London Borough of Lewisham

TEEP Assessment of Kerbside Collection Options

November 2015

Anthesis

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London Borough of Lewisham

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Executive Summary

Background to the work

The London Borough of Lewisham is a Unitary Authority located in South East London, responsible for both the collection and disposal of recycling and waste. Over 2016/17 and 2017/18 the Council as a whole must save £45m. In order to help achieve this saving £1.1m per annum must be cut from the waste and recycling budget. In order to identify how these savings might be made the Council has explored different options for kerbside collection of waste and recycling through financial and performance modelling. The three methods of collecting dry recyclables within the options that the Council has explored are; fully comingled, twin stream and kerbside sort.

Since the Waste (England and Wales) Regulations 2011 (as amended) place a duty on local authorities to provide separate collection services, subject to the two tests, the Council wanted to assess the options being considered for kerbside collection in relation to compliance with these regulations. As part of the preparation of this report a number of local authorities and private waste management firms were contacted for information and outcomes of modelling undertaken by the Council and an independent consultant were used to assess potential service performance.

Legislative background

The European revised Waste Framework Directive of 2008 (Directive 2008/98/EC on waste, rWFD) set out various requirements, including one in article 10 that "waste shall be collected separately "if technically, environmentally and economically practicable" (TEEP). European Commission guidance was provided as to what technically, environmentally and economically practicable would mean:

- 'Technically practicable': 'technically developed and proven to function in practice'
- 'Environmentally practicable': 'added value of ecological benefits justify possible negative environmental effects of the separate collection (e.g. additional emissions from transport)'
- 'Economically practicable' : 'does not cause excessive costs in comparison with the treatment of a non-separated waste stream, considering the added value of recovery and recycling'

The requirements of the rWFD regarding separate collection, were transposed into UK law through The Waste (England and Wales) Regulations 2011, and then amended by The Waste (England and Wales) (Amendment) Regulations 2012. The requirement for Waste Collection Authorities (which include Unitary Authorities) to institute separate collections of waste paper, metal, plastic and glass from the 1st January 2015 is subject to two tests. The plain reading of the text leads to the following possible understanding of the tests:

1. A necessity test – i.e. are separate collections necessary to ensure that waste is "recovered" as high up the waste hierarchy as possible (Article 4 rWFD) and that this "recovery" of the waste protects human health and the environment (Article 13 rWFD) and necessary to "facilitate or improve recovery".
2. A practicability test – i.e. it needs to be demonstrated that separate collections are practicable in terms of: a technically feasible system being available that is suitable for the locality; net environmental benefits accruing through the supply chain; and the cost not being comparatively excessive.

Summary of outcomes

A summary of the outcomes of the tests and identification of actions that the Council may consider undertaking in the future in relation to the options are set out below and provided in detail in the body of the report.

Necessity: Based on the modelling undertaken it appears that the separate collection option would result in a higher quantity of recycling captured than the baseline (existing) option but does not perform as well as the highest performing comingled and twin stream options.

Based on the likely methods available to Lewisham for managing materials collected under different options it is not clear that the kerbside sort or twin stream options would result in higher quality materials than comingled materials processed by a high performing MRF.

Technical practicability: The regulations require consideration of whether separate collections are technically practicable. Information has been provided in the assessment regarding the practicability of the comingled and twin stream options for comparison.

- Kerbside sort: Despite issues with congestion, H&S and significant additional vehicle movements making kerbside sort collections technically undesirable, it is not considered that these issues would make them unfeasible. However, Lewisham would need to secure use of a suitable Waste Transfer Station (WTS) to make this option feasible.

- Twin stream: There are a limited number of local facilities that would accept the container only stream proposed in these options. Lewisham would need to secure a contract with a MRF or PRF that could allow paper and containers to be tipped in the same location, or, secure use of a WTS.

- Comingled: Since the current collections in Lewisham are fully comingled it has been proven that this option is technically feasible. However it should be noted that a number of MRF representatives engaged expressed that the quality of materials from Lewisham would either result in material not being accepted or high gate fees being charged. It would therefore be important for Lewisham to improve the quality of comingled material delivered to the MRF should it retain comingled collections.

Environmental practicability: The Council has undertaken an assessment of the greenhouse gas emissions of the options using a greenhouse gas calculator. The outcomes indicate that the highest performing option is a twin stream option but the differences between options are not substantially different. It is therefore not possible to conclude that a kerbside sort, twin stream or comingled collection would perform significantly differently in environmental terms based on the modelling undertaken. It should be noted that the options modelled were all substantially better than the baseline (current) option indicating that by changing its collection system in line with the options modelled Lewisham could improve its environmental performance.

Economic practicability: The financial assessments indicate that the kerbside sort option would substantially increase the net service cost from the (current) baseline. Applying the Council's test of 'excessive cost' (that any increase to the current cost profile of the waste services will be viewed as' excessive'), it can be concluded that separate collections would be likely to result in excessive costs in comparison with baseline (current) services and twin stream and comingled options assessed.

Conclusion

Greenhouse Gas modelling does not provide evidence that comingled or twin stream options would lead to substantially better performance than the kerbside sort option (as the Route Map indicates would be required

should Lewisham make an argument for the collection options on the basis of environmental performance). However, the evidence gathered indicates that the use of separate collections by the Council is not necessary to achieve high quality recycling as long as high performing MRF facilities could be secured to sort recyclables. The lack of WTS makes separate collection of recyclables technically impracticable currently. Further discussion and negotiation with potential local authority partners and private contractors would be needed to try and secure a facility to make separate collection feasible. The economic assessment indicates that the all options with the exception of the kerbside sort option would reduce the costs of the collection. The kerbside sort option does not appear to be economically practical as it is predicted to significantly increase the cost of service delivery.

Recommendations

The assessment of waste management arrangements against the regulations is not a one-off activity, and Lewisham will need to update its assessment as it determines the details of the operational arrangements for the options it choose to progress with, and as it starts to procure relevant contracts (e.g. for bulking, transport and reprocessing).

In progressing with procurement of services and joint working with other authorities under any of the options Lewisham would need to ensure that materials are managed and handled in a way that retains and maximises their value wherever possible. As Lewisham progresses the development of options it could continue to review and develop the modelling and cost assumptions related to each option in order to evaluate how this influences overall performance.

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1 Introduction

The London Borough of Lewisham is a unitary authority located in South East London, responsible for both the collection and disposal of recycling and waste. The Council currently provides a fully comingled recycling collection service for approximately 80,000 kerbside properties using 240 litre wheeled bins. The targeted materials are: glass bottles and jars, paper and cardboard, steel and aluminium cans, empty aerosols, foil, plastic pots, tubs and trays, plastic bottles, plastic bags and film and food and drink cartons.

Over 2016/17 and 2017/18 the Council as a whole must save £45m. In order to help achieve this saving, £1.1m per annum must be cut from the waste and recycling budget. In order to identify how these savings might be made the Council has undertaken financial options assessments on different elements of the waste services. As part of these financial assessments the Council has explored different options for kerbside collection of waste and recycling through financial and performance modelling.

Since the Waste (England and Wales) Regulations 2011 (as amended) place a duty on local authorities to provide separate collection services, subject to the two tests, the Council wanted to assess the options being considered for kerbside collection in relation to compliance with these regulations. The Council has already undertaken a large amount of modelling and evaluation in the assessment of options. Anthesis was commissioned to assess the outcomes of this data and information gathering in relation the duty outlined in the regulations to separately collect recyclable material and the outcomes of this assessment are provided in this report. The approach outlined in the Waste Regulations Route Map (Route Map[1]), which is considered by the Environment Agency (EA) to be a good practice approach, has been followed in preparing this report.

The scope of this report is limited only to consideration of options for kerbside recycling. In Lewisham approximately 80,000 households are served by the kerbside service and 41,000 are served by the flats service. This means that 33% of households in the borough receive the flats collection service. The Council's other operations involving the collection of recyclable materials (e.g. collections from households in flats, commercial properties and street cleansing operations) will be influenced by decisions made regarding kerbside recycling and should be subject also to a similar assessment.

As part of the preparation of this report a number of local authorities and private waste management firms were contacted for information. **This report contains information provided by these local authorities and waste management firms that is commercially sensitive. Therefore this report should not be distributed externally to Lewisham Council without this information being first removed.**

2 Legislative background

2.1 European Directive

The European revised Waste Framework Directive of 2008 (Directive 2008/98/EC on waste, rWFD) set out various requirements, including one in article 10 that "waste shall be collected separately "if technically, environmentally and economically practicable" (TEEP). This is set in the context of such separate collections being necessary for "waste to undergo recovery operations" and to "facilitate or improve recovery". One of the objectives of the rWFD, stated in recital 28, is that the "Directive should help move the EU closer to a 'recycling society', seeking to avoid waste generation and to use waste as a resource", and source segregation

[1] Waste Regulations Route Map, 2014

and separate collections are incorporated as measures that would help to bring this about. Article 11 again brings in the requirement for separate collections, but in the context of promoting "high quality recycling" and meeting the quality standards of the recycling sector dealing with the material.

European Commission guidance was provided as to what technically, environmentally and economically practicable would mean:

- 'Technically practicable' = 'technically developed and proven to function in practice'
- 'Environmentally practicable' = 'added value of ecological benefits justify possible negative environmental effects of the separate collection (e.g. additional emissions from transport)'
- 'Economically practicable' = 'does not cause excessive costs in comparison with the treatment of a non-separated waste stream, considering the added value of recovery and recycling'

2.2 Transposition into the law of England and Wales

The requirements of the rWFD regarding separate collection, were transposed into UK law through The Waste (England and Wales) Regulations 2011, and then amended by The Waste (England and Wales) (Amendment) Regulations 2012. The relevant text of the regulations is provided for convenience in Appendix 1. It will be noted that the requirement for Waste Collection Authorities (which include unitary authorities) to institute separate collections of waste paper, metal, plastic and glass from the 1st January 2015 is subject to two tests. Guidance on how to interpret the tests has not been provided by DEFRA, but the plain reading of the text leads to the following possible understanding of the tests:

1. A necessity test – i.e. are separate collections necessary to ensure that waste is "recovered" as high up the waste hierarchy as possible (Article 4 rWFD) and that this "recovery" of the waste protects human health and the environment (Article 13 rWFD) and necessary to "facilitate or improve recovery".
2. A practicability test – i.e. it needs to be demonstrated that separate collections are practicable in terms of: a technically feasible system being available that is suitable for the locality; net environmental benefits accruing through the supply chain; and the cost not being comparatively excessive.

