ITEM 5

PAPER NO. WRWA 863

WESTERN RIVERSIDE WASTE AUTHORITY

MEETING	19th September 2018
REPORT AUTHOR/DATE	General Manager *(Contact Mark Broxup - Tel. 020 8871 2788)* 11th September 2018
SUBJECT	Report outlining progress with operations and other matters since the previous meeting of the Authority.
CONTENTS	
STATUS	Open

BACKGROUND PAPERS	None

EXECUTIVE SUMMARY

1. This paper brings Members up to date on operational and other matters which, in themselves, do not warrant production of a separate paper. The majority of these matters are for Members' information, but where approval is sought this is referred to in the report. The specific matters covered in this report are:-

   a) Operations
   b) Performance Monitoring
   c) Joint Statement in response to LGA's report on Problems with Plastic Recycling
   d) Joint Waste Policy Support
   e) End of the line Waste Avoidance/Reduction Campaign
   f) Constituent Council New Recycling Initiatives
   g) English Resources and Waste Strategy
   h) Cory Riverside Energy's plan for a new Energy Park
   i) Autumn Open Day for Residents
   j) Members Visit to Belvedere
   k) Items costing between £5,000 and £30,000

OPERATIONS

Transfer Stations/ Materials Recycling Facility (MRF)

2. There has been no major disruption in service to the main Transfer Stations' operations since the last Authority meeting.

PERFORMANCE MONITORING

Introduction

3. Detailed performance monitoring is shown at Appendix A to this report. The tables shown set out:

   a. the tonnages of each waste type (including co-mingled recycling contamination) delivered by each constituent council in the current financial year to date, together with projected outturn tonnages, compared against those budgeted for and the previous financial year's outturn;

b. the projected annual cost for each commodity, compared to what these would be if the Authority's budgeted tonnage of each commodity was received;

c. forecast tonnages for future years, adjusted simply by the number of working days in each year; the major waste type and co-mingled contamination tonnages are also shown on a monthly as well as an annual basis;

d. comparisons of the tonnage of each major waste type handled by each constituent council on an annual basis;

e. comparisons by borough of the tonnages of Locally Authority Collected Waste (LACW), household and non-household waste, household waste arisings per dwelling and per person; and

f. weight-based recycling performance on a household and LACW basis.

Points to Highlight

4. Whilst General Waste (the residual waste that cannot be reused or recycled and is sent for energy recovery) accounts for around 77% of the delivered waste stream, it accounts for almost 93% of the Authority's costs after allowing for the treatment of the contamination within the co-mingled recycling. By comparison co-mingled recycling represents 18% of the delivered tonnage, but only accounts for 4% of the Authority's costs.

5. From tonnage data to date we are predicting a 1.7% reduction in total waste handled by the Authority in 2018/19 from that budgeted for and a 2.6% reduction in General Waste. The levels of reductions vary across the constituent councils with, for example, Hammersmith & Fulham and Kensington and Chelsea predicted to have 3.1% and 1.3% reductions in General Waste respectively.

6. General Waste for 2018/19 at the Household Waste and Recycling Centre is currently forecast to be over 19% below that predicted in the budget and the total waste figure is down by around 8% (possibly due to General Waste successfully being diverted into the reuse and recycling waste streams). However, these figures could change in time as there is a great deal of seasonality in the HWRC figures, with the

prolonged spell of hot weather experienced this summer likely to be a factor in this reduction.

7. The tonnage of co-mingled recycling collected by Lambeth is down on the forecast for 2018/19, by nearly 2%, with Kensington and Chelsea's and Hammersmith & Fulham's down by around 1%. In contrast, Wandsworth's co-mingled recycling tonnage is forecast to be up by 1% on that originally forecast for the year. Contamination levels are generally better than the corresponding period last year, with an overall figure of 14.1% now predicted for 2018/19.

JOINT STATEMENT IN RESPONSE TO THE LOCAL GOVERNMENT ASSOCIATION'S STATEMENT ON PROBLEMS WITH PLASTIC RECYCLING

8. On 4th August 2018 the Local Government Association (LGA) issued a statement concerning the problems associated with the recycling of plastic waste, suggesting that two-thirds of plastics are not recyclable, and they are calling for manufacturers to work with councils to develop a plan to stop unrecyclable packaging from entering the environment in the first place. Further information can be found here: https://www.local.gov.uk/about/news/two-thirds-plastic-packaging-pots-and-trays-unrecyclable

9. The Authority and Cory prepared a joint statement in response to the LGA's statement and also produced fact sheets that provide detailed information on how materials are recycled, where they are recycled and what products are made from the recycled material. Copies of both the joint statement and the fact sheets are attached at Appendix B and are available on the Authority's website.

JOINT WASTE POLICY SUPPORT

10. In June 2017, the Authority considered a Recycling Performance report (Paper No. WRWA 832) which led to a seminar being held for Authority Members on 14th September 2017, the outcomes of which were discussed at the Authority's September 2017 meeting (Paper No. WRWA 838). Authority officers subsequently met with officers from the constituent councils, on 4th October 2017, to discuss the matter further.

11. In January 2018, following a procurement exercise as detailed at the last Authority meeting (Paper No. WRWA 850), Ricardo were appointed to advise on:

i. the accuracy of the data used to prepare Paper No. WRWA 832 and the reasonableness of the conclusions drawn from it;

ii. any differences in performance between the constituent councils on different waste types;

iii. the suitability of having a range of performance targets, as opposed to the current ‘one size fits all’ weight-based recycling targets;

iv. the enhancement of the current recycling programme, with a new focus on a number of waste minimisation initiatives; and

v. building on the work detailed in i) to iv) above, to draft a new joint waste policy for the Authority and its constituent councils.

