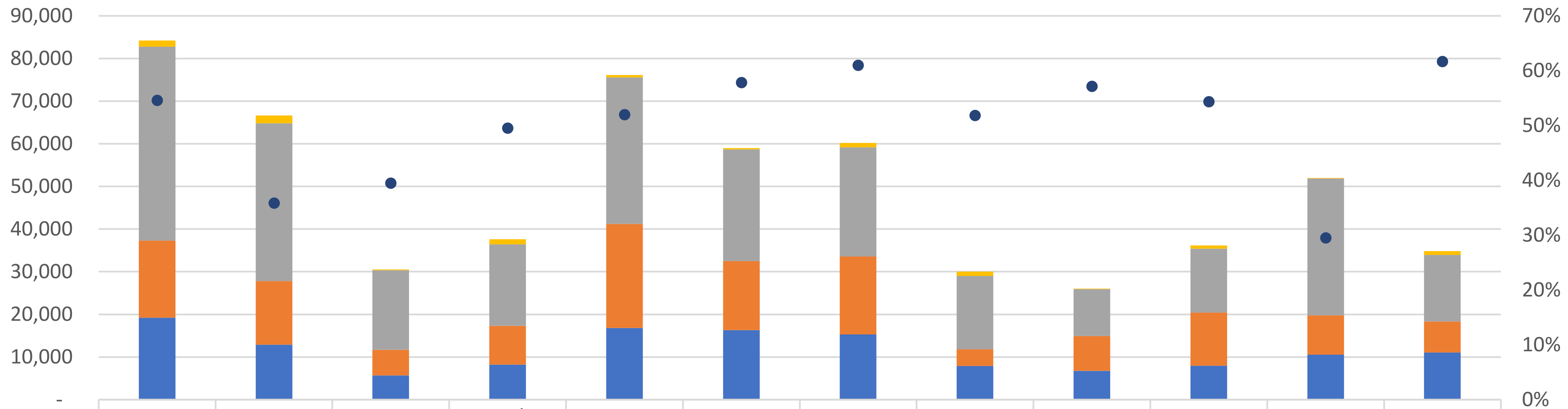


- Basildon and Castle Point have the highest residual waste yields, with 564 kg/hh/yr and 535 kg/hh/yr produced, respectively. Basildon operates a weekly residual waste collection in black sacks so, based on the WRAP trend analysis, this higher frequency of collection than most other councils may suggest a rationale for Basildon having higher residual waste yields than other councils. Similarly, the collection of residual waste in sacks in Castle Point, may suggest that although the residual collection is fortnightly, the lack of effective restriction to the amount of residual waste that residents can present for collection reflects the same trend.
- Colchester has by far the lowest residual waste yield of all the councils. In Colchester's dry recycling collection, metals, paper and card, glass, and plastics are all separated out. This produces high quality recycling, and Colchester attains the second highest overall capture rate for dry recyclables. This runs counter to the WRAP trend analysis, and further investigation of this may provide useful in exploring approaches to encouraging residents to recycle more and hence produce less residual waste.

4.3.4 Waste flow outcomes – WFM

Figure 34 presents the waste arisings for each council from the WFMs. This figure examines only the core household collections (i.e., household residual, household dry recycling, household garden waste and household food waste). It does not examine street cleansing, bulky waste, fly tips, RCHW waste or any non-household collections. The contamination tonnage from dry recycling, residual waste tonnage, organic waste tonnage and dry recycling tonnage can be observed, along with the overall capture rates of dry recyclables. These reflect similar alignment with the WRAP trend data as identified at 4.3.1 and Table 9. Councils with comingled recycling collections – Braintree, Harlow, Rochford, Uttlesford, and twin-stream (glass out) collections – Basildon, Castle Point, and Epping Forest, have much higher contamination tonnages than the councils with multi-stream recycling collections, such as Brentwood and Colchester.

Figure 34: Baseline core household collection outcomes for all councils (Tonnes per Annum)



	Basildon	Braintree	Brentwood	Castle Point	Chelmsford	Colchester	Epping	Harlow	Maldon	Rochford	Tendring	Uttlesford
Contamination	1,467	1,832	179	1,200	560	332	986	990	171	758	102	886
Residual	45,449	37,018	18,693	19,087	34,338	26,135	25,670	17,227	10,974	15,008	32,034	15,602
Organic	18,122	14,920	5,963	9,094	24,412	16,249	18,256	3,878	8,178	12,465	9,240	7,246
Recycling	19,181	12,888	5,705	8,215	16,821	16,273	15,279	7,907	6,735	7,927	10,565	11,076
Total	82,752	64,826	30,361	36,396	75,571	58,656	59,205	29,013	25,887	35,400	51,839	33,924
Capture rate	55%	36%	39%	50%	52%	58%	61%	52%	57%	54%	29%	62%

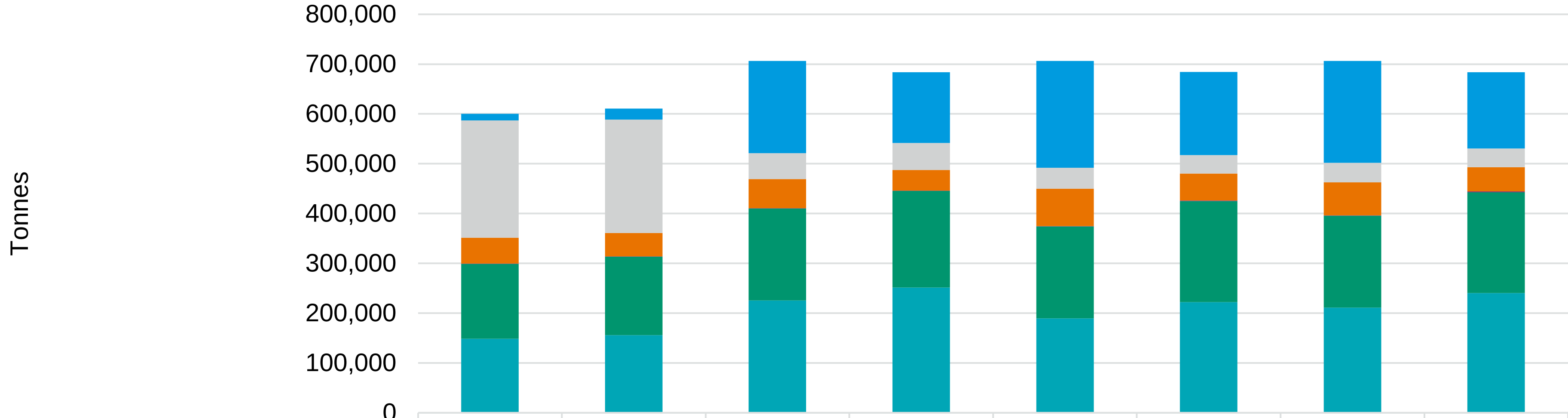
4.3.5 Household tonnage fates – WDM

The WDM outcomes for the household waste collected in EWP are shown in Figure 35 below. After each household and non-household waste stream is collected, the waste is sent to a final destination, sometimes via a transfer station. Figure 35 presents the fates of these waste streams as total tonnages that are landfilled, recovered (the process of converting waste to energy e.g., Refuse Derived Fuel), reused, composted, recycled, and classified as ‘losses’ which include process losses at MBT and composting facilities. The higher losses in Scenarios 1, 3 and 5 are due to the increased residual waste going to EfW for the fortnightly collections compared to the three-weekly collections in the other Scenarios.

- Total landfilled tonnes (235,619) in the Baseline year constitutes for 39.2% of total waste arisings.

- Total recycled and composted tonnes make up just under half of total waste arisings – 49.8%
- Total reused tonnes are very small, 591 tonnes in total across the EWP.

Figure 35: EWP household tonnage fates (FY2020-21)



	Baseline	Scenario 0+	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
Total Losses	13,248	21,918	185,245	141,870	214,495	166,449	204,167	152,760
Total Landfilled	235,619	228,101	51,759	54,234	42,131	37,476	39,556	37,688
Total Recovered	51,751	46,993	58,869	41,330	75,126	54,186	66,366	48,973
Total Reused	591	535	712	731	731	1,183	712	1,563
Total Composted	150,602	157,232	184,615	193,587	184,737	202,834	184,543	202,409
Total Recycled (excl. IBA Metals)	148,499	155,981	225,305	251,698	189,383	221,937	210,957	240,191
Total Arisings	600,310	703,825	706,504	683,452	706,603	684,065	706,301	683,585

4.3.6 Front line vehicles – collections resourcing

In this section, the collection vehicles required for each council are presented. Figure 36 displays the number of vehicles required for each council's waste collection system in the baseline year. The number of vehicles required are presented as a ratio to the number of households so comparisons can be made between councils since all councils have a different number of households. The number of collection vehicles required for each council without a household number ratio is presented in Figure 37.

- Maldon has by far the largest number of collection vehicles required, 56, relative to the number of households in the district (28,784): this is due to the higher rurality of Maldon, impacting the number of properties each collection round can visit.
- Tendring’s food waste co-collection scheme with dry recyclables means a small number of vehicles are required for the waste collections, 25, relative to the number of households in the district.
- Uttlesford also co-collected food waste with dry recyclables and residual waste too in 32T large twin packs – so this produces an efficient collection service, 32 vehicles per 100k households.

Figure 36: Vehicles required per 100k households for Councils' collection systems

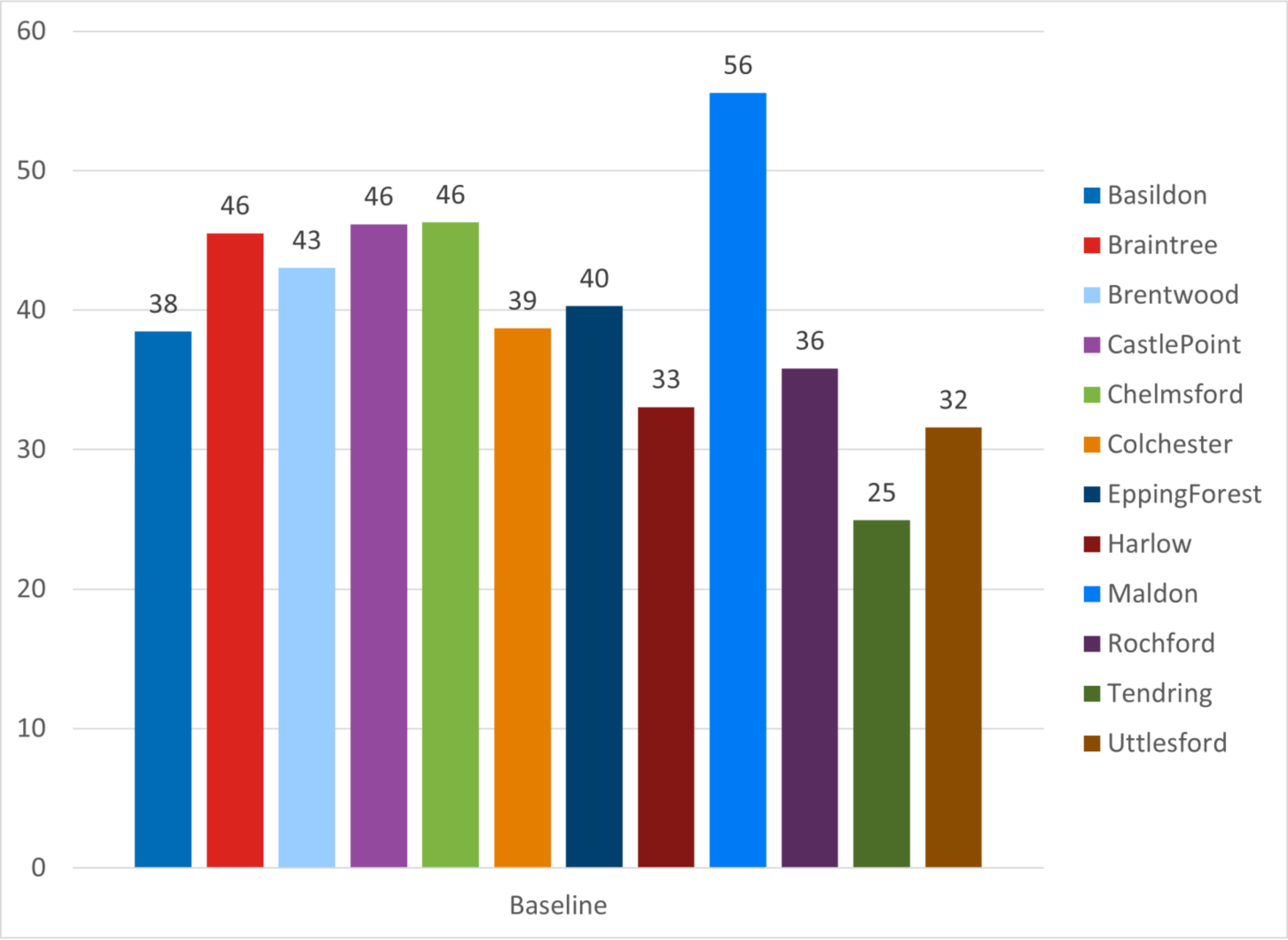
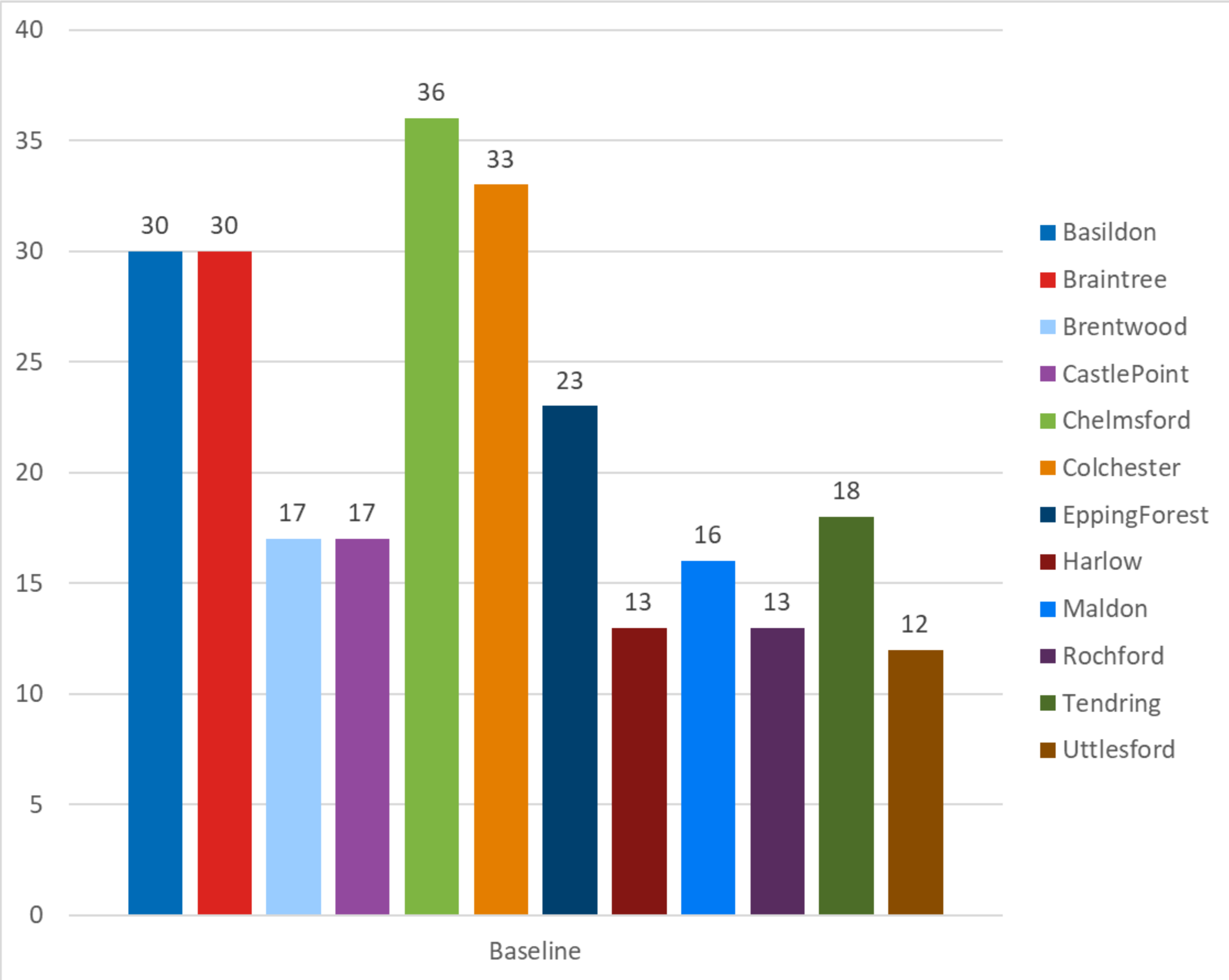


Figure 37 Vehicles required for Councils' collection systems



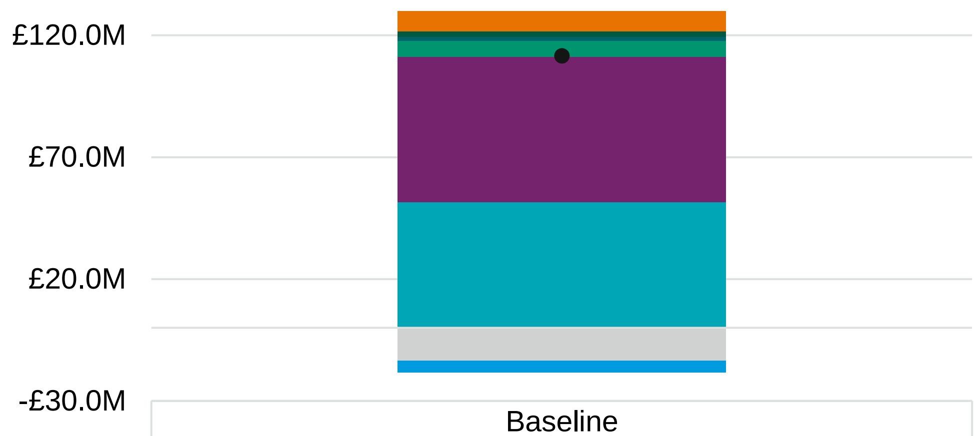
4.3.7 Overall EWP Processing and Disposal

Figure 38 below identifies the total ‘Whole System Cost’ for dealing with the waste managed across the EWP. Showing the EWP whole system costs for the core household waste streams, accounting for all WCA costs and the costs borne by ECC. These whole system costs have been arrived at through a process of detailed bottom-up modelling of each WCA’s gross collection costs, layering on the transport and handling costs, gate fees and any income from the sale of materials or from garden waste charges. ECC’s costs (such as RCHW operation costs, residual waste disposal and other gate fees, inter-authority payments such as tipping away, and other costs) were then added on to provide a whole system overview for EWP.

In the baseline year (FY2020-21), the MBT facility still received waste (approximately 62k tonnes). The modelled gate fee was £150/tonne. As the MBT facility is no longer used, this may result in an underrepresentation of costs below.

Across the councils, net income from recyclate and collection costs varies, dependant on the volume of material collected, with the number of properties across the councils (and thus the cost of collection) varying substantially. WCA collection costs thus largely correlate to the size of the authority. Income from collected recyclate also varies across the councils, dependant not only on the volume of recyclate but also the collection methodology, with co-mingled collections attracting the highest gate fees, twin-stream mitigating this cost and minimising material sorting costs.

Figure 38: EWP Whole system costs in FY2020-21 (Total Cost Per Annum)



	Baseline
Inter Authority	£8.3M
RCHW Operation	£2.3M
Transfer Station	£1.6M
Haulage	£6.6M
Gate Fees	£59.6M
Collection	£51.6M
Garden Waste Income	-£4.7M
Material Income	-£13.6M
Whole System	£111.5M

5. FORECASTING

For the collection and treatment scenario modelling stage, the year FY2027-28 was selected because it represented the first point in time when the known DRS/EPR/National Waste Strategy legislative changes should have occurred and been implemented[9]. It therefore represents a sensible 'stable system' point against which to assess the scenarios. Since FY2027-28 is several years in the future, the first stage of scenario modelling involved forecasting how the waste streams would change over time between the baseline and the scenarios year. This section examines the forecasting steps and assumptions.

5.1 ASSUMPTIONS

This section details the forecasting assumptions that were made to project future waste arisings as accurately as possible.

5.1.1 Covid-19 Impact

Since FY2020-21 was selected as the baseline year, some waste streams will be higher, and some will be lower because of the impacts on waste generation and composition during the Covid-19 pandemic.

The 5-year historical trend of tonnes was examined to determine the high-level impact of Covid-19 on the larger waste streams to determine the most suitable course of action, for example applying the average historical growth rate to waste per household over the forecasting period.

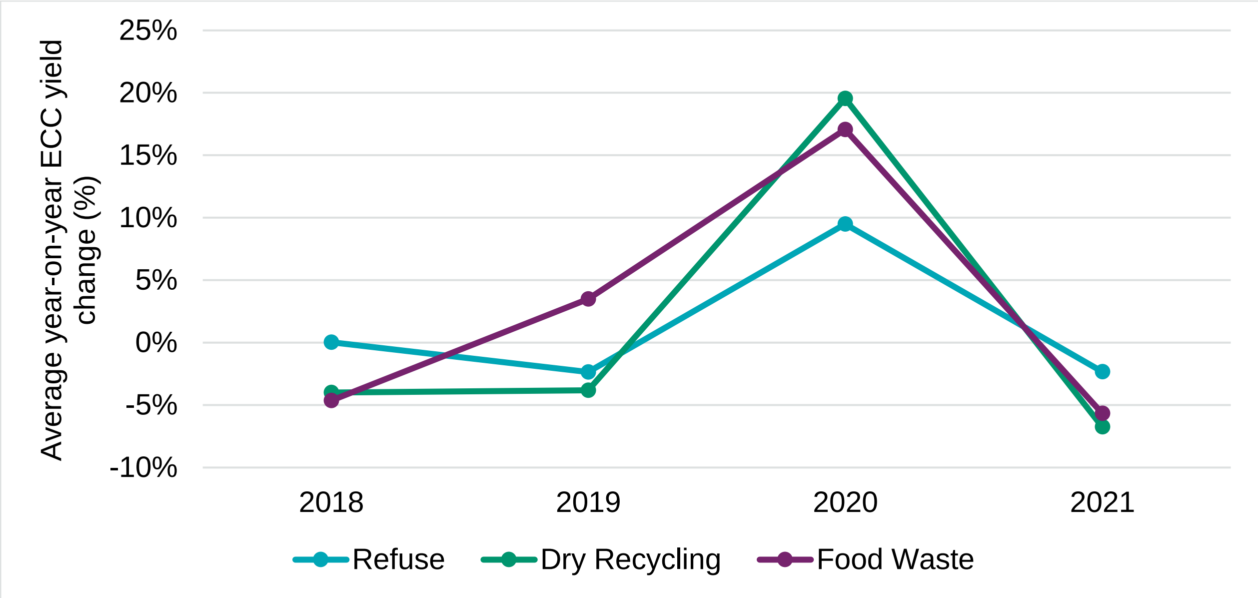
From the 5-year data trends provided and WasteDataFlow (WDF), the following has been determined:

- Pre-Covid-19 yield trends for refuse, dry recycling and food waste were mostly stagnant, and variations were largely insignificant in comparison to the impacts of Covid-19.
- Covid-19 resulted in a growth peak in the FY 2020-21 yields for all three streams (peak in 2020 shown in Figure 39)
    - The average refuse yield increased by 9% due to Covid-19.
    - The average dry recycling yield increased by 20% due to Covid-19.
    - The average food waste yield increased by 17% due to Covid-19.
- In FY 2021-22, arisings have come down slightly from the covid peaks, but have not returned to pre-Covid-19 levels (drop in 2021 in Figure 39).

It is assumed that the 'new normal' in terms of yields will not return to pre-Covid-19 levels, as changes such as the prevalence of 'work from home' have increased due to Covid-19 and are not expected to return to 2019 levels in the foreseeable future. Therefore, it was assumed that all three streams will reduce to halfway between 2019 and 2020 levels over a period of 3 years, and then remain constant (in terms of kg/hh/year). This is shown in the downward trend in the 2021 data.

[9] Since the modelling was completed, there have been delays to the implementation of the relevant waste policies.

Figure 39: Five-year trend of waste streams most impacted by Covid-19 (% change compared with previous year)



5.1.2 Deposit Return Scheme (DRS)

It was assumed that an “all-in” DRS will be implemented in 2024. This date is now in some doubt; Defra’s response to the DRS consultation hasn’t yet been published, and the Recycling Minister stated (24 November 2022) that “a date for publication has not yet been set.” Implementation of DRS by 2024 is thus considered unlikely. Once implemented, the DRS will target plastic bottles and aluminium cans. The current situation is that glass will not be in scope of the planned DRS in England and Northern Ireland, due to concerns over its handling safety and weight. Yield and participation assumptions were based on existing trial schemes across Wales and Defra’s own assumptions to determine the likely level of diversion of material from dry recycling collections and from residual waste. In previous projects, an 85% capture rate was assumed, with the proportion of eligible containers to be dependent on each WCA’s composition data.

For the WRATE modelling, the impacts of DRS (excluding reduced tonnage) were not assumed in the scenario modelling.

5.1.3 Extended producer responsibility (EPR)

The impacts of EPR on residual waste are unknown and difficult to quantify at this stage. Some minor changes in the composition of packaging (a reduction in ‘difficult to recycle’ packaging) are anticipated over the longer-term. However, for the purpose of this project, no impacts have been assumed.

5.1.4 Waste destinations and performance

Destinations and transfer stations of each waste stream are based on the council provided data in the initial waste data capture sheets. The proportion of waste going to recycling, recovered and landfilled after being processed at a facility are based on Ricardo’s industry experience and knowledge and data from other projects.

The reductions and reuse assumptions for the different waste streams starting 2027/2028, were based on data provided by and agreed with ECC, in addition to Ricardo’s industry experience and knowledge and data from other projects.

5.1.5 Collection consistency

5.1.5.1 Dry recycling

The majority of Essex WCAs already collect the core recyclables (glass, metal, paper and card, PTTs, cartons), except for Braintree (no glass) and Tendring (no glass, no PTTs). At the time of developing modelling assumptions, it was proposed that collections for these 2 WCAs will encompass the core six materials from 2024, with expected impacts from 2025[10].

As part of their consultation on the Resource & Waste Strategy, consultations on EPR, DRS and Collection Consistency were published by Defra between March and May 2021 (see Section 8.8 for full details).

Eventually published in March 2022, Defra's response to the Extended Producer Responsibility (EPR) consultation confirmed how the government intends to deliver their proposals to move the full cost of dealing with packaging waste from households away from local taxpayers and Councils to the packaging producers, applying the 'polluter pays principle'.

The response also touched on elements from the Collection Consistency, Extended Producer Responsibility for packaging and scenarios for Deposit Return Schemes. The Consistency consultation proposed that Plastic film and flexible packaging should be included in kerbside collections from 2027. The EPR response confirms that this will be required.

In addition to Plastic film and flexible packaging, it has also been assumed that all councils will collect textiles, small batteries and small WEEE from 2027. This reflects the EWP's ambition to maximise the tonnage and proportion of recyclables collected from the kerbside, as reflected in the Vision Statement. It has been assumed that the impact of this change will be measurable from 2028.

Whilst the additional tonnages of these waste streams have been allowed for, it is assumed that their collection will be encompassed by the identified collection methodologies. In the case of co-mingled and twin-stream collections, WEEE and textiles will be collected in cages attached to the vehicle chassis, with plastic film co-collected with DMR. For multi-stream collections, additional compartments will be incorporated on the dedicated vehicles.

To determine capture rate assumptions for the collection of materials that the districts currently do not collect, available data for those that do currently collect the materials has been reviewed. The proposed capture rates are shown at the bottom of Table 11 below as 'Suggested Assumptions'.

Table 11: Capture rate assumptions

	Cartons (%)	PTTs (%)	Glass (%)	Plastic Film (%)	Textiles (%)	WEEE (%)
Basildon	0	25	78	0	0	0
Braintree	0	55	81	5	0	0
Brentwood	0	24	78	0	3	0
Castle Point	0	33	83	10	0	0
Chelmsford	0	30	83	0	3	17
Colchester	0	37	85	0	6	0
Epping Forest	0	43	19	0	5	7
Harlow	0	35	86	0	0	0
Maldon	0	4	87	5	0	0
Rochford	0	25	82	0	5	0
Tendring	0	0	79	0	0	0
Uttlesford	0	36	68	0	0	0
Average (in WCAs collecting this stream	**0**	**32**	**76**	**7**	**4**	**12**
Suggested Assumption	**60**	**35**	**80**	**10**	**10**	**10**

As residents become better acquainted with additional materials being targeted, it is anticipated that capture rates will grow for the first few years. In previous projects, +one to two% per year increase for three to five

[10] Since the modelling was completed, there have been delays to the relevant policies. It is possible that collection of these materials will not be required until a later date.

years was modelled, and the assumption is that this growth rate is sensible for the materials that are less commonly collected at kerbside (film, textiles, WEEE).

Dry recycling composition depended on data provided by the council. Where councils provided compositions, no assumptions were made as actual data was used. This applies to assumptions made for targeted materials in dry recycling streams. Where councils did not provide compositions, the order or priority of sources for assumptions was as follows: WRAP Material Facility Portal, National composition estimates. If further disaggregated data was required, WRAP data was used. Also in this case, targeted materials were assumed using information available on council websites.

For scenario modelling, yield changes to dry recycling were based on estimates extrapolated from WRAP data and expert judgement. Changes in dry recycling contamination for each scenario was based on Ricardo's industry experience and knowledge and data from other projects, including projects delivered in association with WRAP.

5.1.5.2 Food waste

It was assumed that all WCAs that currently collect mixed food and garden will implement separate food waste collections by 2024, and the yield will be based on WRAP's food waste ready reckoner. It is expected that these services will be implemented throughout the course of the year and hence the impact from the first full year of separate collections will be seen from 2025 onwards.

Impacts of separate food waste collections and moving to weekly collections have been modelled based on existing council data, Isonomia reports, and/or WRAP ready reckoner data. Higher food waste yields are achieved with reduced frequency residual collections and when collected separately from garden waste.

5.1.5.3 Garden waste

Garden waste is included in the Environment Act as one of the six recyclable waste streams to be collected from households in England for recycling. Like food waste, it must be collected separately from other household waste and from other recyclable waste streams. It can, however, be collected with food waste where separate collection of food waste is not technically or economically practicable or there is no significant environmental benefit from separate collection of food waste.

Defra's preferred model in their impact assessment is a free minimum garden waste collection service provided by local authorities to householders. Collections would be fortnightly utilising 240 litre wheeled bins. This preference is based on the positive carbon impacts of this approach.

However, as Defra have not yet published their response to the consistency consultation, it remains unclear whether local authorities will be allowed to continue to charge for garden waste collections as permitted under The Controlled Waste (England and Wales) Regulations 2012.

In the consultation, Defra suggest that should they provide updated guidance on reasonable garden waste charges (it should be noted that that this is described as guidance rather than being prescriptive), allowing for variations based on rurality and density of housing, this could allow the charging scenario to be continued, avoiding the significant increases in in terms of greenhouse gas emissions that a universal free scheme would generate without leading to the high costs associated with introducing a free minimum collection service for garden waste

The modelling thus assumes that all local authorities will have to arrange for the universal separate collection of garden waste for recycling in the 2023/24 financial year. It was assumed that this roll-out of universal garden waste collections in 2024 will increase the amount of garden waste collected at kerbside – part of which will be diverted from that which is currently collected at recycling centres for household waste (RCHWs). It is expected that these services will be implemented throughout the course of the year and hence the impact from the first full year of separate collections will be seen from 2025 onwards. Moving from chargeable garden waste collection to free collections, it is assumed that garden waste yields will increase by 11%.

5.1.5.4 Single-use plastics

It was assumed that 70% of plastic packaging will be recycled from 2025. This is a 20% uplift in the plastic recycling rate. It was assumed this will be achieved by additional diversion of hard plastics, and a reduction in soft plastics generation.

5.1.5.5 *Residual waste*

As residual waste composition was not provided by all councils, a weighted average across Essex from a 2016 residual composition study was used as a proxy for councils that didn't provide this.

A change to fortnightly or three-weekly collections for residual waste collections was assumed to reduce the overall waste arisings. For those changed from weekly residual to fortnightly collections, a reduction of two % was assumed, from weekly to three-weekly a reduction of six % and from fortnightly to three-weekly a reduction four %.

For scenario modelling, yield changes to residual waste were based on estimated extrapolated from WRAP data and expert judgement.

5.1.6 Household type and growth

Housing growth assumptions from baseline year onwards were based on data on ECC provided data, WCA provided data or previous projects. For councils that provided limited information on operations and the split between property types, one stream of properties was modelled.

For flats waste generation, assumptions were made on the average flat performance compared with an average street level property. These include for:

- residual waste: flats generate same quantity as street level properties.
- dry recycling: flats generate 90% of street level property quantity.
- contamination: flats generate same quantity as street level properties.

5.1.7 Collection resources and costs

5.1.7.1 *Waste materials*

Assumptions of material bulk densities were taken from WRAP's study [11] and the KAT tool. Vehicle compaction of these materials differed depending on waste stream:

- residual waste: full compaction
- dry recycling (commingled/twin-stream): partial compaction
- garden Waste: partial compaction
- dry recycling (multi-stream): no compaction
- food waste: no compaction

5.1.7.2 *Collection vehicles and containers*

Vehicle specifications were modelled using data provided by councils. Where details were missing (payload, GVW etc.), Ricardo's database was used. Number of vehicles currently used to deliver core services (household waste, dry recycling, organics) were modelled as provided in data by councils. Where a council had different vehicles used on the same collection service, a user-defined vehicle was created with a representative weighted-average specification of all vehicles used (blended vehicle) and modelled for that authority.

Operational data of waste collection vehicles (distances to and from depot/tipping points, speeds, times etc), were modelled using data as provided by councils. If not provided, industry averages were used to calibrate the model to best represent the specific Council's current operations.