2.3 Enforcement

The Environment Agency (EA), as the enforcement agency for the relevant Regulations, has issued guidance to all local authorities, detailing their enforcement approach. The key elements are as follows: -

- Collectors who do not have separate collection arrangements should review their collection practices and consider carefully if and how they comply. They should rigorously apply the Necessity and TEEP tests described above. Collectors who have concluded it not necessary or not TEEP to operate separate collection arrangements should keep, and be able to provide for inspection, an audit trail which will help the EA to understand the basis of their decision-making. Records should be such that, if necessary, they could demonstrate compliance with the Regulations in a court of law. Collectors should consult their lawyers to ensure they are compliant with this legislation.
- Collectors are expected to ensure in all cases that customers can avoid putting paper, plastic, metal or glass in the same collection container as their general waste. In addition, they are expected to collect paper, plastic, metal and glass separately from each other, subject to the above two tests.

The above emphasises the importance of the data analysis, and how retaining this data and presenting the conclusions in this report are part of the audit trail required by the EA. There is further explanatory text in the guidance regarding the enforcement approach that the EA will take, emphasising that their aim will be to help collectors to achieve compliance, working with them to help them to comply. As with all its enforcement regimes, a risk based approach will be used, with enforcement being a last resort.

There is an additional risk to the Council arising from the possibility of an independent third party requesting a judicial review of the process by which the Council has determined its waste collection arrangements because it was either unlawful or unfair. Such a request for a review can only be brought by someone whose interests will somehow be harmed sufficiently if the decision stands, so this could include those with an interest in the recycling of materials.

3 Borough profile

The inner London borough of Lewisham lies to the south east of the city. It is bordered by Greenwich to the east, Bromley to the south, Southwark to the west and Tower Hamlets to the north across the River Thames. It is the 13th densest populated authority in England and is 13.4 square miles, making it the second largest inner city borough in London.

Lewisham's population is around 293,064 (2015), with estimates suggesting that this will rise to 306,815 by 2019[2]. Over the next two decades Lewisham is forecast to see the second highest rate of population growth in Inner London. 33% of households in the borough are flats that need to be provided with a waste and recycling service using communal containers. The borough is also the 15th most ethnically diverse local authority in England[3] and 170 languages are spoken[4]. These demographic factors can affect recycling performance. Specifically:

- A high density of housing means that space for recycling containers, both internally and externally, can be limited[5]
- Operations and vehicle movements can be challenging, for example, there are Health and Safety implications associated with loading vehicles on busy roads and collection operations can contribute significantly to congestion[6]
- There are challenges associated with communicating with residents who do not speak English as a first language.

4 Kerbside collection options assessment

As part of assessments to identify how budget savings will be made to waste and recycling services, the Council has explored 10 different options for kerbside collection through undertaking financial and

[2] http://portal.lewishamjsna.org.uk/Population_Projections.html

[3] http://www.lewishamjsna.org.uk/a-profile-of-lewisham/social-and-environmental-context/ethnicity

[4] http://www.lewishamjsna.org.uk/a-profile-of-lewisham/social-and-environmental-context/languages-spoken-in-schools/what-the-data-shows

[5] WRAP, Recycling Collections for Flats, 2012

[6] WRAP, Recycling Collections for Flats, 2012

performance modelling. These options are summarised in Table 1. In 2014, eight options were modelled using the Kerbside Assessment Tool (KAT)[7] by an independent consultant on behalf of the London Waste and Recycling Board (LWARB) as part of an efficiency review undertaken for Lewisham[8]. Lewisham officers then undertook further financial assessment to verify and update the costs of a number of the modelled options and to explore two further options. Scenario references are provided in Table 1 developed by the independent consultant (RF) and Lewisham officers (LW).

Lewisham officers also modelled greenhouse gas emissions using a tool provided to local authorities by the Greater London Authority (GLA) as part of the Mayor of London's Municipal Waste Management Strategy[9].

As part of the preparation for this report, Anthesis undertook desk based research and engaged with a number of local authorities and private waste management firms to try and establish how dry recyclable materials might be managed and processed within the options previously assessed. A full list of the facilities engaged with is included in Appendix 2.

Table 1. Summary of kerbside recycling options assessed

Scenario reference	Recycling collection system	Recycling collection frequency	Residual collection frequency	Food waste collection frequency	Garden waste collection frequency
4 RF / 6 LW	Kerbside sort	Weekly	Fortnightly	Weekly	Weekly (charged)
2 RF	Twin stream	Fortnightly	Fortnightly	Not collected	Fortnightly (charged)
3 RF / 2 LW	Twin stream	Fortnightly	Fortnightly	Weekly	Weekly (charged)
5 RF	Twin stream	Weekly	Fortnightly	Weekly	Weekly (charged)
6 RF	Twin stream	Weekly	Weekly	Not collected	Fortnightly (charged)
7 RF / 3 LW	Twin stream	Fortnightly	Weekly	Not collected	Fortnightly (charged)
8 RF / 4 LW	Twin stream	Fortnightly	Fortnightly	Weekly	Fortnightly (charged)
Baseline+ RF / Baseline+ LW	Fully comingled	Weekly	Weekly	Not collected	On request (free)
1 RF	Fully comingled	Fortnightly	Fortnightly	Weekly	Weekly (charged)
5 LW	Fully comingled	Fortnightly	Fortnightly	Weekly	Fortnightly (charged)
1 LW	Fully comingled	Weekly	Weekly	Not collected	Fortnightly (charged)

[7] KAT is a nationally available tool that is provided by the Waste and Resources Action Programme (WRAP. It is used for modelling the cost and operational requirements of kerbside collection schemes.

[8] LWARB, Efficiency Review for London Borough of Lewisham, 2014

[9] The Greenhouse Gas Calculator is a free tool provided to local authorities to allow them to determine the emissions resulting under different waste management scenarios.

The three methods of collecting dry recyclables within these scenarios are:

- Fully comingled (dry recyclables all mixed together within a wheeled bin)
- Twin stream (paper and cardboard collected within a kerbside box and containers mixed together within a wheeled bin)
- Kerbside sort (dry recyclables collected within two kerbside boxes and manually sorted onto a stillage vehicle at the point of collection)

5 Wastes collected by the Council and the application of the waste hierarchy

Within this section the first three steps of the Route Map are worked through, namely:

- Documenting what wastes are collected and how.
- Explaining the fate of each stream of waste collected.
- Identifying where on the Waste Hierarchy each waste stream is handled.

The approach taken has examined the current method of managing a particular material or waste stream with commentary on how this might be influenced through the introduction of different options for kerbside collection being considered.

5.1 Explanation of the waste hierarchy

The waste hierarchy expresses diagrammatically how certain approaches to waste management are to be preferred above others. Disposal (e.g. landfilling) is the least preferred, whereas preventing waste arising in the first place is at the top of the hierarchy of options.

Figure 1. Waste hierarchy[10]

Obtaining some energy benefit ("Recovery" in the diagram) is preferred above disposal, and recycling is still better. Taking something that has been discarded and enabling it to be re-used or find another use is second only to prevention.

[10] http://ec.europa.eu/environment/waste/framework/

5.2 Wastes collected by the Council

The 2011 Regulations impose a duty on the Council to apply the waste hierarchy to the wastes that it manages. This has been in force since 2011, and the Council has undertaken a number of steps to ensure it fulfils this duty. The duty is qualified by considerations of technical and economic feasibility and environmental protection, and therefore the Council must exercise its judgement in deciding where on the hierarchy a material is treated. Table 2 summarises the steps taken by the Council to manage each material in line with the waste hierarchy and any influence the kerbside collection options might have on this. Further consideration of the three main material streams influenced by the kerbside collection options considered is provided in sections 5.2.1 to 5.2.3.

Table 2: Current approaches to management of wastes in Lewisham

Material	Prevention	Reuse	Recycling / composting	Energy Recovery	Disposal	Managed in line with Waste Hierarchy? What is impact of kerbside options?
Paper, card, plastics, metals, glass	Promotion of prevention on website – sensible shopping	Re-use options have very limited impact, and will not be applicable to most materials.	Co-mingled dry recycling kerbside collection, bring banks and commercial collection	Some residues from MRF to energy from waste.	Some residues from MRF to landfill.	Yes, the vast majority of households in the borough have access to kerbside collection with bring bank provision for those who do not. This access to services is not anticipated to change under any kerbside option. The kerbside sort option would eliminate MRF residues (4RF / 6 LW) although several twin stream and comingled options (2 RF, 3RF / 2LW and 5 LW) result in 120 tonnes extra of (uncontaminated) dry recycling captured.
Textiles and shoes	Social media promotion Swishing events Love Your Clothes Campaign	Swishing events Projects with Goldsmiths Uni Promotion of charity shops	Sir Vivor Bag trialled using bags placed within recycling bins Textiles also collected via bring banks	Some residues from MRF to energy from waste.	Some residues from MRF to landfill.	Yes, although there may be scope to improve prevention by promoting repair on the website, as well as increasing re-use e.g. at swishing events. Textile collection should be possible in addition to each of the kerbside collection options. However a higher quality and quantity might be expected from the kerbside sort option based on the potential for survival bags containing recycling to split and materials be lost or damaged under the comingled and twin stream options.
Garden	Not applicable	Composting	Pre-paid garden	Garden waste	No	Yes, Lewisham has taken a number of

Material	Prevention	Reuse	Recycling / composting	Energy Recovery	Disposal	Managed in line with Waste Hierarchy? What is impact of kerbside options?
waste		information on website Home composting workshops and subsidised bins	waste sack service – request. Sent for composting.	banned from residual bin but some will no doubt be placed there and sent for energy recovery.		steps to manage green waste towards the top of the waste hierarchy. All kerbside options considered assume that an improved service for the collection of garden waste will be provided and that tonnages captured will increase from the baseline.
Food waste	Promotion of prevention on website – sensible shopping Promotion of Love Food Hate Waste	Promotion of Home Composting – bins and workshops Social media	Not currently collected for recycling.	Collected with refuse – EfW	Some residues from energy recovery are sent to landfill.	Yes, Lewisham has taken a number of steps to manage food waste at the top of the waste hierarchy. Six of the ten options modelled for kerbside collection allow for weekly food waste collection making these options most desirable in relation to moving food waste up the waste hierarchy. Specifically these options are 1RF, 4RF/6 LW, 5RF, 8 RF/4 LW, 3 RF/2 LW, 5 LW
Nappies	Not applicable	Information on website promoting use of real nappies	No	Collected with refuse – EfW	Some residues from energy recovery are sent to landfill.	Yes, focus is on prevention through promotion of real nappies. A number of the kerbside collection options modelled show a reduction in residual waste with the lowest being 3RF / 2LW, 8RF / 4LW and 5 LW. However it is unlikely that any of this reduction would be via decreased numbers of nappies entering the waste stream.