12. Two reports from Ricardo, which cover points i) to iv) above, are attached as Appendices C and D, respectively, to this report.

13. The Ricardo reports’ confirm the accuracy of the data used by officers to prepare Paper No. WRWA 832 and the reasonableness of the conclusions drawn from it. The Ricardo reports are very comprehensive but officers would wish to highlight the following points:

   a) waste prevention/minimisation, including reuse, is a more effective intervention, since, by removing or reducing the demand for goods, it maximises the reduction in demand for raw materials and the associated environmental impact of their production. The Authority’s proposal for the consideration of material specific campaigns to minimise the volume of waste discarded by residents, as outlined in Paper No. WRWA 842 in June 2017, would reduce not only the level of material wasted by residents, but would also represent a saving for residents against the purchasing costs involved. This approach would reduce the carbon impact of these wastes, whether introduced as stand-alone initiatives or in conjunction with the introduction of dedicated collection services.

   b) given their built environment and demographics, the Authority and its constituent councils generally perform well in comparison to London as a whole and the rest of the UK in terms of dry recycling performance. The 2015 ‘At This Rate’ report by SITA (now Suez) noted that the highest reported recycling rate for authorities with a proportion of multi-occupancy dwellings of above 50% was 39%. In 2016/17 WRWA recorded a capture rate of 34% with a multi-occupancy rate of 73%;

c) the lack of garden waste available constrains the Authority and its constituent councils overall weight-based recycling rate, which is a combination of dry and organic recycling. As a result, the level of recycling performance contrasts poorly with outer London and England, where garden waste tonnages are more easily available;

d) consideration of alternative methodologies for measuring the best environmental option for each material stream would enable more appropriate targets to be set which would better reflect the performance in the Authority's area, whilst also demonstrating environmental best practice. For example reducing or recycling textiles and WEEE would generate significant carbon savings but would contribute very little to weight based recycling targets.

e) conversely, food and garden waste recycling would only result in small (if any) carbon savings although they might make a greater, but probably still modest, contribution to weight bases targets. The reports highlight that the carbon benefits of treating food waste by Anaerobic Digestion are small when compared to EfW and would be reduced further, or possibly disappear completely, after factoring in the carbon impact of the necessary additional collection services, transport from WTS to reprocessor, delivery of containers (including regular delivery of liners), and the embedded carbon in the containers provided. Utilising the Waste & Resources Action Programme's (WRAP) mean capture rate for food waste recycling, suggests it would be also be difficult to achieve a five percentage point increase from the Authority's current weight based recycling rate of around 26.5% to 31.5%. Similarly there also appears to be little or no carbon advantage in recycling Garden waste as compared to sending it to EfW.

f) whilst Energy from Waste has a positive carbon impact, it can only mitigate the carbon footprint of non-organic waste to a limited extent compared to recycling. The major carbon benefits are therefore achieved through the recycling of co-mingled dry recyclables, as the use of that recyclate, as a substitute for raw materials, can minimise the requirements for the extraction of raw materials, reduce the amount of fossil fuel burnt in their extraction and transport and reduce the energy required in the manufacturing process.

g) the negative carbon impact of the constituent council collection services is relatively minor in comparison with the carbon benefit of the Authority's methodology for treating the waste. Whilst not factored into the comparisons, Ricardo's performance report also demonstrates the positive environmental benefit of the Authority transferring its residual waste by river rather than by road.

h) Nitrogen Oxide (NOx) emissions, which are indicative of air quality, caused by waste collection activities must be considered in perspective. Effectively, their impact represents 0.09% of the NOx emissions in each Borough. However, congestion caused by collection activities may cause emissions from other vehicles not captured by this analysis. Similarly, the tipping facilities at Smugglers Way and Cringle Dock will be visited by the majority of collection vehicles on multiple occasions, and will thus have a concentrated local impact on air quality.

14. The intention is now to use the Ricardo reports as the basis for production of a new joint waste policy document for the Authority and the constituent councils. The intention is to try to base this policy document around a set of environmental metrics that are easily measurable, simple to monitor and easy to communicate to a variety of stakeholders and which drive forward environmental improvements in performance.

15. However, any targets against these metrics, including weight-based recycling targets, will need their potential environmental benefits to be balanced against their economic cost so as to ensure that they are affordable and represent good value. It has to be recognised that the constituent councils might be able to use their resources to make greater environmental savings in areas other than waste management.

16. Given that the Government is expected to publish an English Resource & Waste Strategy shortly, the EU Circular Economy Package is due to be implemented, Brexit details are unknown and a Deposit Return Scheme may be introduced in the near future, it is recommended that work on a joint waste policy document be delayed until the New Year so that it can properly reflect any change in national Government policy.

17. Delaying presentation of a draft joint waste policy document to the Authority until 2019 will also allow the results of the next planned waste composition survey, in October 2018, to be taken account of.

“END OF THE LINE” - WASTE AVOIDANCE /REDUCTION CAMPAIGN

18. Following the “Creative Concepts” presentation provided by Mr Steven Bates from Envirocomms at the last Authority meeting, Members agreed to delegate authority to the General Manager, in consultation with the Chairman, to approve the final concepts and work streams to enable the campaign to launch in autumn 2018.