Numbers of containers for each waste stream were assumed as follows: one per household for standard properties and one bulk container for every 8 flats.

Costs of vehicles (purchase, operation, maintenance, fuel etc.) assumed were dependant on whether an authority's current vehicle fleet matched those proposed for the scenarios. Where they were the same, current

[11] Material bulk densities | WRAP

prices provided by authority were adjusted for inflation (+12%) and used for the scenarios. Where they were not, recent industry average prices (with +12% inflation) were used.

Container costs (purchase, replacement) were modelled using council provided data for baseline modelling. Adjustments for inflation (+12%) were made for scenario modelling.

5.1.7.3 Staffing

The number of staff (drivers and loaders) assumed was 1 driver and 2 loaders for each vehicle. For vehicles collecting food waste, 1 driver and 1 loader was assumed. For baseline modelling, cost assumptions of these labourers were made using data provided by the authorities; if not provided, industry average cost were used. For scenario modelling, baseline labour costs were adjusted to account for inflation (+12%).

For days and hours worked by collection staff, council-provided data was used, with slight modifications made to calibrate the models. Industry averages were used for councils that did not provide data.

5.1.7.4 Overhead costs

Overheads (back office, contract operating costs, central support charge etc.) were assumed to be approximately10% of overall costs in all scenarios.

5.1.8 Whole system costs

For haulage costs, data provided by the councils show costs differentiated by the source and charged on a per tonne per laden mile basis. Waste hauled from a WTS are charged at the bulk residual rate per tonne per laden mile. Green waste and residual waste hauled from an RCHW is charged per tonne per laden mile. To calculate haulage miles, Google Maps was used to pinpoint distances between facilities and transfer stations.

For the following transfer, treatment and handling costs, assumptions were based on data provided by the councils:

- transfer station fees
- gate fees for each waste treatment facility
- handling charges for different waste streams
- garden waste householder charge
- tipping away payments
- inter-authority payments
- recycling credits/performance payments

5.1.9 WRATE modelling

All following assumptions were discussed and agreed with ECC.

5.1.9.1 Transport and destination facilities of waste

For the WRATE modelling, it was assumed that all collections vehicles were taking place in Standard 26 tonne RCVs and that all transport from transfer station to treatment facilities takes place in intermodal road transport. For mileage covered from the WTS onwards, average distances were assumed rather than weighted averages.

Destinations of waste depended on the type of waste. All residual waste and street cleansing skips were assumed to go to landfill. Textiles assumed to be sent directly to recycling, street sweepings to MBT and organic waste (food and garden waste) to an IVC facility as OAW facility does not accept food. As dry mixed recycling (DMR) destinations will not accept more than 5% contamination, any remaining contamination is assumed to go to landfill.

Waste arisings from bring banks were assumed using the number of bring banks across ECC of approximately 80 bring banks per local authority. Also, it was assumed that there is no impact of WEEE waste being managed.

5.1.9.2 Facility operations

Regarding operating the treatment facilities/final destinations of the waste, electricity supply was assumed using information from Future Energy Scenarios 2022 provided in the National Grid ESO Data Workbook[12].

[12] https://www.nationalgrideso.com/electricity-transmission/document/202851/download

Electricity efficiency of Energy from Waste facilities used the WRATE default electricity efficiency of 23.1%. As the latest Tolvik report states an efficiency of 22.1%, it was agreed with ECC to leave efficiency rate as is as it they are close to the assumption[13].

5.2 BASELINE + (SCENARIO 0+)

To account for the impact of the factors outlined above, a second 'Baseline' was developed. This 'Baseline +' assumes that the current services offered by each WCA remain unchanged, aside from the effects of the policy changes outlined above (e.g., separate food waste collections, kerbside glass collections provided by all WCAs). Baseline + is thus based on the projection of the current WCA service provision to 2027/28. Also, note that for the Baseline + and the scenario modelling year FY 2027-28, a 12% increase has been applied to vehicle, container, and staffing costs to estimate inflation rates for the future.

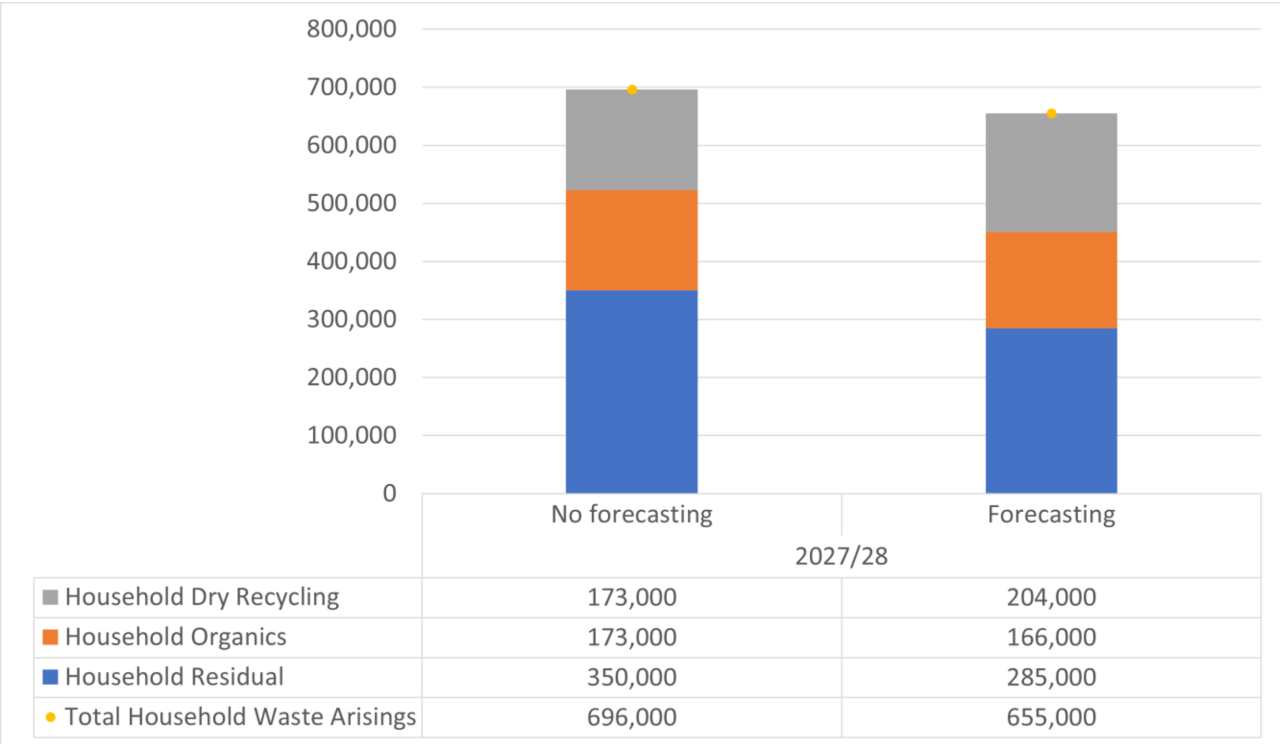
5.3 OUTCOMES

In this section, the impact of forecasting assumptions on the models are presented. To examine the impact of the forecasting assumptions, the projected household waste arisings and household residual waste composition were modelled across the EWP.

5.3.1 Forecasting Impacts on Arisings

Figure 40: presents a comparison between the WDMs with no forecasting assumptions made (except for housing growth), and the WDMs with the forecasting assumptions made, with the household arisings detailed.

Figure 40: Household waste arising tonnes with and without forecasting assumptions 27/28



[13] Tolvik-UK-EfW-Statistics-2021_Published-May-2022.pdf

Figure 41: Forecasting Impacts

- Both the 'no forecasting' and the 'forecasting' scenarios include the assumed housing growth and the associated growth in waste arisings, to show the impacts by the policies and COVID-19.
- In the 'no forecasting' scenario, waste arisings continue to grow from the baseline year of 20-21 in line with household growth projections. In the 'forecasting' scenario, it has been assumed that the 20-21 waste arisings are abnormally high due to the impact of the COVID-19 pandemic (see section 5.1.1). For this reason, the 'forecasting' scenario assumes waste arisings will reduce for three years immediately following the baseline year (21-22, 22-23, 23-24), and then resume growth in line with housing growth. The impact of this is shown in Figure 40, with the 'forecasting' scenario arisings approximately 41k tonnes lower than the 'no forecasting' scenario.
- Despite the decrease in all arisings from the COVID-19 impact modelling, total household dry recycling tonnes increase by 31,000 tonnes once the forecasting assumptions are applied. This is primarily due to the projected impact of the collections consistency policy, which is expected to mandate the collection of materials that are not currently collected by all authorities (PTTs, cartons, aluminium foil, textiles, WEEE). In addition to this, there is additional diversion of plastic bottles and cans from the household residual waste stream due to DRS (based on the current understanding that councils will be credited for the DRS tonnage collected in their area). This also helps to explain the reduction in household residual waste tonnes – decreasing by 65,000 tonnes when applying the forecasting assumptions.
- Household organics decrease by 7,000 tonnes when applying the forecasting assumptions. This is because the baseline year is 2021, when tonnages were impacted by Covid (as identified above). All collection authorities already collect food waste, thus the consistency policy's requirement to collect food waste has not resulted in an increase in organic waste. The decrease in tonnes would be more significant, but it has been offset by a slight growth in separate food waste quantities for the three authorities that were collecting food waste mixed with garden organics during the modelling period.

5.3.2 Forecasting Impacts on waste composition

In addition to impacts on waste arisings, Ricardo also examined how waste compositions may change in the future. The key factors impacting waste composition changes are:

- Policies:

- The Collections Consistency policy requires that additional materials (WEEE, Textiles, PTTs, cartons and other items) are collected for recycling, which is expected to alter the composition of the dry recycling and residual streams.
- The Collections Consistency policy also requires food waste collections to be collected separately and proposed free garden waste collections. This is expected to result in additional food and garden waste yields, impacting food, garden and residual waste stream compositions.
- DRS is expected to result in additional drinks containers being recycled through services that are not provided by the council, altering both the dry recycling and residual stream compositions of local authority collected waste.

- Reduction and Reuse:
  - EWP proposed that several waste reduction and reuse initiatives would be implemented by 2027-28. This includes programmes that encourage a reduction in unwanted mail, textile waste and waste from nappies and sanitary products. The detailed assumptions are in section 5.1. These interventions have also been modelled as they are projected to result in changes to waste compositions.

5.3.3 Waste Reuse and Reduction

The EWP and Ricardo have worked together to estimate potential waste reduction and reuse activities that could be introduced and the potential reduction in waste arisings. To do this, we first calculated the total residual, dry recycling, WEEE, food waste, garden waste, textiles and bulky waste tonnage for each council. We then used this to assign a percentage of waste stream that each council generates in comparison to the Essex County Council. For example, 21% of the textile waste currently recycled in the county is collected in Basildon. The potential reduction tonnage for each initiative is a figure for all councils combined; therefore, the potential reduction for each council is a percentage of the total potential reduction for ECC. The reductions are summarised in Table 12 below. The assumptions below have been incorporated into the modelling of each of the scenarios. For the detailed calculations please refer to Appendix 4.

Table 12 : Reuse and Reduction Assumptions

Item	Assumption	Comments	Potential Reduction (tonnes/year)
Food waste reduction	14% reduction on average = 7,729 tonnes per year	Ricardo have used a WRAP case study and ECC data to estimate a 14% reduction in food waste in the Residual stream. The food waste element makes up approximately 25% of this using ECC data to back this up.	7,729
Reuse (bulky waste)	20% of RCHW bulky waste (2,330 tonnes per year) + 400 tonnes per year avoided through Freegle and 600 tonnes per year avoided through bulky waste reuse at RCHWs	This figure comes from WRAP research combined with ECC's RCHW data and some assumptions. This gives us a figure of approximately 2,330t of further reuse that could be captured at RCHWs. In addition to this, it is proposed that waste avoided through Freegle (400t) and bulky waste collected for reuse (600t) is also considered as a potential reduction.	3,330
Home composting	2,000 to 10,000 compost bins at 150kg/bin per year = 300t to 1400t	Assumed 5,000 households will request composting bins each year and 3% drop-out each year.	728
Cloth nappies (infants)	250kg per household, 5% uptake	These assumptions are based on WRAP data that shows 874 kg of nappies are used per child over 3.5 years. A 5% uptake was assumed on this scheme with a reduction of 250kg per household. This could potentially save approximately 200 tonnes of residual waste per year.	122
Sanitary products	Estimated tonnes avoided for all local authorities is 153 tonnes (average 128 tonnes per LA)	Our assumptions are that each user will use around 180 items or 45 kg per year. If an assumed 0.5% of users switched to reusable products, this could lead to a reduction of 153 tonnes per year.	153
Unwanted mail	0.5 kg per household per year and 5% uptake = 16 tonnes	It was assumed 0.5 kg/hh/yr and an uptake of 5% of households using the Mailing Preference Service. Across the authorities this could lead to a potential reduction in waste of 16 tonnes per year.	16
Textiles (swish and style + free collection)	0.423 kg per household per year with 0.021% engaged	Using data from Swish & Style we have estimated an average figure of 0.87kg/hh/yr that could potentially be reused. Using this average	0.13

Item	Assumption	Comments	Potential Reduction (tonnes/year)
		and and estimated engagement figure of 0.021%, this may only lead to 132kg per year. This is a very conservative estimate based on 1 case study.	
Textiles (free collection)	0.87 kg per household per year averaged over all households = 571 tonnes per year	We have used data from TRAID to estimate an average of 0.87 kg/hh/yr with a 100% engaged population. This would give a potential reduction on 571 tonnes across all authorities.	571
Tool library	23 tonnes reduction over two years	Data from a case study on the ‘Library of Things’ website to estimate a reduction of 23 tonnes over 2 years. Assuming 2 sites would be built in the ECC area this could give a reduction of 11.5 tonners per site per year.	11.5
Reducing Residual waste capacity through smaller container size or move to less frequent collections.	Total kerbside yields reduction when moving to 180L three-weekly collections (impact included in scenario modelling).	WRAP’s data is incomplete on authorities with a single container type. Only data for authorities that state they exclusively use the containers listed on the corresponding tab were used. Fortnightly residual waste yields are significantly lower than weekly residual waste yields on average, with sacks showing the lowest range, and an increasing trend in residual yield as container sizes increase.	Reduction has been modelled in Scenario Modelling, not included here to avoid double-counting.
		Total estimated Reduction	**12,660**

Several other interventions and activities were examined, but the tonnage impact could not be quantified due to the lack of robust evidence. These are listed in Table 13.

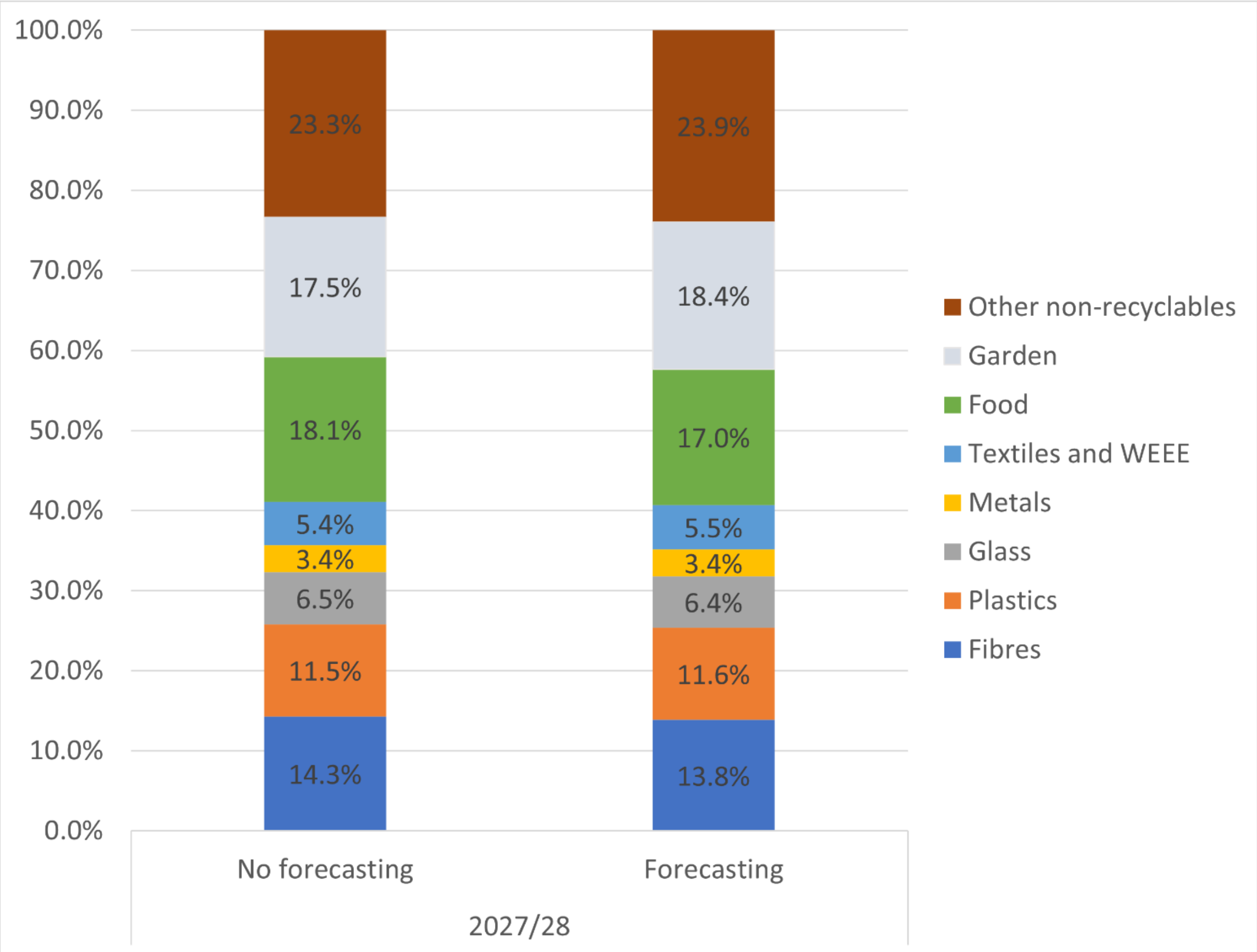
Table 13: Additional Reduction and Reuse Interventions

Item	Assumption
Waste prevention strategy (informed by waste composition analysis)	Procurement of an in-depth composition analysis. Procurement of light touch annual composition analysis to inform a waste prevention strategy (WPS) and support annual action plan. Development of a long term WPS for the EWP, supported by annual action plan to inform priority areas for the coming year and allow an annual review of WPS targets and Waste Data Flow to highlight progress. Alignment to national resource efficiency and carbon reduction targets. Consideration of life-cycle assessment of products, so waste and carbon impact are understood. Monitoring and evaluation CIRCULATES (useful for insight/ planning).
Revive EWP	To achieve greater waste reduction, reuse and recycling by working in partnership with Essex local authorities. Members of the EWP should work together to identify new activities aimed at waste reduction.
EWP to lead by example	Champion waste reduction, reuse and recycling in their own organisations. Establishment of Circular Economy Hub and sharing networks
Increase reuse through existing networks	Initiatives: - Love Essex (LE) Search Function - Love Essex Fund - support/enable repair network
Increase use of reusable adult incontinence products	Through awareness campaign
Side waste	Initiatives: - 'No side waste' policy
Consistent collections	Initiatives: - Agree a consistent set of recyclables across EWP - Ensure all residents in Essex have recycling collection (including flats)
Build trust on where waste is sent	Initiatives: - to ensure where possible waste and recycling is dealt with in the UK - to communicate with residents where waste and recycling is sent and why
Littering	Initiatives: - awareness campaign - enforcement drive
Fly tipping	Initiatives: - awareness campaign - enforcement drive
Schools' behaviour change	Initiatives: - sign post to existing resources

Item	Assumption
Schools to lead by example	Getting estate in order work could enable schools to see the cost savings to invest themselves
Communications channels	Use of the following communications channels to promote waste reduction activities: - LE Brand - LE Website - LE Facebook - LE Instagram - LE Twitter - Linking with national campaigns (WRAP)

As an indication of the scale of impacts on waste composition, Figure 42 presents the household residual waste composition for the EWP from the WDMs with and without forecasting assumptions applied. It is worth noting that some compositional changes are unintended consequences due to the zero-sum nature of compositional analysis. As an example, a reduction in the proportion of food waste in the residual stream will result in a relative increase in the proportion of all other materials.

Figure 42: Household residual waste composition with and without forecasting assumptions applied 27/28



- Food waste decreases from 18.1% to 17.0% with the inclusion of forecasting assumptions, as by 27/28, councils will be expected to have separate food waste collections.

- Additional collection of Glass and WEEE and textiles (see 5.1.5.1) will increase the capture of these material streams, reducing residual tonnage.
- All other changes are knock-on impacts of the policies and interventions described above.

6. SCENARIO MODELLING

6.1 SELECTED SCENARIOS FOR MODELLING

6.1.1 Long-list of Scenarios and Evaluation Criteria

On the 29 November 2021 a workshop was held with Officers and Members of the EWP Authorities. The aims of this workshop were to:

- Agree on a set of evaluation criteria to assess the long list of scenarios.
- Agree on the Red, Amber, Green (RAG) descriptions for each evaluation criterion.
- Agree on the weighting of the criteria to be applied to the long list of collection scenarios.
- Agree on the weighting of the criteria to be applied to the long list of treatment scenarios.
- Approve the long list of collection and treatment scenarios.

The workshop was run as an interactive presentation to provide information and survey sessions using the online survey tool Menti.com, recording responses from Members and Officers.

The long-list evaluation stage was used to assess the relative performances of the long-list of collection and treatment technology scenarios set out in Table 14 and Table 15. These tables represent the relevant waste collection and treatment scenarios that were known at the time of creating the long list. The aim was to use the long-list evaluation criteria to eliminate scenarios that do not meet the criteria and provide a ‘short-list’ of scenarios for more detailed reviews and assessment. During the workshop, the long-list evaluation criteria were discussed and agreed and where necessary, amendments were proposed and agreed.

Table 14: Long-list collection scenarios

Dry recycling collection	Food waste collection	Garden waste collection	Dry recycling frequency	Organic waste frequency	Residual waste frequency
• Commingled • Twin stream: commingled recycling and separate paper&card • Twin stream: commingled recycling and separate glass collection • Multi-stream	• Separate food collections • Co-collected food and garden waste	• Separate - without subscription • Separate - with subscription • Co-collected with food waste	• Weekly • Fortnightly • Three-weekly	• Weekly • Fortnightly	• Weekly • Fortnightly • Three-weekly • Four-weekly

Table 15: Long-list Technology scenarios

Thermal waste treatment	Mechanical Materials Recovery	Biological Treatment	Other residual treatment
• Combustion: moving grate • Combustion: fluidised bed • Combustion: oscillating kiln • ATT: plasma gasification • ATT: pyrolysis	• Clean MRF: single-stream • Clean MRF: Twin-stream • Clean MRF: multi-stream • MBT: anaerobic digestion • MBT: composting • MBT: autoclave • MBT: enzyme	• Aerobic: open air windrow composting • Aerobic: enclosed housed composting halls • Aerobic: in-vessel composting • Anaerobic: wet-AD • Anaerobic: dry-AD	• Landfilling

Dry recycling includes the following materials: paper, card, plastic bottles, pots tubs and trays, cartons, aluminium and steel cans, glass. Plastic film and flexible packaging are also included in this stream based on the current direction of government policy through the Environment Act.

In the UK there are currently three primary approaches to dry recyclate collections:

- Commingled in which all dry recyclate is collected in a single container and then separated at a Materials Recovery Facility (MRF) before onward transport to reprocessors.
- Twin-stream collections in which one material stream (in general glass or paper and card) is collected in a separate container from the rest of the dry recyclate. In general, either glass or paper & card (co-collected) are the material streams collected separately. The remaining co-collected materials are separated at a Materials Recovery Facility (MRF) before onward transport to reprocessors.
- Multi-stream collections commonly involve separate collection of
    - Paper and card.
    - Glass.
    - Plastics, plastic film and cans collected as three streams.
    - Other materials: Small WEEE, batteries, textiles.

The more separation occurs at the kerbside the higher the collection costs. However, this can be offset against reduced mechanical separation and consequent MRF gate fees and potentially improve material qualities and incomes. While lower gate fees have been modelled for scenarios with increased separation, the modelling has not examined higher incomes for these scenarios, due to the lack of robust evidence.

Collection frequency can influence the yields collected for recycling and organic treatment. Reducing residual waste collection frequencies can reduce collection costs and increase recycling yields. More frequent recycling collections can also improve yields.

The evaluation criteria were divided into four themes:

- Technical and deliverability.
- Cost.
- Environmental.
- Sustainability.

The long-list evaluation criteria are presented in Table 16.

Table 16: Long-list evaluation criteria

Theme	Qualitative Assessment	Red	Amber	Green	Pass/fail criteria
Technical and Deliverability	**Evaluation of deliverability risk (i.e. is the technology proven at the scale required)**	No track record or only demonstration plants available	Operating at commercial scale in UK but with some significant operational issues or operating at scale in non-UK OECD countries.	Commercially viable in UK with a proven track record of success without significant operational issues	Must be green to go to shortlist
	Extent to which technology is flexible to changes in waste composition	Technology likely to fail with significant changes in waste composition	Technology may cope with significant changes in waste composition, however with some reduction in performance	Technology can cope with significant changes in waste composition	
	Ease of use for the householders	Completely new system (which is more difficult for the householder with majority of WCAs changing)	The same as the current system (for the majority of householders within the WCAs)	Easier to use than current system (for the majority of householders within the WCAs)	
	Extent to which technology would be accepted from the public	Not expected to be accepted by the majority of the public under any circumstances	Expected to be accepted by the majority of the public, with additional mitigations and sensitive siting	Expected to have widespread public acceptance	
	Does the scenario require significant new waste infrastructure?	Major new waste infrastructure required	Some new waste infrastructure required	Minimal waste infrastructure required for the scenario.	
	Evaluation of exposure to market risk (price) – recyclate and other offtake streams (e.g. RDF)	High market risk – system design increases risk due to quality and marketability of recyclate and offtake streams	Medium market risk – system design slightly increases risk due to quality and marketability of recyclate and offtake streams	Low market risk – system design mitigates risk due to quality and marketability of recyclate and offtake streams	

Theme	Qualitative Assessment	Red	Amber	Green	Pass/fail criteria
	Is this sympathetic to local policy?	Not sympathetic to local policy	Partially sympathetic to local policy	Sympathetic to all relevant local policy	
	Is the scenario consistent with current and proposed new legislation (e.g. will it need TEEP exemption)?	Not compliant with current nor incoming legislation	Compliant with current legislation. Partially compliant with incoming legislation, requiring exemptions	Compliant with current and incoming legislation	Must be amber to go to shortlist
Cost	Not evaluated at this stage				
Environmental	**Qualitative assessment of waste hierarchy position**	Does not contribute to waste reduction and improving recycling and landfill diversion rates	Slightly contributes to waste reduction and improving recycling and landfill diversion rates	Substantially contributes to waste reduction and improving recycling and landfill diversion rates	
	Qualitative assessment of environmental impact	Higher environmental impact than Baseline (e.g. has high carbon equivalent impact, worsen aesthetics, lower air and water quality, more transport required)	Similar environmental impact than Baseline	Lower environmental impact than Baseline (e.g. has low carbon equivalent impact, improved aesthetics, higher air and water quality, less transport required)	
Sustainability	Not evaluated at this stage				

The Qualitative Assessment criteria were weighted by the Stakeholders during the workshop, by distributing 100 points across them to understand the relative priority of each criterion. This exercise was conducted twice, once to assess the weighting for the collection scenarios and once for the treatment scenarios. The results are presented in Figure 43 and Figure 44, respectively.

Figure 43: Criteria weighting for collection scenarios.

Figure 44: Criteria weighting for treatment scenarios

The outcomes showed that the environmental impact and deliverability risk were identified as the most important criteria by the EWP when assessing the proposed collection and treatment scenarios. Flexibility and new waste infrastructure were the lowest scoring criteria for collection scenarios, at 7% and 6%, respectively.

Public acceptability was the third most voted criterion for the treatment scenarios, followed by new waste infrastructure and the waste hierarchy. Sympathy to local policy and ease of use for householders were not scored as highly possibly reflecting that there is less interface between householders and waste treatment infrastructure in general.

These weightings have been applied to the proposed long-list of scenarios, to identify which scenarios will be brought forward to the short-list of scenarios that will be modelled. The long-list of future waste collection and treatment technology scenarios was presented to the stakeholders prior to the Workshop in an "Issues and scenarios Briefing Note" (see Appendix 2).

6.1.2 Short-listed scenarios

Following the workshop on the 29 November 2021, EWP Officers were asked to score each scenario in the long-list against the agreed evaluation criteria in an Excel spreadsheet developed by Ricardo and circulated by ECC. Only the views of the authorities that completed the matrices on Excel are included in the scoring.

The results of the scoring provided by the authorities has been analysed by Ricardo and the modal averages of the scoring provided for the collection scenarios long-list and the treatment technologies long-list are provided in Table 17: Collection long-list scoring and Table 18: Treatment technologies long-list respectively. A summary of the results received is provided in Appendix 3.

Table 17: Collection long-list scoring

		Deliverability risk	Technology flexibility	Ease of Use	Public acceptability	New waste infrastructure	Exposure to market risk	Local policy alignment	Legislation compliance	Waste hierarchy	Environmental impact	Total score
	Weight (As Agreed at Workshop)	13%	7%	7%	10%	6%	8%	8%	12%	11%	18%	100%
Dry recycling collections	Commingled	3	3	3	3	3	2	3	2	2	2	2.51
	Twin-stream (paper&card out)	3	3	2	3	3	2	2	2	2	2	2.30
	Twin-stream (glass out)	3	2	2	3	3	2	2	2	2	2	2.23
	Multi-stream	3	3	2	2	2	3	3	3	3	2	2.59
Food waste collections	Separate food colln	3	3	2	3	3	3	3	3	3	3	2.93
	Food co-collected with garden waste	2	2	3	3	2	3	2	0	2	2	2.45
Garden waste collection	Separate - w/o subscription	3	3	3	3	3	3	3	3	3	2	2.82
	Separate - w subscription	3	3	2	2	3	3	3	2	3	3	2.81
Dry recycling frequency	Weekly	2	3	3	3	3	3	2	3	3	2	2.61
	Fortnightly	3	3	3	3	3	3	3	3	3	3	2.82
	Three-weekly	2	3	2	2	2	3	2	2	3	3	2.44
Garden waste frequency	Weekly	3	3	3	3	3	3	2	3	3	2	2.82
	Fortnightly	3	3	2	3	3	3	3	3	3	3	2.93
Residual waste frequency	Weekly	2	3	3	3	2	3	2	3	0	0	1.86
	Fortnightly	3	3	3	3	3	3	3	3	3	3	2.82
	Three-weekly	3	3	0	0	2	3	2	2	3	3	2.43
	Four-weekly	2	2	0	0	2	3	0	0	3	3	1.58

Table 18: Treatment technologies long-list

Category	Technology	Deliverability risk	Technology flexibility	Ease of Use	Public acceptability	New waste infrastructure	Exposure to market risk	Local policy alignment	Legislation compliance	Waste hierarchy	Environmental impact	Total score	Waste stream
	Weight (As Agreed at Workshop)	18%	8%	2%	11%	11%	5%	5%	8%	8%	24%	100%	
Landfilling	Landfill	3	3	3	2	2	3	0	0	0	2	1.91	Residual waste
Thermal treatment	Combustion - moving grate	3	3	3	2	0	3	2	3	2	2	2.19	Residual waste
Thermal treatment	Combustion - fluidised bed	2	3	2	2	0	3	2	3	2	2	1.99	Residual waste
Thermal treatment	Combustion - oscillating kiln	2	2	2	2	0	3	2	3	2	2	1.91	Residual waste
Thermal treatment	ATT - gasification	0	2	2	2	0	3	2	3	2	3	1.79	Residual waste
Thermal treatment	ATT - pyrolysis	0	2	2	2	0	3	2	3	2	3	1.79	Residual waste
Mechanical materials recovery	MBT: anaerobic digestion	2	2	2	2	0	2	3	3	2	2	1.91	Residual waste
Mechanical materials recovery	MBT: composting	2	2	2	2	0	2	3	3	2	2	1.91	Residual waste
Mechanical materials recovery	MBT: autoclave	2	2	2	2	0	2	3	3	2	2	1.91	Residual waste
Mechanical materials recovery	MBT: enzyme	2	2	2	2	0	2	3	3	2	2	1.91	Residual waste
Mechanical materials recovery	Clean MRF - single-stream	3	3	3	3	2	2	3	2	3	2	2.52	Dry recycling
Mechanical materials recovery	Clean MRF - two-stream	3	3	3	2	2	2	2	3	3	2	2.44	Dry recycling
Mechanical materials recovery	Clean MRF - multistream	3	3	3	2	2	2	3	3	3	2	2.49	Dry recycling
Biological treatment	Aerobic: open air windrow composting	3	3	3	3	3	3	3	3	3	2	2.76	Organic waste
Biological treatment	Aerobic: enclosed housed composting halls	3	3	3	3	2	3	3	3	3	2	2.65	Organic waste
Biological treatment	Aerobic: in-vessel composting	3	3	3	3	2	3	3	3	3	2	2.65	Organic waste
Biological treatment	Anaerobic: dry AD	3	3	2	2	3	3	3	3	3	2	2.63	Organic waste
Biological treatment	Anaerobic: wet AD	2	2	2	2	0	3	3	3	3	2	2.04	Organic waste

Based on the outcome of the long-list scoring, the scenarios presented in Table 19 have been identified as short-listed whole system scenarios to be modelled. These scenarios represent a range of approaches that have been used elsewhere. It is not intended to provide every conceivable waste collection and treatment scenario, but to provide a manageable number that can be tested, modelled and used to assist the EWP with developing its strategic framework. Note that twin-stream was not selected as it was considered to fall between comingled and multi-stream and therefore using these two opposite solutions provided a conservative range of impact to assist the EWP's decision making.