Material	Prevention	Reuse	Recycling / composting	Energy Recovery	Disposal	Managed in line with Waste Hierarchy? What is impact of kerbside options?
Bulky items (i.e. furniture, white goods)	Spoken to partners within third sector organisation to prevent items becoming waste	Information on website promoting reuse and donation to furniture reuse charities	Collected through bulky waste service (on request, charging system at £15 for three items and £30 for a fridge / freezer) and at RRC – proportion gets recycled. Free household collection of mattresses. Stripped and metals are sent for recycling. Free WEEE recycling for schools, colleges and universities	Bulky waste service – proportion goes to EfW, Mattresses stripped and fabrics are recycled or made into an RDF for energy recovery and metals recycled[11].	Bulky waste service – small proportion goes to landfill	Lewisham is currently restricted with regards how much can be reused or recycled due to size of RRC restricting segregation. Management of bulky items were not considered within any of the collection options. It is unlikely that the kerbside collection method would influence the method of collecting bulky waste though identification and use of a local transfer station within the twin stream and kerbside sort options (2 RF, 3 RF/2 LW, 8 RF/4 LW, 4 RF/6 LW, 7 RF/3 LW, 5 RF and 6 RF) might allow additional reuse and recycling of bulky waste if managed alongside dry materials.
Small WEEE	Not directly, but some through promotion of reuse and donation to charities	Information on website promoting reuse and donation to charities	Collected through bulky waste service, designated bring banks and RRC, and sent for recycling. Free WEEE recycling for schools, colleges	No	No	Yes, collections provided at kerbside, bring banks and at RRC and sorted for recycling. It is likely that collection of small WEEE would be most compatible with a kerbside sort scheme (option 4 RF) as residents could present WEEE in their box and a stillage could be

[11] http://www.mattressrecycling.co.uk/recycling/

Material	Prevention	Reuse	Recycling / composting	Energy Recovery	Disposal	Managed in line with Waste Hierarchy? What is impact of kerbside options?
			and universities			provided as part of the vehicle. However it may also be possible to provide a separate container for residents and compartment for WEEE on vehicles undertaking comingled or twin stream collections.
Batteries	No	No	Street level property battery recycling collection, bring banks and RRC	No	No	Yes, collections provided at kerbside, bring banks and at RRC and recycled. Residents currently present bagged batteries in a clear bag on top of their comingled recycling container. This indicates that battery collection would be feasible within any of the kerbside collection options considered.
Used cooking oil	No	No	Collected at RRC for recycling	No	No	In process of getting used cooking oil bring banks. Some local authorities have collected used cooking oil from the kerbside. It would be unfeasible to collect it mixed with other materials within the comingled and twin stream options and it is therefore most compatible with the kerbside sort option (4 RF/6LW) as a compartment on the vehicle could be provided. However the efficiency of this would need considerations due to likely infrequent set out by householders.

Material	Prevention	Reuse	Recycling / composting	Energy Recovery	Disposal	Managed in line with Waste Hierarchy? What is impact of kerbside options?
Hard Plastics (e.g. toys etc)	No	No	No	Mixed plastics collected at RRC are sent to energy recovery	No	There are very limited markets for hard plastics currently meaning it is currently unfeasible to collect them. Collection from the kerbside would not be particularly compatible with any of the kerbside schemes considered due to impact of processing oversize / irregular shaped items via a MRF and difficulties collecting within a stillage vehicle.
Wood	No	No	No	Wood collected at RRC is sent to energy recovery	No	Wood collected from the RRC could be recycled – this has been looked into on many occasions but has been discounted due to cost increase being felt to be prohibitive. Collection of wood via the kerbside would not be appropriate within any kerbside option considered due to the likely size of items handled and impact on vehicles and sorting equipment.
Tyres	No	No	Yes	No	No	Yes. Recycling is currently felt to be the most appropriate form of management for tyres as it is unlikely that reduction or reuse activities are appropriate to this material stream. It would not be appropriate to collect these from the kerbside.
Hardcore &	No	Collected at RRC	No	No	No	Recycling of this stream could be

Material	Prevention	Reuse	Recycling / composting	Energy Recovery	Disposal	Managed in line with Waste Hierarchy? What is impact of kerbside options?
Rubble		and sent for landfill cover				considered. It would not be appropriate to collect this material stream via a kerbside collection scheme therefore it would not be influenced by any of the kerbside collection options being considered.
Scrap Metal	No	No	Metals collected at RRC are sent for recycling	No	No	It is unlikely that collection of scrap metal would be desirable in any kerbside collection option as the potential difference in alloys of scrap metal could impact the quality of the steel and aluminium cans collected. Potentially it could be collected within a kerbside sort scheme (4 RF) but could result in inefficient use of a compartment of the vehicle due to likely infrequent set out by householders.
Residual waste	Promotion of sensible shopping, Love Food Hate Waste and home composting including social media	No	No	EfW	Some residues from energy recovery are sent to landfill.	Yes, as recovered energy from waste rather than send direct to landfill. A number of the kerbside collection options modelled show a reduction in residual waste with the lowest being 3RF / 2LW, 8 RF / 4LW and 5 LW.
Clinical waste	Clinical waste reduced due to reclassification	No	No	Household collection is in place and	Some residues from energy	Yes, as reuse and recycling are not applicable. Clinical waste collection would not be influenced by any of the

Material	Prevention	Reuse	Recycling / composting	Energy Recovery	Disposal	Managed in line with Waste Hierarchy? What is impact of kerbside options?
				materials autoclaved recovery	recovery are sent to landfill.	kerbside collection options due to the requirement to manage clinical waste as a separate stream.
Paint	No	Promotion of Repaint on website	Household Collection Contract with City of London	Household Collection Contract with City of London	Household Collection Contract with City of London	Yes, promote reuse of paint. Limited potential to move hazardous waste management up the waste hierarchy. It would be unfeasible to collect paint mixed with other materials within the comingled and twin stream options. Therefore it is therefore most compatible with the kerbside sort option (4 RF/6 LW) as a compartment on the vehicle could be provided. However the efficiency of this would need considerations due to likely infrequent set out by householders.
Waste arising from fly tipping	No	No	Approx. 22%	EfW & RDF	No	Yes, materials segregated and sent for recycling with remainder is sent to energy recovery. Please see bulky waste for commentary regarding compatibility with options. It is unlikely that the kerbside options would influence any other types of flytipped waste.
Street cleansing waste (litter bins	No	No	No	Yes	No	There is an opportunity for litter from street cleansing to be recycled. This is likely to be most compatible within a comingled recycling system (e.g. options

Material	Prevention	Reuse	Recycling / composting	Energy Recovery	Disposal	Managed in line with Waste Hierarchy? What is impact of kerbside options?
etc.)						Baseline RF+/Baseline+ LW, 1 RF and 5 LW) due to the operational difficulties associated with separate collection e.g. sorting litter into numerous streams requirement for multiple bags / barrow compartments for sweepers, multiple compartment litter bins and inefficiencies of having a separate disposal route for street sweepings.

5.2.1 Residual waste

Residual waste collected by the Council is currently sent for incineration with energy recovery at the South East London Heat and Power (SELCHP) facility. The contract was established in the 1990s and ends in 2024 with no arrangement for extension. There is a financial benefit to the Council of reducing tonnages delivered to SELCHP as spare capacity at the facility could be sold at merchant rates, with the Council and SELCHP sharing profits.

Currently residual waste is collected weekly from 80,000 kerbside properties using 240 and 180 litre wheeled bins. The Council has already taken a number of steps to reduce residual waste arisings, including:

- Encouraging the uptake of 180 litre bins for residual waste to replace 240 litre bins
- Introduction of a recycling service for a wide range of dry recyclable materials, supported by a Reuse and Recycling Centre and network of bring banks
- Extensive waste prevention work including encouragement and support for home composting, food waste reduction and reusable nappies (further details in Table 2: Current approaches to management of wastes)
- Use of a 'lid down', 'no side waste' and 'ban of garden waste within residual stream' policies to encourage reuse and recycling and discourage presentation of excess waste

The kerbside collection options modelled the potential to reduce residual waste capacity through the use of smaller containers or reduced collection frequency for residual waste, and also modelled improvements to the recycling service through changes in recycling and garden waste collections, and through the introduction of food waste collections.

The forecast amounts of residual waste collected in each option are presented in Appendix 2. All of the options modelled forecast a smaller tonnage of residual waste than the baseline (existing) option. In 2014/15 the amount of residual waste collected from the kerbside was estimated to be 51,377 tonnes which is broadly in-line with the baseline option. The lowest residual waste is forecast for the three options where recycling is collected either fully comingled or twin stream alongside fortnightly residual waste collections, weekly food waste collections and an arrangement for the collection of garden waste. The kerbside sort option also has a relatively low residual waste tonnage. The poorest performing options in terms of residual waste are those in which food waste is not collected.