19. The “End of the Line” campaign as described during the presentation will be a digital campaign using social media platforms; namely, Facebook, Instagram and Twitter, constituent council websites and an Authority “digital hub”, with the aim of encouraging residents to avoid purchasing certain plastic items and to reduce food and nappy waste.

20. After further exploration and investigation into established Reusable Nappy Campaigns and Laundry service schemes, officers now consider that offering a financial subsidy to encourage parents to stop using disposable nappies is not financially viable. A significant financial investment would be necessary to offer an incentive to make either purchasing reusable nappies or using a nappy laundry service attractive and this investment would not be covered by the estimated waste disposal savings. Officers are not therefore recommending that Nappies are included in the End of Line waste reduction campaign.

21. Based on waste composition analysis, the two waste streams that have the potential to yield the biggest savings in waste disposal costs through waste minimisation measures are food waste and garden waste. Plastic waste is not as significant in terms of waste tonnage, but it has a very high carbon impact and, given the current level of public interest on the impact of plastic waste pollution, it is felt that plastics waste should be targeted. Textiles also have a high carbon impact, but it is less clear how to target that material through a waste minimisation campaign (as opposed to a recycling campaign).

22. It is planned to launch a staggered campaign, commencing in October 2018, starting with a focus on Plastics with the launch of a video, followed by a focus on Food Waste with the launch of a second video some ten days later. It is planned to launch the Garden Waste campaign in the New Year at the start of the growing season, when residents are likely to be more receptive. The campaign is looking to offer home composting solutions to encourage residents with gardens to deal with their waste at home.

CONSTITUENT COUNCIL NEW RECYCLING INITIATIVES

23. At the meeting of the Authority on 22nd September 2010 (Paper No. WRWA 669A) Members instructed the Clerk to write to each of the constituent councils to inform them that, in future, should they wish to make arrangements themselves to recycle any significant tonnage of waste then, in accordance with Section 48 of the Environment Protection Act 1990, they must, as soon as reasonably practicable, notify the Authority in writing. The Authority will then approve or object to any such proposal at its next available meeting. The Clerk wrote to the constituent councils, as instructed, on 27th October 2010.

24. The constituent councils have not notified the Authority of any new initiatives since the previous Authority meeting.

ENGLISH RESOURCES AND WASTE STRATEGY

25. The Department for Environment, Farming and Rural Affairs (Defra) is expected to publish a new Resources and Waste strategy for England in the second half of 2018. This would be a key element in the Government's environmental policy, following the publication of its Clean Growth strategy in October 2017 and its 25 Year Environment Plan in January 2018.

26. At the time of writing there has been no update from the Government on when this document will be published, but it is thought that the Government's Autumn 2018 budget will include a number of environment related initiatives.

CORY RIVERSIDE ENERGY'S PLANS FOR A NEW RIVERSIDE ENERGY PARK

27. At the last Authority meeting it was reported that Cory has published its plans to build an integrated, low-carbon energy park at its site in Belvedere, South East London (Paper No. WRWA 859) and, on 20th June 2018, the Planning Inspectorate acknowledged that it had been formally notified of Cory's proposed application for an order granting development consent for the purposes of Section 46 of the Planning Act 2008 and supplied the information for consultation under Section 42.

AUTUMN OPEN DAY FOR RESIDENTS

28. Officers are making arrangements for an Open Day for residents at the Smugglers Way facility on Saturday, 17th November 2018. It will be the first time that the Authority has hosted such an event. Educational talks and tours will be open to

adults and children (accompanied by a parent) and children will also have the option to participate in craft activities. All residents will be required to book in advance. Once arrangements have been finalised, Authority officers will inform constituent councils in order that the event can be advertised as widely as possible.

MEMBERS' VISIT

29. At the Authority meeting on 17th July 2018, Members agreed that a visit to the existing Energy from Waste Facility at Belvedere should be organised for Autumn 2018. The date of the visit has since been agreed as 8th November 2018. Members will be contacted nearer the time to finalise the arrangements.

ITEMS COSTING BETWEEN £5,000 AND £30,000

30. The following item of expenditure has been authorised by officers under delegated powers within the band range of £5,000 to £30,000 since the last Authority meeting:

Ansador Ltd.	Essential Repair to ANPR System	£5,542

RECOMMENDATIONS

31. The Authority is recommended:

a) Agree, for the reasons given in paragraph 16 above, that presentation of a new draft joint waste policy document for the Authority and the constituent councils be delayed until 2019; and

b) to otherwise receive this report as information.

M. Broxup
GENERAL MANAGER

Western Riverside Transfer Station
Smugglers Way
Wandsworth
SW18 1JS.