The identified solutions for the management of each waste stream by EWP (Wet AD for food waste, Open Air Windrow for garden waste and EFW for residual waste treatment) is based on the reliability and suitability of these methodologies, along with their compliance with national policy. This reflects the evaluation criteria agreed by Officers and Members of the EWP Authorities. It should also be noted that whilst landfill is part of the baseline modelling, it does not feature as a scenario.

Table 19: Short-listed whole system scenarios for modelling

Scenarios		Dry recycling	Food waste	Garden waste	Residual waste
Scenario 1	Collection	**Commingled, fortnightly**	Separate, weekly	Separate, fortnightly (no subscription)	Fortnightly
	Treatment	MRF	Wet AD	OAW composting	EFW – Moving Grate
Scenario 2	Collection	Commingled, fortnightly	Separate, weekly	Separate, fortnightly (no subscription)	**Three-weekly**
	Treatment	MRF	Wet AD	OAW composting	EFW – Moving Grate
Scenario 3	Collection	**Multi-stream, fortnightly**	Separate, weekly	Separate, fortnightly (no subscription)	Fortnightly
	Treatment	Direct to Reprocessor	Wet AD	OAW composting	EFW – Moving Grate
Scenario 4	Collection	Multi-stream, fortnightly	Separate, weekly	Separate, fortnightly (no subscription)	**Three-weekly**
	Treatment	Direct to Reprocessor	Wet AD	OAW composting	EFW – Moving Grate
Scenario 5	Collection	Multi-stream, weekly	Separate, weekly	Separate, fortnightly (no subscription)	Fortnightly
	Treatment	Direct to Reprocessor	Wet AD	OAW composting	EFW – Moving Grate
Scenario 6	Collection	Multi-stream, weekly	Separate, weekly	Separate, fortnightly (no subscription)	**Three-weekly**
	Treatment	Direct to Reprocessor	Wet AD	OAW composting	EFW – Moving Grate

During workshop 6, (15 February 2022), Members were presented with the proposed shortlist of combined collection and treatment scenarios (as presented in Table 19), to be taken forward for the next stage to model the relative performances of each scenario. The set of 6 scenarios resulted from a scoring exercise undertaken by EWP Officers (using the evaluation model agreed with Members at a previous workshop), and following discussions held with Officers on the 26th January 2022. The purpose of the Member session held on 15th February was to secure Members' views and validate the agreed set of scenarios that will be brought forward for detailed modelling in the next stages of the project.

In addition to the scenarios above, it was proposed to carry out further modelling of additional scenarios (or 'sensitivity' modelling) on the preferred scenario(s), with the intention that one scenario is brought forward. The proposed additional scenarios include analysis of the performances of the preferred scenario with the following changes applied:

- garden waste collections with a householder subscription service
- residual waste treatment of EfW with the addition of:
    - CHP enabled
    - CCUS in line with industry best practice and Net Zero Strategy
    - use of pre-treatment prior to combustion to pull out further recyclable materials and maximise recycling

These additional scenarios were derived through the discussions with EWP Officers and validated by Members at the workshop on 15th February.

6.2 SCENARIOS MODELLING ASSUMPTIONS

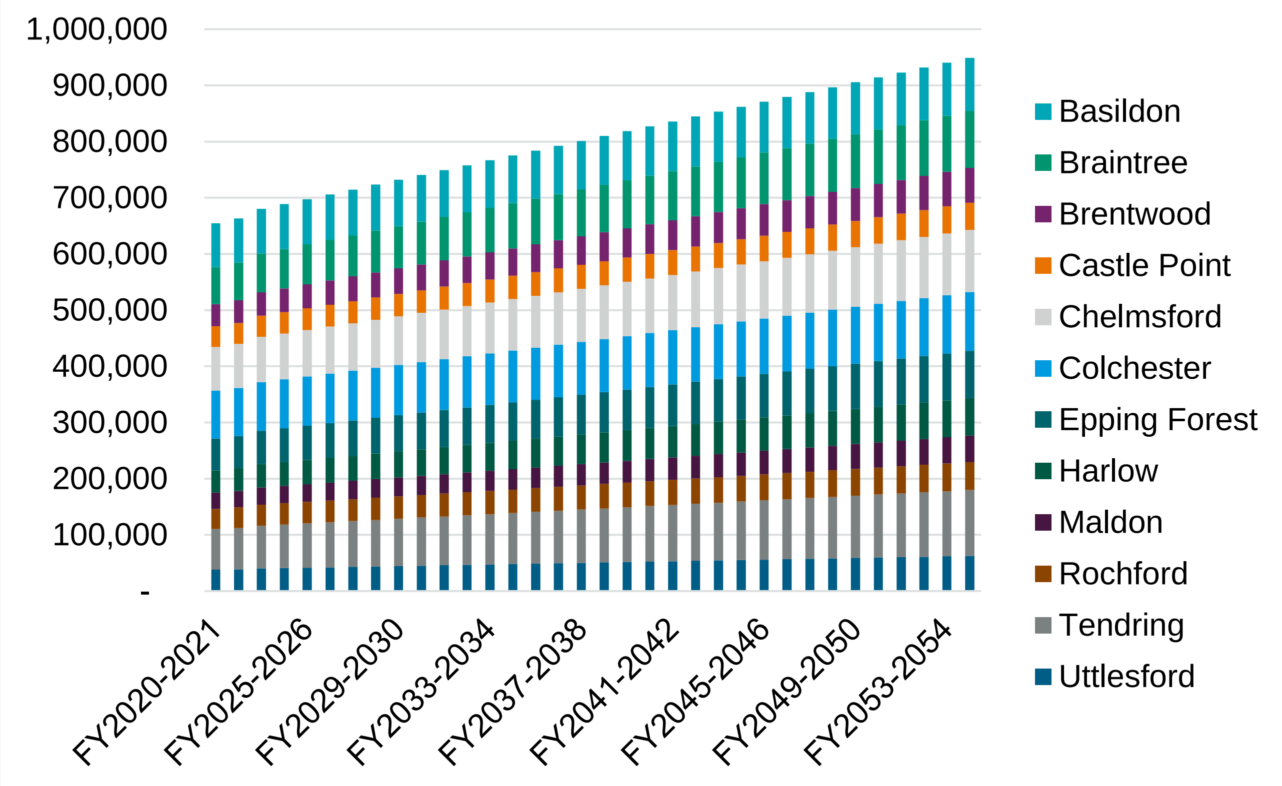
6.2.1 Housing Growth

Assumptions around housing growth in the Essex Districts and Boroughs were generated using a variety of sources, including specific council housing trajectory reports, data gathered by direct contact with EWP officers and Office of National Statistics (ONS) data. A summary of the sources used and the number of households new households by year is shown in Table 20. The total number of forecasted household growth by Council is shown in Figure 45. For a detailed explanation of how these figures have been forecasted please refer to Appendix 4.

Table 20: Expected Housing Growth in EWP Councils

District	Quantity of new households	By Year	Source	Assumption
Basildon	6,985	Beyond 2034	ECC	2034/35
Braintree	12,319	2032/33	REE	2032/33
Brentwood	7,958	2032/33	ECC	2032/33
Castle Point	4,118	2033	ECC	2032/33
Chelmsford	14,600	2035/36	Chelmsford	2035/36
Colchester	8,164	2027/28	ONS	2027/28
Epping Forest	9,807	2032/33	REE	2032/33
Harlow	9,584	2032/33	ECC	2032/33
Maldon	3,738	2028	Direct engagement with Maldon	2027/28
Rochford	2,759	2027/28	ONS	2027/28
Tendring	9,299	2028	ECC	2027/28
Uttlesford	5,053	2027/28	ONS	2027/28

Figure 45: Forecasted Housing Growth in EWP Council



6.2.2 Vehicles and Containers

The vehicles and containers specifications listed in Table 21 and the costs presented in Table 22 have been used to model the scenarios for the Strategy. These have been assumed based on the current collection systems. For example, three out of the four Councils collecting co-mingled recycling on a fortnightly basis use 26t refuse collection vehicles (RCV), therefore it was agreed that this specification of vehicle would be used to model scenarios 1 and 2. Costs assumptions presented come from Ricardo's cost database. Note that for scenario modelling year FY2027-28, a 12% increase has been applied to vehicle, container, and staffing costs to estimate inflation rates for the future. So, the collection costs model will apply 12% increases to the values stated in Table 22.

Table 21: Vehicles and containers specifications

	Dry recycling			Food Waste			Garden waste			Residual waste		
Scenario	Vehicle	Container		Vehicle	Container		Vehicle	Container		Vehicle	Container	
		Standard Properties	Flats		Standard Properties	Flats		Standard Properties	Flats		Standard Properties	Flats
Scenario 1	26T RCV	240L wheeled bin	360L/1100L wheeled bin	7.5T Food collection	Indoor + outdoor caddy	180L wheeled bin	26T RCV	240L wheeled bin	N/A	26T RCV	180L wheeled bin	360L/1100L wheeled bin
Scenario 2	26T RCV	240L wheeled bin	360L/1100L wheeled bin	7.5T Food collection	Indoor + outdoor caddy	180L wheeled bin	26T RCV	240L wheeled bin	N/A	26T RCV	180L wheeled bin	360L/1100L wheeled bin
Scenario 3	Romaquip	Sack/Box	360L/1100L wheeled bin	7.5T Food collection	Indoor + outdoor caddy	180L wheeled bin	26T RCV	240L wheeled bin	N/A	26T RCV	180L wheeled bin	360L/1100L wheeled bin
Scenario 4	Romaquip	Sack/Box	360L/1100L wheeled bin	7.5T Food collection	Indoor + outdoor caddy	180L wheeled bin	26T RCV	240L wheeled bin	N/A	26T RCV	180L wheeled bin	360L/1100L wheeled bin
Scenario 5	Romaquip	Sack/Box	360L/1100L wheeled bin	7.5T Food collection	Indoor + outdoor caddy	180L wheeled bin	26T RCV	240L wheeled bin	N/A	Twin Pack 26T	180L wheeled bin	360L/1100L wheeled bin
Scenario 6	Romaquip	Sack/Box	360L/1100L wheeled bin	7.5T Food collection	Indoor + outdoor caddy	180L wheeled bin	26T RCV	240L wheeled bin	N/A	26T RCV	180L wheeled bin	360L/1100L wheeled bin

Table 22: Vehicles and containers cost assumptions

	Dry recycling			Food Waste			Garden waste			Residual waste		
Scenario	**Vehicle**	**Container**		**Vehicle**	**Container**		**Vehicle**	**Container**		**Vehicle**	**Container**	
		Standard Properties	**Flats**		**Standard Properties**	**Flats**		**Standard Properties**	**Flats**		**Standard Properties**	**Flats**
Scenario 1	£170,185 per vehicle	£18.40 per unit	£273.00 per 1,100 L bin	£71,073 per vehicle	£4.01 per indoor and outdoor caddy	£16.75 per container	£170,185 per vehicle	£18.40 per unit	N/A	£170,185 per vehicle	£16.75 per container	£273.00 per 1,100 L bin
Scenario 2	£170,185 per vehicle	£18.40 per unit	£273.00 per 1,100 L bin	£71,073 per vehicle	£4.01 per indoor and outdoor caddy	£16.75 per container	£170,185 per vehicle	£18.40 per unit	N/A	£170,185 per vehicle	£16.75 per container	£273.00 per 1,100 L bin
Scenario 3	£204,345 per vehicle	£3.12 per box	£273.00 per 1,100 L bin	£71,073 per vehicle	£4.01 per indoor and outdoor caddy	£16.75 per container	£170,185 per vehicle	£18.40 per unit	N/A	£170,185 per vehicle	£16.75 per container	£273.00 per 1,100 L bin
Scenario 4	£204,345 per vehicle	£3.12 per box	£273.00 per 1,100 L bin	£71,073 per vehicle	£4.01 per indoor and outdoor caddy	£16.75 per container	£170,185 per vehicle	£18.40 per unit	N/A	£170,185 per vehicle	£16.75 per container	£273.00 per 1,100 L bin
Scenario 5	£204,345 per vehicle	£3.12 per box	£273.00 per 1,100 L bin	£71,073 per vehicle	£4.01 per indoor and outdoor caddy	£16.75 per container	£170,185 per vehicle	£18.40 per unit	N/A	£204,345 per vehicle	£16.75 per container	£273.00 per 1,100 L bin
Scenario 6	£204,345 per vehicle	£3.12 per box	£273.00 per 1,100 L bin	£71,073 per vehicle	£4.01 per indoor and outdoor caddy	£16.75 per container	£170,185 per vehicle	£18.40 per unit	N/A	£170,185 per vehicle	£16.75 per container	£273.00 per 1,100 L bin

6.2.3 Yield assumptions

The assumed changes in dry recycling and residual waste yields are presented in Table 23and Table 24, respectively. These assumptions come directly or have been extrapolated from WRAP's Indicative Cost and Performance (ICP) tool.

It is expected that changes in the dry recycling collection method (containment and frequency) would impact both dry recycling and residual waste yields. Changes in residual waste collections would also have an impact on both dry recycling and residual waste yields.

Note that these yield changes were sense-checked during the modelling stage to ensure that the figures were achievable. Table 25 presents the cap applied on the capture rate for each recycling material. If an overall dry recycling yield change was only possible by exceeding one of the limits, then that LA was deemed to not be able to achieve the projected overall dry recycling yield change.

Please note that the impact on contamination has not been evaluated at this stage.

Table 23: Impact on dry recycling yields

Current dry recycling scheme	**Current residual scheme**	**Scenario 1** (fortnightly residual, fortnightly co-mingled)	**Scenario 2** (three-weekly residual, fortnightly co-mingled)	**Scenario 3** (fortnightly residual, fortnightly multi-stream)	**Scenario 4** (fortnightly residual, fortnightly multi-stream)	**Scenario 5** (fortnightly residual, weekly multi-stream)	**Scenario 6** (three-weekly residual, weekly multi-stream)
Two-stream, Fortnightly	Weekly	25%	[14]48%	-2%	27%	16%	36%
Co-mingled, Fortnightly	Fortnightly	0%	[15]27%	-22%	0%	-7%	13%
Multi-stream, Fortnightly	Weekly	36%	60%	7%	36%	27%	48%
Two-stream, Fortnightly	Fortnightly	12%	[16]36%	-12%	13%	0%	[17]27%
Multi-stream, Fortnightly	Fortnightly	28%	[18]48%	0%	27%	19%	[19]36%

[14] The maximum yield Basildon can achieve is 41.6%
[15] The maximum yield Braintree can achieve is 27.0%
[16] The maximum yield Tendring can achieve is 19.0%
[17] The maximum yield Tendring can achieve is 19.0%
[18] The maximum yield Colchester can achieve is 32.8%
[19] The maximum yield Colchester can achieve is 32.8%

Table 24: Impact on residual waste yields

Current Dry Recycling	Current Residual	**Scenario 1** (fortnightly residual, fortnightly co-mingled)	**Scenario 2** (three-weekly residual, fortnightly co-mingled)	**Scenario 3** (fortnightly residual, fortnightly multi-stream)	**Scenario 4** (fortnightly residual, fortnightly multi-stream)	**Scenario 5** (fortnightly residual, weekly multi-stream)	**Scenario 6** (three-weekly residual, weekly multi-stream)
Two-stream, Fortnightly	Weekly	-19%	-32%	-7%	-16%	-13%	-23%
Co-mingled, Fortnightly	Fortnightly	0%	-16%	15%	0%	8%	-9%
Multi-stream, Fortnightly	Weekly	-23%	-40%	-11%	-23%	-17%	-32%
Two-stream, Fortnightly	Fortnightly	-6%	-23%	8%	-9%	0%	-16%
Multi-stream, Fortnightly	Fortnightly	-13%	-32%	0%	-16%	-6%	-23%

Table 25: Capture rate caps applied to each recyclable for FY 2027/28

Material	Capture Rate cap (27/28)
Recyclable paper	95%
Recyclable card	95%
Liquid cartons	80%
Plastic films	60%

Material	Capture Rate cap (27/28)
Plastic bottles	95%
PTTs	80%
Recyclable glass	95%
Ferrous	90%
Non ferrous	90%
All textiles	60%
WEEE	60%

For a more detailed explanation of how these impacts have been estimated, please refer to Appendix 4.

6.2.4 Other Assumptions

It was assumed that staff costs, such as salaries for drivers, loaders, managers, would change from the Baseline information provided by the EWP Councils in accordance with the 12% inflation assumption mentioned previously. Costs data will vary by WCA.

The MRF/bulking gate fees for each scenario have been estimated based on data received from EWP Councils (specifically Rochford, Uttlesford and Brentwood). They are presented in Table 26. Please note the figures below include haulage.

Table 26: MRF/bulking gate fees

Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
£61/tonne	£61/tonne	£35/tonne	£35/tonne	£35/tonne	£35/tonne

The material income values used in the modelling are based on 3-year averages to account for price volatility and have been sourced from LetsRecycle.com. They are shown in Table 27 below. Negative values are costs, positive values are incomes.

Table 27: Material income prices

Material Income	3-year average
Mixed Paper	£20.04/tonne
Paper (separate)	£25.78/tonne
Cardboard	£58.58/tonne
Mixed Glass	£10.36/tonne
Mixed Plastic Bottles	£70.00/tonne
Plastic Films	£31.25/tonne
Pots, Tubs and Trays	-£3.75/tonne
Liquid Cartons	£20.04/tonne
Aluminium Cans	£810.69/tonne
Steel Cans	£105.43/tonne

6.3 EWP – SCENARIO MODELLING OUTPUTS

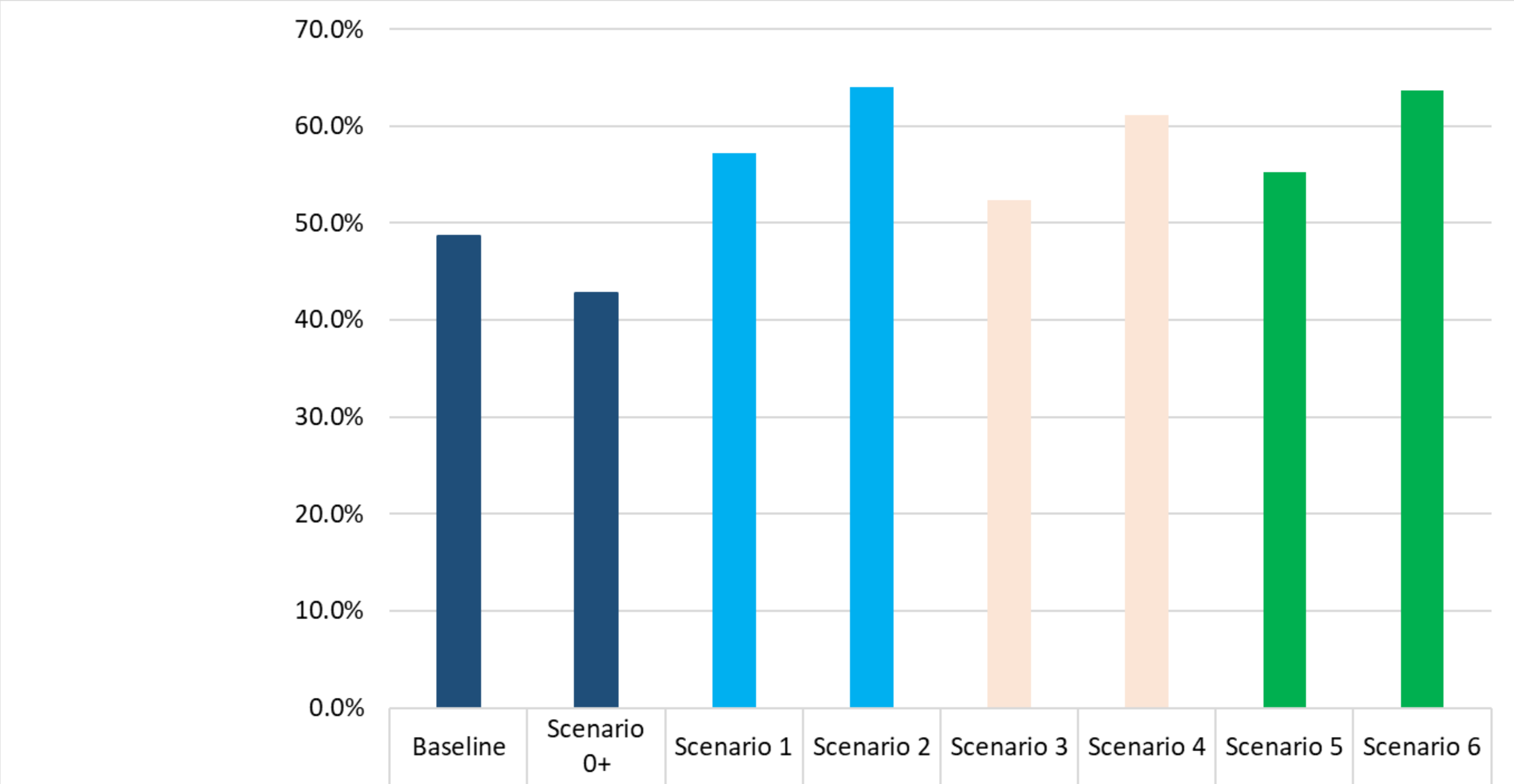
In this section, the total combined modelling results for all districts and ECC (EWP) will be presented for the scenarios. This includes the Key Performance Indicators (KPIs) from the Waste Destination Model (WDM), the total tonnage for waste streams from the Waste Flow Model, the outputs of the Collection Resourcing and Costs models, and the Whole System Costs Model results.

The current Baseline is shown as a comparator against which each of the scenarios modelled can be compared. However, the scenario model will also show the projected performance and costs of the current services for the financial year (FY) in 2027-2028: this is included in the scenario modelling as scenario 0+. This mirrors the modelling of each of the scenarios, which are also based on the assumptions of service provision for FY 2027/28.

From the WDM, the recycling rates of all waste streams (including commercial waste) and recycling collected via DRS can be presented for each district council and Essex County Council (ECC). All 12 district councils and ECC's results can be combined and recycling rates from the WDM are presented in Figure 46 below.

- All scenarios have an increase in recycling rate when compared to scenario 0+
- Scenario 2 has the highest recycling rate at 64.0%
- Scenarios 2, 4, and 6 (three-weekly residual collections) have an increase in recycling rate when compared to fortnightly residual collection with the same recycling collection – increasing by ~ 10%. Scenario 3 – a combination of fortnightly multi-stream recycling and residual waste being collected fortnightly –has the lowest recycling rate out of scenarios 1-6.

Figure 46: EWP combined recycling rate



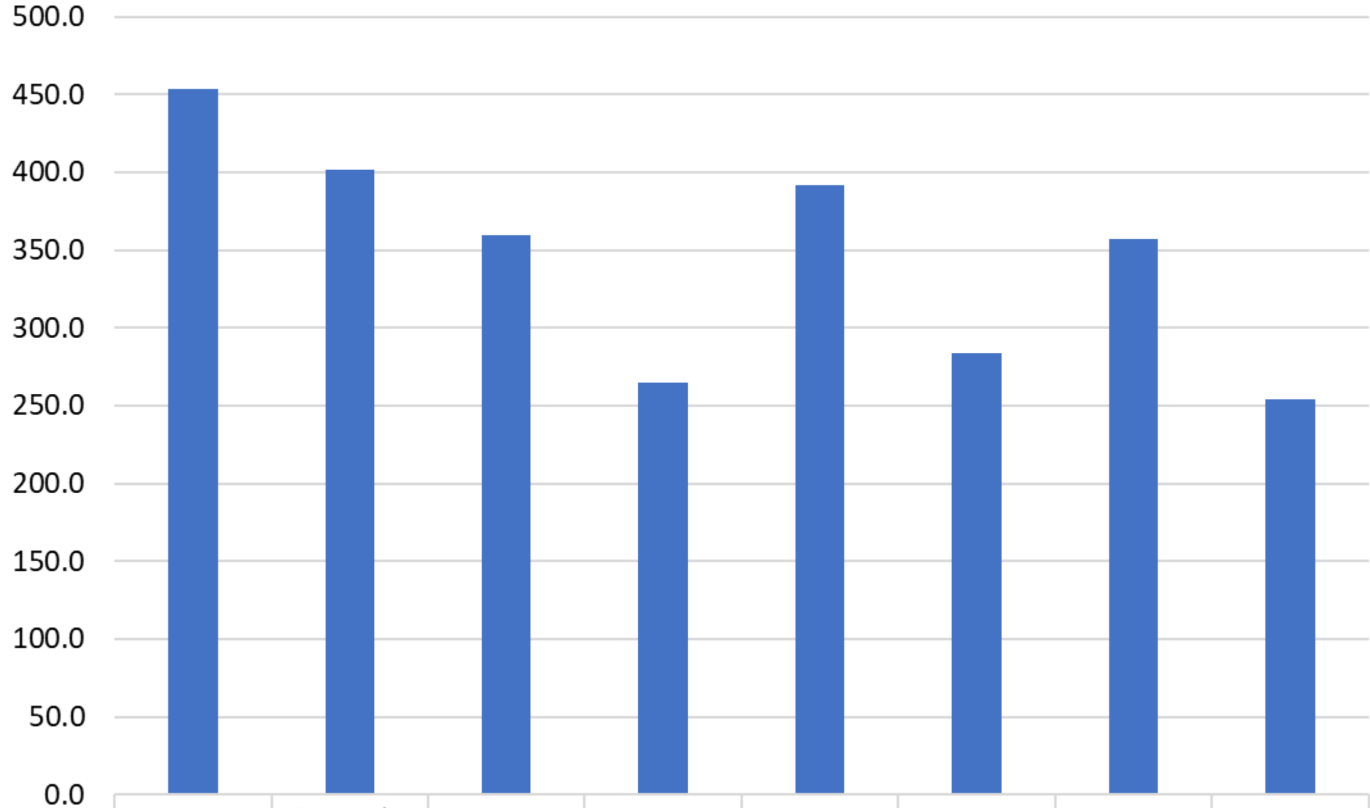
	Baseline	Scenario 0+	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
LACW Recycling (inc. reuse)	48.7%	42.8%	57.2%	64.0%	52.4%	61.1%	55.3%	63.7%

Figure 47 shows the EWP's residual waste per household for each scenario.

- All scenarios have a reduction in LACW residual waste per household relative to the baseline (a proxy for residual waste per capita).
- Fortnightly (scenario 1, 3 and 5) and three-weekly residual collections (scenario 2, 4, and 6) have reduced residual waste per household in comparison to scenario 0+ (mix of weekly and fortnightly).
- Scenario 6 has the lowest residual waste per household: 255 kg/hh/year, due to the additional food waste capture and higher recycling rate.

- The scenarios with the lowest residual waste score higher in the scenarios Appraisal due to the lower cost of collections and higher recycling.

Figure 47: EWP's residual waste per household



	Baseline	Scenario 0+	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
LACW Residual (kg/hh/year)	453.9	401.4	360.0	264.9	391.4	283.7	356.9	254.4

6.3.1 Waste Flow Model outcomes

The total modelled waste arisings for residual waste, organics waste, dry recycling, and dry recycling contamination are shown in Figure 48.

Total waste arisings:

- Total waste arisings increase from the Baseline to scenario 0+ due to the housing growth from the Baseline year to the Baseline + and scenario modelling year – 2027/2028.
- Scenarios 2, 4, and 6 have the lowest total waste arisings as residual waste collections are three-weekly in these scenarios, whilst scenarios 1, 3, and 5 are fortnightly residual waste collections. Less frequent waste collections are more likely to produce lower waste arisings, because of additional waste storage required and reduced ability to dispose of the waste as regularly. However, scenario 1 (fortnightly) has slightly higher total waste arisings than scenario 0+ (mix of weekly and fortnightly) despite having lower residual waste arisings.

Residual waste:

- For all the scenarios, the residual waste arisings are reduced when compared to scenario 0+.
- Scenarios 2, 4, and 6 have the largest reduction in residual waste arisings compared to scenario 0+ due to the three-weekly collections. The three-weekly residual waste collection encourages residents to recycle more, so more waste is diverted from the residual container.
- Scenario 6 has the lowest residual waste tonnes (181,791) which is a reduction of more than 100,000 tonnes from scenario 0+ (286,869).

Dry Recycling:

- Dry recycling tonnes increase for all scenarios relative to scenario 0+ (147,342 tonnes), except scenario 3 which decrease to 135,229 tonnes.
- Scenarios 2, 4, and 6 have the largest increase in dry recycling tonnes compared to scenario 0+ due to the three-weekly residual waste collections incentivising residents to recycle more.

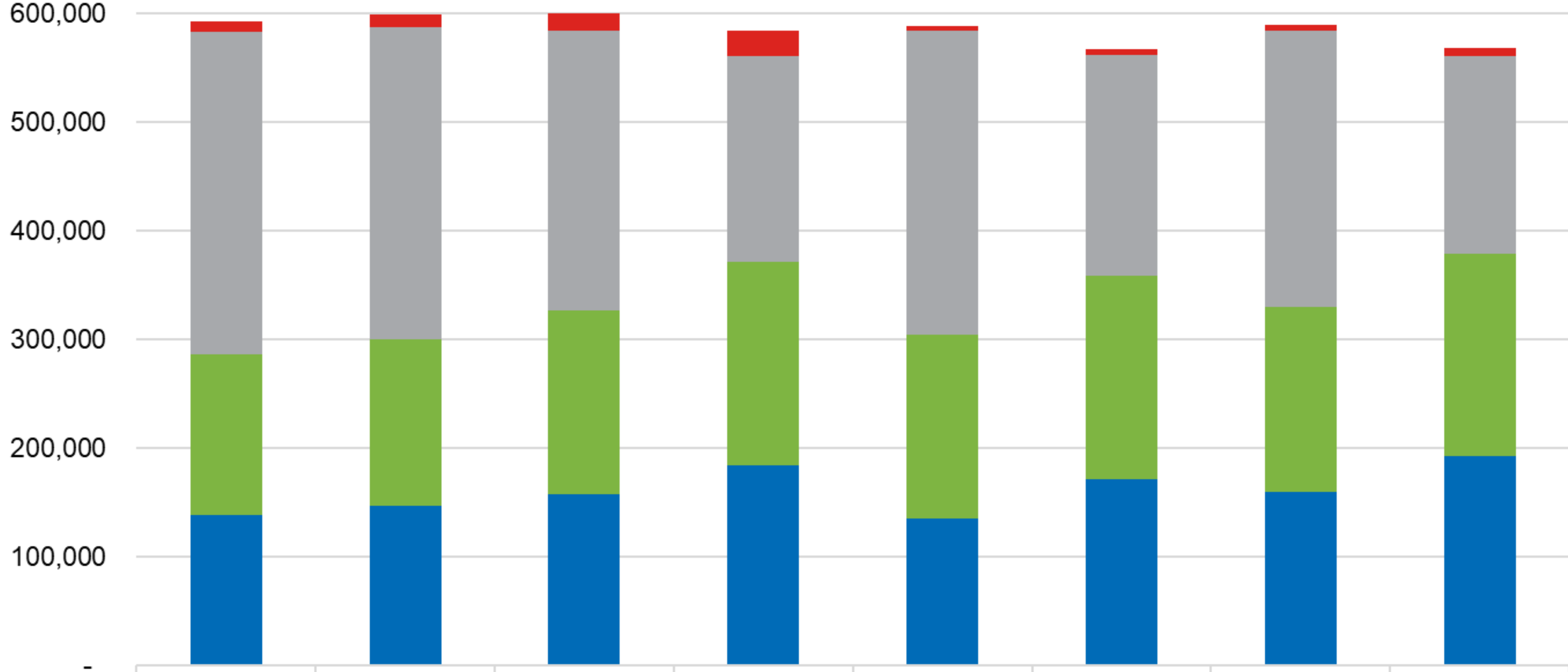
Organics:

- The three-weekly residual waste collection scenarios 2, 4 and 6 have the highest organic waste yields. This is like the reasons for the same scenarios' increase in dry recycling tonnes; three-weekly residual waste collections incentives residents to recycle more – including organic waste.

Contamination:

- Comingled recycling collection schemes in scenarios 1 and 2 have the highest dry recyclate contamination tonnes.
- Multi-stream recycling collection schemes in scenarios 3 to 6 have the lowest contamination tonnes.

Figure 48: Core household collections waste arisings per scenario, Total EWP, FY2020-21



	Baseline	Sc. 0+	Sc. 1	Sc. 2	Sc. 3	Sc. 4	Sc. 5	Sc. 6
Contamination	9,463	11,310	18,176	23,355	4,100	5,854	4,861	6,633
Residual	297,236	286,869	257,308	189,342	279,727	202,720	255,058	181,791
Organic	148,024	153,495	169,949	187,166	169,949	187,166	169,949	187,166
Recycling	138,572	147,342	157,484	184,968	135,229	171,790	159,835	192,520
Total	593,294	599,015	602,917	584,832	589,005	567,530	589,703	568,109

6.3.2 Collection Resourcing and Costs outcomes

A summary of the collection costs and vehicle resources required for the EWP are shown in Figure 49 where the total number of front-line collection vehicles across the Councils are presented relative to the number of households. Figure 50 presents the number of front-line vehicle costs required for each Council for each scenario. Figure 51 reciprocates this but for the total front-line vehicles across all Councils. Note that the costs for the scenarios are modelled in accordance to changes due to the assumed 12% inflation rate.

- The overall trend shows a strong correlation between the number of vehicles required and the total gross collection costs, which is logical as more vehicles means more staff, and vehicles and staff make up over half the costs.
- The introduction of separate food waste collections and free garden waste collections to all authorities increases the combined cost of all the scenarios relative to the Baseline.
- Scenarios 1 and 2 are the most economical, due to the efficiency of comingled collections. The relative cost efficiencies of comingled collections are primarily due to fewer resources being required.
- Scenarios 3 and 4 require more vehicles, and thus result in higher costs. The modelling has not examined the potential for higher material incomes for scenarios that include source-separation of dry recyclables. If these are included, it is possible that the difference in costs between the comingled collection scenarios and the source-separation scenarios will reduce.
- Scenarios 5 and 6 require even more vehicles due to the higher collection frequency.