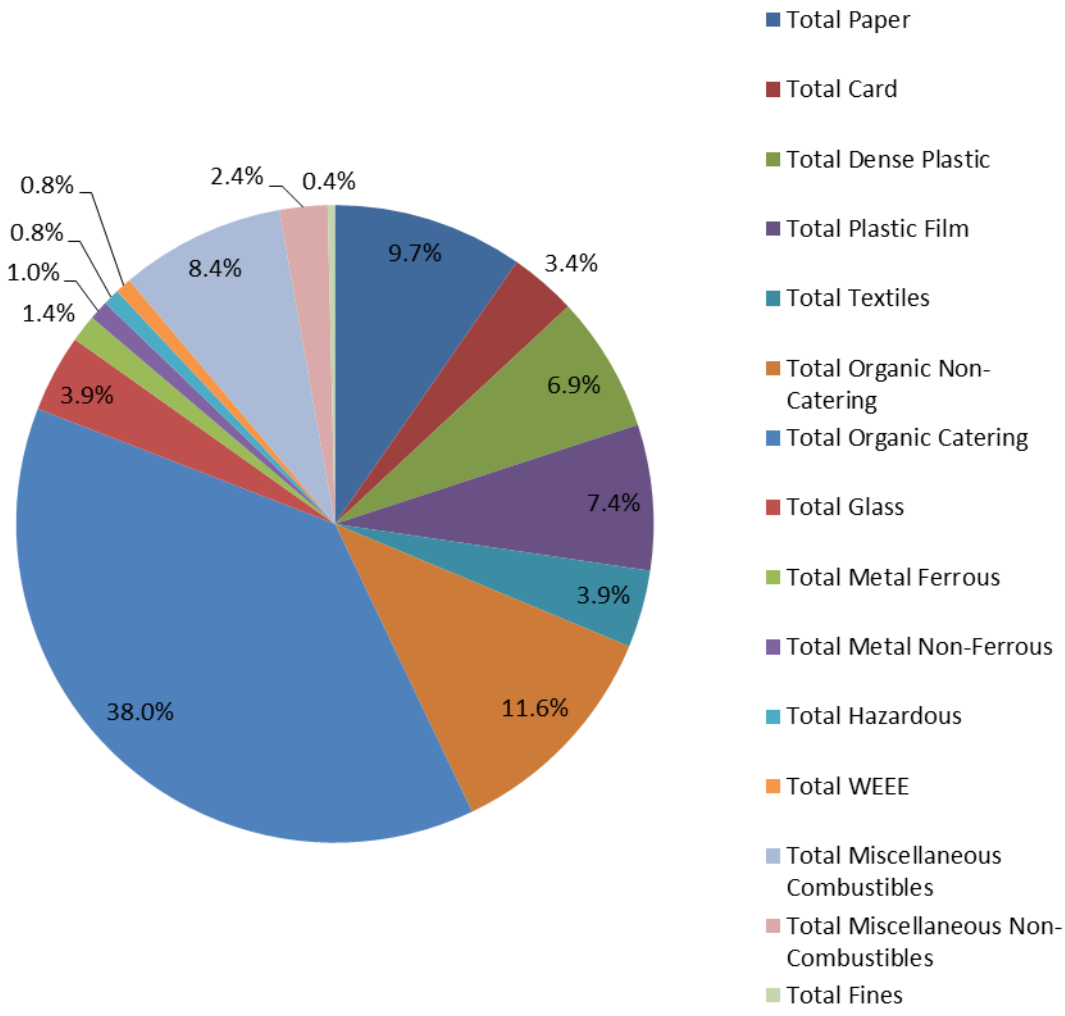
5.2.2 Organic wastes

Food waste is not currently collected separately, and therefore is collected as part of the residual waste service. Garden waste is collected from kerbside households for composting. The service is a charged through an 'on request' service, where households pay £10 per roll of 10 bags, and book a collection either by telephone or online. The Council has a separate arrangement with Bromley, a neighbouring authority, for the disposal of garden waste. The garden waste is collected and directly delivered to Bromley's waste transfer station where the material is sent for in-vessel composting. The compost produced is to PAS 100 standard.

In July 2014 a compositional analysis of the residual waste and co-mingled dry recycling streams was undertaken for the Council. The research aimed to provide the authority with accurate and comprehensive data on the quantities and composition of residual waste and recycling collected from kerbside households. In total 186 households were included in the study; the sample was stratified in four groups using Output Area

Classification. In total 1,758 kg of residual waste and 566 kg of recycling was sorted of a total 2,816 kg collected. Overall, at 38%, food waste accounted for the largest proportion of the residual sample. Total organic non-catering waste, or garden waste, made up 11.6% of the sample. Figure 2 shows the composition of the residual sample.

Figure 2. Residual composition.



Weekly collection of food waste is considered within several of the options for kerbside collection. The options for a garden waste service include both weekly and fortnightly charged separate collections.

Appendix 2 summarises the anticipated tonnages to be collected for the options modelled. The amount of food waste collected is forecast to remain the same regardless of the method of collecting dry recyclables. Since food waste collection has only been modelled alongside fortnightly residual waste scenarios it is not possible to determine the impact that a weekly collection of residual waste would have. Both weekly and fortnightly charged garden waste collection options are forecast to capture the same amount of garden waste with performance anticipated to be significantly higher than the baseline models.

5.2.3 Dry recyclable materials

During autumn 2003 a paper and card kerbside collection scheme using a 55 litre box was fully rolled out to kerbside properties, and a processing arrangement was put in place with Aylesford Newsprint[12]. However, Lewisham's recycling performance was low and the authority was called in to see Defra to identify ways to improve performance. One of the options identified at the time was to increase the range of materials that could be recycled and as such, a fully comingled recycling scheme was introduced in 2005.

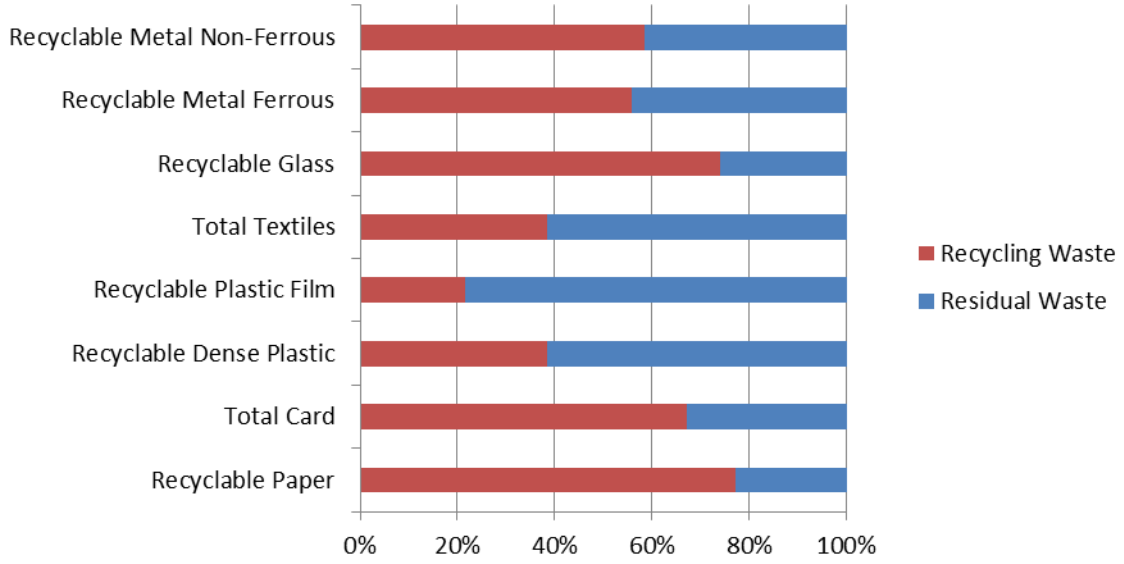
Currently dry recycling is collected fully comingled from approximately 80,000 kerbside properties, primarily contained in 240 litre wheeled bins though a small number of households are still presenting material in boxes that were historically used for collecting paper only. Collections are made weekly.

Being a unitary authority, with no long term investments in PFI or other long term contracts, Lewisham has the benefit that recycling contracts can be short term therefore allowing the authority to choose MRFs offering the lowest gate fees or different capabilities as it needs to. As the Council was assessing its collection services, an interim arrangement with Viridor's MRF in Crayford was made in 2014. The contract is short term and the Council is considering extending it for another six months while decisions regarding the collection system are made. Due to poor market conditions for materials, the Council has suffered financially from increased amounts of material being sampled as residue due to contamination levels. The market becomes more competitive when markets fall and MRFs seek higher quality material to sell and become less accepting of contaminated material. The Council has also been quoted high gate fees for processing material via MRFs due to its relatively high contamination of material and a fall in prices on the secondary commodities market.

The waste compositional study that was undertaken in July 2014 included assessment of both the residual waste stream and the recycling stream. It identified that 24.7% by weight of materials that were in the residual waste stream could be recycled by the householder at the kerbside. Capture rates for different materials based on the waste composition analysis are provided in Figure 3. It indicates that there is an opportunity to significantly increase the capture rates of most materials through the kerbside recycling scheme.

[12] Aylesford Newsprint is no longer in operation

Figure 3. Capture rates for recyclable materials



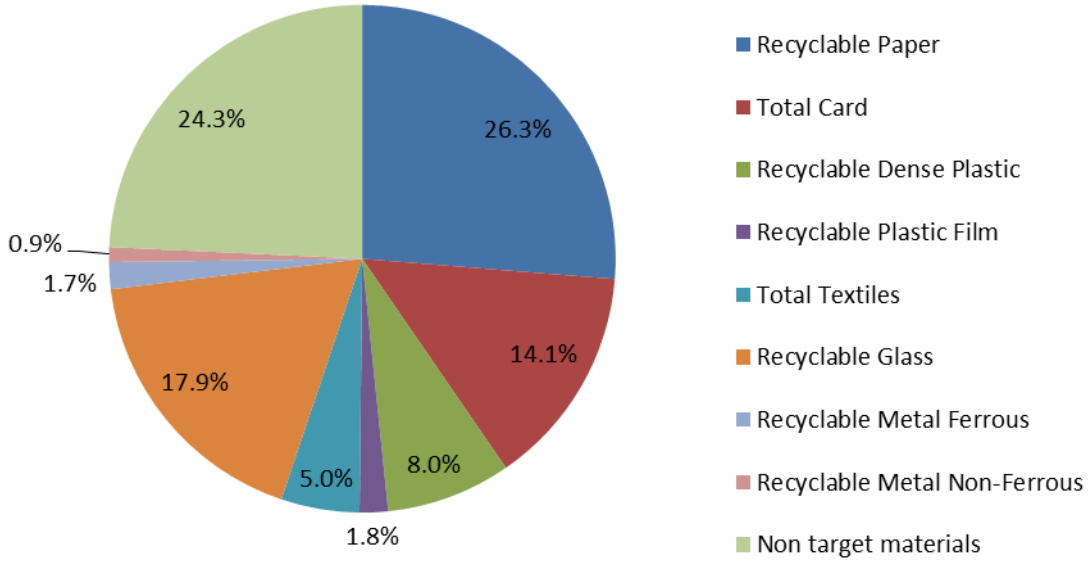
The waste audits also identified that 24.3% of material being presented within the recycling stream was non-target material (as shown in

Figure 4). It should also be noted that recent engagement with MRFs for the purposes of this assessment indicate that plastic film and textiles are undesirable materials within MRFs, and therefore are considered as 'contamination'. In 2014/15, it is estimated that 2,311tonnes of material that had been collected from Lewisham kerbside properties as part of the recycling service, were subsequently rejected by the MRF and sent to an energy from waste facility instead. As a proportion of the total sent, this was 15%. It should be noted that this excludes recycling identified as contaminated by recycling collection crews and collected as part of the residual waste stream instead.

Anecdotally, Lewisham officers believe that a large proportion of contamination is arising from bulk recycling containers at blocks of flats (as this is more difficult for the collection crews to identify) although contamination from kerbside properties is also recognised as a problem. Since it is likely that the dry recycling collection scheme for flats will be similar to that for kerbside properties (e.g. comingled, twin stream or source segregated) the issues related to contamination in relation to the different collection systems for dry recyclables need to be carefully considered. Higher levels of contamination will result in higher MRF gate fees, or in the material not being accepted by the MRF at all, and therefore costs incurred through rejection fees as well as additional disposal fees. The engagement with MRFs undertaken as part of this assessment identified that at least two of them would not accept material that was contaminated to the extent that the waste audits indicate Lewisham's material is currently[13].