11th September 2018

Hammersmith & Fulham	After	5	months of	2018/2019	Printed	03/09/2018 14:45
	= Forecast Figures					

Tonnage	2017/2018 Outturn	2018/2019 Budget	2018/2019 Forecast	Difference to Budget: Tonnes	Difference to Budget: Percentage	2018/2019 £/Tonne	Budget 2018/2019 Cost £	Projected 2018/2019 Cost £	Projected 2018/2019 Variance £
Batteries	1	1	-	- 1	-100%	57.50	58	-	- 58
Clinical Waste	27	27	22	- 5	-18.1%	552.00	14,904	12,210	- 2,694
Co-Mingled	11,305	11,279	11,155	- 124	-1.1%	27.00	304,533	301,198	- 3,335
Detritus Waste	733	695	695	0	0.0%	78.50	54,558	54,561	3
Electricals	15	17	7	- 10	-61.2%	51.00	867	337	- 530
Fridges	94	101	84	- 17	-17.0%	48.50	4,899	4,065	- 834
Gas Bottles	2	2	1	- 1	-68.7%	130.00	260	81	- 179
General Waste	58,478	58,842	57,036	- 1,806	-3.1%	147.50	8,679,195	8,412,741	- 266,454
Glass Mixed	-	-	-	-		36.50	-	-	-
Green Waste	115	207	139	- 68	-33.0%	88.00	18,216	12,214	- 6,002
Inert Waste	-	-	-	-		30.00	-	-	-
Oil & Paint	-	-	0	0		124.50	-	17	17
Paper & Cardboard	-	-	-	-	-	13.00	-	-	-
Scrap Metals	13	16	4	- 12	-77.3%	7.50	120	27	- 93
Textiles & Carpets	-	-	-	-	-	180.00	-	-	-
Tyres	-	-	0	0		280.50	-	62	62
Wood	-	-	-	-		123.00	-	-	-
Grand Total	**70,785**	**71,187**	**69,142**	**- 2,045**	**-2.9%**	**Sub-Total**	**9,077,609**	**8,797,513**	**- 280,096**
Contamination	1,593	1,595	1,564	- 31	-1.9%	147.50	235,240	230,669	- 4,572
						Grand Total	**9,312,849**	**9,028,181**	**- 284,668**

Forecast Tonnes	2019/2020	2020/2021	2021/2022
Batteries	-	-	-
Clinical Waste	22	22	22
Co-Mingled	11,200	11,155	11,155
Detritus Waste	698	695	695
Electricals	7	7	7
Fridges	84	84	84
Gas Bottles	1	1	1
General Waste	57,261	57,036	57,036
Glass Mixed	-	-	-
Green Waste	139	139	139
Inert Waste	-	-	-
Oil & Paint	0	0	0
Paper & Cardboard	-	-	-
Scrap Metals	4	4	4
Textiles & Carpets	-	-	-
Tyres	0	0	0
Wood	-	-	-
Grand Total	**69,415**	**69,142**	**69,142**
Contamination	1,570	1,564	1,564

Co-Mingled Contamination	2014/2015	2015/2016	2016/2017	2017/2018	2018/2019
Apr	15.0%	13.3%	14.2%	11.6%	13.4%
May	14.8%	15.5%	12.1%	15.9%	13.0%
Jun	15.3%	11.3%	14.2%	12.1%	12.5%
Jul	14.7%	15.3%	11.0%	13.3%	15.8%
Aug	14.2%	16.3%	13.0%	17.1%	15.8%
Sep	11.7%	15.7%	12.9%	11.5%	14.0%
Oct	20.5%	14.7%	13.5%	15.1%	14.0%
Nov	16.0%	14.7%	16.0%	13.5%	14.0%
Dec	17.5%	15.9%	18.5%	16.8%	14.0%
Jan	18.6%	13.3%	15.7%	16.1%	14.0%
Feb	14.1%	11.9%	15.2%	13.7%	14.0%
Mar	16.7%	15.0%	11.9%	12.0%	14.0%
Average	15.8%	14.4%	14.0%	14.1%	14.0%
				Budget	14.1%

Working Days	2017/2018	2018/2019	2019/2020	2020/2021	2021/2022
Total	254	253	254	253	253
Diff from Year before		-1	1	-1	0
Change		-0.39%	0.40%	-0.39%	0.00%

General Waste Tonnes	2017/2018	2018/2019	Difference	
Apr	4,507	4,746	240	5.32%
May	5,262	5,291	29	0.56%
Jun	5,254	4,933	- 321	-6.11%
Jul	5,106	5,015	- 91	-1.78%
Aug	4,929	4,775	- 153	-3.11%
Sep	4,885	4,717	- 168	-3.43%
Oct	5,119	4,943	- 176	-3.43%
Nov	5,081	4,907	- 174	-3.43%
Dec	4,795	4,631	- 164	-3.43%
Jan	4,832	4,666	- 166	-3.43%
Feb	3,967	3,831	- 136	-3.43%
Mar	4,742	4,580	- 163	-3.43%
Total	**58,478**	**57,036**	**- 1,443**	**-2.47%**

Co-Mingled Tonnes	2017/2018	2018/2019	Difference	
Apr	855	900	45	5.32%
May	1,009	999	- 10	-0.95%
Jun	970	951	- 20	-2.03%
Jul	928	965	37	4.01%
Aug	875	823	- 53	-6.02%
Sep	935	914	- 21	-2.26%
Oct	970	948	- 22	-2.26%
Nov	976	954	- 22	-2.26%
Dec	999	976	- 23	-2.26%
Jan	988	966	- 22	-2.26%
Feb	810	792	- 18	-2.26%
Mar	990	968	- 22	-2.26%
Total	**11,305**	**11,155**	**- 150**	**-1.33%**

Detritus Waste Tonnes	2017/2018	2018/2019	Difference	
Apr	45	66	21	45.21%
May	59	68	10	16.25%
Jun	64	53	- 11	-16.66%
Jul	74	56	- 18	-24.17%
Aug	62	49	- 13	-21.60%
Sep	64	60	- 4	-6.13%
Oct	55	52	- 3	-6.13%
Nov	67	63	- 4	-6.13%
Dec	59	55	- 4	-6.13%
Jan	72	68	- 4	-6.13%
Feb	54	51	- 3	-6.13%
Mar	57	53	- 3	-6.13%
Total	**733**	**695**	**- 38**	**-5.22%**