Figure 49: EWP collection costs and number of vehicles required

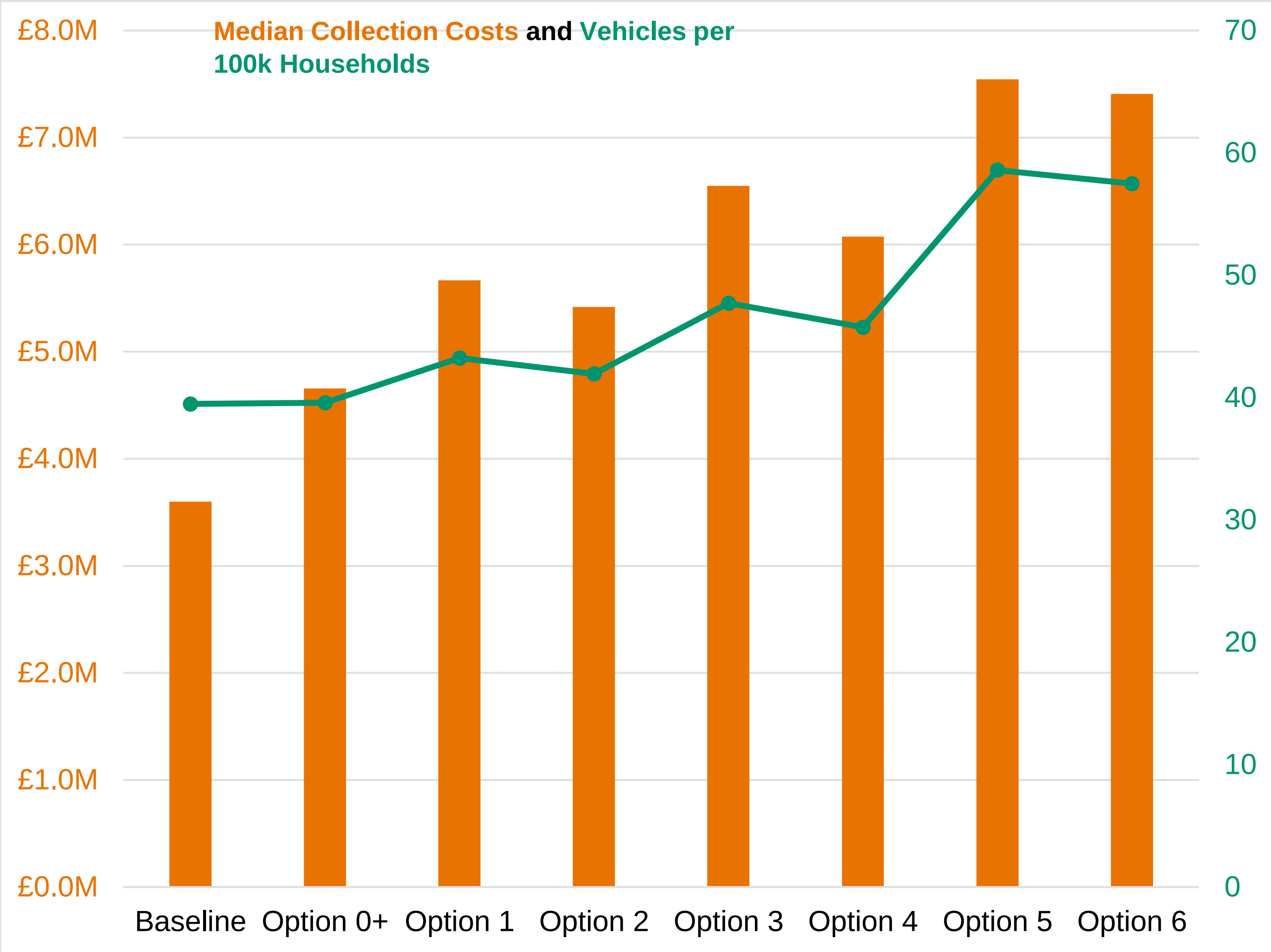
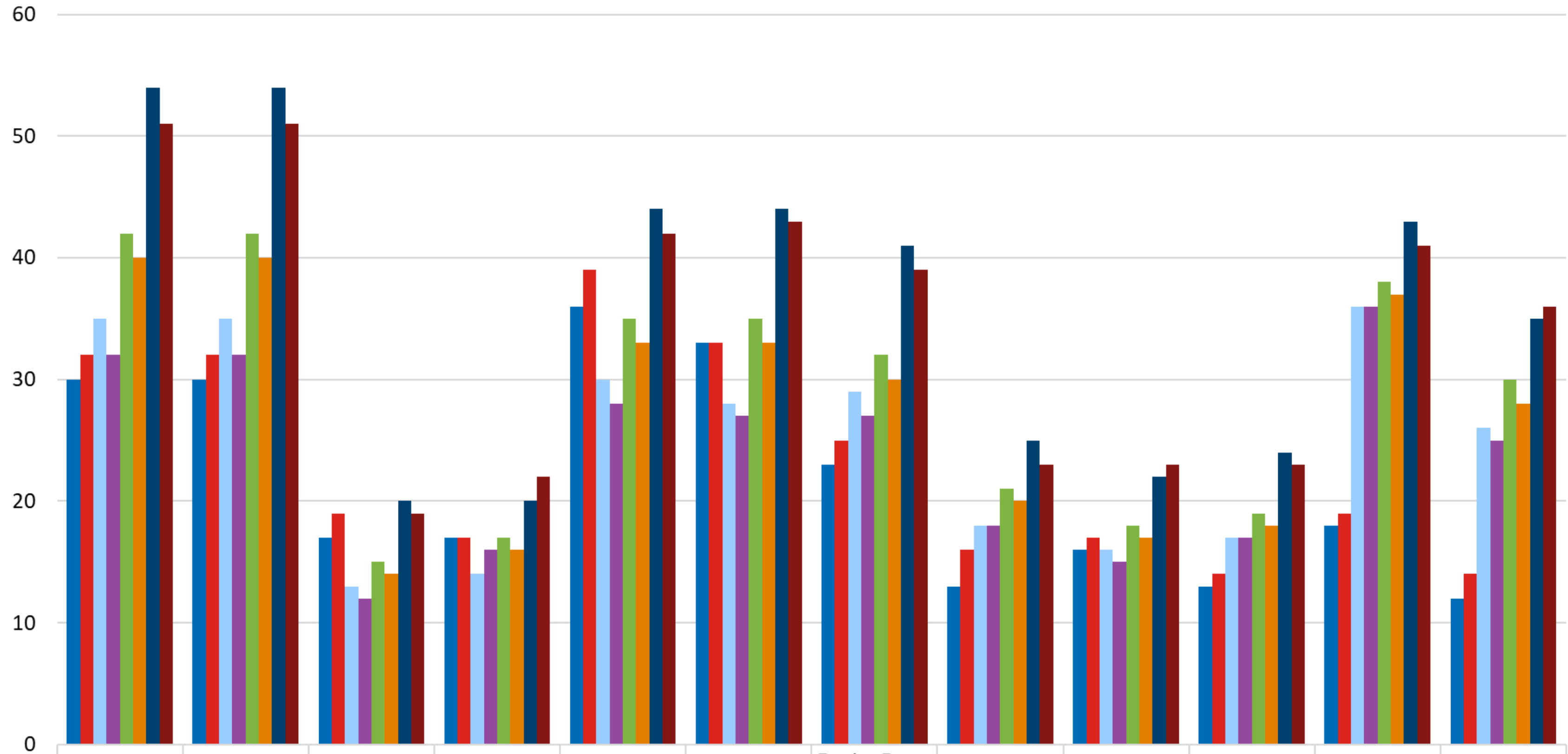
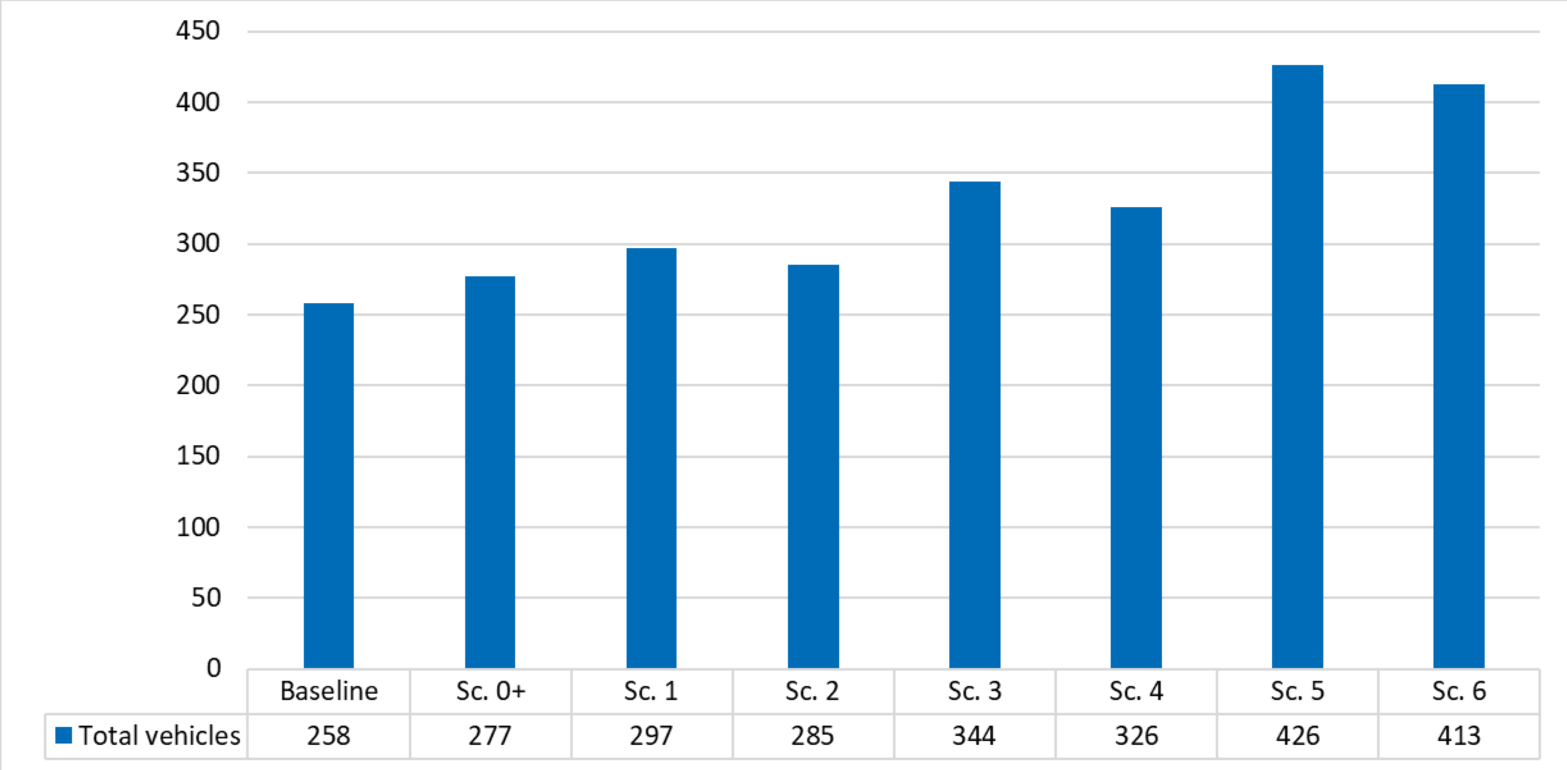


Figure 50 Front line collection vehicles for each Council



	Basildon	Braintree	Brentwood	CastlePoint	Chelmsford	Colchester	EppingForest	Harlow	Maldon	Rochford	Tendring	Uttlesford
Baseline	30	30	17	17	36	33	23	13	16	13	18	12
Sc. 0+	32	32	19	17	39	33	25	16	17	14	19	14
Sc. 1	35	35	13	14	30	28	29	18	16	17	36	26
Sc. 2	32	32	12	16	28	27	27	18	15	17	36	25
Sc. 3	42	42	15	17	35	35	32	21	18	19	38	30
Sc. 4	40	40	14	16	33	33	30	20	17	18	37	28
Sc. 5	54	54	20	20	44	44	41	25	22	24	43	35
Sc. 6	51	51	19	22	42	43	39	23	23	23	41	36

Figure 51 Total front-line vehicles for each scenario across all Councils



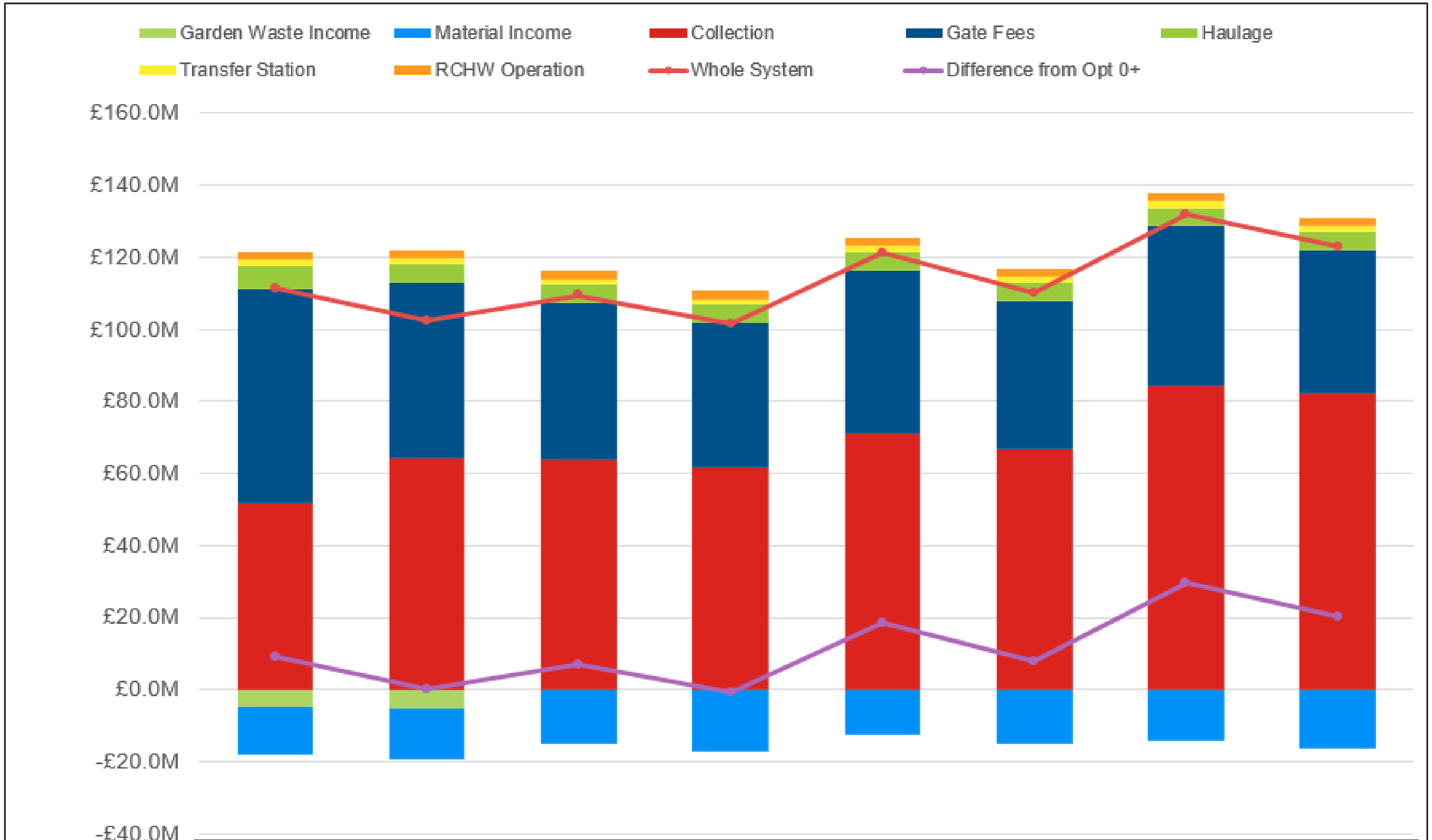
6.3.3 WSCM

The combined collection costs, haulage costs, treatment costs and other associated costs are shown in Figure 52.

- Collection and Treatment (treatment is indicated by Gate Fees in the figure) costs constitute over 75% of the total cost. The other 25% consists of haulage, transfer station and RCHW operation costs.
- For the EWP as a whole, cost such as recycling credits and inter-authority payments balance out (cost for ECC, income for districts), noting that this does not mean a net zero cost as funding is drawn from different areas.
- Overall, scenario 2 is projected to provide cost savings compared with scenario 0+.

- Scenarios 3, 5 and 6 are expected to cost an additional £18.6M (Scenario 3) to £29.4M (scenario 5) due to the increased number of vehicles and collection frequency.

Figure 52: Whole System Costs EWP (Total Cost per annum)



	Baseline	Scenario 0+	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
Total Gate Fees	£59.554M	£48.894M	£43.775M	£40.146M	£45.568M	£40.977M	£44.264M	£39.870M
Gross Cost	£129.828M	£130.184M	£124.547M	£118.942M	£133.750M	£125.132M	£146.011M	£139.325M
Income	-£18.287M	-£19.338M	-£15.071M	-£17.323M	-£12.585M	-£14.893M	-£14.050M	-£16.409M
Net Cost	£111.542M	£102.539M	£109.478M	£101.620M	£121.165M	£110.239M	£131.961M	£122.916M
Difference from Scenario 0+	£9.003M	£0.000M	£6.939M	-£0.919M	£18.626M	£7.700M	£29.422M	£20.377M

6.3.4 WRATE

The environmental assessment software used (WRATE) was chosen due to the ability to assess a variety of environmental impacts, rather than just carbon dioxide-equivalent emissions.

When reporting carbon dioxide-equivalent emissions to the Government for your net zero target, only Scope 1 and 2 emissions are counted.

This is to avoid double counting emissions, i.e., although the Council has the scenario to choose whether their materials are sent for recycling or disposal and therefore the Council has the power to impact the tonnes of emissions avoided from recycling existing materials rather than mining and using virgin materials, these lower emissions would be reported by the manufacturer as Scope 1 emissions and would not be reported by the Council.

However, the WRATE software is not set up in a way that can easily break the emissions down into Scope 1 and 2.

Figure 53 presents the greenhouse gas emissions associated for each scenario.

- Total greenhouse gas emissions are reduced for scenarios 1 to 6 when compared to scenario 0+.
- This is mainly due to the avoided emissions associated with higher recycling rates.
- Landfill emissions have reduced.
- Scenario 2 has the lowest greenhouse gas emissions as this scenario has the highest dry recycling tonnage and reduced total tonnage, resulting in the most avoided emissions.
- Scenario 3's total greenhouse gas emissions are only slightly lower than scenario 0+. This is, in part, down to the greater treatment & recovery emissions.
- Note that the GHG emissions include Scope 1 emissions that would not be reported by the council. The Scope 1 emissions have been included for the purpose of this report as they represent a positive impact that would be delivered from a council action.

Figure 53: Greenhouse Gas Emissions – Global Warming Potential (kg CO2-Eq)

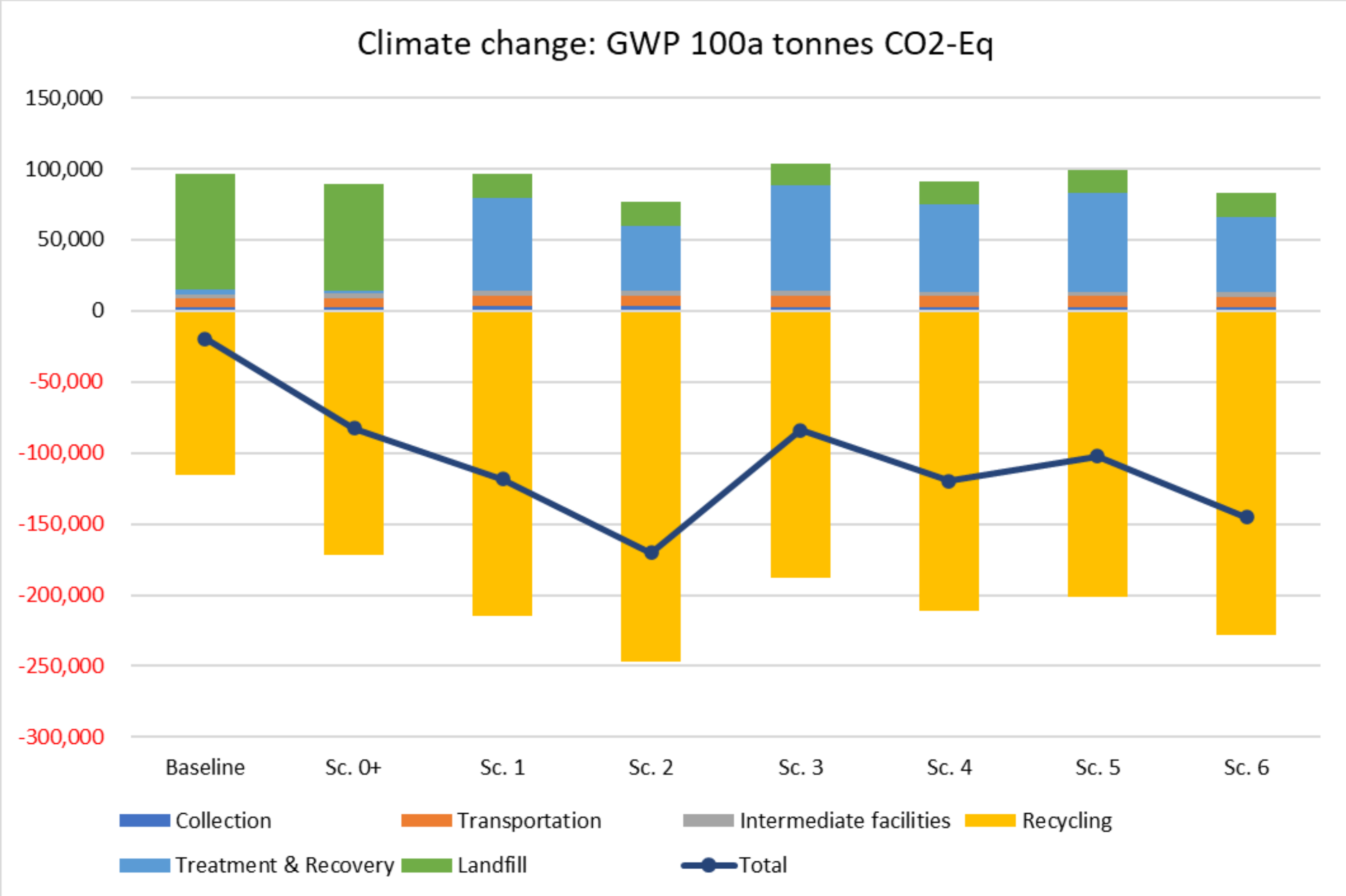


Figure 54 presents the impact of the activities on the potential for acid rain in Essex.

- Similar trend to total greenhouse gas emissions.
- Scenario 2 avoids the most tonnes of SO2-Eq through higher recycling and reduced overall waste arisings.

Figure 54: Acidification Potential (kg SO2-Eq)

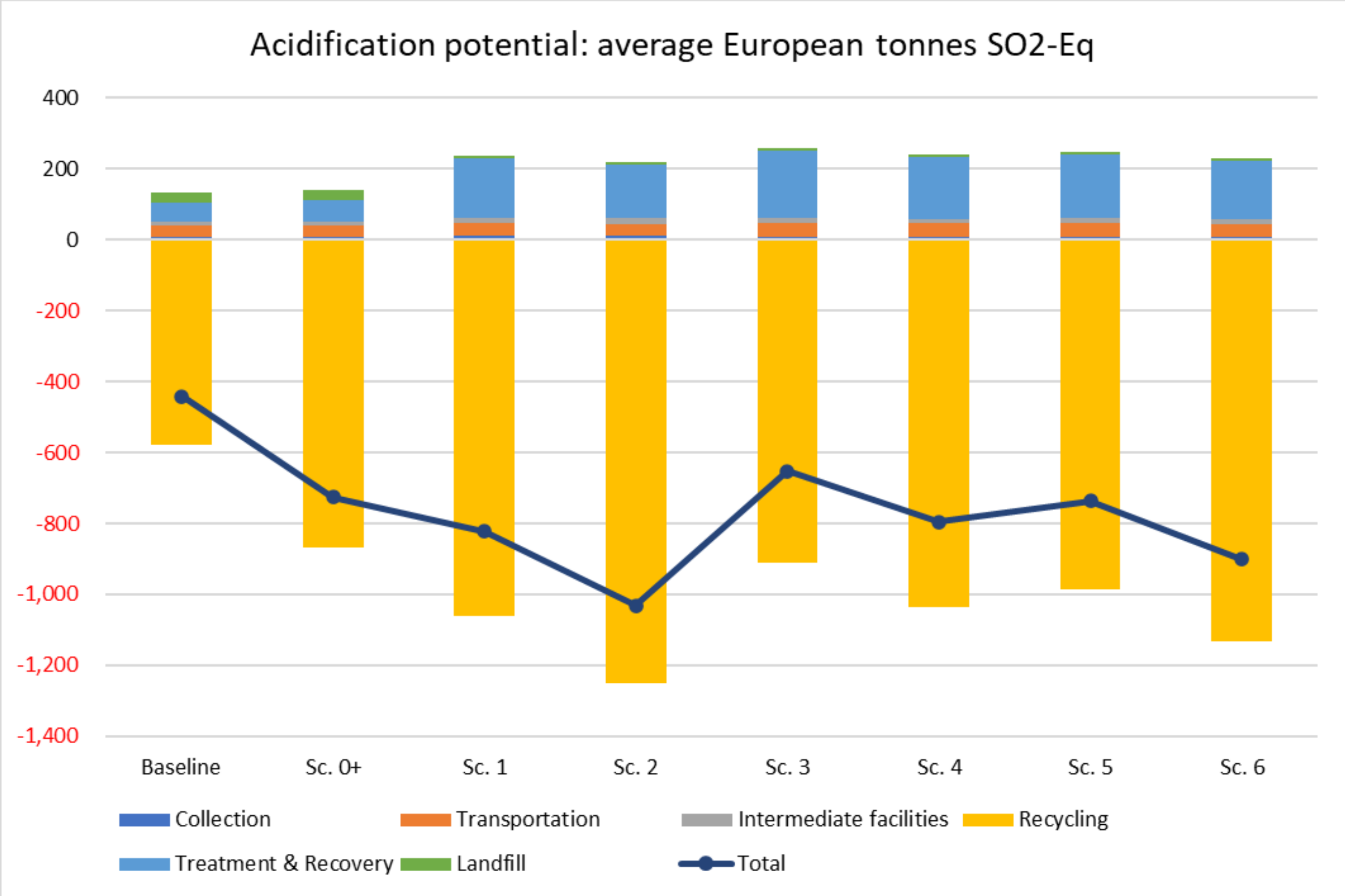


Figure 55 presents the impact of the activities on the amounts of potentially polluting substances that could harm aquatic life.

- Ecotoxicity is reduced from scenario 0+ for all scenarios.
- The increase in recycling in all scenarios results in lower ecotoxicity levels.

Figure 55: Freshwater Aquatic Ecotoxicity (kg 1,4-DCB-Eq)

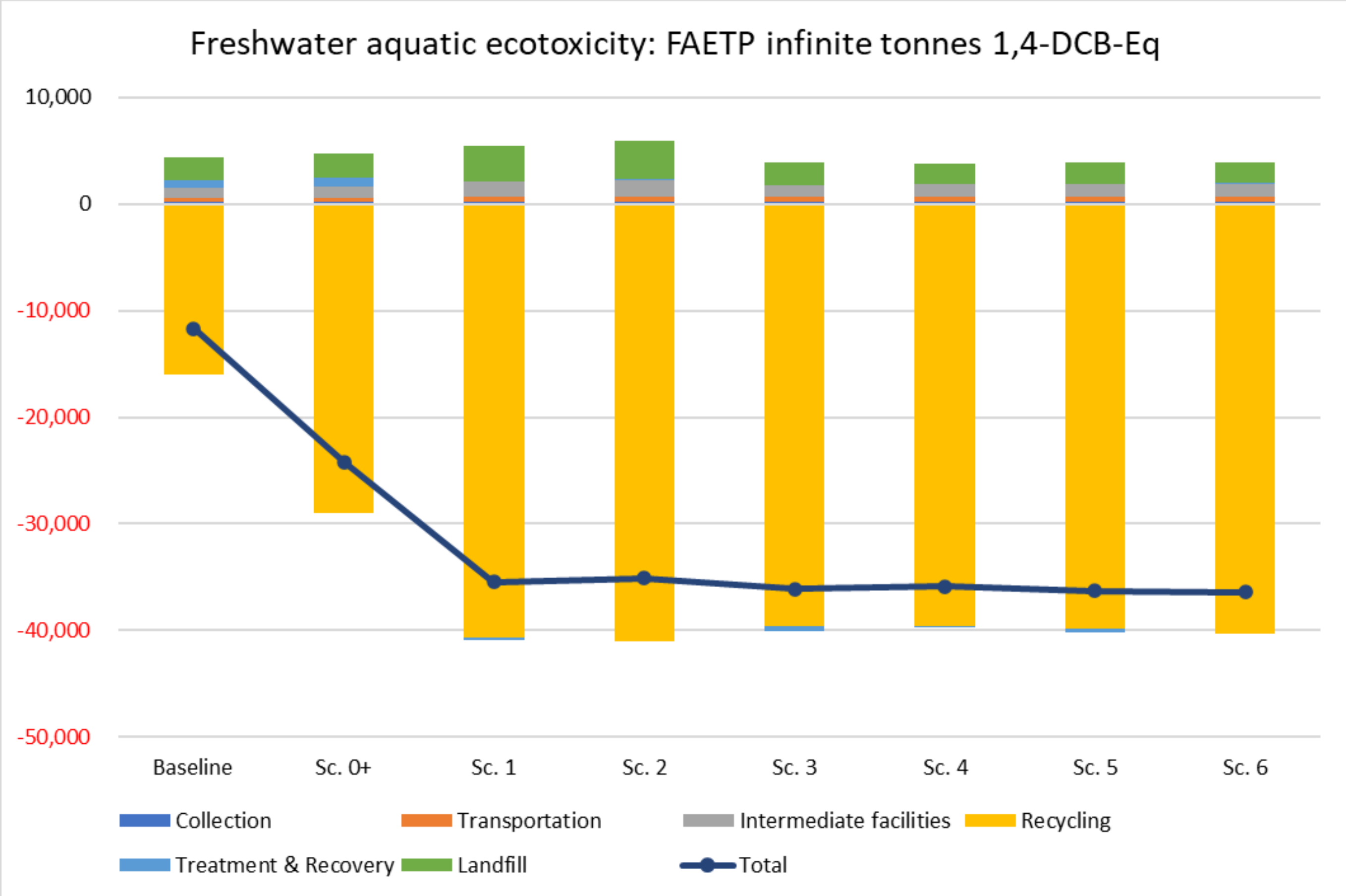


Figure 56 refers to the impact of the activities on the amounts of substances that are potentially toxic to humans. Human toxicity is measured in terms of tonnes of dichlorobenzene equivalent as a measure of toxins emitted by the system.

- Human toxicity is reduced from scenario 0+ for all scenarios.
- The increase in recycling for all scenarios results in lower toxicity levels.

Figure 56: Human Toxicity (kg 1,4-DCB-Eq)

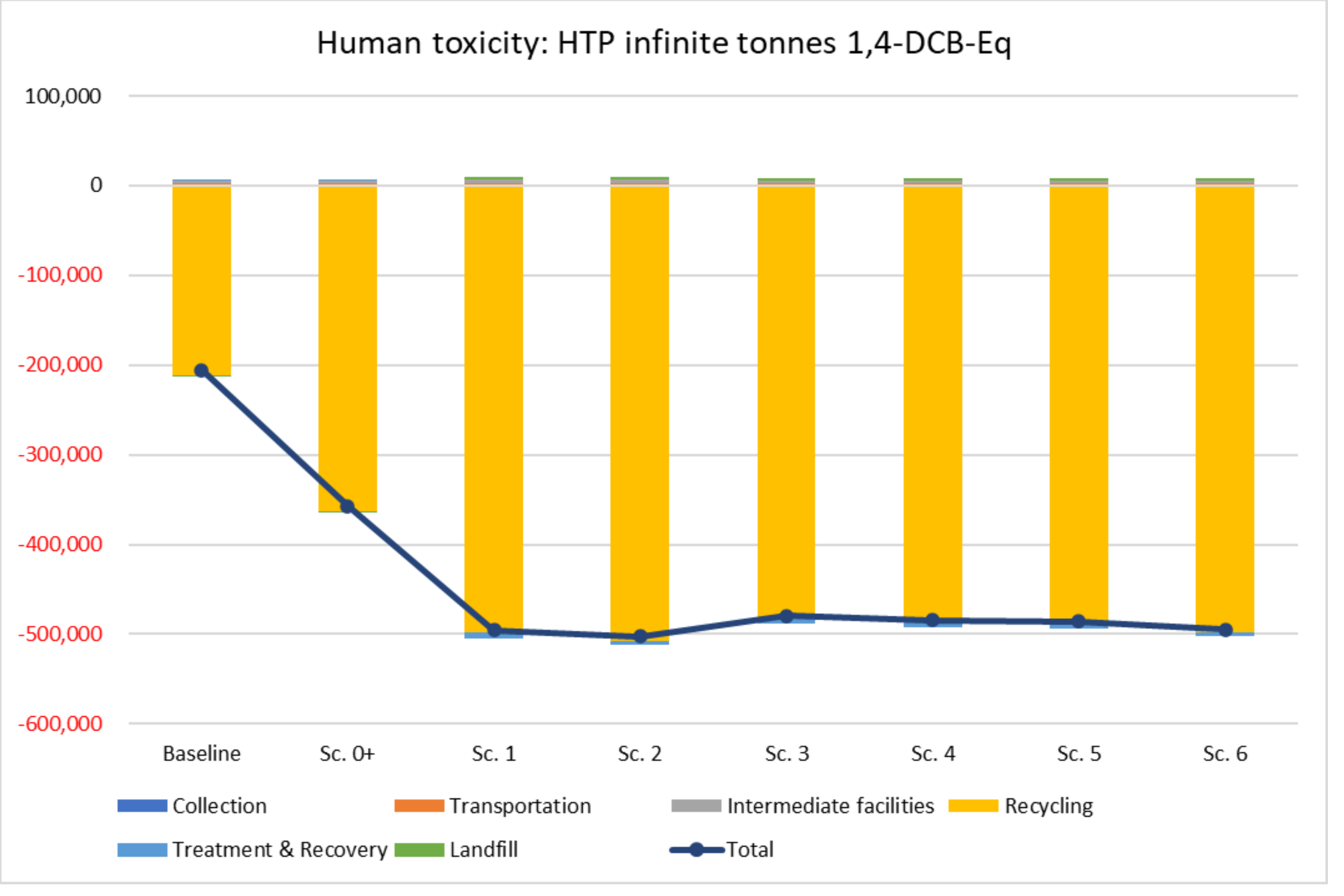


Figure 57 refers to the impact of the activities on the number of resources available in the environment, using antimony as a proxy.