[13] One indicated that the average contamination of materials they process is around 15% so they would be seeking something below this and materials of over 25% contamination would not be wanted and one saying it would reject anything over 10% contamination

Figure 4: Composition of dry mixed recycling collection



The forecast dry recycling performance of each of the kerbside collection options modelled is summarised in Appendix 2. The three options for collection of dry recycling considered are fully comingled, twin stream and kerbside sort with fortnightly collection considered for some of the twin stream and fully comingled options. The highest estimated tonnage captured is for four options that collect materials either twin stream or fully comingled despite assuming fortnightly collections of recycling. The kerbside sort option (4 RF/6 LW) achieves around 120 tonnes less dry recycling per year than the highest performing comingled and twin stream options but almost 3,000 more than the poorest. It should be noted that an assumption has been made within the modelling regarding the amount of contaminated recycling that will be managed under each option. The amount of contamination assumed in the kerbside sort option is the lowest as crews have an opportunity to reject contaminant materials as they are sorted into the vehicle.

6 Tests

This section considers the different options modelled in relation to the regulatory requirement for separate collections of materials against the two tests: a necessity test and a practicability test (in relation to technical, environmental and economic practicability).

6.1 Separate Collection

The three methods of collecting recyclables within the options that the Council has explored are; fully comingled, twin streams and kerbside sort. Each of these three methods of collecting recyclables provide an opportunity for residents to put plastic, glass, metals and paper in a separate container from their residual waste. Within the scenarios these materials would never be re-mixed with other waste streams having been

collected separately. This meets one of the stipulations in the EA's briefing note. However within the twin stream and fully comingled options the four priority materials are not kept separate from each other and therefore there is a requirement to rigorously apply the necessity and practicality tests.

6.2 Necessity

Referring to the Route Map, which is considered good practice by the EA, the following questions are considered:

- Examine the quantity and quality of recycling to show if separate collection is necessary to 'facilitate' or 'improve' recovery.
- Is it clear that separate collection either will or will not lead to an increase in either the quantity or quality of material collected?
- Does separate collection deliver the best results?

6.2.1 Quantity and contaminated tonnages

Prior to introducing a fully comingled collection system in 2005, Lewisham collected paper only from kerbside properties within a 55 litre box. Lewisham therefore does not have information related to how well a twin stream or kerbside sort collection system for kerbside properties might perform in relation to the current comingled collections. It has therefore estimated performance based on the modelling initially undertaken by an independent consultant using KAT with financial information later updated by Lewisham.

Within each of the options for the kerbside recycling service that Lewisham is considering, the quantity of materials collected (e.g. tonnage), as well as the quality (e.g. tonnage of contaminated recycling), has been estimated. It should be noted that the Baseline+ scenario assumes a reduction in the percentage of contamination in the dry recycling collection based on the assumption that a well delivered communications campaign could help to achieve a lower contamination rate.

The dry recycling tonnage and contaminated tonnages anticipated to be achieved through each scenario are summarised in Appendix 2. The outcomes of the modelling indicate that the highest performing options in terms of tonnage capture are either comingled or twin stream. The kerbside sort option achieves 120 tonnes less than these options though 2,888 tonnes more than the two poorest performing options (which are both twin stream). The kerbside sort option has the lowest amount of contamination associated with it as crews have an opportunity to reject non-recyclable materials at the kerbside.

6.2.2 Quality

Clearly, the quantity of recycling collected should not be taken in isolation, and so it is necessary to consider the quality of recycling produced from the four priority waste streams. Recycling quality is currently not subject to officially recognised standards but the grade of materials and end use of materials provides an indication of quality. For example, glass that is sent for remelt could be assumed to be a higher quality than glass used for aggregate, and "news and pams" is viewed as a higher quality product than "mixed paper".

The Environmental Permitting (England and Wales) (Amendment) Regulations 2014 (the Regulations) were laid on 11 February 2014 and came into force on 5 March 2014. Schedule 9A of the Regulations automatically adds a condition into the environmental permits of all qualifying Material Facilities (MFs) to require them to

routinely report the composition of their input and output materials. This has been effective since 1st October 2014; reporting outcomes are published on a publically accessible Portal provided by WRAP[14].

In order to assess whether the quality of recycling achievable through the twin stream and fully comingled collections is comparable to quality achievable from kerbside sort collections, the information from the MF portal for a number of MRFs local to Lewisham has been assessed, alongside information provided by Lewisham Council and provided to Anthesis directly by the authorities, MRFs and WTS to assess likely ways in which materials would be managed under each option.

Paper:

- [redacted]Kerbside sort: If collected via a kerbside sort collection, paper would need to be tipped at a WTS for bulking and onward transport to reprocessors. As outlined in section 6.3 Lewisham does not currently have access to a WTS for this use. One of the more feasible options identified would be for Lewisham to contribute to the upgrading of the Churchfields site in Bromley. It is then assumed that the most efficient way of managing the fibre material would be for Lewisham's fibres to be managed alongside those from Bromley. [redacted]

- Twin stream: Within the twin stream options dry recyclables would need to be delivered to a WTS for onward transport, with paper going to a suitable paper reprocessor, and containers going to a MRF / PRF. Alternatively both streams could be delivered directly to a MRF that would process the containers and manage the paper separately (further discussion on approaches is in section 6.3). Bywaters MRF indicated that it would consider accepting these two material streams at its MRF site and manage the fibre stream separately without processing it through its MRF. However the company commented that the fibre stream they currently manage separately is from commercial clients and is very clean currently. They have some reservations regarding mixing it with a municipal stream in case this introduces contamination. The fibres that are delivered to the MRF separately are currently managed separately to MRF outputs and are primarily sold as two grades – 'mixed paper' and 'cardboard'. The other most likely option for management of twin stream materials is for both streams to be managed alongside materials collected in Bromley (which are already collected twin stream); comments regarding fibre quality in this scenario are provided in the paragraph above.

- Comingled: As part of the preparation for this report, a number of MRFs were engaged that expressed an interest in managing Lewisham's materials. Data for the following MRFs from the MF reporting portal was assessed for: Bywaters, Cory (Smugglers Way), Viridor (Crayford) and Veolia (Southwark). The data suggests that Cory and Veolia are both producing separated paper grades (e.g. newspapers and magazines, cardboard as well as mixed paper) with fairly significant amounts of this being newspapers and magazines (a higher grade than mixed paper). MF portal data also suggests that non-recyclable materials within the output fibre grades for the Veolia and Cory MRFs are low, e.g. Veolia's ranges from 0.06% non-recyclable material for cardboard to 0.7% for mixed paper. Viridor has indicated directly to Lewisham that its end use

[14] http://mfrp.wrap.org.uk

of paper has recently changed and it is now sending it to a UK mill for reprocessing which indicates that material is of relatively high quality (non-recyclable material within mixed paper was reported as between 1.1% and 3%).

Conclusion: Based on the likely methods available to Lewisham for managing materials collected under different options it is not clear that the kerbside sort or twin stream options would currently result in higher quality paper than comingled materials being processed by a high performing MRF. The comingled option appears to be the only option that would allow fibres to be sold as sorted grades. Bromley commented that it might be possible for Lewisham to organise their own end destinations for materials from the Churchfields site (allowing separate sale of paper and card under the kerbside sort option) but issues with additional vehicle movements impacting planning requirements, separate contracts and loss of efficiency from not managing the material streams jointly would need to be considered.

Glass:

- Kerbside sort: It is assumed that Lewisham's kerbside sorted materials would be managed through Bromley's Churchfield's site. [redacted]
- Twin stream: The most feasible scenarios appear to be that twin stream recyclables would either be delivered to Bywaters or managed alongside Bromley's materials. Veolia indicated there could be potential to consider separate management of paper at their site in Rainham in future, as this is not the current set up, and a move to this approach would require careful consideration before a final decision was made. [redacted] After 2019 it is likely that Bromley and Lewisham could jointly secure a contract for sorting the containers. The acceptance of the container only stream seemed to be most acceptable to the two PRFs that provided information for this research; one operated by Viridor in Rochester; and one operated by Veolia in Rainham. [redacted]
- Fully comingled: [redacted]

Conclusion: The research indicates that there are some MRFs potentially available to Lewisham that can produce glass that is sent to remelt. [redacted]

[redacted]

[redacted]

[redacted]

[redacted] As outlined for paper, Bromley commented that it might be possible for Lewisham to organise their own end destinations for materials from the Churchfields site but issues with additional vehicle movements impacting planning requirements, separate contracts and loss of efficiency from not managing the material streams jointly would need to be considered.

Plastics:

High-technology sorting of plastics into separate polymer grades would be required for plastics collected from a kerbside sort collection as well as produced from the twin stream and fully comingled options. It is likely therefore that the materials collected within each option would be sorted within a similar way and quality of plastics achieved for each option would be approximately the same. For example it is likely to be the case that in the fully comingled option the plastics are processed by a MRF and in the kerbside sort option processed by a PRF. As an illustration Rainham PRF reports 1.5% non recyclable materials within the plastic bottle outputs which is similar to the 1.7% reported by Bywaters MRF.

Metals:

Non recyclable content of the metal streams appears relatively low based on MF portal data. For example Viridor Crayford reported 0.1% non-recyclable materials within the aluminium stream and 0.2% within the steel stream while Rainham PRF reported 0.09% and 0.1% respectively. This suggests that high quality recycling output could be achieved by MRF's for the twin stream and comingled options and is likely to be comparable to the kerbside sort option.

6.3 Practicality

6.3.1 Technical

This section considers the technical feasibility of each of the three collection methods for kerbside dry recycling (kerbside sorted, twin stream and comingled). A key barrier to the introduction of a kerbside sort scheme currently is that Lewisham's existing facilities and contracts do not provide access to a waste transfer station (WTS), and due to the number of material streams collected it would not be feasible to deliver materials individually to different reprocessors. There is also uncertainty as to whether a twin stream collection arrangement would be possible as this would ideally rely on paper and containers being tipped in the same location (i.e. at a MRF that would accept paper and containers separately or using a WTS to bulk and transport the two streams).

As part of this assessment representatives of a number of local MRFs and WTS were contacted to investigate the feasibility of twin stream and kerbside sort options being introduced in the future. Their feedback has been used to assess the technical feasibility of the options.

6.3.1.1 Kerbside sort

Within the kerbside sort option, residents would be required to use two boxes to present recycling. The collection crew would then sort the recycling into a stillage vehicle. The vehicles drive to tip when one of the compartments is full.

Lewisham is a densely populated borough, where kerbside properties, in general have limited external storage space. Larger properties are often converted to multi-occupancy households, which mean that external space available for individual apartments within the property is also limited. The need for residents to present two containers could cause issues for some properties and reduce the participation in the service, thereby reducing the overall capture of recyclables.