Co-mingled Contamination Tonnes	2017/2018	2018/2019	Difference	
Apr	99	120	21	21.31%
May	160	129	- 31	-19.38%
Jun	117	118	1	0.89%
Jul	124	152	29	23.08%
Aug	150	130	- 20	-13.10%
Sep	107	128	21	19.15%
Oct	147	133	- 14	-9.50%
Nov	132	134	2	1.20%
Dec	168	137	- 31	-18.44%
Jan	159	135	- 23	-14.68%
Feb	111	111	- 0	-0.06%
Mar	119	136	17	14.00%
Total	**1,593**	**1,564**	**- 29**	**-1.85%**

Green Waste Tonnes	2017/2018	2018/2019	Difference	
Apr	-	10	10	0.00%
May	-	6	6	0.00%
Jun	-	1	1	0.00%
Jul	-	3	3	0.00%
Aug	1	7	6	1034.48%
Sep	2	2	- 0	-2.27%
Oct	3	2	- 0	-2.27%
Nov	8	8	- 0	-2.27%
Dec	1	1	- 0	-2.27%
Jan	90	88	- 2	-2.27%
Feb	3	3	- 0	-2.27%
Mar	8	7	- 0	-2.27%
Total	**115**	**139**	**23**	**20.35%**

Wood Waste Tonnes	2017/2018	2018/2019	Difference	
Apr	-	-	-	0.00%
May	-	-	-	0.00%
Jun	-	-	-	0.00%
Jul	-	-	-	0.00%
Aug	-	-	-	0.00%
Sep	-	-	-	0.00%
Oct	-	-	-	0.00%
Nov	-	-	-	0.00%
Dec	-	-	-	0.00%
Jan	-	-	-	0.00%
Feb	-	-	-	0.00%
Mar	-	-	-	0.00%
Total	**-**	**-**	**-**	**0.00%**

Kensington and Chelsea	After	5	months of	2018/2019	Printed	03/09/2018 14:45
	= Forecast Figures					

Tonnage	2017/2018 Outturn	2018/2019 Budget	2018/2019 Forecast	Difference to Budget Tonnes	Difference to Budget Percentage	2018/2019 £/Tonne	Budget 2018/2019 Cost £	Projected 2018/2019 Cost £	Projected 2018/2019 Variance £
Batteries	-	-	-	-		57.50	-	-	-
Clinical Waste	2	2	1	- 1	-43.8%	552.00	1,104	621	- 483
Co-Mingled	15,889	15,960	15,837	- 123	-0.8%	27.00	430,920	427,591	- 3,329
Detritus Waste	499	474	451	- 23	-4.8%	78.50	37,209	35,423	- 1,786
Electricals	27	25	51	26	104.7%	51.00	1,275	2,609	1,334
Fridges	61	69	61	- 8	-11.4%	48.50	3,347	2,965	- 381
Gas Bottles	1	1	1	- 0	-31.3%	130.00	130	89	- 41
General Waste	59,730	59,884	59,096	- 788	-1.3%	147.50	8,832,890	8,716,655	- 116,235
Glass Mixed	-	-	-	-		36.50	-	-	-
Green Waste	387	423	432	9	2.2%	88.00	37,224	38,034	810
Inert Waste	-	-	-	-		30.00	-	-	-
Oil & Paint	-	-	-	-		124.50	-	-	-
Paper & Cardboard	-	-	-	-		- 13.00	-	-	-
Scrap Metals	1	1	4	3	269.3%	7.50	8	28	20
Textiles & Carpets	-	-	-	-		- 180.00	-	-	-
Tyres	-	-	0	0		280.50	-	33	33
Wood	1	1	2	1	125.6%	123.00	123	277	154
Grand Total	**76,597**	**76,840**	**75,936**	**- 904**	**-1.2%**	**Sub-Total**	**9,344,229**	**9,224,326**	**- 119,903**
Contamination	1,943	2,027	1,859	- 168	-8.3%	147.50	298,971	274,244	- 24,726
						Grand Total	**9,643,200**	**9,498,570**	**- 144,630**

Forecast Tonnes	2019/2020	2020/2021	2021/2022
Batteries	-	-	-
Clinical Waste	1	1	1
Co-Mingled	15,899	15,837	15,837
Detritus Waste	453	451	451
Electricals	51	51	51
Fridges	61	61	61
Gas Bottles	1	1	1
General Waste	59,330	59,096	59,096
Glass Mixed	-	-	-
Green Waste	434	432	432
Inert Waste	-	-	-
Oil & Paint	-	-	-
Paper & Cardboard	-	-	-
Scrap Metals	4	4	4
Textiles & Carpets	-	-	-
Tyres	0	0	0
Wood	2	2	2
Grand Total	**76,236**	**75,936**	**75,936**
Contamination	1,867	1,859	1,859