- Reduction in abiotic resources tonnes for scenarios 1 to 6 when compared to scenario 0+.
- Due to reduction of tonnes through landfills and recovery through recycling.

Figure 57: Resources Depletion (kg antimony-Eq)

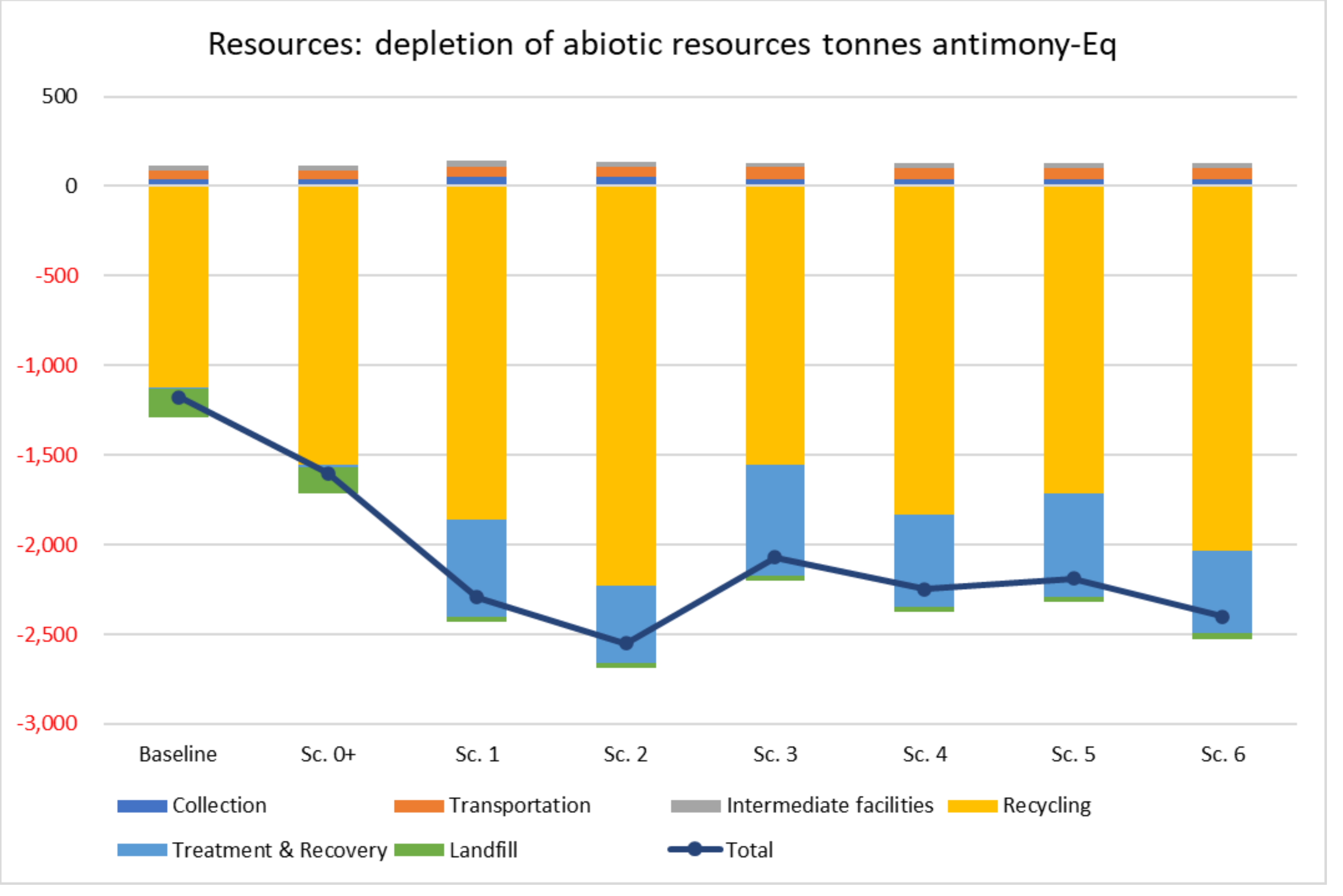
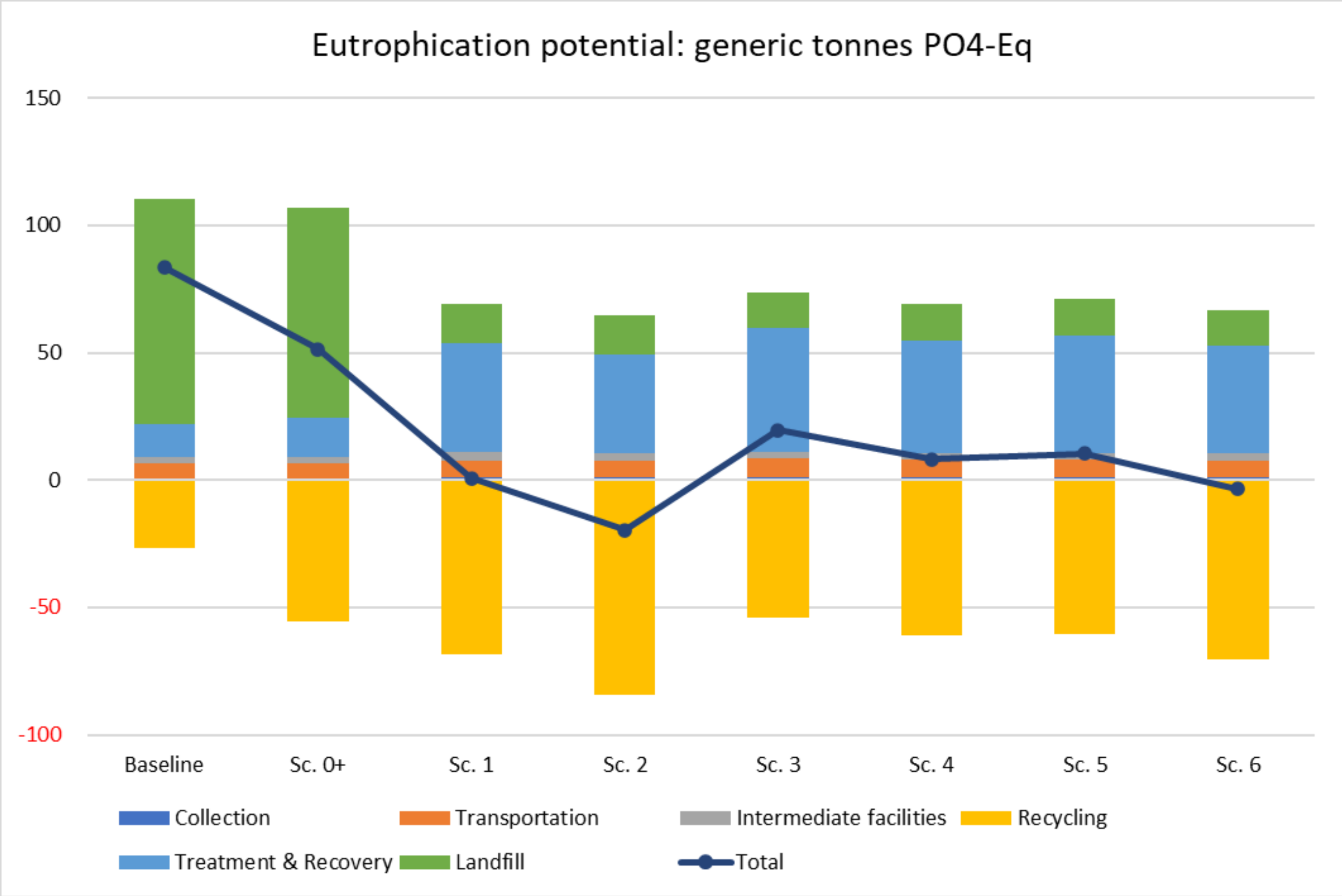


Figure 58: refers to the impact of the activities on the amount of phosphate in surface waste systems.

- Increased levels of phosphate (and nitrogen) can lead to algal blooms in surface water which can lead to substantial ecological degradation (killing other aquatic life).
- Reduction in tonnes Phosphate Equivalent (PO4-eq) in landfills for scenarios 1 to 6 when compared to scenario 0+.
- Scenario 2 has the lowest total PO4-eq tonnes of all scenarios as tonnes recovered through recycling are largest and it has lower tonnes to landfill.

Figure 58: Eutrophication Potential (kg PO4-Eq)



7. SCENARIO APPRAISAL

7.1 SHORT-LIST EVALUATION CRITERIA

Following the scenario modelling, the Short List was subjected to detailed evaluation to assess the relative performances of the 6 'whole system' scenarios set out in Table 19 above. The evaluation was undertaken using the following 'themes,' and the intention was to score each scenario to identify a preferred scenario:

- Technical and deliverability.
- Cost.
- Environmental.
- Sustainability (Socio-economic).

During the workshops, the Short List evaluation criteria were discussed and agreed and where differing views were expressed, discussions were held to reach consensus on the way forward.

7.1.1 Technical and Deliverability

The short-list evaluation criteria and descriptions for Technical and Deliverability criteria are set out in Table 28 below. These descriptions match the wording agreed for the corresponding Long List evaluation criteria. During Workshop 6 and Workshop 6a, all participants agreed with the proposed descriptions and red, amber, green (RAG) evaluation criteria.

Table 28: Technical and deliverability criteria

Short List Evaluation	Red (0)	Amber (2)	Green (3)
Evaluation of deliverability risk (i.e. is the technology proven at the scale required)	No track record or only demonstration plants available	Operating at commercial scale in UK but with some significant operational issues or operating at scale in non-UK OECD countries.	Commercially viable in UK with a proven track record of success without significant operational issues
Extent to which technology is flexible to changes in waste composition	Technology likely to fail with significant changes in waste composition	Technology may cope with significant changes in waste composition, however with some reduction in performance	Technology can cope with significant changes in waste composition
Ease of use for the householders	Completely new system (which is more difficult for the householder with majority of WCAs changing)	The same as the current system (for the majority of householders within the WCAs)	Easier to use than current system (for the majority of householders within the WCAs)
Extent to which technology would be accepted from the public	Not expected to be accepted by the majority of the public under any circumstances	Expected to be accepted by the majority of the public, with additional mitigations and sensitive siting	Expected to have widespread public acceptance
Does the option require significant new waste infrastructure?	Major new waste infrastructure required	Some new waste infrastructure required	Minimal waste infrastructure required for the option.
Evaluation of exposure to market risk (price) - recyclate and other offtake streams (e.g. RDF)	High market risk - system design increases risk due to quality and marketability of recyclate and offtake streams	Medium market risk - system design slightly increases risk due to quality and marketability of recyclate and offtake streams	Low market risk - system design mitigates risk due to quality and marketability of recyclate and offtake streams
Is this sympathetic with local policy	Not sympathetic to local policy	Partially sympathetic to local policy	Sympathetic to all relevant local policy
Is the option consistent with current and proposed new legislation (e.g. will it need TEEP exemption)?	Not compliant with current nor incoming legislation	Compliant with current legislation. Partially compliant with incoming legislation, requiring exemptions	Compliant with current and incoming legislation

7.1.2 Cost

It was proposed that the assessment of the whole system costs for each scenario would be based on the relative comparison of quantitative results (see Table 29). The best scoring scenario (lowest cost) will be assigned a score of 100%, whereas the remaining scenarios will be scored as a percentage of that scenario.

This approach was agreed by Members and Officers during Workshops 6 and 6a, respectively.

Table 29: Cost criteria

Short List Evaluation	Red (0)	Amber (2)	Green (3)
Quantitative assessment of whole system cost	Ranked based on relative comparison of quantitative results		

7.1.3 Environment

The proposed environmental criteria would be assessed through a quantitative scoring approach for most of the criteria, with three criteria assessed on a qualitative approach. These are presented in Table 30 below. In answer to a query during Workshop 6, it was confirmed that fly tipping would be included in the litter criteria. All voting Members and Officers during Workshop 6 and Workshop 6a agreed with the proposed descriptions and RAG assessments for these criteria.

For the quantitative criteria, a similar approach to that proposed for the cost criteria was adopted. If the modelling results are negative values (e.g., avoided GHG emissions), the lowest figure would be scored as 0 and all remaining values would be scaled according to the relative difference from the least desirable figure.

Table 30: Environmental criteria

Short List Evaluation	Red (0)	Amber (2)	Green (3)
Waste reduction (quantitative assessment of kg/hh/yr)	Ranked based on relative comparison of quantitative results		
Quantitative assessment of GHG emissions (CO_2eq)	Ranked based on relative comparison of quantitative results		
Quantitative assessment of recycling rate (Local Authority Collected Waste)	Ranked based on relative comparison of quantitative results		
Evaluation of local and wider transport impacts - distance travelled (collections & haulage)	Ranked based on relative comparison of quantitative results		
Acid rain potential	Ranked based on relative comparison of quantitative results		
Potential water pollution	Ranked based on relative comparison of quantitative results		
Human toxicity	Ranked based on relative comparison of quantitative results		
Resources depletion	Ranked based on relative comparison of quantitative results		
Litter	High potential for littering	Moderate potential for littering	Low potential for littering
Noise	High potential for noise	Moderate potential for noise	Low potential for noise
Odour	High potential for odour	Moderate potential for odour	Low potential for odour

7.1.4 Sustainability

Table 31 below presents the proposed sustainability (socio-economic) evaluation criteria, to be assessed using a quantitative approach (like that described for the costs criteria) and ranked to assess these criteria. All voting Members and Officers during Workshop 6 and 6a agreed with the proposed scoring approach.

Table 31: Sustainability (Socio-economic) criteria

Short List Evaluation	Red (0)	Amber (2)	Green (3)
Quantitative assessment of jobs created or sustained	Ranked based on relative comparison of quantitative results		
Evaluation of local energy creation and potential for useable heat	Ranked based on relative comparison of quantitative results		

7.2 THEME AND CRITERIA WEIGHTINGS

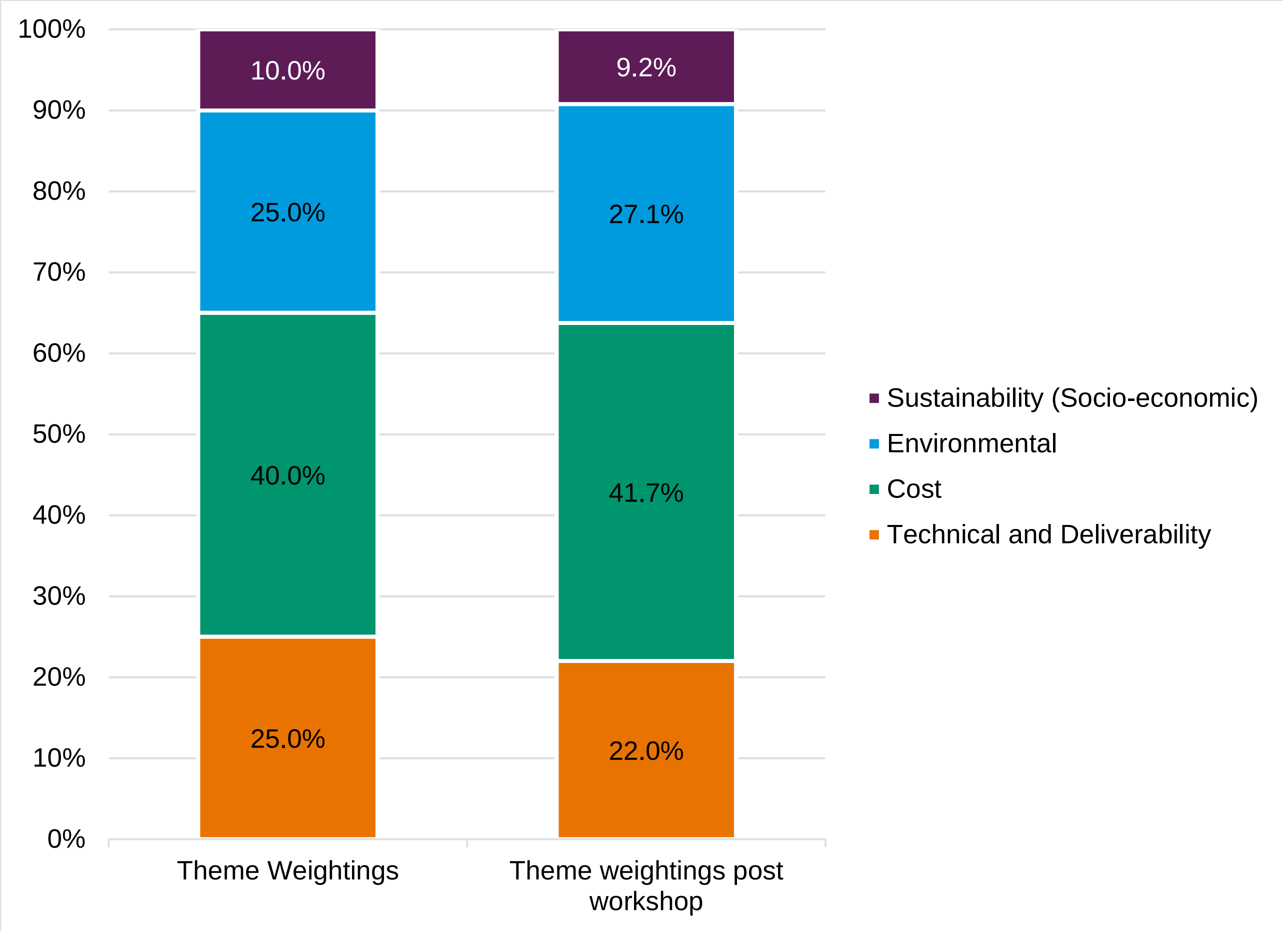
Based on the outcome of the Vision Statement Workshops held between September and October 2021 (see section 2 Vision), the Long List criteria weightings agreed during Workshop 4 in November 2021 and industry knowledge, Ricardo proposed weightings for the criteria set out in section 2 above. These weightings are applied to the themes firstly and then to each criterion included in each theme. These were presented to EWP officers and elected members for discussion. Where views were considerably different from those proposed by Ricardo, elected members and officers were given the opportunity to raise their views and to revisit the proposed weightings by voting through the Menti.com webtool.

7.2.1 Theme weightings

Figure 59 below shows the theme weightings proposed initially by Ricardo. Based on the Vision Statement Workshops, it was understood that cost will play an important role in the assessment of the modelled whole system scenarios, and this was therefore assigned a weighting of 40%. Technical and Deliverability and Environmental criteria were assigned weightings of 25% each, whereas Sustainability (Socio-economic) criteria were assigned a weighting of 10%. Following discussion with Members on 15th February, Members were provided the opportunity to revisit the weightings by voting through the Menti.com webtool. The results are shown in the second column in the figure below and show Environmental criteria scoring slightly higher at 27%, whereas Technical and Deliverability scored slightly lower at 22%. Cost also scored slightly higher at 41% and Sustainability (Socio-economic) criteria therefore scored 9%.

During Workshop 6a Officers discussed the weightings particularly around allocating 41% to Cost, however it was agreed that this was an acceptable figure.

Figure 59 : Theme weightings before and after workshop

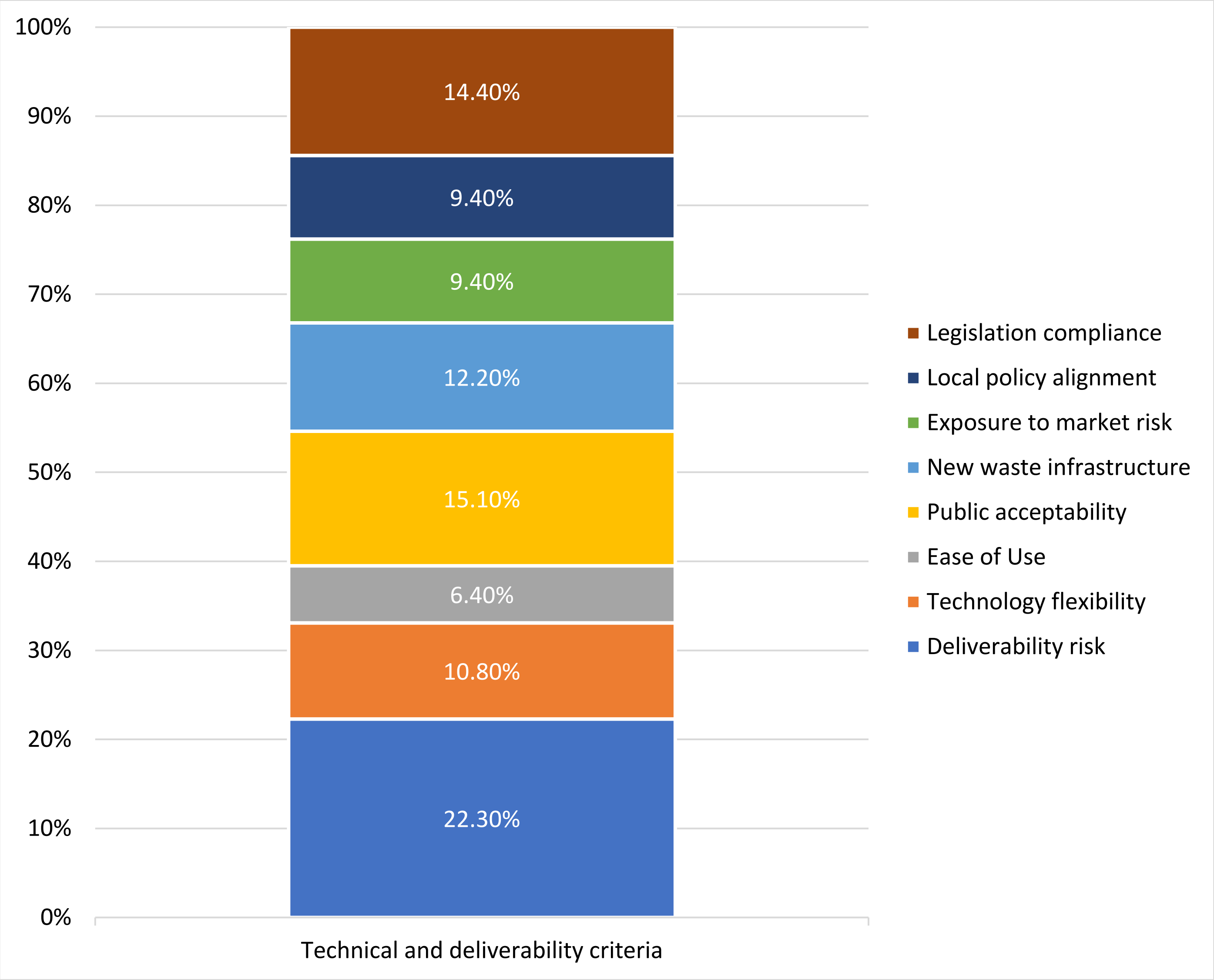


7.2.2 Criteria weightings

The Technical and Deliverability criteria weightings presented in Figure 60 are the average of the collection scenarios and treatment scenarios weightings agreed during Workshop 4 by Officers and Members for the Long List evaluation criteria. These were used to score the Long List scenarios.

All Members and Officers during Workshops 6 and 6a agreed with the proposed approach and therefore it was not necessary to reassess the proposed weightings.

Figure 60: Technical and deliverability criteria weightings



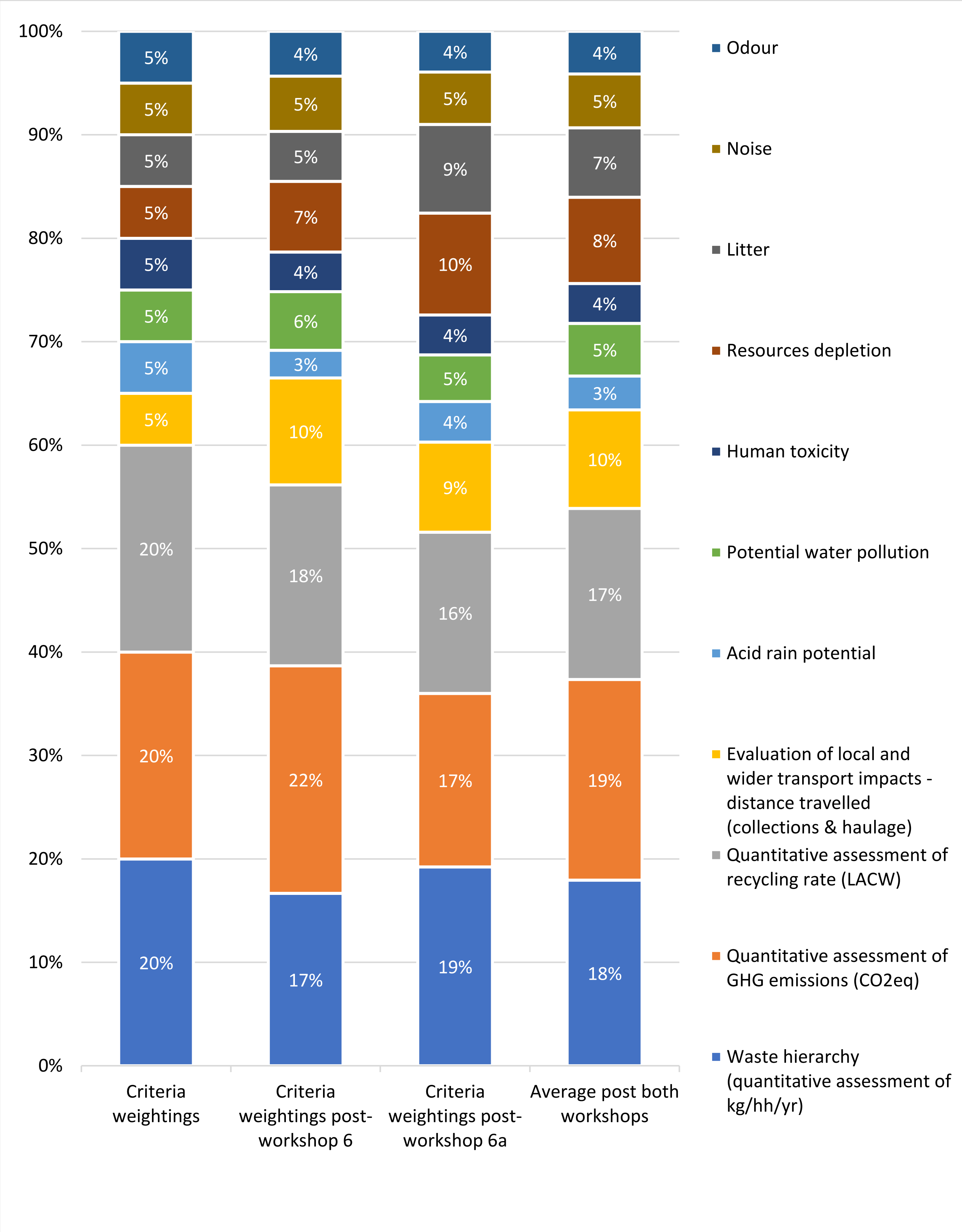
The proposed weightings assigned to the Environmental criteria are shown in the first column of Figure 61 below. It was proposed that the quantities of waste generated per household, the quantitative assessment of the greenhouse gases (GHG) associated with the scenarios and the recycling rate would be assigned 20% each, whereas the remaining criteria would be assigned 5% each.

During Workshop 6, Members expressed their view that climate change impacts (quantitative assessment of CO2eq) and resource depletion should be given more importance. Members were therefore given the opportunity to revisit the weightings by voting through Menti.com. The results are shown in the second column in the figure below, with GHG emissions scoring 22%, waste generated per household 17% and recycling rate scoring 18%. The evaluation of the transport impact also scored higher than initially proposed, at 10%.

During Workshop 6a, Officers expressed the desire to redistribute the weightings for the environmental criteria. The results are shown in the third column. Compared to the Members' view, Officers believed that the waste hierarchy should be given more importance while reducing the weighting assigned to the GHG emissions. It is noted that there is some natural overlap across the criteria and this view of Officers was based on the position that adherence to the hierarchy would in itself deliver GHG reductions through waste avoidance and resource efficiency, which was deemed to be of more importance than looking to reduce GHG emissions through the treatment technology. The importance given to resources depletion and litter is also considerably higher than that proposed by Members.

The average of the votes submitted by Members and the votes submitted by Officers is provided in the fourth column in Figure 61 below. During Workshop 6a it was proposed and agreed for this average to be used for assessing the short-listed whole system scenarios.

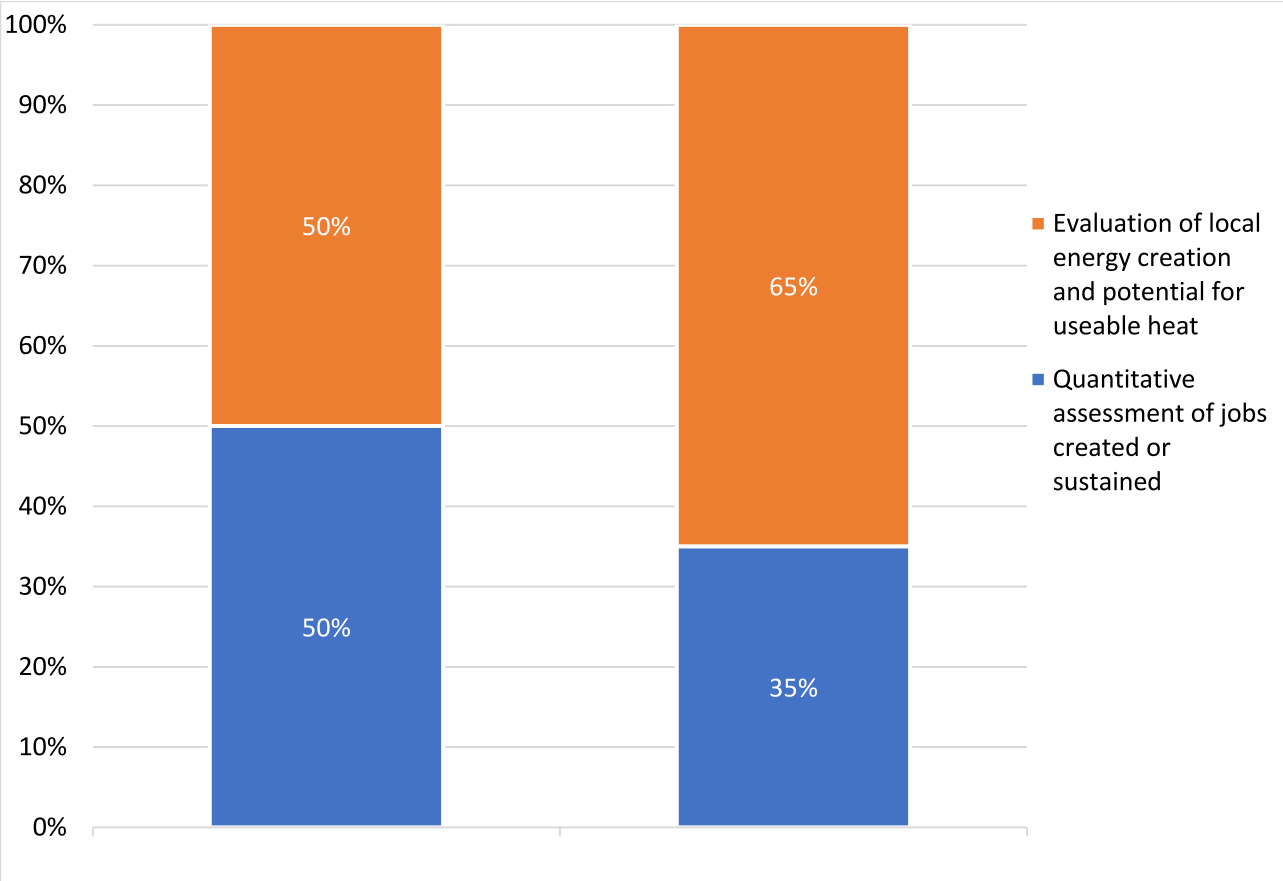
Figure 61: Environmental criteria weightings



Ricardo proposed that the two sustainability (socio-economic) weightings considered should be assigned equal importance in the scenarios assessment, as shown in the first column of Figure 62. However, Members felt that it was less likely that a considerable number of new jobs would be created by any of the scenarios, therefore this criterion was considered to be less important than the creation of local energy or heat.

During Workshop 6, Members revisited the weightings and allocated 65% to local creation of energy and 35% to creation of jobs, as shown in the second column of Figure 62 below. During Workshop 6a, Officers agreed with this approach and therefore the redistribution of the points was not required.

Figure 62: Sustainability (socio-economic) weightings



7.3 RESULTS

7.3.1 Unweighted Outputs

Once the modelling was complete, each of the scenarios were evaluated based on the agreed quantitative and qualitative criteria.

Each criterion was scored as 0, 2, or 3, with each score allocated a colour to enable a visual grid to be developed to assist overall evaluation.

- Red = 0.00 to 0.99.
- Yellow = 1.00 to 1.99.
- Green = 2.00 to 3.00.