As an inner London Borough, Lewisham suffers from traffic congestion. It should be noted that the kerbside sort option is anticipated to use 21 vehicles in comparison to around 5 to 8 (rounded up to reflect 7.5 required in modelling) vehicles for the comingled and twin stream options. It is also assumed that only two loaders would be used due to limited space in the cab of stillage vehicles compared to 4 loaders in the twin stream and comingled options. The reduced number of loaders and need for these loaders to sort materials onto the vehicle rather than just present a bin for lifting will result in much slower loading of vehicles. The increased number of vehicles and slow loading is likely to significantly increase congestion during operations. Health and safety issues concerning sharps injuries, exposure to excessive noise and bodily stress due to manual handling would also need to be considered and mitigated by adopting safe systems of work. Although collections from flats are not included within the modelling of kerbside options they would need to be considered within any decisions made on service change. Currently properties as part of the flats collection service have large bins for comingled recycled which could not reasonably be replaced with boxes or similar containment. This would involve the Council having to introduce separate bins for different materials and collecting each material stream separately. This would most likely be achieved via the use of split back vehicles which would further increase vehicle movements and would mean that kerbside and flats collections would require different vehicles (meaning collections from kerbside and flats households could not be undertaken on the same rounds, as the vehicle passed the properties, potentially reducing efficiencies).

For the kerbside sort scheme to be successful, a WTS would be required. The following WTSs were investigated as part of this research to understand the feasibility of Lewisham using these sites. The outcomes are summarised below with further details in Appendix 3. For an option to be feasible for Lewisham it needs to ensure a drive time of no more than 45 minutes, in order to allow deliveries to be made within the crews working hours.

- [redacted]Hinkcroft: Privately owned WTS located within Lewisham. Focusses on commercial and C&D waste currently. [redacted]
- London Borough of Bromley: Has a site at Churchfields Road. Lewisham has had some initial discussions with Bromley regarding the development of the site and there is some potential that if Lewisham can contribute to the development costs it could use this site to tip materials. Bromley collect twin stream: paper separate and containers co-collected, and the view of Bromley officers is that the easiest way for Churchfields to be used would be if Lewisham were collecting in a similar way. However since there is quite a lot of space it might be possible for a kerbside sort option to also be considered by Lewisham. Bromley has highlighted that vehicle movements could be an issue due to the proximity of the site to a school and residential area therefore the significant number of additional collection vehicles modelled in the kerbside sort option vs the twin stream option could be a barrier to the use of the site for kerbside sorted materials.

Bromley has commented that the additional vehicle movements would need to be further assessed as planning permission for the site upgrade has already been sought. Lewisham would also need to make a contractual arrangement with Veolia for use of the site until the current contract for collection, bulking and sorting that Bromley has with Veolia expires in 2019 (post March 2019 Bromley indicated that it could name Lewisham in the new contract).

- London Borough of Bexley: Has a small WTS at Thames Road which is the other side of the river to Crayford MRF. It generally accepts materials such as wood and mattresses plus glass from Bexley's kerbside collection rounds and paper and card. Bexley has indicated that it would be willing to consider Lewisham's material being managed through the site. However the contract that they have with SITA would have to be varied to allow for this. Bexley has also indicated that ideally it would want Lewisham to tip plastics and cans in another location. This would mean Lewisham delivering to two different sites which is unlikely to be possible within the 45 minute drive time required to allow collections to be completed within crew working hours. Therefore this point would need further discussion and negotiation.

Conclusion: Despite issues with congestion, H&S and significant additional vehicle movements making kerbside sort collections technically undesirable, it is not considered that these issues would make them unfeasible. However, following collection, the materials would need to be tipped at a WTS or similar for bulking and transport onto reproccessors. Lewisham would therefore need to secure use of a suitable WTS to make this option feasible. Further discussions would need to be undertaken with Bexley and Bromley regarding whether suitable contractual and operational arrangements could be made for use of their sites. Hinkcroft could also be further engaged to identify whether suitable end destinations for recyclables could be developed and guaranteed in future.

Twin stream

The twin stream option assumes that paper and card will be presented by residents in a 55 litre box and collected mixed together as a single stream. Containers would be presented in a wheeled bin. Collections of both streams would be made at the same time using split back vehicles. The modelling for this option indicates that between 5 and 8 vehicles would be needed which is around the same as assumed for the comingled collections (at 4, 7 and 7 vehicles). Crew sizes would be larger than in the kerbside sort option with four loaders. Although the crew size is the same as for the comingled option it is likely that collections would be slightly slower due to the need to manage two containers from each household rather than just one.

The twin stream option requires a processing route for containers (which can be less desirable than fully mixed materials to MRFs), ideally with paper and containers tipped in the same location to reduce drive time. Lewisham would need to consider potential inefficiencies should one side of the vehicle fill faster than the other requiring the vehicle to tip before capacity is fully utilised. Other authorities using split back vehicles have also suffered from contamination where one side has filled more quickly than the other and crews have loaded materials into the incorrect side to save time. This would, therefore, need careful monitoring and supervision.

The impact on the services provided to flats would be less significant than the kerbside sort option. Although there may be challenges at a number of flat locations in relation to identifying a location for a separate container for paper, the collections could be made using a split back vehicle which would mean vehicle movements at sites should not increase and the same vehicles could be used to collect materials from flats and kerbside properties.

In collecting materials twin stream Lewisham might either tip both material streams at a WTS or identify a MRF that can accept paper separately and send it direct to a reprocessor while containers are MRF sorted.

- London Borough of Bromley (estimated 19 to 24 minutes drive time): As outlined above in the kerbside sort scheme, accepting material delivered twin stream by Lewisham at the Churchfields site is the preferred option for Bromley because this mirrors the material streams that Bromley is collecting. However the site would need to be upgraded before it can be used so Lewisham and Bromley would have to reach an agreement regarding this.

- London Borough of Bexley (estimated 26 to 38 minutes drive time): Paper and card could be delivered to the site however they are likely to be mixed with commercial paper and card which Bexley reports has a much higher cardboard portion and is therefore sold as lower grade material. There is a possibility of mixed containers being accepted but this would need to be discussed further and agreed.

- Bywaters MRF: Bywaters indicated that they would consider taking a container only stream for MRF processing and can accept paper and card separately from other materials. The fibres would be likely sold as a mixed paper grade. Bywaters is within an estimated 22 to 46 minutes' drive time for Lewisham.

- Veolia PRF Rainham: Can accept mixed containers for processing does not accept paper (there is some possibility paper could be accepted as a separate stream in future, but the facility does not currently do this and said it would need further consideration before a decision was made). The facility could take around 40 minutes to reach in good traffic conditions but over an hour if roads are more congested. This means bulking of containers would need to be considered to make this option feasible within the 45 minute delivery requirement, particularly as it is likely that paper would need to be taken to another location.

- Veolia Southwark: Would not accept containers only from Lewisham.

- Cory Western Riverside MRF: Would not accept containers including glass. If Lewisham removed the glass then they would consider accepting the other containers mixed for separate processing.

- Viridor Crayford: Would not accept containers only.

- Viridor Rochester PRF: Would accept containers only (but no paper). Indications are that it is around 40 minutes drive time in free flowing traffic but can take over an hour when roads are more congested. Therefore bulking of containers would need to be considered to make this option feasible, particularly as paper would need to be taken to another location

Conclusion: The engagement undertaken as part of the preparation of this report, indicates that there would be a limited number of facilities that would accept the container only stream. Bywaters is the only facility that would currently allow paper and card to be tipped in the same location as the containers. Use of the two PRF facilities would most likely require paper to be tipped at a separate site before containers were tipped at the PRF, which is unlikely to be possible within the 45 minute drive time although further discussions could be undertaken with these facilities. A more preferable option might be for paper and containers to be tipped at a WTS for bulking and onward transport to appropriate facilities. Since Bromley currently collect materials twin stream there could be efficiencies in using their Churchfields site to do this but further investigation and negotiations regarding costs and contractual arrangements is needed in assessing whether use of this site would be feasible.

Comingled

Comingled collections modelled indicate that around the same number of vehicles would be needed to collect from kerbside properties as with the twin stream option, and that the number of loaders would be around the same. Comingled collections only require the use of one container which is beneficial at the many households where space is limited; particularly if an additional container is introduced for food waste. Materials would be collected, as they are currently, in single bodied RCVs, which provides an opportunity for material from flats (and other property types) to be collected on the same vehicle.

Conclusion: Since the current collections in Lewisham are fully comingled it has been proven that this option is feasible. However it should be noted that a number of representatives engaged with expressed that the quality of materials collected from Lewisham would either result in material not being accepted or high gate fees. It would therefore be important for Lewisham to improve the quality of comingled material delivered to the MRF should it retain comingled collections.

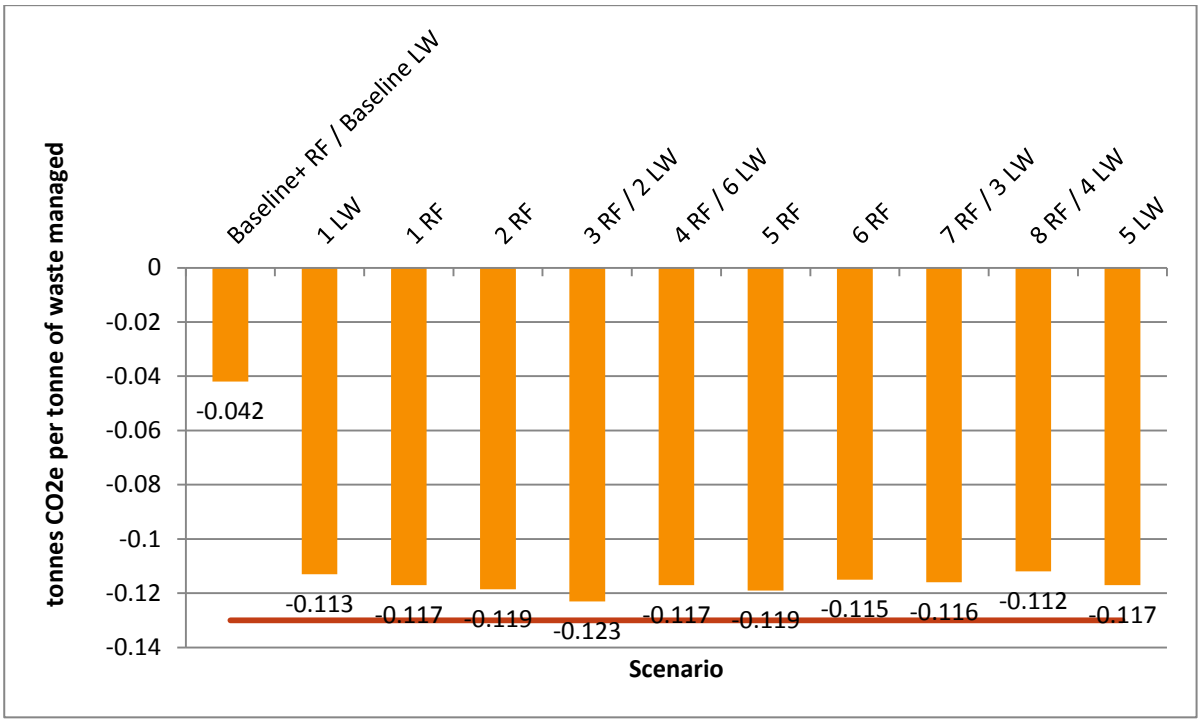
6.4 Environmental

Lewisham has undertaken an assessment of greenhouse gas emissions of a number of the collection options using a greenhouse gas calculator provided by the GLA. The intention of the GLA in providing the greenhouse gas calculator was to allow authorities to determine how waste management options perform against a greenhouse gas emissions performance standard (EPS) that has been set for all of London's municipal waste management activities.