Co-Mingled Contamination	2014/2015	2015/2016	2016/2017	2017/2018	2018/2019
Apr	15.2%	13.0%	10.8%	14.7%	12.2%
May	16.6%	15.7%	11.5%	11.8%	10.9%
Jun	16.4%	12.3%	11.1%	13.2%	11.0%
Jul	14.0%	14.1%	11.1%	12.1%	13.2%
Aug	17.4%	10.0%	11.3%	14.3%	11.4%
Sep	16.6%	13.9%	13.1%	11.9%	11.7%
Oct	11.9%	14.3%	11.9%	14.0%	11.7%
Nov	15.5%	13.0%	12.1%	10.6%	11.7%
Dec	13.5%	14.8%	11.4%	12.3%	11.7%
Jan	14.6%	16.9%	11.8%	11.3%	11.7%
Feb	13.3%	17.5%	12.6%	11.7%	11.7%
Mar	12.6%	13.5%	13.6%	9.2%	11.7%
Average	14.8%	14.1%	11.9%	12.2%	11.7%
				Budget	12.7%

Working Days	2017/2018	2018/2019	2019/2020	2020/2021	2021/2022
Total	254	253	254	253	253
Diff from Year before		-1	1	-1	0
Change		-0.39%	0.40%	-0.39%	0.00%

General Waste Tonnes	2017/2018	2018/2019	Difference	
Apr	4,492	4,858	366	8.15%
May	5,214	5,250	36	0.70%
Jun	5,282	5,004	- 277	-5.25%
Jul	5,102	5,289	187	3.67%
Aug	4,980	4,733	- 247	-4.96%
Sep	4,990	4,889	- 101	-2.02%
Oct	5,371	5,263	- 108	-2.02%
Nov	5,281	5,174	- 107	-2.02%
Dec	4,917	4,818	- 99	-2.02%
Jan	5,010	4,909	- 101	-2.02%
Feb	4,298	4,211	- 87	-2.02%
Mar	4,794	4,698	- 97	-2.02%
Total	**59,730**	**59,096**	**- 634**	**-1.06%**

Co-Mingled Tonnes	2017/2018	2018/2019	Difference	
Apr	1,191	1,266	76	6.34%
May	1,411	1,378	- 33	-2.31%
Jun	1,415	1,352	- 63	-4.48%
Jul	1,361	1,431	71	5.18%
Aug	1,160	1,176	17	1.45%
Sep	1,365	1,347	- 17	-1.27%
Oct	1,418	1,400	- 18	-1.27%
Nov	1,379	1,361	- 18	-1.27%
Dec	1,396	1,378	- 18	-1.27%
Jan	1,344	1,327	- 17	-1.27%
Feb	1,152	1,137	- 15	-1.27%
Mar	1,298	1,281	- 17	-1.27%
Total	**15,889**	**15,837**	**- 52**	**-0.33%**

Detritus Waste Tonnes	2017/2018	2018/2019	Difference	
Apr	31	47	16	50.41%
May	45	43	- 2	-3.50%
Jun	41	40	- 1	-1.85%
Jul	43	23	- 20	-45.74%
Aug	53	42	- 12	-21.62%
Sep	42	38	- 4	-10.40%
Oct	45	40	- 5	-10.40%
Nov	47	42	- 5	-10.40%
Dec	28	25	- 3	-10.40%
Jan	48	43	- 5	-10.40%
Feb	35	31	- 4	-10.40%
Mar	41	37	- 4	-10.40%
Total	**499**	**451**	**- 47**	**-9.51%**

Co-mingled Contamination Tonnes	2017/2018	2018/2019	Difference	
Apr	175	154	- 21	-11.91%
May	166	150	- 17	-9.94%
Jun	187	149	- 38	-20.51%
Jul	164	188	24	14.58%
Aug	166	134	- 31	-18.98%
Sep	162	158	- 4	-2.52%
Oct	198	164	- 34	-16.97%
Nov	146	160	13	9.14%
Dec	171	162	- 9	-5.38%
Jan	152	156	3	2.21%
Feb	134	133	- 1	-0.59%
Mar	120	150	31	25.71%
Total	**1,943**	**1,859**	**- 83**	**-4.29%**

Green Waste Tonnes	2017/2018	2018/2019	Difference	
Apr	16	23	8	48.59%
May	32	38	6	18.28%
Jun	27	34	7	25.52%
Jul	25	23	- 3	-10.51%
Aug	26	26	- 1	-2.20%
Sep	32	35	3	10.93%
Oct	31	35	3	10.93%
Nov	49	54	5	10.93%
Dec	24	27	3	10.93%
Jan	95	105	10	10.93%
Feb	13	14	1	10.93%
Mar	16	18	2	10.93%
Total	**387**	**432**	**46**	**11.77%**

Wood Waste Tonnes	2017/2018	2018/2019	Difference	
Apr	-	-	-	0.00%
May	-	-	-	0.00%
Jun	-	-	-	0.00%
Jul	-	-	-	0.00%
Aug	-	1	1	0.00%
Sep	-	-	-	0.00%
Oct	1	1	- 0	-2.27%
Nov	-	-	-	0.00%
Dec	-	-	-	0.00%
Jan	-	-	-	0.00%
Feb	-	-	-	0.00%
Mar	1	1	- 0	-2.27%
Total	**1**	**2**	**1**	**112.82%**