The Qualitative Evaluation criteria were scored based on the previous Long List to Short List scores.

The Quantitative Evaluation criteria were scored relative to the highest and lowest performing scores in the subset. In this case, the subset included Baseline, scenario 0+, scenario 1, scenario 2, scenario 3, scenario 4, scenario 5 and scenario 6.

Table 32 below shows the breakdown of unweighted scores for each scenario against each of the agreed criteria.

Table 32: Unweighted Scores for each Scenario

Theme	Evaluation Criteria		Baseline	Sc. 0+	Sc. 1	Sc. 2	Sc. 3	Sc. 4	Sc. 5	Sc. 6
Technical and Deliverability	Technical Deliverability (Collections and Waste Treatment/Disposal Technology)/Reliability		3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
	Flexibility of solution		3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
	Public acceptability – Ease of Use (Collections)		2.00	2.00	3.00	0.00	2.00	0.00	2.00	0.00
	Public acceptability (Treatment technologies)		2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
	Waste Infrastructure Requirements		3.00	3.00	2.00	2.00	2.00	2.00	2.00	2.00
	Market Risk		2.00	2.00	2.00	2.00	3.00	3.00	3.00	3.00
	Sympathy with local policy		0.00	0.00	2.00	2.00	2.00	2.00	2.00	2.00
	Compliance with legislation		0.00	0.00	0.00	0.00	3.00	3.00	3.00	3.00
Cost	Total cost of option		2.71	2.97	2.77	3.00	2.42	2.75	2.10	2.37
Environmental	Waste Hierarchy contribution – Waste Reduction		0.65	1.27	1.75	2.88	1.38	2.65	1.79	3.00
	Greenhouse gas reduction potential – Low Carbon		0.34	1.46	2.08	3.00	1.48	2.11	1.80	2.56
	Recycling rate		2.28	2.01	2.68	3.00	2.45	2.87	2.59	2.99
	Transport impact		3.00	2.95	2.52	2.42	2.32	2.27	2.47	2.43
	Local Environmental Impact	Acid rain potential (Acidification potential)	1.29	2.11	2.39	3.00	1.90	2.32	2.14	2.62
		Water pollution potential (specifically Eutrophication potential)	0.00	0.93	2.41	3.00	1.86	2.19	2.13	2.53
		Human toxicity	1.23	2.13	2.96	3.00	2.86	2.89	2.90	2.95
		Resources depletion	1.38	1.88	2.70	3.00	2.44	2.65	2.57	2.82
		Litter	2.00	2.00	3.00	3.00	2.00	2.00	2.00	2.00
		Noise	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
		Odour	0.00	0.00	2.00	2.00	2.00	2.00	2.00	2.00
Sustainability	Local community benefits (jobs)	Quantitative assessment of jobs created or sustained	1.99	2.11	2.05	1.97	2.40	2.26	3.00	2.91
	Local community benefits (energy and heat)	Quantitative assessment (tonnes) of waste which could be sent to AD/EFW for energy (electricity/heat) creation	0.31	0.40	2.55	2.16	3.00	2.57	2.83	2.40
Total Unweighted Score			**53%**	**61%**	**79%**	**79%**	**78%**	**80%**	**81%**	**83%**

As can be seen, scenarios 5 and 6 score the best against the unweighted evaluation criteria despite being the highest cost scenarios due to representing:

- Consistency with policy and legislation.
- Quality of recyclate.
- Lowest environmental impacts.

It should be noted that the modelling does not currently incorporate higher recyclate income for kerbside sorted recyclate (which would favour scenarios 5 and 6) or factor in any cost incentive (or disincentives) arising from the EPR "efficient and effective" collections which are anticipated to favour kerbside sort systems. This is due to the delays in Defra's publication of their response to the Consistency consultation element of the Resource & Waste Strategy and the delay in releasing the consultation on the proposed Statutory Guidance to accompany the Environment Act 2021 at the time of undertaking this modelling and scenario appraisal. This makes any assessment of the likely impact of government policy decisions on the scenarios speculative at present. When greater clarity on these issues is provided by the Government, further analysis would be required which may include a change to weightings/evaluation criteria.

Table 32 above contains both qualitative and quantitative criteria. The results shown in the table can thus be divided into two sub-sets, with each grouping assessing either qualitative or quantitative criteria.

Table 33 below shows the Technical Deliverability and Environmental criteria, which were each given qualitative scores between 0, 2, or 3.

Table 33: Technical Deliverability and Environmental Criteria (Qualitative)

Theme	Evaluation Criteria		Baseline	Sc. 0+	Sc. 1	Sc. 2	Sc. 3	Sc. 4	Sc. 5	Sc. 6
Technical and Deliverability	Technical Deliverability (Collections and Waste Treatment/Disposal Technology)/Reliability		3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
	Flexibility of solution		3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
	Public acceptability – Ease of Use (Collections)		2.00	2.00	3.00	0.00	2.00	0.00	2.00	0.00
	Public acceptability (Treatment technologies)		2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
	Waste Infrastructure Requirements		3.00	3.00	2.00	2.00	2.00	2.00	2.00	2.00
	Market Risk		2.00	2.00	2.00	2.00	3.00	3.00	3.00	3.00
	Sympathy with local policy		0.00	0.00	2.00	2.00	2.00	2.00	2.00	2.00
	Compliance with legislation		0.00	0.00	0.00	0.00	3.00	3.00	3.00	3.00
Environmental	Local Environmental Impact	Litter	2.00	2.00	3.00	3.00	2.00	2.00	2.00	2.00
		Noise	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
		Odour	0.00	0.00	2.00	2.00	2.00	2.00	2.00	2.00

For each of the qualitative criteria:

- Technical Deliverability – all scenarios scored 3. This is due to the utilisation of EfW and AD (proven technologies) for waste treatment and the use of collection systems (vehicles and containers) in common use, including in EWP Council areas.
- Flexibility of solution – all scenarios scored 3 (Scenarios were required to achieve a score of 3 to be accepted onto the shortlist). This is due to extensive evidence of successful performance of each of the scenarios in UK authorities and an analysis of the flexibility of each scenario within foreseeable parameters.
- Public acceptability – scenario 1 scored highest, followed by scenarios 3 and 5 for ease of use. Scenarios 2,4 and 6 scored 0 due to the requirement for 3-weekly residual collections. Effectively, the lower the level of change from current systems, the higher the score. However, other than the frequency of residual collections, the recyclable collection element of each scenario is successfully operated in at least one of the EWP Council areas.
- Waste Infrastructure Requirements –scenarios 1-6 scored 2. This is due to the fact that there is currently no EfW facility, and a procurement process will need to be undertaken to secure capacity. There will also be a requirement for some WCAs to undertake infrastructure changes to accommodate the increased separation of DMR and/or food and garden waste.
- Market Risk – scenarios 1 and 2 scored 2 due to the preponderance of co-mingled DMR collections, whilst the other 4 scenarios were scored at 3. This is due to the improved quality and lower contamination levels resulting from source-segregated collections, improving the marketability of the recyclate.
- Sympathy with local policy – all scenarios were given a score of 2, due to the utilisation of EfW (which does not form part of the current Essex Waste Strategy for the treatment of residual waste) in all scenarios; this is in accordance with the policy scoring within the long list evaluation.
- Compliance with legislation – scenarios 1 and 2 were scored at 0, with all other scenarios scored at 3. This is due to the requirement in the Environment Act (2021) for all dry recyclable material streams to be separately collected (Section 45A: recyclable household waste must be collected separately from other household waste for recycling or composting, recyclable streams must be collected separately, food waste must be collected weekly). It should be noted that the Environment Act does make provision for exemptions to be granted against these requirements, meaning that the co-mingled approach detailed for Scenario 2 remains legally viable; this is addressed at section 9.7. However, due to the delays (at the time of undertaking the scenario appraisal) in Defra's publication of their response to the Consistency consultation element of the Resource & Waste Strategy and the delay in releasing the consultation on the proposed Statutory Guidance to accompany the Environment Act 2021, any assessment of the likely impact of government policy decisions on the scenarios is speculative at present.

The rest of the evaluation criteria are based on quantitative outputs from the modelling exercise. A detailed breakdown of the results can be seen in Table 34 below.

Table 34: Quantitative Outputs derived from Modelling

Theme	Evaluation Criteria		Baseline	Sc. 0+	Sc. 1	Sc. 2	Sc. 3	Sc. 4	Sc. 5	Sc. 6
Cost	Total cost of option		£ 111,542,000	£ 102,539,000	£ 109,478,000	£ 101,620,000	£ 121,165,000	£ 110,239,000	£ 131,961,000	£ 122,916,000
Environmental	Waste Hierarchy contribution – Waste Reduction		453.93	401.39	360.03	264.93	391.40	283.65	356.88	254.37
	Greenhouse gas reduction potential – Low Carbon		-19,458.65	-82,734.01	-118,317.98	-170,252.03	-83,885.72	-119,576.44	-102,243.07	-145,151.13
	Recycling rate		48.70%	42.83%	57.20%	63.98%	52.35%	61.13%	55.27%	63.71%
	Transport impact		1,076,214.64	1,094,713.12	1,250,011.82	1,283,679.99	1,320,798.73	1,339,533.54	1,265,043.01	1,282,015.86
	Local Environmental Impact	Acid rain potential	-442.11	-726.66	-823.23	-1,031.19	-652.78	-795.90	-737.16	-900.82
		Potential water pollution	83.42	51.35	0.70	-19.67	19.56	8.05	10.39	-3.52
		Human toxicity	-205,909.65	-357,509.92	-495,369.99	-502,900.57	-479,504.06	-484,258.22	-485,885.91	-494,708.46
		Resources depletion	-1,175.67	-1,601.63	-2,293.22	-2,550.76	-2,070.81	-2,249.34	-2,188.39	-2,400.27
Sustainability	Local community benefits (jobs)	Jobs created or sustained	743	789	765	736	897	844	1122	1090
	Local community benefits (energy and heat)	Quantitative assesment (tonnes) of waste which could be sent to AD/EFW for energy (electicity/heat) creation	35,834.56	47,298.37	298,527.20	253,294.43	351,203.05	300,765.24	331,279.02	281,010.79

- Total cost of scenario (net cost) – scenario 2 is the least expensive and scenario 5 the most expensive. Scenario 5 is estimated to be 18% more expensive than the Baseline, while the Baseline is approximately 10% more expensive than scenario 2.
- Waste hierarchy contribution – scenario 2 generates the lowest residual waste arisings (254.37 kg/hh/yr). Scenario 3 generates the highest residual waste arisings with 391.40 kg/hh/yr and hence scored lowest out of scenarios 1-6.
- Recycling rate – the modelling outputs show scenario 2 having the highest LACW recycling rate; this is due to the combination of 3 weekly residual collections incentivising recycling combined with the relative ease of co-mingled recycling collections further enhancing participation.
- Local/Environmental Impact – scenario 2 has the best scores across these criteria, followed by scenario 6. This is influenced by the 3-weekly residual collections minimising the adverse effects of residual management whilst maximising the positive influence of higher recycling rates.
- Local Community Benefits (Jobs) – The additional collection resources required for scenario 5 and scenario 6 would result in opportunities for jobs for the local community, hence these scenarios score the highest in this section of the evaluation.
- Local Community Benefits (Energy and Heat) – the combined tonnage of residual waste and food waste in scenarios 3 & 5 maximises the opportunity for energy and heat generation from the processing of these material streams.

All quantitative results were then compared relative to the others in the subset to determine the relative scores, as shown in Table 35.

Table 35: Relative Scores for Quantitative Criteria

Theme	Evaluation Criteria		Baseline	Sc. 0+	Sc. 1	Sc. 2	Sc. 3	Sc. 4	Sc. 5	Sc. 6
Cost	Total cost of option		90.2%	99.1%	92.3%	100.0%	80.8%	91.5%	70.1%	79.0%
Environmental	Waste Hierarchy contribution – Waste Reduction		21.5%	42.2%	58.5%	95.8%	46.1%	88.5%	59.7%	100.0%
	Greenhouse gas reduction potential – Low Carbon		11.4%	48.6%	69.5%	100.0%	49.3%	70.2%	60.1%	85.3%
	Recycling rate		76.1%	66.9%	89.4%	100.0%	81.8%	95.5%	86.4%	99.6%
	Transport impact		100%	98%	84%	81%	77%	76%	82%	81%
	Local Environmen	Acid rain potential (Acidification potential)	43%	70%	80%	100%	63%	77%	71%	87%
		Water pollution potential (specifically Eutrophi	0%	31%	80%	100%	62%	73%	71%	84%
		Human toxicity	41%	71%	99%	100%	95%	96%	97%	98%
		Resources depletion	46%	63%	90%	100%	81%	88%	86%	94%
Sustainability	Local community benefits (jobs)	Quantitative assessment of jobs created or sustained	66%	70%	68%	66%	80%	75%	100%	97%
	Local community benefits (energy and heat)	Quantitative assesment (tonnes) of waste which could be sent to AD/EFW for energy (electicity/heat) creation	10%	13%	85%	72%	100%	86%	94%	80%

7.3.2 Weighted Outputs

The Weightings for each of the criteria, as described and identified in Section 7.2 were then applied, giving each scenario a weighted score. The results of this can be seen in Table 36 below.

This approach ensures that the outputs of the modelling have been revised to reflect the outcomes of the Vision Statement Workshops held between September and October 2021 (see section 2 Vision), where the weightings to be applied to each of the Criteria were agreed, based on initial proposals made by Ricardo and then revised and refined in partnership with EWP officers and elected Members.

Table 36: Weighted Scores

Theme	Evaluation Criteria		Baseline	Sc. 0+	Sc. 1	Sc. 2	Sc. 3	Sc. 4	Sc. 5	Sc. 6
Technical and Deliverability	Technical Deliverability (Collections and Waste		0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
	Flexibility of solution		0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
	Public acceptability – Ease of Use (Collections)		0.03	0.03	0.04	0.00	0.03	0.00	0.03	0.00
	Public acceptability (Treatment technologies)		0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
	Waste Infrastructure Requirements		0.08	0.08	0.05	0.05	0.05	0.05	0.05	0.05
	Market Risk		0.04	0.04	0.04	0.04	0.06	0.06	0.06	0.06
	Sympathy with local policy		0.00	0.00	0.04	0.04	0.04	0.04	0.04	0.04
	Compliance with legislation		0.00	0.00	0.00	0.00	0.10	0.10	0.10	0.10
Cost	Total cost of option		1.13	1.24	1.16	1.25	1.01	1.15	0.88	0.99
Environmental	Waste Hierarchy contribution – Waste Reduction		0.03	0.07	0.09	0.15	0.07	0.14	0.09	0.16
	Greenhouse gas reduction potential – Low Carbon		0.02	0.07	0.09	0.14	0.07	0.10	0.08	0.12
	Recycling rate		0.10	0.08	0.11	0.13	0.10	0.12	0.11	0.13
	Transport impact		0.07	0.07	0.06	0.06	0.05	0.05	0.06	0.06
	Local Environmen	Acid rain potential (Acidification potential)	0.01	0.02	0.03	0.03	0.02	0.02	0.02	0.03
		Water pollution potential (specifically Eutrophication potential)	0.00	0.01	0.03	0.04	0.02	0.03	0.03	0.03
		Human toxicity	0.01	0.02	0.03	0.03	0.03	0.03	0.03	0.03
		Resources depletion	0.04	0.05	0.07	0.08	0.06	0.07	0.07	0.08
		Litter	0.05	0.05	0.07	0.07	0.05	0.05	0.05	0.05
		Noise	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
		Odour	0.00	0.00	0.02	0.02	0.02	0.02	0.02	0.02
Sustainability	Local community benefits (jobs)	Quantitative assessment of jobs created or sustained	0.06	0.07	0.07	0.06	0.08	0.07	0.10	0.09
	Local community benefits (energy and heat)	Quantitative assessment (tonnes) of waste which could be sent to AD/EFW for energy (electricity/heat) creation	0.02	0.02	0.15	0.13	0.18	0.15	0.17	0.14
Total weighted score			**67%**	**75%**	**83%**	**88%**	**79%**	**86%**	**77%**	**83%**

As can be seen, this process resulted in the following ranking of the scenarios appraisal results, from highest to lowest score:

- Scenario 2: Fortnightly comingled, 3-weekly residual.
- Scenario 4: Fortnightly multi-stream, 3-weekly residual.
- Scenario 1: Fortnightly comingled, fortnightly residual and Scenario 6: Weekly multi-stream, 3-weekly residual.

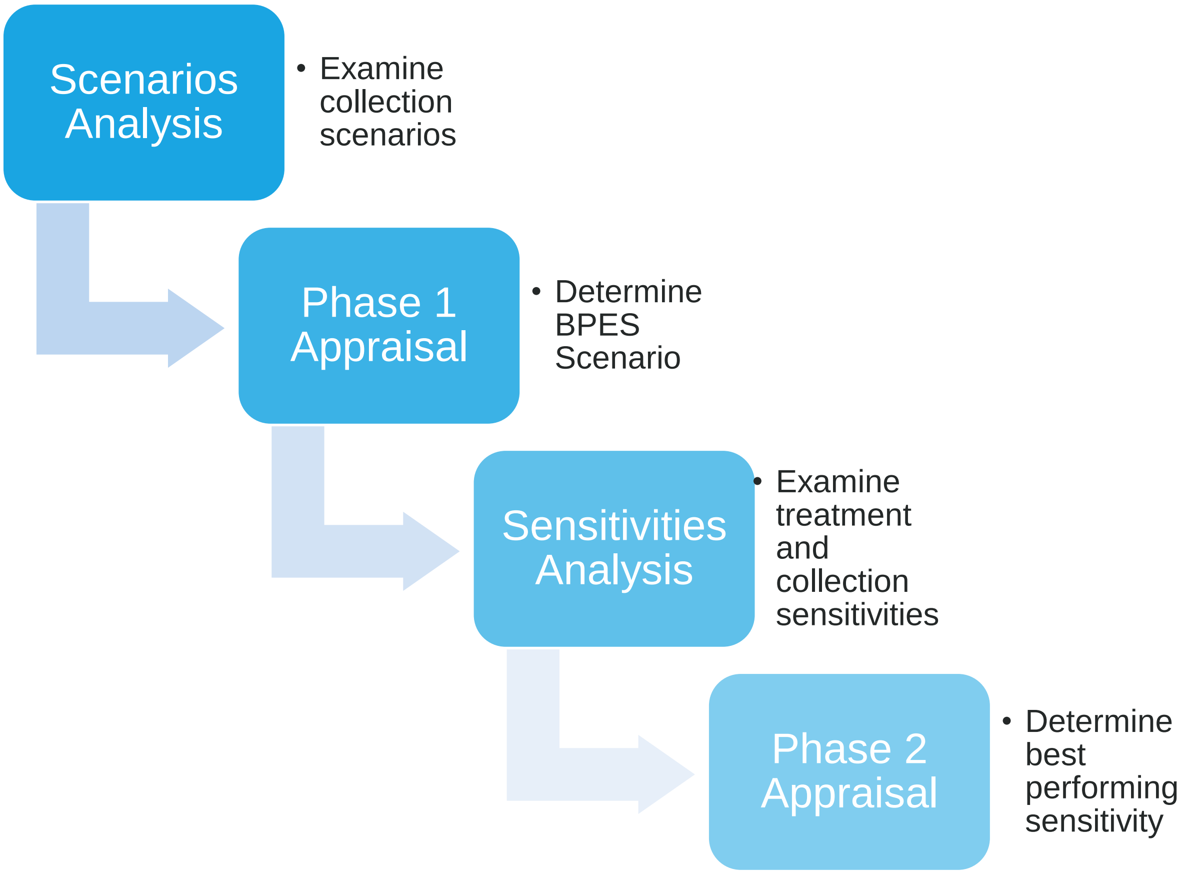
- Scenario 3: Fortnightly multi-stream, fortnightly residual.
- Scenario 5: Weekly multi-stream, fortnightly residual.
- Scenario 0+: Baseline in 2027/28.
- Baseline.

8. SENSITIVITIES

8.1 CONTEXT

Sections 6 and 7 explored the scenarios analysis and appraisal results. Through the scenarios appraisal (referred to as the Phase 1 appraisal) it was determined that when applying the selected weighted evaluation criteria scenario 2 is identified as the Best Practicable Environmental scenario (BPES). This BPES was carried forward for additional sensitivity modelling. Following this next phase of modelling, the Sensitivities appraisal (referred to as the Phase 2 appraisal) then examined the performance of the sensitivities relative to the BPES. Figure 63 illustrates this process. This section provides further detail on the sensitivities analysis, appraisal and results.

Figure 63: Appraisal Process



8.2 APPRAISAL SCORING

The Phase 1 Appraisal examined the relative performance of each of the scenarios compared with the baseline and the other scenarios. The Phase 2 Appraisal examined the relative performance of the sensitivities compared with the BPES. Due to the difference in comparators in the subset, Phase 2 Appraisal scores cannot be directly compared with Phase 1 Appraisal scores. This is because the quantitative criteria have been scored in a relative manner and scaled relative to the highest and lowest performing scores in the subset.

8.3 BACKGROUND TO SENSITIVITIES

In agreement with the EWP, four sensitivities were modelled for scenario 2 in order to assess the effect of introducing the following in combination with scenario 2.

- Sensitivity 1: Front-end recycling to the EfW facility for household residual waste.
- Sensitivity 2: Addition of combined heat and power (CHP) at the EfW facility.

- Sensitivity 3: Addition of carbon capture, utilisation, and storage technology (CCUS) at EfW facility.
- Sensitivity 4: Introduction of householder charges for garden waste collections.

The assumptions made in the modelling of these sensitivities are:

8.3.1 Front end recycling at Energy from Waste facilities

The percentages of materials recovered from household residual waste for recycling in the front-end recycling EfW facility were assumed based on industry knowledge:

- Plastic bottles: 50%.
- PTTs: 30%.
- Recyclable glass: 75%.
- Aluminium (non-ferrous): 75%.
- Steel (ferrous): 80%.

8.3.2 Combined heat and power (CHP) at Energy from Waste facilities

The electrical efficiency and heat efficiency assumed in the WRATE model for this sensitivity were 23.1% and 23.6%, respectively. This was taken from the 'flexible EfW process' defined in the WRATE model. Note that the heat efficiency figure is the maximum possible within the WRATE model. Actual efficiencies for CHP are higher, so the environmental performance of CHP has been under-represented in the modelling results.

8.3.3 Carbon capture Utilisation, and storage (CCUS) technology at Energy from Waste facilities

After a literature review on various carbon capture facilities, a carbon capture efficiency of 85% and additional on-site electricity requirements of 82 kWh/tonnes were assumed for this sensitivity in the WRATE model.

8.3.4 Garden waste collection charge

For local authorities with current chargeable garden waste, baseline data was used. For those currently on free garden waste collection, it was assumed that:

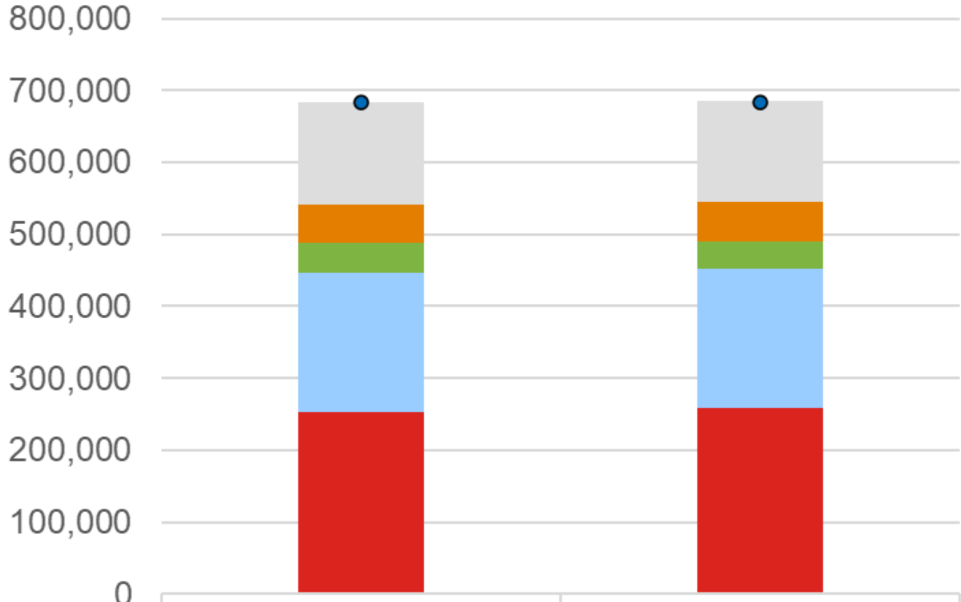
- A reduction of 11% was applied in organic growth rate for Councils.
- Collection's coverage is 46% (average from other councils).
- Set out rate is 61% (average from other councils).
- Annual garden waste collection charge is £45.00 (average from other councils).
- A growth of 5% to garden waste arisings in ECC's RCHWs has been assumed as a result of some residents moving garden waste from kerbside collection and to the RCHWs.

8.4 FRONT-END RECYCLING EFW

Figure 64 presents the fates of EWP's waste arisings for scenario 2 and Sensitivity 1 for FY 27/28.

- Total recycled tonnage increases with the introduction of front-end recycling at the EfW facilities for household residual waste. The projected recycled tonnes for FY 27/28 without front-end recycling EfW is 252,000. Sensitivity 1 projects an increase by 6,000 tonnes as more plastics, glass, and metals are picked up for recycling in the household residual waste stream.
- Total tonnes recovered and total tonnes as losses decrease in Sensitivity 1 as the proportion of tonnes recycled increase meaning that the proportion of tonnes recovered, and losses decrease. The proportion of tonnes landfilled also decrease to make room for the increased proportion of recycling, but this decrease is less significant than those for recovery and losses.

Figure 64: Fates of EWP waste arisings 27/28 – Sensitivity 1

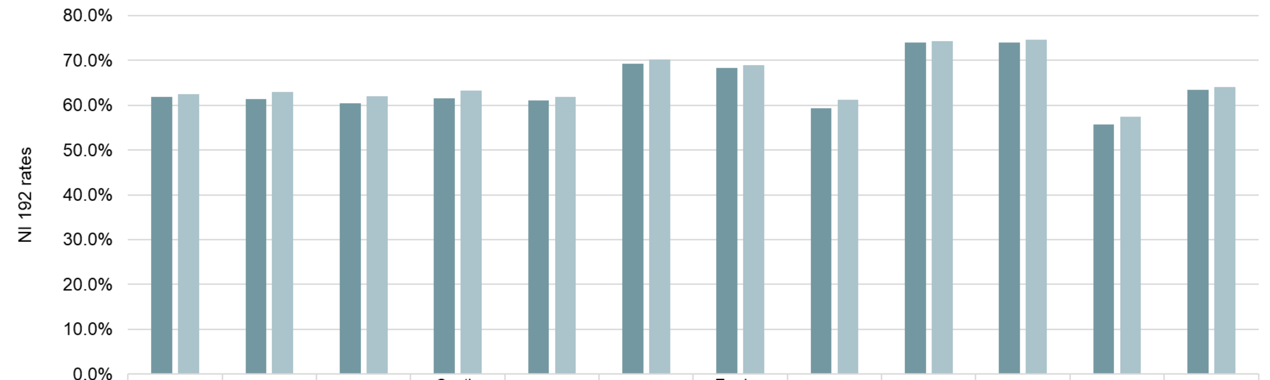


	Original model	Sensitivity 1
Total Losses	142,000	140,000
Total Landfilled	54,000	54,000
Total Recovered	41,000	38,000
Total Reused	730	730
Total Composted	194,000	194,000
Total Recycled (excl. IBA Metals)	252,000	258,000
Total Arisings	683,000	683,000

Figure 65 shows the projected recycling rates of the Councils, ECC, and EWP for FY 27/28 in the scenario 2 models and sensitivity models. The recycling rate includes both dry recycling materials and organics.

- All Councils' recycling rates increase when the sensitivity of front-end recycling at the EfW facilities are introduced. The average increase for each Council is 1.2%.
- The EWP's recycling rate increases by 1.0% for this sensitivity. This is a result of additional recycling of residual waste collected at RCHWs.

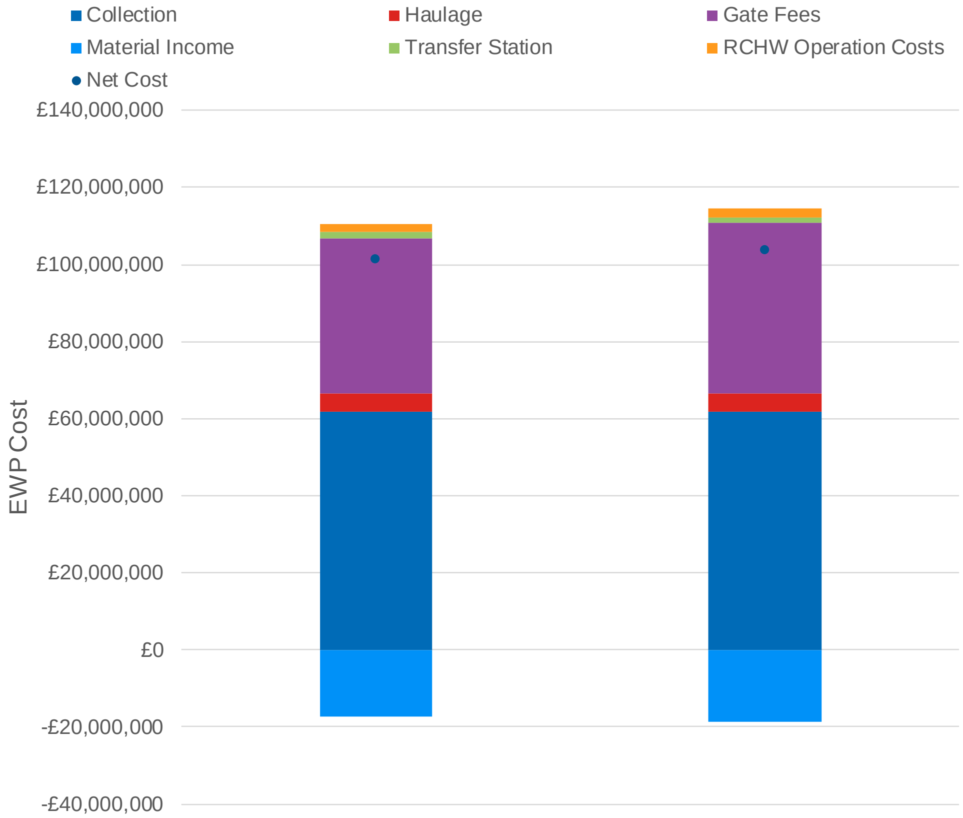
Figure 65: Recycling rate for Councils – Sensitivity 1



	Basildon	Braintree	Brentwood	Castle Point	Chelmsford	Colchester	Epping Forest	Harlow	Maldon	Rochford	Tendring	Uttlesford
Scenario 2	61.9%	61.5%	60.4%	61.6%	61.1%	69.3%	68.3%	59.4%	74.0%	74.0%	55.8%	63.4%
Sensitivity 1	62.6%	62.9%	62.0%	63.3%	61.9%	70.2%	68.9%	61.3%	74.4%	74.7%	57.4%	64.1%

Figure 66 shows the WSCM (whole systems cost model) for Sensitivity 1. Although, due to the proportion of tonnes recycled increasing and the proportion of tonnes landfilled decreasing (leading to higher recycled tonnage and thus material income), material income increases, this is outweighed by the increased gate fees due to the additional sorting cost.

Figure 66: EWP WSCM - Sensitivity 1



	Scenario 2	Sensitivity 1
Gross cost	£118,942,000.00	£122,851,000.00
Income	-£17,323,000.00	-£18,762,000.00
Net Cost	£101,620,000.00	£104,089,000.00

8.5 ADDITION OF COMBINED HEAT AND POWER (CHP) AT EFW FACILITY

Waste arisings across EWP remain the same in Sensitivity 2 as they do in scenario 2. The additional costs associated with CHP have not been included in calculations due to the high level of uncertainty around these costs. The uncertainty is primarily due to the following factors:

- Local Infrastructure: The existing infrastructure at the EfW facility and its compatibility with the proposed CHP system can significantly affect the costs. The site may need considerable retrofitting to house the CHP system and make it operational. This may include modifications to the electrical system, plumbing, building structure, waste handling system, and more.
- Heat Offtake Demand: The feasibility and cost of a CHP system at an EfW facility are closely linked to the demand for the heat it will produce. If there's low demand, the heat produced may go to waste, affecting the system's efficiency and economics. The cost of creating infrastructure to supply heat to potential users (such as district heating networks) must also be considered.

These uncertainties prevented cost modelling, but it may be safe to assume that the operator of the EfW facility would not implement CHP if it were not commercially viable. The inability to model the costs associated with CHP should be considered when looking at the sensitivities appraisal.

8.6 ADDITION OF CARBON CAPTURE, UTILISATION AND STORAGE TECHNOLOGY (CCUS) AT EFW FACILITY

Waste arisings across EWP remain the same in Sensitivity 3 analysis as in scenario 2. Sensitivity 3 whole system cost increases in comparison to scenario 2, approx. £12M higher than scenario 2 due to the modelled gate fee increase of £61/tonne. This figure has been based on Ricardo's previous project experience.