The EPS has been set at -0.13 tCO_2e / t waste for 2015. Each of the scenarios has been modelled to calculate the tonnes of CO_2 equivalent per tonne of waste managed, and Figure 5 shows that none of the scenarios quite meet the EPS set for 2015. 3 RF / 2 LW is the best performing option, with 8 RF / 4 LW the worst. However all options are a significant improvement on the baseline scenario.

Conclusion: The kerbside sort option considered (4 RF / 6 LW) does not have a clear benefit in relation to CO_2 equivalent per tonne of waste managed in comparison to the comingled and twin stream options.

Figure 5: Results from the GLA Carbon tool modelling for each scenario



6.5 Economic

As outlined in section 1 the Council is facing ongoing budgetary pressures and must reduce the annual waste and recycling budget by £1.1m to £10.9m per annum. The Council is investigating where within the current service the required £1.1m savings can be made, but, due to previous cuts to the street cleansing service, and relatively limited opportunities to cut other services, officers envisage that the majority of savings will need to be made from the kerbside collection service.

Against this backdrop, the Council considers "excessive cost" to be any increase in the current cost profile of the waste services. Economic practicality of the options therefore has to be judged against the constraints of existing and future budgetary provision.

The KAT modelling undertaken by the independent consultant in 2014 included costing of each option, however, since this work was completed, recycling markets have changed significantly. For example, instead of receiving income for comingled materials delivered to a MRF, the Council now anticipates future gate fees of up to £50 per tonne of delivered quality material. This change in costs meant that the Council needed to undertake an up to date assessment of the total system costs. Officers selected options for this updated economic assessment on the basis of the most likely scenarios under which different operational methods of dry recyclables collection would be employed.

Table 3 summarises the outcomes of the modelling shown as the difference in costs to the baseline (existing) service. Net and gross costs are shown as some income is assumed from the chargeable garden waste service that would be introduced in each option. The outcomes show that all options, with the exception of that in which materials are kerbside sorted (4 RF / 6 LW), should result in a reduction of costs in comparison to the baseline (current) operations, and should therefore contribute to the budget savings that the Council requires. The kerbside sort collection is predicted to result in costs significantly greater than the current service and is

therefore deemed to result in "excessive cost" to the Council. The main contributor to the high cost of the kerbside sort option is the higher collection costs (due to a greater number of vehicles and operatives that would be required in comparison to those required in the twin stream and comingled options). This is exacerbated by limited opportunities for income due to current poor markets for materials, and a requirement to pay bulking and haulage costs plus a processing fee for plastics. It should be noted that the financial modelling undertaken used information on current market prices for gate fees and income available to Lewisham in Autumn 2015. The markets for recyclable materials and gate fees for facilities can fluctuate significantly and therefore the relative cost performance of the different options will change over time and would be dependent on the contracts that Lewisham secured.

Table 3. Collection options and related costs

Option reference	Description	Movement from Baseline+ (Net) £k	Movement from Baseline+ (Gross) £k
Baseline+ RF / Baseline+ LW	Current collection system (comingled weekly, residual weekly, no food waste and garden waste on request)	0	0
1 LW	Comingled weekly, residual weekly, no food waste collection, garden waste fortnightly	-858	-228
3 RF / 2 LW	Twin stream fortnightly, residual fortnightly, food waste weekly, fortnightly garden waste	-1,162	-532
7 RF / 3 LW	Twin stream fortnightly, residual weekly, food not collected and garden waste fortnightly	-1,058	-429
8 RF / 4 LW	Twin stream fortnightly, residual fortnightly, food waste weekly, fortnightly garden waste	-1,089	-460
5 LW	Comingled fortnightly, residual fortnightly, food waste weekly and garden waste fortnightly	-1,020	-391
4 RF / 6 LW	Kerbside sort weekly, residual fortnightly, food waste weekly and garden waste weekly	1,846	2,476

7 Outcome of Tests

The data relevant to the different options modelled in relation to the regulatory requirement for separate collections of materials against the two tests: a necessity test and a practicability test (in relation to technical, environmental and economic practicability), necessity and TEEP tests is outlined section 6. A summary of the options with commentary regarding the tests is provided in Appendix 4.

This section summarises the outcomes of the tests and identifies actions that the Council may consider undertaking in the future in relation to the options. The assessment of waste management arrangements against the regulations is not a one-off activity. Lewisham will need to update its assessment as determines the details of the operational arrangements for the options it progresses and starts to procure relevant contracts (e.g. for bulking, transport and reprocessing).

7.1 Necessity

For each material that should be separately collected, the data presented in section 6.1 indicates that the highest performing options in terms of quantity of material captured are either twin stream or comingled collection methods. However, the kerbside sort option has the lowest amount of contamination associated with it as crews have an opportunity to reject non-recyclable materials at the kerbside.

Based on the modelling undertaken it appears that the separate collection option would result in a higher quantity of recycling captured than the baseline scenarios but does not perform as well as the highest performing comingled and twin stream options. However, this would be reliant on the contamination tonnages estimated in the modelling being achieved.

Based on the likely methods available to Lewisham for managing materials collected under different options it is not clear that the kerbside sort or twin stream options would result in higher quality materials than comingled materials being processed by a high performing MRF. Specifically:

- Paper: There is potential for paper collected under the kerbside sort or twin stream option to become mixed with commercial paper and card / low quality paper and card. Some, but not all, MRFs are producing a number of paper grades including significant amounts of 'newspapers and magazines' with apparently low amounts of non-recyclable materials suggesting that they are capable of sorting fibres to a high quality.

- Glass: Two MRFs are sending the majority of glass outputs to remelt (with others sending a portion). This suggests that end use of glass could be the same for materials collected comingled as those separated on collection depending on the sorting facility used.

- Metals: Non recyclable content of the metal streams output from MRFs appears relatively low based on MF portal data. This suggests that high quality recycling output could be achieved for the twin stream and comingled options. There was no evidence found that metals from separate collections would reach alternate destinations to those from comingled collections.

- Plastics: Plastics collected under any option will need to be sent for further sorting. It is likely that they would be sorted by similar facilities in a similar way and therefore the quality of plastics achieved for each option would be approximately the same.

In progressing with procurement of services and joint working with other authorities under any of the options Lewisham would need to ensure that materials were managed and handled in a way that retained and maximised their value. Specifically this would include:

- Ensuring that paper and card grades were maintained and that it was not mixed with paper and card of a lower quality

- Any sorting contracts secured were with facilities that can produce high quality outputs

- End destinations for materials were appropriate (one facility engaged with was sending potentially recyclable materials for RDF)
- Taking significant steps to improve the quality of material Lewisham collects from households

7.2 Technical practicability

The regulations require consideration of whether separate collections are technically practicable. Information has also been provided in the assessment regarding the practicability of the comingled and twin stream options for comparison.

- Kerbside sort: Despite issues with congestion, H&S and significant additional vehicle movements making kerbside sort collections technically undesirable it is not considered that these issues would make them unfeasible. However, Lewisham would need to secure use of a suitable WTS to make this option feasible. Further discussions would need to be undertaken to identify whether sites such as those managed by Bexley, Bromley and Hinkcroft could be suitable in future.
- Twin stream: There are a limited number of facilities that would accept the container only stream. Bywaters is the only facility that would currently allow paper and card to be tipped in the same location as the containers. Use of the PRF facilities may require paper to be tipped at a separate site before containers were tipped at the PRF, which is unlikely to be possible within the drive time (although further discussions could be undertaken with the facilities to determine the potential for paper to be tipped at the facilities in future). A more preferable option might be for paper and containers to be tipped at a WTS for bulking and onward transport to appropriate facilities. Since Bromley currently collect materials twin stream there could be efficiencies in using their Churchfields site to do this but further investigation and negotiation regarding costs and contractual arrangements is needed in assessing whether use of this site would be feasible.
- Comingled: Since the current collections in Lewisham are fully comingled it has been proven that this option is technically feasible. However it should be noted that a number of MRF representatives engaged with expressed that the quality of materials from Lewisham would either result in material not being accepted or high gate fees. It would therefore be important for Lewisham to improve the quality of comingled material delivered to the MRF should it retain comingled collections.

7.3 Environmental practicability

The Council has undertaken an assessment of the greenhouse gas emissions of the options using a greenhouse gas calculator provided by the GLA. The outcomes indicated that the highest performing option was a twin stream option but the differences between options were not substantially different. It is therefore not possible to conclude that a kerbside sort, twin stream or comingled collection would perform significantly differently in environmental terms based on the modelling undertaken. It should be noted that the options modelled were all substantially better than the baseline option indicating that by changing its collection system in line with the options modelled Lewisham could improve its environmental performance.

As Lewisham progresses the development of options it should consider updating this modelling in light of the likely operational arrangements (e.g. sites used for tipping, processing etc) in order to identify whether these impact the environmental performance of the options.

7.4 Economic practicability

The financial assessments reported in section 6.5 indicate that the kerbside sort option would substantially increase the net service cost from the (current) baseline based on current market prices. Applying the Council's test of 'excessive cost' (that any increase to the current cost profile of the waste services will be viewed as' excessive'), it can be concluded that separate collections would be likely to result in excessive costs in comparison with baseline (current) services and twin stream and comingled options assessed. Lewisham should continue to review and develop the cost assumptions related to each option as it progresses work to assess service changes. This might include identifying how the approach to contracting (e.g. sharing of risk and reward), market fluctuations and details of operational delivery (e.g. WTS used) influences the overall economic performance of each option.

8 Conclusion

Greenhouse Gas modelling does not provide evidence that comingled or twin stream options would lead to substantially better performance than the kerbside sort option. However, the evidence gathered indicates that the use of separate collections by the Council is not necessary to achieve high quality recycling as long as high performing MRF facilities could be secured to sort recyclables. The lack of WTS makes separate collection of recyclables technically impracticable currently. Further discussion and negotiation with potential local authority partners and private contractors would be needed to try and secure a facility to make separate collection feasible. The economic assessment indicates that the all options with the exception of the kerbside sort option would reduce the costs of the collection. The kerbside sort option does not appear to be economically practical as it is predicted to significantly increase the cost of service delivery.