Lambeth	After	5	months of	2018/2019	Printed	03/09/2018 14:45
	= Forecast Figures					

Tonnage	2017/2018 Outturn	2018/2019 Budget	2018/2019 Forecast	Difference to Budget Tonnes	Difference to Budget Percentage	2018/2019 £/Tonne	Budget 2018/2019 Cost £	Projected 2018/2019 Cost £	Projected 2018/2019 Variance £
Batteries	-	-	-	-		57.50	-	-	-
Clinical Waste	1	1	2	1	131.0%	552.00	552	1,275	723
Co-Mingled	19,902	20,142	19,754	- 388	-1.9%	27.00	543,834	533,356	- 10,478
Detritus Waste	610	556	983	427	76.8%	78.50	43,646	77,178	33,532
Electricals	172	125	80	- 45	-35.9%	51.00	6,375	4,084	- 2,291
Fridges	182	177	167	- 10	-5.7%	48.50	8,585	8,098	- 487
Gas Bottles	4	4	3	- 1	-34.6%	130.00	520	340	- 180
General Waste	89,451	89,819	87,960	- 1,859	-2.1%	147.50	13,248,303	12,974,138	- 274,165
Glass Mixed	-	-	-	-		36.50	-	-	-
Green Waste	298	380	662	282	74.3%	88.00	33,440	58,295	24,855
Inert Waste	-	-	-	-		30.00	-	-	-
Oil & Paint	-	-	-	-		124.50	-	-	-
Paper & Cardboard	484	552	445	- 107	-19.4%	- 13.00	- 7,176	- 5,787	1,389
Scrap Metals	115	120	67	- 53	-44.1%	7.50	900	503	- 397
Textiles & Carpets	-	-	-	-		- 180.00	-	-	-
Tyres	12	11	18	7	60.0%	280.50	3,086	4,936	1,851
Wood	245	238	242	4	1.7%	123.00	29,274	29,772	498
Grand Total	**111,477**	**112,125**	**110,384**	**- 1,741**	**-1.6%**	**Sub-Total**	**13,911,338**	**13,686,188**	**- 225,149**
Contamination	3,276	3,307	3,060	- 248	-7.5%	147.50	487,829	451,277	- 36,552
						Grand Total	**14,399,167**	**14,137,465**	**- 261,702**

Forecast Tonnes	2019/2020	2020/2021	2021/2022
Batteries	-	-	-
Clinical Waste	2	2	2
Co-Mingled	19,832	19,754	19,754
Detritus Waste	987	983	983
Electricals	80	80	80
Fridges	168	167	167
Gas Bottles	3	3	3
General Waste	88,308	87,960	87,960
Glass Mixed	-	-	-
Green Waste	665	662	662
Inert Waste	-	-	-
Oil & Paint	-	-	-
Paper & Cardboard	447	445	445
Scrap Metals	67	67	67
Textiles & Carpets	-	-	-
Tyres	18	18	18
Wood	243	242	242
Grand Total	**110,820**	**110,384**	**110,384**
Contamination	3,072	3,060	3,060

Co-Mingled Contamination	2014/2015	2015/2016	2016/2017	2017/2018	2018/2019
Apr	16.5%	13.2%	12.6%	16.5%	15.7%
May	14.7%	14.3%	13.8%	17.7%	12.2%
Jun	13.3%	15.0%	14.9%	11.5%	16.8%
Jul	13.7%	12.8%	11.9%	22.4%	16.2%
Aug	19.0%	11.4%	11.9%	18.9%	16.7%
Sep	13.2%	13.8%	13.4%	14.9%	15.5%
Oct	17.8%	11.5%	11.9%	13.1%	15.5%
Nov	20.6%	13.6%	15.3%	15.0%	15.5%
Dec	15.3%	16.8%	12.2%	17.8%	15.5%
Jan	14.7%	15.6%	16.3%	16.2%	15.5%
Feb	16.2%	16.3%	13.2%	15.9%	15.5%
Mar	14.7%	15.5%	18.6%	17.6%	15.5%
Average	15.7%	14.2%	13.9%	16.5%	15.5%
				Budget	16.4%

Working Days	2017/2018	2018/2019	2019/2020	2020/2021	2021/2022
Total	254	253	254	253	253
Diff from Year before		-1	1	-1	0
Change		-0.39%	0.40%	-0.39%	0.00%

General Waste Tonnes	2017/2018	2018/2019	Difference	
Apr	6,993	7,420	427	6.10%
May	7,905	7,998	93	1.18%
Jun	7,762	7,568	- 194	-2.50%
Jul	7,773	7,795	22	0.28%
Aug	7,909	7,418	- 491	-6.20%
Sep	7,375	7,180	- 194	-2.64%
Oct	7,893	7,684	- 208	-2.64%
Nov	7,629	7,428	- 201	-2.64%
Dec	7,307	7,114	- 193	-2.64%
Jan	7,575	7,375	- 200	-2.64%
Feb	6,294	6,128	- 166	-2.64%
Mar	7,037	6,851	- 186	-2.64%
Total	**89,451**	**87,960**	**- 1,491**	**-1.67%**

Co-Mingled Tonnes	2017/2018	2018/2019	Difference	
Apr	1,495	1,572	76	5.10%
May	1,735	1,742	7	0.40%
Jun	1,752	1,629	- 123	-7.02%
Jul	1,656	1,750	94	5.66%
Aug	1,638	1,633	- 5	-0.31%
Sep	1,609	1,582	- 27	-1.70%
Oct	1,646	1,618	- 28	-1.70%
Nov	1,679	1,650	- 28	-1.70%
Dec	1,722	1,693	- 29	-1.70%
Jan	1,857	1,825	- 31	-1.70%
Feb	1,472	1,447	- 25	-1.70%
Mar	1,643	1,615	- 28	-1.70%
Total	**19,902**	**19,754**	**- 148**	**-0.74%**