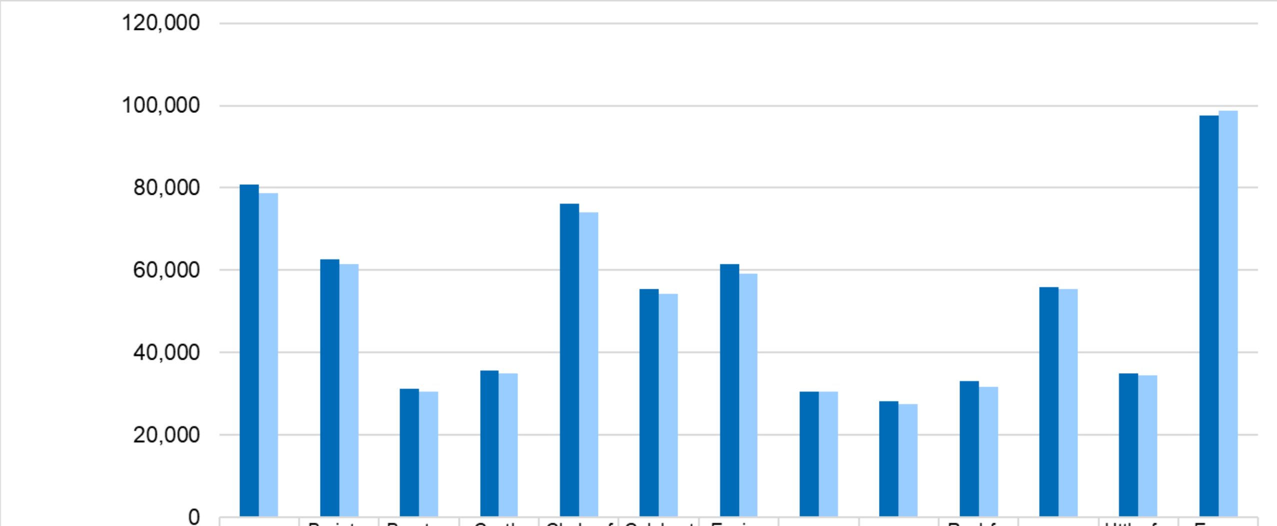
8.7 GARDEN WASTE HOUSEHOLDER CHARGE

Sensitivity 4 analyses the effect of introducing subscription charges for garden waste collections for residents in the Councils.

Figure 69 presents the total waste arisings and recycling rates for the Councils' and ECC's scenario 2 and Sensitivity 4 analysis. Figure 70 presents the same but for the combined EWP.

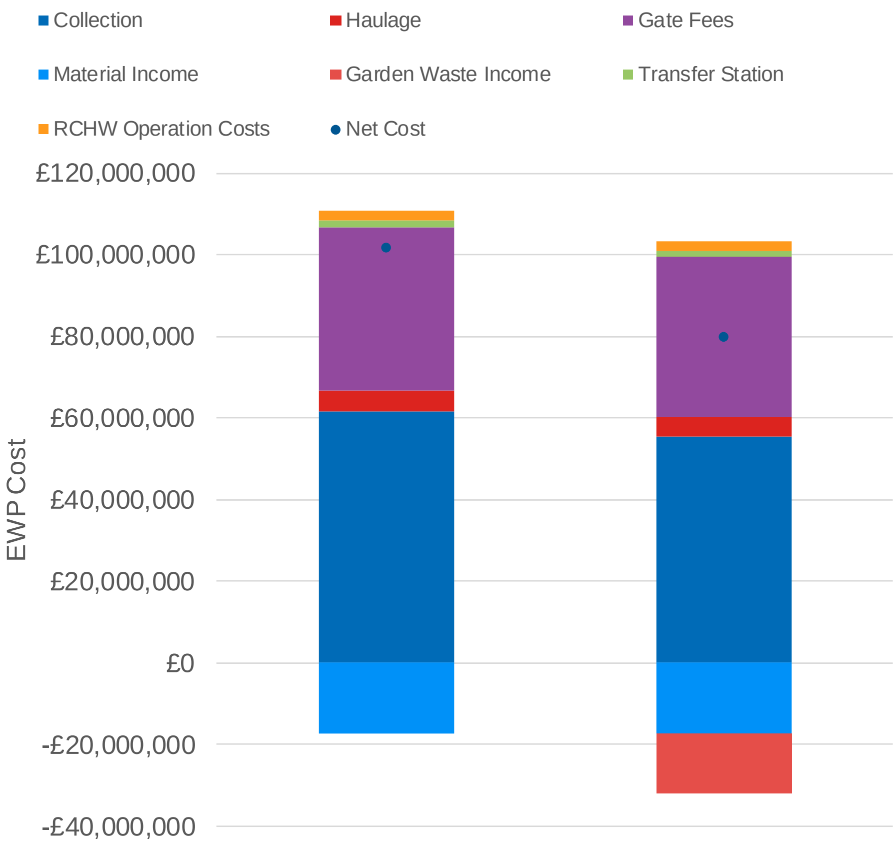
- Across all Councils, the total waste arisings are reduced with the introduction of garden waste collection charges, as subsequently the garden waste yields will be reduced.
- The total waste arisings for ECC increase when householder charges are introduced for garden waste as some residents will make use of local RCHWs instead of using kerbside collections for garden waste.
- The average recycling rate of the Councils decreases by 0.4% when Sensitivity 4 is compared to the scenario 2 models as residents are not incentivised to recycle their garden waste with the additional charge required for the collection.
- ECC's recycling rate is increased by 0.3% as the organic waste uptake is observed for the RCHWs.
- On a combined level for the EWP, the total waste arisings reduce from 683,500 tonnes scenario 2 to 671,400 for Sensitivity 4. And recycling rate for Sensitivity 4 is reduced by 0.3% when compared to scenario 2.

Figure 67: EWP Waste Arisings – Sensitivity 4



	Basildon	Braintree	Brentwood	Castle Point	Chelmsford	Colchester	Epping Forest	Harlow	Maldon	Rochford	Tendring	Uttlesford	Essex CC
Scenario 2 Tonnes	80,800	62,600	31,100	35,700	76,200	55,400	61,400	30,500	28,100	33,000	56,000	35,000	97,600
Sensitivity 4 Tonnes	78,700	61,400	30,600	35,000	74,000	54,300	59,200	30,400	27,400	31,600	55,500	34,500	98,800

Figure 68: EWP WSCM – Sensitivity 4



	Scenario 2	Sensitivity 4
Gross cost	£118,942,000.00	£111,579,000.00
Income	-£17,323,000.00	-£31,865,849.46
Net Cost	£101,620,000.00	£79,713,150.54

Figure 69: EWP total waste arisings and recycling rate - Sensitivity 4

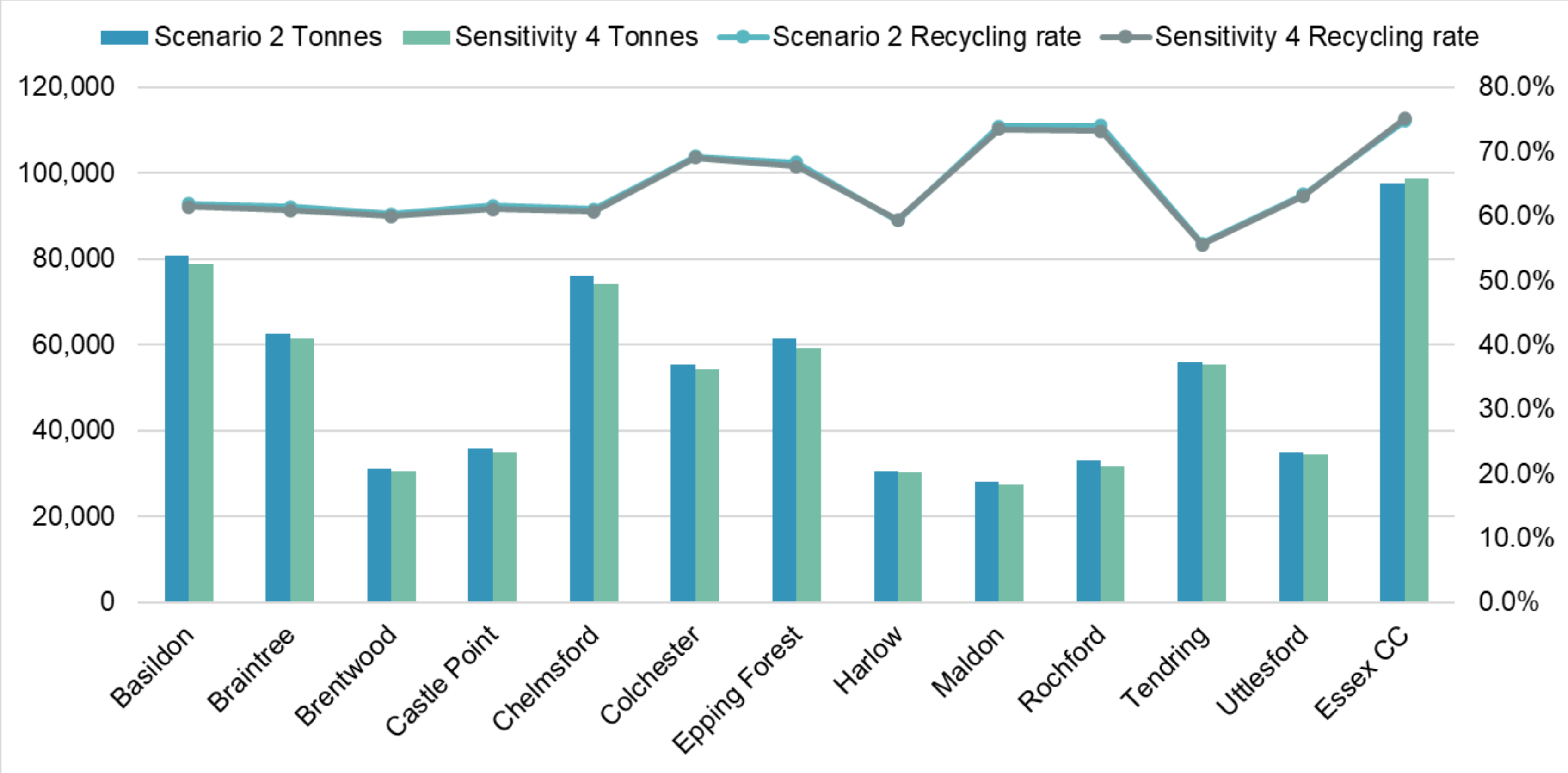
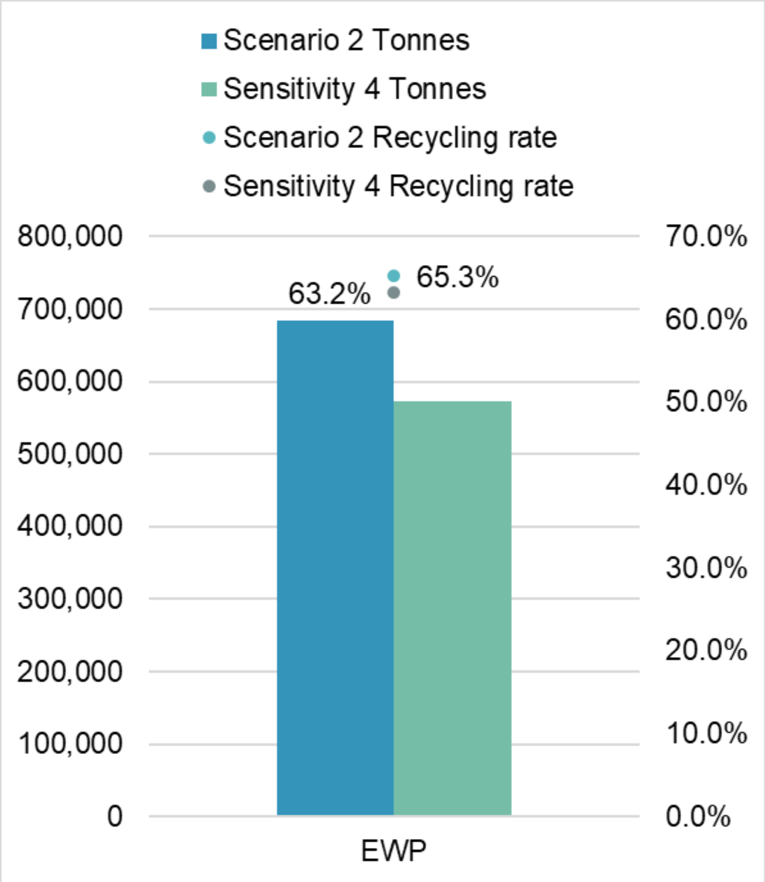


Figure 70: EWP total waste arisings and recycling rate - Sensitivity 4



The total number of collection vehicles required for each Council are presented in Figure 71 to compare resourcing demand when introducing garden waste collection charges. Further, Figure 72 presents the total collection costs for each Council and the subscription revenue from the garden waste collection charges for Sensitivity 4.

- The number of collection vehicles required are reduced for most Councils for Sensitivity 4 when compared to scenario 2. More garden waste tonnes will be produced for free collection services than those with charged, so since Sensitivity 4 has reduced garden waste arisings for the Councils, then fewer vehicles will be required.
- Net costs decrease for Sensitivity 4 when compared to scenario 2 results for each Council due to the income derived from the garden waste householder charge. A total subscription revenue is £14.4M for the Councils.
- ECC total costs increase by £0.6M when introducing the garden waste householder charge – this is because of the additional garden waste tonnage at RCHWs as a result of the householder charge, meaning that more associated cost for gate fees for garden waste treatment.
- On a combined EWP level, there are savings of £21.8M for Sensitivity 4, when compared to scenario 2.

Figure 71: Councils' vehicles required - Sensitivity 4

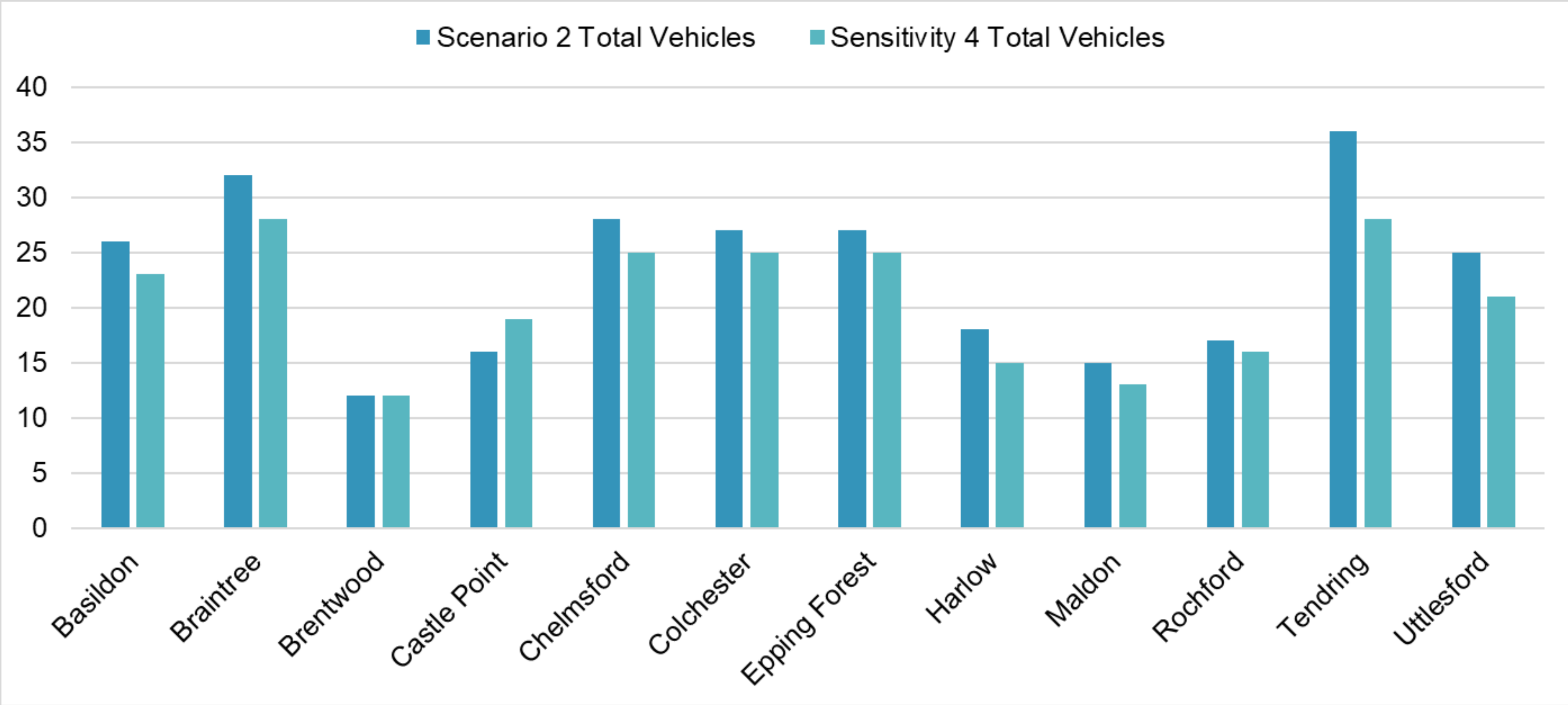
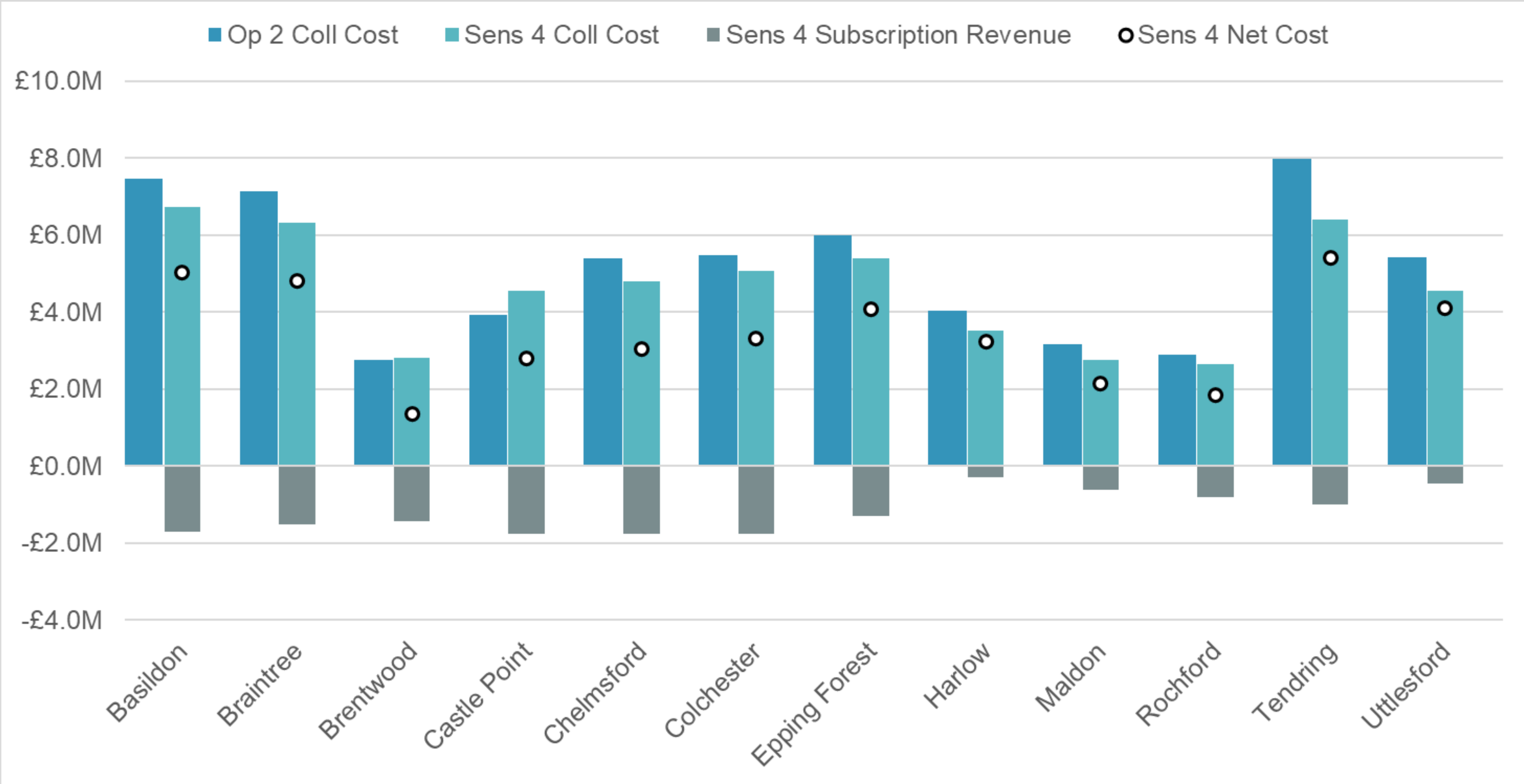


Figure 72: Councils' collection costs and subscription revenue - Sensitivity 4



8.8 RESULTS

8.8.1 Unweighted Outputs

Once the modelling was complete, each of the Sensitivities were evaluated based on the agreed quantitative and qualitative criteria.

Each criterion was scored as 0, 2, or 3, with each score allocated a colour to enable a visual grid to be developed to assist overall evaluation.

- Red = 0.00 to 0.99.
- Yellow = 1.00 to 1.99.
- Green = 2.00 to 3.00.

The Qualitative Evaluation criteria were scored based on the previous Long List to Short List scores.

The Quantitative Evaluation criteria were scored relative to the highest and lowest performing scores in the subset. In this case, the subset included scenario 2, Sensitivity 1, Sensitivity 2, Sensitivity 3 and Sensitivity 4.

Table 37 below shows the breakdown of unweighted scores for each Sensitivity against each of the agreed criteria.

Table 37: Unweighted Scores for Scenario 2 and each Sensitivity

Theme	Evalution Criteria		Sc. 2	Sens 1	Sens 2	Sens 3	Sens 4
Technical and Deliverability	Technical Deliverability (Collections and Waste Treatment/Disposal Technology)/Reliability		3.0	2.0	3.0	0.0	3.0
	Flexibility of solution		3.0	2.0	3.0	3.0	3.0
	Public acceptability – Ease of Use (Collections)		0.0	0.0	0.0	0.0	0.0
	Public acceptability (Treatment technologies)		2.0	2.0	2.0	3.0	2.0
	Waste Infrastructure Requirements		2.0	2.0	0.0	0.0	2.0
	Market Risk		2.0	0.0	2.0	2.0	2.0
	Sympathy with local policy		2.0	2.0	2.0	2.0	2.0
	Compliance with legislation		0.0	0.0	0.0	0.0	0.0
Cost	Total cost of option		2.2	2.1	2.2	1.7	3.0
Environmental	Waste Hierarchy contribution – Waste Reduction		3.0	3.0	3.0	3.0	2.4
	Greenhouse gas reduction potential – Low Carbon		2.1	2.2	2.5	3.0	2.1
	Recycling rate		2.9	3.0	2.9	2.9	2.8
	Transport impact		2.6	2.6	2.6	2.6	3.0
	Local Environmental Impact	Acid rain potential (Acidification potential)	2.9	3.0	3.0	2.9	2.9
		Water pollution potential (specifically Eutrophication potential)	0.7	2.5	3.0	0.0	2.4
		Human toxicity	3.0	3.0	3.0	3.0	3.0
		Resources depletion	2.7	2.8	3.0	2.7	2.7
		Litter	3.0	3.0	3.0	3.0	3.0
		Noise	3.0	3.0	3.0	3.0	3.0
		Odour	2.0	2.0	2.0	2.0	2.0
Sustainability	Local community benefits (jobs)	Quantitative assessment of jobs created or sustained	3.0	3.0	3.0	3.0	2.7
	Local community benefits (energy and heat)	Quantitative assessment (tonnes) of waste which could be sent to AD/EFW for energy (electricity/heat) creation	3.0	3.0	3.0	3.0	2.9
Total Unweighted Score			**76%**	**73%**	**78%**	**69%**	**79%**

As can be seen, Sensitivity 4 scores the best against the unweighted evaluation criteria due to an improved environmental performance and a cost saving.

Table 37 above contains both qualitative and quantitative criteria. The results shown in the table can thus be divided into two sub-sets, with each grouping assessing either qualitative or quantitative criteria.

Table 38 below shows the Technical Deliverability and Environmental criteria, which were each given qualitative scores between 0, 2, or 3.

Table 38: Technical Deliverability and Environmental Criteria (Qualitative)

Theme	Evalution Criteria		Sc. 2	Sens 1	Sens 2	Sens 3	Sens 4
Technical and Deliverability	Technical Deliverability (Collections and Waste Treatment/Disposal Technology)/Reliability		3.0	2.0	3.0	0.0	3.0
	Flexibility of solution		3.0	2.0	3.0	3.0	3.0
	Public acceptability – Ease of Use (Collections)		0.0	0.0	0.0	0.0	0.0
	Public acceptability (Treatment technologies)		2.0	2.0	2.0	3.0	2.0
	Waste Infrastructure Requirements		2.0	2.0	0.0	0.0	2.0
	Market Risk		2.0	0.0	2.0	2.0	2.0
	Sympathy with local policy		2.0	2.0	2.0	2.0	2.0
	Compliance with legislation		0.0	0.0	0.0	0.0	0.0
Environmental	Local Environmental Impact	Litter	3.0	3.0	3.0	3.0	3.0
		Noise	3.0	3.0	3.0	3.0	3.0
		Odour	2.0	2.0	2.0	2.0	2.0

For each of the qualitative criteria, scenario 2 scores have been kept consistent with the Phase 1 Appraisal. For the sensitivities:

- Technical Deliverability – Sensitivities 2 and 4 scored a 3 as the technology used in these sensitivities is proven at scale. Sensitivity 1 scored a 2, as there is one facility using front-end recycling (Levenseat), however it is not common. Sensitivity 3 scored a 0 as CCUS has not been proven at scale.
- Flexibility of solution - all Sensitivities scored 3 except for Sensitivity 1 which scored lower because it does rely on sufficient recyclable material being present in the waste stream to be commercially viable.
- Public acceptability (Collections) – All sensitivities scored a 0, due to the inconvenience of 3-weekly residual waste collections.
- Public acceptability (Treatment technologies) – All sensitivities scored a 2 except for Sensitivity 3, which scored higher as there is broad public support for lower carbon technologies. While Sensitivity 2 also reduces carbon impacts, it was felt that the indirect carbon benefits of this solution would not be as easy to market.
- Waste Infrastructure Requirements – Sensitivities 1 and 4 scored a 2 as some additional infrastructure is required. Sensitivities 2 and 3 scored a 0 as significant additional infrastructure is required.
- Market Risk – All Sensitivities scored a 2 except for Sensitivity 1, which scored a 0 due to the high risk associated with the quality of the additional recyclate recovered.
- Sympathy with local policy – all Sensitivities were given a score of 2, due to the utilisation of EfW in all Sensitivities; this is in accordance with the policy scoring within the long list evaluation. Sensitivities 1, 2, and 3 provide some further alignment with local policy (increased recycling, carbon emissions benefits), however the difference was not considered significant enough to score these at a 3.
- Compliance with legislation – all Sensitivities were given a score of 0. This is due to the requirement in the Environment Act (2021) for all dry recyclable material streams to be separately collected (Section 45A: recyclable household waste must be collected separately from other household waste for recycling or composting, recyclable streams must be collected separately, food waste must be collected weekly). It should be noted that the Environment Act does make provision for exemptions to be granted against these requirements, meaning that the co-mingled approach detailed for Scenario 2 remains legally viable; this is addressed at section 9.7. However, due to the delays in Defra's publication of their response to the Consistency consultation element of the Resource & Waste Strategy and the delay in releasing the consultation on the proposed Statutory Guidance to accompany the Environment Act 2021, any assessment of the likely impact of government policy decisions on the Sensitivities is speculative at present. This approach would be reviewed following the publishing of government guidance on the consistency and packaging reforms consultations.

The rest of the evaluation criteria are based on quantitative outputs from the modelling exercise. A detailed breakdown of the results can be seen in Table 39 below.

Table 39: Quantitative Outputs derived from Modelling

Theme	Evalution Criteria		Sc. 2	Sens 1	Sens 2	Sens 3	Sens 4
Cost	Total cost of option (£)		£101.6M	£104.1M	£101.6M	£113.6M	£79.7M
Environmental	Waste Hierarchy contribution (residual waste		265	265	265	265	320
	Greenhouse gas reduction potential (tonnes CO2-Eq)		-170,252	-179,946	-202,924	-244,436	-171,049
	Recycling rate (%)		63.98%	66.09%	63.98%	63.98%	61.37%
	Transport impact (distance travelled by all vehicles)		1,283,680	1,283,680	1,283,680	1,283,680	1,145,486
	Local Environmental Impact	Acid rain potential (tonnes SO2-Eq)	-1,031	-1,064	-1,059	-1,029	-1,035
		Potential water pollution (tonnes PO4-Eq)	-20	-22	-22	-19	-22
		Human toxicity (tonnes 1,4-DCB-Eq)	-502,901	-502,901	-507,656	-501,828	-503,670
		Resources depletion (tonnes antimony-Eq)	-2,551	-2,608	-2,819	-2,540	-2,561
Sustainability	Local community benefits (jobs)	Quantitative assessment of jobs created or sustained (FTEs in collection services)	736	736	736	736	655
	Local community benefits (energy and heat)	Quantitative assesment (tonnes) of waste which could be sent to AD/EFW for energy (electicity/heat) creation	253,294	253,294	253,294	253,294	243,423

For each of the quantitative criteria, scenario 2 scores have been kept consistent with the Phase 1 Appraisal, however due to the changes in the comparison subset in this phase of evaluation, colour-coding may change due to changes in relative performance. The findings are:

- Total cost of scenario – Sensitivity 4 is the least expensive due to income from garden waste subscriptions and Sensitivity 3 is the most expensive due to the significant CCUS infrastructure costs. Sensitivity 2 costs have not been modelled, due to the uncertainties explained in section 8.5. It is possible that Sensitivity 2 costs will be lower than Scenario 2 due to the additional revenue from the heat offtake.
- Waste hierarchy contribution – Sensitivity 4 results in a residual waste increase effect due to the implementation of a subscription fee for charged garden waste and therefore fewer people using the service, which results in garden waste being disposed of as residual waste instead. The other sensitivities perform the same as scenario 2.
- Greenhouse gas reduction potential – Sensitivity 3 results in significant GHG emissions savings through CCUS technology, followed by Sensitivity 2 due to the efficiency of CHP.
- Recycling rate – Sensitivity 1 has the strongest impact on recycling rate, with the additional capture of recyclable material from residual waste.
- Local/Environmental Impact – Sensitivity 2 has the highest scores for most criteria, due to the benefits associated with CHP (specifically, the replacement of fossil fuels). Sensitivity 1 also scores highly on acid rain potential due to the improved recyclate separated from the residual stream.
- Local Community Benefits (Jobs) – Sensitivity 4 requires fewer collection resources due to the introduction of a garden waste subscription resulting in lower uptake, the remaining Sensitivities are estimated to be the same as scenario 2. The jobs associated with plant operation have not been included as it is not known where the plant will be located.
- Local Community Benefits (Energy and Heat) - the combined tonnage of residual waste and food waste in Sensitivities 1, 2 and 3 maximises the opportunity for energy and heat generation from the processing of these material streams. Sensitivity 4's waste reduction impact reduces the potential of that sensitivity.

All quantitative results were then compared relative to the others in the subset to determine the relative scores, as shown in Table 40.

Table 40: Relative Scores for Quantitative Criteria

Theme	Evalution Criteria		Sc. 2	Sens 1	Sens 2	Sens 3	Sens 4
Cost	Total cost of option		72.5%	69.4%	72.5%	57.5%	100.0%
Environmental	Waste Hierarchy contribution – Waste Reduction		100.0%	100.0%	100.0%	100.0%	79.1%
	Greenhouse gas reduction potential – Low Carbon		69.7%	73.6%	83.0%	100.0%	70.0%
	Recycling rate		96.8%	100.0%	96.8%	96.8%	92.9%
	Transport impact		87.9%	87.9%	87.9%	87.9%	100.0%
	Local Environmental Impact	Acid rain potential (Acidification poten	96.9%	100.0%	99.5%	96.8%	97.3%
		Water pollution potential (specifically E	24.3%	84.3%	100.0%	0.0%	80.6%
		Human toxicity	99.1%	99.1%	100.0%	98.9%	99.2%
		Resources depletion	90.5%	92.5%	100.0%	90.1%	90.9%
Sustainability	Local community benefits (jobs)	Quantitative assessment of jobs created or sustained	100.0%	100.0%	100.0%	100.0%	89.0%
	Local community benefits (energy and heat)	Quantitative assesment (tonnes) of waste which could be sent to AD/EFW for energy (electicity/heat) creation	100.0%	100.0%	100.0%	100.0%	96.1%

8.8.2 Weighted Outputs

The Weightings for each of the criteria, as described and identified in Section 7.2 were then applied, giving each Sensitivity a weighted score. The results of this can be seen in Table 41 below.

This approach ensures that the outputs of the modelling have been revised to reflect the outcomes of the Vision Statement Workshops held between September and October 2021 (see section 2 Vision), where the weightings to be applied to each of the Criteria were agreed, based on initial proposals made by Ricardo and then revised and refined in partnership with EWP officers and elected Members.