Appendix 1 Relevant text of regulations

Duties in relation to collection of waste

13. (1) This regulation applies from 1st January 2015.

(2) Subject to paragraph (4), an establishment or undertaking which collects waste paper, metal, plastic or glass must do so by way of separate collection.

(3) Subject to paragraph (4), every waste collection authority must, when making arrangements for the collection of waste paper, metal, plastic or glass, ensure that those arrangements are by way of separate collection.

(4) The duties in this regulation apply where separate collection—

(a) is necessary to ensure that waste undergoes recovery operations in accordance with Articles 4 and 13 of the Waste Framework Directive and to facilitate or improve recovery; and

(b) is technically, environmentally and economically practicable.".

Appendix 2 Summary table of tonnage performance of different options

Scenario reference	Tonnage of dry recycling collected (excluding contaminated tonnage)	Tonnes of dry recycling contamination	Tonnes of food waste	Tonnes of garden waste	Residual waste (including contaminated recycling)	Commentary
5 LW	14,673	1,558	5,017	3,056	43,667	This fully comingled option is one of four achieving the highest capture of dry recycling tonnage. It also achieves the lowest tonnes of residual waste (including contaminated material).
2 RF	14,673	1,209	0	3,056	48,759	This twin stream option is one of four achieving the highest capture of dry recycling tonnage. However the lack of food waste collection contributes to a relatively high residual waste.
3 RF / 2 LW	14,673	1,209	5,017	3,056	43,742	This twin stream option is one of four achieving the highest capture of dry recycling tonnage. It also achieves the second highest tonnes of residual waste.
4 LW / 8 RF	14,673	1,209	5,017	3,056	43,744	This twin stream option is one of four achieving the highest capture of dry recycling tonnage. It also achieves the third lowest residual waste

Scenario reference	Tonnage of dry recycling collected (excluding contaminated tonnage)	Tonnes of dry recycling contamination	Tonnes of food waste	Tonnes of garden waste	Residual waste (including contaminated recycling)	Commentary
						arisings.
4 RF / 6 LW	14,553	291	5,017	3,056	44,076	This kerbside sort option achieves around 120 tonnes less dry recycling per year than the highest performing comingled and twin stream options but almost 3,000 more than the poorest. It achieves the lowest amount of dry recycling contamination of any of the options and has a relatively low residual waste tonnage.
1 RF	14,143	744	5,017	3,056	44,195	This fully comingled option performs relatively well in terms of recycling capture and residual waste. Contamination is assumed lower than other comingled options and Lewisham would need to consider if this is achievable.

Scenario reference	Tonnage of dry recycling collected (excluding contaminated tonnage)	Tonnes of dry recycling contamination	Tonnes of food waste	Tonnes of garden waste	Residual waste (including contaminated recycling)	Commentary
7 RF / 3 LW	12,827	1,057	0	3,056	50,595	This twin stream option has a relatively low recycling capture and relatively high residual waste tonnage.
LW 1	12,827	1,151	0	256	50,528	This comingled option has relatively low recycling capture and relatively high residual waste.
Baseline+ RF / Baseline LW	12,811	1,423	0	256	53,022	This comingled option is one of two baseline options modelled. It has relatively low recycling capture and the highest residual waste.
5 RF	11,664	961	5,017	3,056	46,734	This twin stream option is one of the two poorest performing options in terms of dry recycling tonnage. It performs worse than both the baseline options in terms of tonnage captured.
6 RF	11,664	961	0	3,056	51,752	This twin stream option is one of the two poorest performing options in terms of dry recycling tonnage. It also has relatively high residual waste collecting over 8,000 tonnes more residual waste than

Scenario reference	Tonnage of dry recycling collected (excluding contaminated tonnage)	Tonnes of dry recycling contamination	Tonnes of food waste	Tonnes of garden waste	Residual waste (including contaminated recycling)	Commentary
						the highest performing option.

Appendix 3 Local authorities and waste management firms engaged with

Facility	Approximate drive time without traffic[18] (times vary dependant on route)	Approximate drive time with some congestion[19]	Facility description
London Borough of Bexley Thames Road, Crayford, DA1 5QJ	26 to 35 minutes	30 to 38 minutes	Waste transfer station
London Borough of Bromley, Churchfields Road, BR3 4QY	19 minutes	21 to 24 minutes	Waste transfer station
Bywaters MRF, Lea Riverside, Twelvetrees Crescent, Bow, London, E3 3JG	22 to 33	45 to 46 minutes	Materials recovery facility
Cory Smugglers Way, Wandsworth, London, SW18 1EG	39 to 41 minutes	49 to 51 minutes	Materials recovery facility
Hinkcroft, Deptford Recycling Centre, Landmann Way, Deptford, London, SE14 5RS	Within the borough		Waste transfer station
RTS, Unit 1 Stockholm Road, Bermondsey, London, SE16 3LP	15 to 16 minutes	20 to 22 minutes	Did not respond despite multiple contact attempts
Veolia, ColdHarbour Lane, Rainham RM13 9BJ	40 to 45 minutes	51 minutes to 1 hour 4 minutes	Plastics recovery facility
Veolia (Southwark), 43 Devon Street (off Old Kent Road), London, SE15 1AL	15 to 17 minutes	23 to 24 minutes	Materials recovery facility
Viridor, Century Wharf Crayford Creek, Dartford DA1 4QG	27 to 31 minutes	30 to 37 minutes	Materials recovery facility
Viridor, Pelican House Clipper Close, Rochester ME2 4QP	40 minutes to 1 hour 2 minutes	46 minutes to 1 hour 14 minutes	Plastics recovery facility

[18] Estimated based on drive times from Lewisham High Street based on Google maps

[19] Estimated based on drive times from Lewisham High Street based on Google maps during times of the day when there is more congestion

Appendix 4 Summary of options against tests

Scenario reference	Recycling collection system	Necessity	Technical	Environmental performance	Economic
4 RF / 6 LW	Kerbside sort, weekly	Not proven as necessary (indications are similar quality could be achieved via comingled and twin stream options)	Not technically possible currently due to lack of WTS. Needs further investigation with potential WTS providers to identify future feasibility.	None of the options meet the EPS set for 2015 though all are an improvement on the baseline and differences between the options are extremely small. This options ranks joint 4th (with 1 RF and 5 LW) in terms of relative performance.	Costs significantly exceed current service budget and therefore considered to be 'excessive'
2 RF	Twin stream, weekly	Not proven as necessary (indications are that similar quality could be achieved via comingled collections)	Not possible within current MRF contract but could be if suitable new contract procured. Ideally needs further investigation regarding WTS use to increase processing options.	None of the options meet the EPS set for 2015 though all are an improvement on the baseline and differences between the options are extremely small. This option is the 3rd highest performing in terms of relative performance.	Not assessed
3 RF / 2 LW	Twin stream, weekly	Not proven as necessary (indications are that similar quality could be achieved via comingled collections)	Not possible within current MRF contract but could be if suitable new contract procured. Ideally needs further investigation regarding WTS use to increase processing options.	None of the options meet the EPS set for 2015 though all are an improvement on the baseline and differences between the options are extremely small. This option is the highest performing.	Costs are reduced in relation to the baseline. This option has the greatest net cost reduction in relation to the baseline.
5 RF	Twin	Not proven as	Not possible	None of the options	Not assessed

Scenario reference	Recycling collection system	Necessity	Technical	Environmental performance	Economic
	stream, weekly	necessary (indications are that similar quality could be achieved via comingled collections)	within current MRF contract but could be if suitable new contract procured. Ideally needs further investigation regarding WTS use to increase processing options.	meet the EPS set for 2015 though all are an improvement on the baseline and differences between the options are extremely small. This option is the 2nd highest performing.	
6 RF	Twin stream, weekly	Not proven as necessary (indications are that similar quality could be achieved via comingled collections)	Not possible within current MRF contract but could be if suitable new contract procured. Ideally needs further investigation regarding WTS use to increase processing options.	None of the options meet the EPS set for 2015 though all are an improvement on the baseline and differences between the options are extremely small. This option is one of the three lowest performing.	Not assessed
7 RF / 3 LW	Twin stream, fortnightly	Not proven as necessary (indications are that similar quality could be achieved via comingled collections)	Not possible within current MRF contract but could be if suitable new contract procured. Ideally needs further investigation regarding WTS use to increase processing options.	None of the options meet the EPS set for 2015 though all are an improvement on the baseline and differences between the options are extremely small. This option is about mid range in terms of performance.	Costs are reduced in relation to the baseline. This option has the third greatest net cost reduction in relation to the baseline.
8 RF / 4 LW	Twin stream, fortnightly	Not proven as necessary (indications	Not possible within current MRF contract but	None of the options meet the EPS set for 2015 though all are an	Costs are reduced in relation to the

Scenario reference	Recycling collection system	Necessity	Technical	Environmental performance	Economic
		are that similar quality could be achieved via comingled collections)	could be if suitable new contract procured. Ideally needs further investigation regarding WTS use to increase processing options.	improvement on the baseline and differences between the options are extremely small. This option is the poorest performing (excluding the baseline).	baseline. This option has the second greatest net cost reduction in relation to the baseline.
Baseline+ RF / Baseline+ LW	Fully comingled, weekly	Indications are high quality could be achieved with use of high performing MRF	Current system and therefore proven to be technically feasible.	The baseline system against which the other options are compared. This baseline had the poorest performance in comparison to the options assessed.	The baseline (current) costs against which other costs were assessed.
1 RF	Fully comingled, fortnightly	Indications are high quality could be achieved with use of high performing MRF	Current system and therefore proven to be technically feasible.	None of the options meet the EPS set for 2015 though all are an improvement on the baseline and differences between the options are extremely small. This options ranks joint 4th (along with 4RF / 6 LW and 5 LW) in terms of relative performance.	Not assessed
5 LW	Fully comingled, fortnightly	Indications are high quality could be achieved with use of high performing MRF	Current system and therefore proven to be technically feasible.	None of the options meet the EPS set for 2015 though all are an improvement on the baseline and differences between the options are extremely small. This options ranks joint 4th (along with 4 RF / 6 LW	Costs are reduced in relation to the baseline. This option has the fourth greatest net cost reduction in relation to the baseline of the

Scenario reference	Recycling collection system	Necessity	Technical	Environmental performance	Economic
				and 1 RF) in terms of relative performance.	six options modelled.
LW 1	Fully comingled, weekly	Indications are high quality could be achieved with use of high performing MRF	Current system and therefore proven to be technically feasible.	None of the options meet the EPS set for 2015 though all are an improvement on the baseline and differences between the options are extremely small. This option is the second poorest performing option considered (excluding the baseline)	Costs are reduced in relation to the baseline. This option has the fifth greatest net cost reduction in relation to the baseline.