Table 41: Weighted Scores

Theme	Evalution Criteria		Weighting	Sc. 2	Sens 1	Sens 2	Sens 3	Sens 4
Technical and Deliverability	Technical Deliverability (Collections and Waste		4.9%	0.15	0.10	0.15	0.00	0.15
	Flexibility of solution		2.4%	0.07	0.05	0.07	0.07	0.07
	Public acceptability – Ease of Use (Collections)		1.4%	0.00	0.00	0.00	0.00	0.00
	Public acceptability (Treatment technologies)		3.3%	0.07	0.07	0.07	0.10	0.07
	Waste Infrastructure Requirements		2.7%	0.05	0.05	0.00	0.00	0.05
	Market Risk		2.1%	0.04	0.00	0.04	0.04	0.04
	Sympathy with local policy		2.1%	0.04	0.04	0.04	0.04	0.04
	Compliance with legislation		3.2%	0.00	0.00	0.00	0.00	0.00
Cost	Total cost of option		41.7%	0.91	0.87	0.91	0.72	1.25
Environmental	Waste Hierarchy contribution – Waste Reduction		5.2%	0.16	0.16	0.16	0.16	0.12
	Greenhouse gas reduction potential – Low Carbon		4.5%	0.09	0.10	0.11	0.14	0.10
	Recycling rate		4.2%	0.12	0.13	0.12	0.12	0.12
	Transport impact		2.4%	0.06	0.06	0.06	0.06	0.07
	Local Environmenta	Acid rain potential (Acidification potential)	1.1%	0.03	0.03	0.03	0.03	0.03
		Water pollution potential (specifically Eutrophication potential)	1.2%	0.01	0.03	0.04	0.00	0.03
		Human toxicity	1.0%	0.03	0.03	0.03	0.03	0.03
		Resources depletion	2.7%	0.07	0.07	0.08	0.07	0.07
		Litter	2.3%	0.07	0.07	0.07	0.07	0.07
		Noise	1.4%	0.04	0.04	0.04	0.04	0.04
		Odour	1.1%	0.02	0.02	0.02	0.02	0.02
Sustainability	Local community benefits (jobs)	Quantitative assessment of jobs created or sustained	3.2%	0.10	0.10	0.10	0.10	0.09
	Local community benefits (energy and heat)	Quantitative assessment (tonnes) of waste which could be sent to AD/EFW for energy (electricity/heat) creation	6.0%	0.18	0.18	0.18	0.18	0.17
Total weighted score				**77.20%**	**73.23%**	**77.23%**	**66.43%**	**87.83%**

As can be seen, this process resulted in the following ranking of the Sensitivities appraisal results, from highest to lowest score:

- Sensitivity 4: scenario 2 with a subscription garden waste service for household.
- Sensitivity 2: scenario 2 with combined heat and power at the EfW facility.
- Scenario 2: scenario 2 without any changes.
- Sensitivity 1: scenario 2 with front-end recycling for household residual waste at the EfW facility.
- Sensitivity 3: scenario 2 with carbon capture, utilisation and storage technology (CCUS) at the EfW facility.

9. INCORPORATION OF ENVIRONMENT ACT AND RESOURCE AND WASTE STRATEGY INTO ASSUMPTIONS AND MODELLING

9.1 SUMMARY – RESOURCE & WASTE STRATEGY (R&W STRATEGY AND ENVIRONMENT ACT 2021)

The government launched their Resources & Waste Strategy in 2018. Following a first consultation exercise in 2019, Defra launched a further set of consultations in 2021 exploring their preferred scenarios on the implementation of the following initiatives:

- A Deposit Return Scheme for drinks containers, where consumers will be incentivised to take their empty drinks containers to return points hosted by retailers.
- Extended Producer Responsibility for packaging, where manufacturers will pay the full costs of managing and recycling their packaging waste, with higher fees being levied if packaging is harder to reuse or recycle.
- Consistency in household and business waste recycling, which includes the proposal of free garden waste collections, a preference for more frequent than fortnightly waste collections in urban areas, weekly food waste collections for all and restrictions on the collection of co-mingled dry recyclate.

Some elements of the R&W Strategy were incorporated in the Environment Act 2021, granted Royal Assent in November 2021. However, whilst certain elements of R&W Strategy are set out in the Act (Section 45A: recyclable household waste must be collected separately from other household waste for recycling or composting, recyclable streams must be collected separately, food waste must be collected weekly), the majority of the proposals in the R&W Strategy consultation will be implemented through secondary legislation, and the details of the implementation of the Act thus remain uncertain. It should be noted that the Environment Act does make provision for exemptions to be granted against these requirements, meaning that the co-mingled approach detailed for Scenario 2 remains legally viable; this is addressed at section 9.7.

These proposals have implications for all EWP members, and have the potential to require significant changes to the current methodologies for the collection, management and disposal of all municipal waste streams across Essex.

9.2 CONSULTATION PROCESS

An initial public consultation on the Government's Resources & Waste Strategy was carried out in 2019, separately considering Collection Consistency, Extended Producer Responsibility for packaging and scenarios for Deposit Return Schemes. Following assessment of the feedback, the Environment Act 2021 was published by the Government, and further consultations on EPR, DRS and Collection Consistency were published between March and May 2021.

The government response to the Extended Producer Responsibility consultation was published earlier in 2022; and as of July 2023 Defra have paused the release of the Consistency and DRS responses indefinitely. They will also publish a Consultation Exercise regarding the Statutory Guidance which will specify elements of waste collection methodology which may constrain WCA choices (eg on frequency of collection); they have previously stated that this will be released at the same time as the consultation responses.

Eventually published in March 2022, Defra's response to the Extended Producer Responsibility (EPR) consultation confirmed how the government intends to deliver their proposals to move the full cost of dealing with packaging waste from households away from local taxpayers and Councils to the packaging producers, applying the 'polluter pays principle'.

The EPR response also touched on elements from the Collection Consistency, Extended Producer Responsibility for packaging and scenarios for Deposit Return Schemes.

The consultation confirmed that "*Payments to local authorities for the cost of managing packaging waste generated by households, both packaging waste that is collected for recycling and packaging waste disposed of in residual waste, will be made under the packaging Extended Producer Responsibility scheme*".

This aspect of the proposals covers household collection services, both kerbside dry recycling collections and residual collections, which deal with packaging waste. This means that the cost of collecting and reprocessing recyclable packaging waste will be covered by the EPR scheme (within the provisos noted above). EPR will also cover the cost of managing (ie collecting and disposing of) packaging waste remaining in the residual stream.

However, on 26th July 2023, the government announced that the decision had been made to defer the obligations under EPR for packaging payments from October 2024 to October 2025. They also confirmed that "consistent recycling collections for households will come in after the implementation of the EPR scheme," adding that "More details on this will be set out in due course." The timeframe for the introduction of Collection Consistency is thus currently unclear, including the deadline for introducing food waste collections and the potential requirement to provide universal garden waste collection at no charge.

9.3 PLASTIC FILM AND FLEXIBLE PACKAGING

The consultation proposed that Plastic film and flexible packaging should be included in kerbside collections from 2027. The EPR response confirms that this will be required.

9.4 FOOD WASTE

Councils were originally required to introduce (or continue) separate weekly collection of food waste from 2023/04.

The consultation stated that "*Given the additional costs involved in separate food waste collection, Government will ensure that local authorities are resourced to meet any new burdens arising from this policy, including up front transition costs and ongoing operational costs*."

Councils who have already introduced food waste collection schemes have asked Defra whether retrospective payments will be made to cover the costs of scheme introduction. Defra have not confirmed whether this will be implemented, but have noted that it remains under consideration.

9.5 GARDEN WASTE

Garden waste is included in the Environment Act as one of the six recyclable waste streams to be collected from households in England for recycling. Like food waste, it must be collected separately from other household waste and from other recyclable waste streams by 2023/24. It can, however, be collected together with food waste where separate collection of food waste is not technically or economically practicable or there is no significant environmental benefit from separate collection of food waste.

Defra's preferred model in their impact assessment is a free minimum garden waste collection service provided by local authorities to householders. Collections would be fortnightly utilising 240 litre wheeled bins. This preference is based on the positive carbon impacts of this approach.

However, as Defra have not yet published their response to the Consistency Consultation, it remains unclear whether local authorities will be allowed to continue to charge for garden waste collections as permitted under The Controlled Waste (England and Wales) Regulations 2012.

In the Consultation, Defra suggest that should they provide updated guidance on reasonable garden waste charges (it should be noted that that this is described as guidance rather than being prescriptive), allowing for variations based on rurality and density of housing, this could allow the charging scenario to be continued, avoiding the significant increases in in terms of greenhouse gas emissions that a universal free scheme would generate without leading to the high costs associated with introducing a free minimum collection service for garden waste.

Defra state that, if implemented, the costs of providing a free minimum service for collection of household garden waste (up to a specified capacity and frequency, with local authorities retaining the scenario to charge beyond this) would be covered through new burdens funding and subject to a new burdens assessment. However, it is unclear whether this funding would include the lost revenue from garden charging on current charge levels; examination of the Impact Assessment accompanying the first consultation response suggests this forgone income will not be replaced.

The modelling for thus assumes that all local authorities will have to arrange for the universal free-of-charge separate collection of garden waste for recycling in the 2023/24 financial year.

9.6 SCHEME ADMINISTRATION AND FUNDING ALLOCATION

In August 2022, Defra released a Webinar titled EPR for packaging: Question Time with Defra (available at https://www.circularonline.co.uk/Webinars/epr-for-packaging-question-time-with-defra/). The webinar included details regarding the proposed methodology for allocating the funding stream from producers to local authorities. This includes details of how each local authority's collection methodology will be assessed, the criteria to be used and the impact on funding.

Defra confirmed that the level of payment to be made to local authorities will be dependent on whether their collection services are judged as "Efficient and Effective". Little detail is provided regarding how this will be quantified. It appears, however, that performance benchmarks will be developed, which will be adjusted for each local authority to allow for factors affecting performance, including rurality and level of deprivation. Defra have stated that "Because all things are not equal across local authorities, we intend to moderate this data-based assessment, taking a localised, evidence-based view of necessary costs, and whether the model-based assessment reflects the costs of an effective and efficient service for each local authority."

Defra have confirmed that the Scheme Administrator (SA) will be a public body, but that it is still in the process of being set up. The performance of each local authority will be assessed by the SA, with Defra stating that those providing 'efficient and effective' systems for managing household packaging waste will be reimbursed in full. The SA will adjust costs accordingly for local authorities failing to meet requirements, as well as covering any additional necessary costs incurred by those exceeding their performance benchmarks.

Defra are developing the process for determining whether services are 'effective and efficient', and accept that their current thinking is subject to change.

Defra's intention is that each Council will be subject to an Independent Technical Assessment, which will incorporate any particular circumstances affecting each local authority's ability to meet the 'Best in Class' standards. It will also explore potential 'gold plating' of services – ie where the level of service is higher (and thus more expensive) than considered necessary.

The SA will employ a team of Technical Assessors, who will play a major role in this process. They will seek evidence from each local authority regarding special circumstances or other reasons why actual and optimal performance may differ. This applies as much to over-performance as under -performance. This process will also include evaluation of any TEEP exemption applications. The Technical Advisors will then make a recommendation to the SA regarding any deductions which may be made to the EPR funding level for each LA based on inefficient or ineffective collection schemes.

This means that the SA will need to calculate the actual collection, disposal and litter bin waste costs for every LA; these will be needed for both 2025/25 and 2025/26, by when it is hoped this will transition to actual cost reporting. The modelling is likely to be a 'bottom up' model based on each service and using standardised costs. The data used will be a combination of data provided by each authority plus default assumptions based on service and geodemographic clusters.

The Actual Cost Models will be able to output metrics including tonnes recycled per household, contamination rate per household, service costs per tonne collected and a cost per % point of the recycling rate. This will provide an individual, local authority level summary for expected costs. By providing details of all input data items, assumptions and default values, this will enable challenge by each local authority when the results are published. The SA will employ a team of Technical Assessors, who will play a major role in this process. They will seek evidence from each local authority regarding special circumstances or other reasons why actual and optimal performance may differ. This applies as much to over-performance as under -performance. This process will also include evaluation of any TEEP exemption applications. The Technical Advisors will then make a recommendation to the SA regarding any deductions which may be made to the EPR funding level for each LA on the basis of inefficient or ineffective collection schemes.

9.7 TEPSEB EXEMPTIONS

The Environment Act 2021, at the revised *Section 45A: England: separate collection of household waste*, states

Dry recyclable streams – paper, glass etc must be collected separately, unless

a) it is not **T**echnically or **E**conomically **P**racticable to collect recyclable household waste in those recyclable waste streams separately, or
b) collecting recyclable household waste in those recyclable waste streams separately has no **S**ignificant **E**nvironmental **B**enefit (having regard to the overall environmental impact of collecting it separately and of collecting it together).

It is currently unclear how these exemptions will be assessed, considered, judged, approved or denied.

The implications of compliance with the Environment Act are two-fold. Compliance with legislative requirements is a duty of local authorities. However, the EPR consultation published by Defra also confirms that:

- *"Payments to local authorities for the cost of managing packaging waste generated by households, both packaging waste that is collected for recycling and packaging waste disposed of in residual waste, will be made under the packaging Extended Producer Responsibility scheme".*
- *Necessary costs will apply to the collection and management of packaging waste produced by households through consideration of effective and efficient services.*
- *Costs in scope must be necessary in collecting, managing, recycling and disposing of household packaging and connected to the delivery of efficient and effective systems.*
- *Not all LA costs incurred will be necessary in that they could be considered unnecessary or unreasonable in delivering services in an efficient and effective way.*
- *The SA will determine which costs are necessary and reasonable in recycling and disposing of packaging waste, linked with their assessment of efficient and effective systems, in consideration of national policies and local circumstances.*

Performance benchmarks will be developed, which will be adjusted for each local authority to allow for factors affecting performance, including rurality, level of deprivation. Defra have stated that "Because all things are not equal across local authorities, we intend to moderate this data-based assessment, taking a localised, evidence-based view of necessary costs, and whether the model-based assessment reflects the costs of an effective and efficient service for each local authority."

Defra confirmed that it is still the intention for EPR to move the cost of managing packaging waste from local authorities to producers. They also outlined the methodology for allocating the funding derived from producers to each individual local authority.

Producers will be responsible for reporting their packaging arisings data to the SA through a digital platform; the data will be used to calculate each producer's obligations.

It is proposed that a reconciliation of obligations will be made twice a year, in April and October; in the same manner, local authorities will receive EPR payments twice a year, covering a six-month period in arrears.

The performance of each local authority will be assessed by the SA, with Defra stating that those providing 'efficient and effective' systems for managing household packaging waste will be reimbursed in full. The SA will adjust costs accordingly for local authorities failing to meet requirements, as well as covering any additional necessary costs incurred by those exceeding their performance benchmarks.

Defra are developing the process for determining whether services are 'effective and efficient' and accept that their current thinking is subject to change.

The SA will develop an Actual Cost Model for each local authority, covering collection, disposal and litter bin waste. This will then be compared with a modelled 'Best in Class' reference, based on an agreed definition of an effective and efficient scheme. This will enable the SA to compare the necessary costs of operating the 'Best in Class' service, and contrast this with the actual costs incurred by each local authority. Performance metrics may include tonnes recycled per household, cost per tonne of disposal, cost per crew member etc.

Defra's intention is that each Council will be subject to an Independent Technical Assessment, which will incorporate any particular circumstances affecting each local authority's ability to meet the 'Best in Class' standards. It will also explore potential 'gold plating' of services – i.e. where the level of service is higher (and thus more expensive) than considered necessary.

This means that the SA will need to calculate the actual collection, disposal and litter bin waste costs for every LA; these will be needed for both 2024/25 and 2025/26, by when it is hoped this will transition to actual cost reporting. The modelling is likely to be a 'bottom up' model based on each service and using standardised costs. The data used will be a combination of data provided by each authority plus default assumptions based on service and geodemographic clusters.

The Actual Cost Models will be able to output metrics including tonnes recycled per household, contamination rate per household, service costs per tonne collected and a cost per % point of the recycling rate. This will provide an individual, local authority level summary for expected costs. By providing details of all input data items, assumptions and default values, this will enable challenge by each local authority when the results are published.

The SA will employ a team of Technical Assessors, who will play a major role in this process. They will seek evidence from each local authority regarding special circumstances or other reasons why actual and optimal performance may differ. This applies as much to over-performance as under -performance. This process will also include evaluation of any TEEP exemption applications. The Technical Advisors will then make a recommendation to the SA regarding any deductions which may be made to the EPR funding level for each LA on the basis of inefficient or ineffective collection schemes.

This confirms that the level of EPR funding provided to each local authority will be determined by the SA's judgement regarding the effectiveness and efficiency of the collection scheme. Where the judgement is that the scheme isn't meeting either (or both) of these requirements, funding will be withheld until an agreed improvement plan has been implemented.

The assessment methodology and criteria are still under consideration, and Defra intend to consult with local authorities on this. However, until the SA is set up, the considerations the SA might make in assessing the efficiency and effectiveness of local authority systems are currently unknown beyond the detail above. It is expected that, following further dialogue between Defra and local authorities, a clearer picture of what the criteria and metrics may be will emerge. However, it should be noted that the criteria setting will be influenced by significant pressure from packaging producers, who have expressed objections to paying extra for council services deemed excessively expensive due to inefficiency or of reasonable cost but producing lower volume or quality of recyclate.

However, until the Defra responses to the Collection Consistency and Deposit Return Schemes are published, the parameters within which changes, enhancements or maintaining of current collection schemes can be considered are unclear; the potential impact on EPR funding of scheme design thus continues to make decision making extremely difficult.

9.8 STATUTORY GUIDANCE

Defra originally stated that they would release a consultation by the end of 2022 seeking views on statutory guidance including service standards for collection arrangements and frequency. However, as this is intended to be released at the same time as the consultation responses, the timescale for this is now unclear. The Environment Act, at 45AZE, states *"The Secretary of State may issue guidance about the duties imposed by sections 45 to 45AZD. The guidance may in particular deal with the frequency with which household waste other than recyclable household waste which is food waste should be collected".*

The Consistency consultation states, *"We support frequent and comprehensive residual waste collections and we will provide more information on this in statutory guidance."*

Defra note that as the quantity of materials collected for recycling increases, they expect the amount of residual 'black bag' waste to continue to decrease. Reductions already made in the amount of residual waste mean that many local authorities now provide alternate weekly collections of residual waste, with a small number of local authorities providing collections of residual waste once every three weeks.

The consultation also states that "*Government wants to ensure that householders are not inconvenienced by being able to get rid of putrescent or smelly waste weekly or having insufficient capacity to recycle or to remove residual waste"*. The consultation notes that weekly separate food waste collection will be mandated, and also states that Defra *"will consider whether a recommended minimum service standard of alternate weekly collection for residual waste (alongside weekly food waste collection) might be appropriate, subject to an assessment of affordability and value for money"*.

Defra state that they will be seeking views on including this in the proposed statutory guidance on minimum service standards for rubbish and recycling, and that they will assess the costs for this when consulting on statutory guidance. They specifically note that local authorities that currently collect residual waste on a fortnightly basis should not need to reduce their capacity of collection or frequency further as a result of consistency measures.

This aspect of the consultation appears to focus on the frequency of residual collections rather than the capacity of containment provided. Defra's approach also fails to consider the impact of reduced residual capacity on increasing recycling rates, the successful introduction of three-weekly collections or the financial savings resulting in reducing the frequency of collections.

The Environment Act, at 45AZE, states "The Secretary of State may issue guidance about the duties imposed by sections 45 to 45AZD. The guidance may in particular deal with the frequency with which household waste other than recyclable household waste which is food waste should be collected".

10. CONCLUSION

The Essex Waste Partnership (EWP), (as the WDA and WCAs) are obliged to maintain a Joint Strategy setting out how household and similar wastes are to be managed. The current Strategy (referred to as the Joint Municipal Waste Management Strategy [JMWMS]) was adopted in 2008 and was expected to be in place until 2032. However, the JMWMS has been subject to no further substantive review or refresh since its adoption; during this period there have been significant changes to national policy, legislative changes and shifts in behaviours and attitudes to waste, particularly the government's Policy Paper outlining their proposed Resource & Waste Strategy for England, which was published in 2018.

The implication of these further legislative and policy drivers by government have resulted in the current JMWMS becoming outdated; the EWP have thus taken the decision, to review, update and develop the Strategy to ensure it better reflects current and future needs. The work to develop a new strategy has been undertaken by the EWP, a group comprising of ECC (Waste Disposal Authority) and the 12 borough, city and district councils (Waste Collection Authorities). The aim of the EWP is "To work in partnership to deliver better results for residents through cost effective services"[20] including the development and delivery of the County's Waste Strategy.

The objective of the refreshed strategy, to be called the "Waste Strategy for Essex" is to provide a policy framework from which ECC and the 12 councils working together as the EWP can provide appropriate infrastructure, ensure services are working closely together and manage resources to maximise beneficial impacts whilst achieving alignment with current and forthcoming policy and legislation.

This report details and summarises the work carried out so far to explore the current activities across the EWP in terms of waste collection, treatment and disposal, and to investigate scenarios and opportunities for the future.

A robust and structured methodology/process was developed for refreshment of the strategy, considering both the qualitative and quantitative elements of the current local and national waste landscape to both develop and fully consider the scenarios to be explored.

The first step was to agree a Partnership Vision for the Strategy, which involved establishing what is important to the EWP as a whole and for individual councils in terms of the provision of waste management services.

At present, each of the waste collection authorities operates differing waste collection schemes, collecting differing material streams in differing containers at differing frequencies. The County is undertaking a procurement to appoint a contractor for the management of residual waste and biowaste; however, this will be for a relatively short-term period to ensure future waste disposal and treatment services secured are fully aligned with any adopted Waste Strategy for Essex.

To develop the Partnership Vision, an extensive series of workshops were held with officers, and Councillors to explore the levels of aspiration and vision for the strategy, develop the Vision Statement for the strategy, understand stakeholder priorities and explore and develop the collection scenarios to be considered. The aim of the workshops was to shape and guide the vision, objectives and priorities for the Strategy, with the goal of understanding and capturing the diverse views across the EWP and to identify areas where there is consensus already within and across the groups. Multiple workshops were held with officers and Councillors across all EWP member authorities, including briefings, presentations, interactive discussions and scenarios reports.

To inform the development of the criteria, EWP developed a Best Practicable Environmental scenario (BPES) approach to the consideration and development of the criteria to be used to assess each of the scenarios to be considered. This approach enabled a framework to be developed to clearly illustrate the relative merits of each scenario considered in terms of:

- emissions to air (including climate change impacts), water and land.
- deliverability.
- performance against national targets.
- performance against EWP vision; and

[20] https://www.loveessex.org/our-waste-strategy/

- financial cost.

These workshops resulted in the agreement of a new working Vision Statement, the agreement of an initial long list of potential collection methodologies and a set of evaluation criteria to be used to assess each scenario. To enable the relative importance of each of the criteria, a weighting was agreed by the EWP during the workshops. The criteria and weightings were developed throughout the workshops, with an agreement that the average of the votes submitted by Members and officers would be used for assessing the short-listed whole system scenarios. A review of UK, EU and international technologies that are available for sustainable waste treatment was undertaken, and the workshops considered how each approach would be likely to advance EWP towards achieving the Vision. The review explored proven and emerging technologies, and evaluation criteria were developed to enable ranking of the scenarios.

The key priorities identified during the workshops included cost-efficiency and the provision of reliable services. Decarbonisation and waste minimisation were also identified as key driving issues and areas of focus, together with landfill diversion and recycling.

Key collaboration areas such as the standardisation of the waste collection systems across the EWP, the segregation of food and garden waste and the approach to treating of food waste, garden waste and residual waste management were explored. The EWP believe that changes in the current collection schemes should only be considered for introduction if beneficial. To fully explore collaboration opportunities the same collection systems were modelled for each of the WCAs.

Regarding residual waste management scenarios, EWP members agreed that more can be done to minimise waste arisings and increase recycling rates; however, it was also agreed that even if world leading waste minimisation and recycling was achieved in Essex, there would still be significant quantities of waste requiring disposal. The county's experience of MBT, combined with the changing composition of residual waste being less suitable to MBT processes, has raised some concerns over the suitability of such technology and there is a recognition that this technology still produces outputs requiring disposal to either landfill or incineration. Throughout the workshops, the EWP consistently showed little support for relying on landfill as the main residual waste disposal route. Although concerns over the acceptability of incineration as a treatment route remain, more discussion needs to take place on this and it was accepted that EfW could be a valid approach, particularly when combined with heat capture. This is a preferred solution over landfill and aligns with the waste hierarchy and national policy.

These views were gathered to form a Strategic Framework, to inform the development of the next steps of the Waste Strategy for Essex. Following extensive consideration of potentially available treatment scenarios, the main areas of agreement and red lines identified during the Workshop sessions were used as a starting point to agree the six collection and treatment scenarios to be modelled, rejecting collection or treatment options that were deemed to be insufficiently tested or currently undeliverable in terms of providing a guaranteed outlet for Essex's waste volumes. Based on the EWP's insight, all the collection scenarios focus on maximising landfill diversion rates and utilising EfW as the treatment solution for residual waste, anaerobic digestion for food waste and open air windrow composting for garden waste. A Baseline model was developed representing each WCA's current service, calibrated to represent, as closely as possible, the resources utilised by each of the WCA's (vehicles, staff, containers), the tonnages of each material stream collected, the collection methodology and the costs, capital and revenue, incurred by the service.

To assess the quantitative impact of each of the collection system scenarios, a modelling exercise was carried out. Each WCA's current collection service performance was benchmarked against appropriate comparators to provide evidence for the improvements represented by each of the scenarios to be modelled.

Waste composition data for both the recycling and residual streams was utilised to determine the tonnage of recyclates collected and, importantly, the tonnage of recyclates left in the residual stream. The tonnage of recyclates left in the residual waste stream was used along with the outcomes of the benchmarking exercise, coupled with an analysis of yields presented by WRAP's Indicative Cost and Performance (ICP) tool, to estimate the potential yields of dry recyclate and food waste to be modelled. This ensures that the modelling of increased yields is based on material which is actually available to capture and checked against the reality of current performance for each WCA.

Producing accurate Baseline models that reflect each Council's current collection service and their specific operations acted to calibrate the models used so that the scenario models will be more accurate. Importantly, presenting the baseline models' outputs to the councils and agreeing that these reflect their current services provides great value and confidence in these models' outputs. to this end, extensive research and analysis was carried out with each of the WCAs to obtain, analyse, check and validate the operational data provided.

The current Baseline was then projected to financial year 2027-2028 to allow for impacts from housing/population growth over the plan period and the predicted impacts of legislative and behavioural change. This was used as the comparator against which each of the scenarios modelled, which are also based on FY 2027/28, could be compared.

The agreed shortlist of six whole system scenarios were modelled using five of Ricardo's bespoke modelling tools. These enabled each scenario to be considered in terms of waste arisings, composition, capture rates, facility destinations, number of vehicles required, productivity, associated (collection) costs for vehicles, staffing levels, number and type of containers, associated (waste management) costs for gate fees, material income and treatment costs. Each scenario was considered on a 'per authority' basis and a combined collection and waste management level, enabling the 'whole system cost' across the EWP for each scenario to be considered. Finally, a whole system WRATE analysis calculated the environmental impacts arising from each collection system, including embodied emissions from bins, sacks, collection vehicles, and collection, transport and treatment of the waste.

This provided the EWP with a current baseline Essex Local Authority Collected Waste management mass balance and associated financial model, and a series of deliverable waste collection, treatment and disposal scenarios for waste management with high, medium and low performance and high, medium and low cost all with potential to meet the EWP vision.

The quantitative outputs from the modelling exercise were then combined with the qualitative elements agreed at the workshops. Each of the six modelled scenarios were evaluated against the criteria and weightings agreed by the EWP during the Partnership Vision stage of the process. This led to a BPES (best practicable environmental scenario) being identified, with the weighted scores shown in Table 36, copied below.

Theme	Evaluation Criteria		Baseline	Sc. 0+	Sc. 1	Sc. 2	Sc. 3	Sc. 4	Sc. 5	Sc. 6
Technical and Deliverability	Technical Deliverability (Collections and Waste		0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
	Flexibility of solution		0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
	Public acceptability – Ease of Use (Collections)		0.03	0.03	0.04	0.00	0.03	0.00	0.03	0.00
	Public acceptability (Treatment technologies)		0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
	Waste Infrastructure Requirements		0.08	0.08	0.05	0.05	0.05	0.05	0.05	0.05
	Market Risk		0.04	0.04	0.04	0.04	0.06	0.06	0.06	0.06
	Sympathy with local policy		0.00	0.00	0.04	0.04	0.04	0.04	0.04	0.04
	Compliance with legislation		0.00	0.00	0.00	0.00	0.10	0.10	0.10	0.10
Cost	Total cost of option		1.13	1.24	1.16	1.25	1.01	1.15	0.88	0.99
Environmental	Waste Hierarchy contribution – Waste Reduction		0.07	0.09	0.11	0.16	0.08	0.14	0.10	0.15
	Greenhouse gas reduction potential – Low Carbon		0.02	0.07	0.09	0.14	0.07	0.10	0.08	0.12
	Recycling rate		0.10	0.10	0.11	0.13	0.10	0.12	0.10	0.12
	Transport impact		0.07	0.07	0.06	0.06	0.05	0.05	0.06	0.06
	Local Environme	Acid rain potential (Acidification potential)	0.01	0.02	0.03	0.03	0.02	0.02	0.02	0.03
		Water pollution potential (specifically Eutrophication potential)	0.00	0.01	0.03	0.04	0.02	0.03	0.03	0.03
		Human toxicity	0.01	0.02	0.03	0.03	0.03	0.03	0.03	0.03
		Resources depletion	0.04	0.05	0.07	0.08	0.06	0.07	0.07	0.08
		Litter	0.05	0.05	0.07	0.07	0.05	0.05	0.05	0.05
		Noise	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
		Odour	0.00	0.00	0.02	0.02	0.02	0.02	0.02	0.02
Sustainability	Local community benefits (jobs)	Quantitative assessment of jobs created or sustained	0.06	0.07	0.07	0.06	0.08	0.07	0.10	0.09
	Local community benefits (energy and heat)	Quantitative assessment (tonnes) of waste which could be sent to AD/EFW for energy (electricity/heat) creation	0.02	0.02	0.15	0.13	0.18	0.15	0.17	0.14
Total weighted score			68%	76%	83%	88%	79%	86%	77%	83%

As can be seen, this process resulted in the following ranking of the scenarios appraisal results, from highest to lowest overall score:

1) Scenario 2: Fortnightly comingled, 3-weekly residual, weekly food waste, fortnightly garden waste

2) Scenario 4: Fortnightly multi-stream, 3-weekly residual, weekly food waste, fortnightly garden waste

3) Scenario 1: Fortnightly comingled, fortnightly residual, weekly food waste, fortnightly garden waste

4) Scenario 6: Weekly multi-stream, 3-weekly residual, weekly food waste, fortnightly garden waste

5) Scenario 3: Fortnightly multi-stream, fortnightly residual, weekly food waste, fortnightly garden waste

6) Scenario 5: Weekly multi-stream, fortnightly residual, weekly food waste, fortnightly garden waste

7) Scenario 0+: Baseline in 2027/28

8) Baseline

See Table 7 for further detail of current collection systems (baseline) for each borough, city and district council.

Following the presentation of this outcome to the EWP Ricardo were asked to carry out further modelling of additional 'sensitivities' on the preferred scenario, to allow the consideration of potential technological and legislative developments considered to have the potential to further impact the waste landscape. In agreement with ECC, four sensitivities were modelled for scenario 2 in order to assess the effect of introducing the following:

- Sensitivity 1: Front-end recycling to the EfW facilities where household residual waste is taken
- Sensitivity 2: Addition of combined heat and power (CHP) at the EfW facilities
- Sensitivity 3: Addition of carbon capture, utilisation and storage technology (CCUS) at EfW facility
- Sensitivity 4: Introduction of householder charges for garden waste collections

Sensitivity 1 assumes the development of a materials recovery facility at the 'front end' of the EfW facility; this would allow the collected residual waste to be further sorted, with some recyclable streams able to be separated out (Plastic bottles, PTTs, glass, aluminium and steel (ferrous)). Although the modelling shows that, due to the proportion of tonnes recycled increasing and the proportion of tonnes landfilled decreasing (leading to higher recycled tonnage and thus material income), material income increases, this is outweighed by the increased gate fees due to the additional sorting cost.

Sensitivity 2 assumes that the EfW would incorporate combined heat and power (CHP) technology. In this approach, CHP is a highly efficient process that captures and utilises the heat that is a by-product of the electricity generation process. However, this approach is reliant on the heat generated during this process being supplied to an appropriately matched heat demand that would otherwise be met by a conventional boiler, which would allow heat requirements to be met that would otherwise require additional fuel to be burnt. The availability of such offtake requirements differs for each EfW site, and we are not able to quantify this without a detailed study into local infrastructure.

Sensitivity 3 explores the potential for carbon capture systems to be incorporated into the EfW process, further improving the carbon efficiency of this disposal method. This approach doesn't affect the waste arisings, but has a positive carbon impact. However, modelling suggests that costs would increase substantially due to the higher gate fees required to fund the installation and operation of this technology.

Sensitivity 4 explores the impact of the government permitting WCAs to continue making a charge to householders for the collection of garden waste. The modelling shows a reduction in the number of collection vehicles compared to scenario 2 (where a universal free service is modelled), a slight reduction in recycling rates and a substantial overall cost saving due to the additional income received from a subscription scheme.

Finally, as this project developed, EWP requested that Ricardo carry out a strategic environmental assessment (SEA) for the Strategy, fulfilling the SEA requirements to: identify the potentially significant environmental effects of the strategy in terms of the waste management scenarios being considered by the Council, help identify appropriate scenarios to avoid, reduce or manage adverse effects and to enhance beneficial effects associated with the implementation of the Strategy wherever possible and to give the statutory SEA bodies, stakeholders and the wider public the ability to see and comment upon the effects that the draft Strategy may have on them, their communities, and their interests, and encourage them to make responses and suggest improvements.

Ricardo have prepared a draft Screening/Scoping Report which sets the context, identifies other relevant plans and programmes, problems and opportunities, establishes the environmental baseline and sets assessment objectives. Provision of this Scoping Report to the Consultation Bodies allows agreement on the scope and level of detail to be included in the Environmental Report, and the consultation arrangements for the Environmental Report. This is currently ongoing, with a full SEA Environmental Report to follow.

The information gathered as part of the vision setting, baseline and scenario modelling, and the methodology and outputs of the BPES appraisal have been included in this report. The report includes the outputs of the benchmarking of the current services across the EWP, identifies the agreed criteria and weightings used to develop the alternative collection methodology scenarios, and demonstrates how the selected scenario(s) fit with the set Vision Statement for the EWP and the current and future legislative/policy framework for waste management. This identifies how the project has been developed to incorporate the rationale for why the strategy is needed, the current performance, the future Vision and the proposed priorities in terms of waste management.

It should be noted that a critical element of the project is that district officers and Councillors have worked closely with the EWP project team and Ricardo to provide the data required to inform the modelling in an intensive process requiring commitment from all partners. The process has also identified local strategic and service objectives and constraints across EWP members.

Regular meetings of the EWP have ensured the project has remained focussed on the collective vision while maintaining engagement and input across the EWP.

APPENDICES

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