Detritus Waste Tonnes	2017/2018	2018/2019	Difference	
Apr	36	71	36	99.38%
May	54	86	32	58.77%
Jun	47	63	17	35.81%
Jul	36	72	36	99.72%
Aug	39	54	15	37.69%
Sep	41	66	25	59.96%
Oct	37	59	22	59.96%
Nov	60	96	36	59.96%
Dec	75	120	45	59.96%
Jan	71	114	43	59.96%
Feb	60	95	36	59.96%
Mar	54	87	32	59.96%
Total	**610**	**983**	**373**	**61.25%**

Co-mingled Contamination Tonnes	2017/2018	2018/2019	Difference	
Apr	247	243	- 4	-1.58%
May	307	270	- 37	-12.10%
Jun	201	252	51	25.33%
Jul	372	271	- 101	-27.07%
Aug	309	253	- 57	-18.30%
Sep	240	245	5	2.12%
Oct	216	251	34	15.96%
Nov	252	256	3	1.37%
Dec	307	262	- 45	-14.61%
Jan	300	283	- 17	-5.78%
Feb	234	224	- 10	-4.36%
Mar	290	250	- 40	-13.64%
Total	**3,276**	**3,060**	**- 216**	**-6.60%**

Green Waste Tonnes	2017/2018	2018/2019	Difference	
Apr	-	2	2	0.00%
May	7	7	0	3.80%
Jun	11	18	8	71.43%
Jul	6	22	16	260.40%
Aug	9	26	17	176.55%
Sep	29	65	36	121.52%
Oct	64	141	77	121.52%
Nov	102	225	123	121.52%
Dec	29	63	35	121.52%
Jan	24	54	30	121.52%
Feb	14	32	17	121.52%
Mar	4	8	4	121.52%
Total	**298**	**662**	**364**	**122.09%**

Wood Waste Tonnes	2017/2018	2018/2019	Difference	
Apr	30	23	- 6	-21.52%
May	23	27	4	15.34%
Jun	22	16	- 6	-27.07%
Jul	21	25	4	20.45%
Aug	18	23	5	25.03%
Sep	18	18	- 0	-2.17%
Oct	22	22	- 0	-2.17%
Nov	21	21	- 0	-2.17%
Dec	21	21	- 0	-2.17%
Jan	17	17	- 0	-2.17%
Feb	14	14	- 0	-2.17%
Mar	17	17	- 0	-2.17%
Total	**245**	**242**	**- 3**	**-1.11%**

Wandsworth	After	5	months of	2018/2019	Printed	03/09/2018 14:45
	= Forecast Figures					

Tonnage	2017/2018 Outturn	2018/2019 Budget	2018/2019 Forecast	Difference to Budget Tonnes	Difference to Budget Percentage	2018/2019 £/Tonne	Budget 2018/2019 Cost £	Projected 2018/2019 Cost £	Projected 2018/2019 Variance £
Batteries	-	-	-	-		57.50	-	-	-
Clinical Waste	65	63	70	7	10.8%	552.00	34,776	38,542	3,766
Co-Mingled	19,900	19,964	20,104	140	0.7%	27.00	539,028	542,796	3,768
Detritus Waste	2,539	2,409	3,633	1,224	50.8%	78.50	189,107	285,219	96,112
Electricals	10	10	3	- 7	-72.6%	51.00	510	140	- 370
Fridges	100	105	91	- 14	-13.1%	48.50	5,093	4,427	- 666
Gas Bottles	2	2	1	- 1	-69.6%	130.00	260	79	- 181
General Waste	77,251	77,371	76,305	- 1,066	-1.4%	147.50	11,412,223	11,254,925	- 157,297
Glass Mixed	-	-	-	-		36.50	-	-	-
Green Waste	503	572	285	- 287	-50.2%	88.00	50,336	25,052	- 25,284
Inert Waste	23	23	0	- 23	-98.8%	30.00	690	8	- 682
Oil & Paint	-	-	-	-		124.50	-	-	-
Paper & Cardboard	-	-	-	-		- 13.00	-	-	-
Scrap Metals	2	1	-	- 1	-100.0%	7.50	8	-	- 8
Textiles & Carpets	-	-	-	-		- 180.00	-	-	-
Tyres	1	2	1	- 1	-48.0%	280.50	561	292	- 269
Wood	-	-	-	-		123.00	-	-	-
Grand Total	100,395	100,522	100,492	- 30	0.0%	Sub-Total	12,232,590	12,151,480	- 81,110
Contamination	2,946	2,959	2,843	- 116	-3.9%	147.50	436,403	419,286	- 17,117
						Grand Total	12,668,993	12,570,766	- 98,227

Forecast Tonnes	2019/2020	2020/2021	2021/2022
Batteries	-	-	-
Clinical Waste	70	70	70
Co-Mingled	20,183	20,104	20,104
Detritus Waste	3,648	3,633	3,633
Electricals	3	3	3
Fridges	92	91	91
Gas Bottles	1	1	1
General Waste	76,606	76,305	76,305
Glass Mixed	-	-	-
Green Waste	286	285	285
Inert Waste	0	0	0
Oil & Paint	-	-	-
Paper & Cardboard	-	-	-
Scrap Metals	-	-	-
Textiles & Carpets	-	-	-
Tyres	1	1	1
Wood	-	-	-
Grand Total	100,889	100,492	100,492
Contamination	2,854	2,843	2,843

Co-Mingled Contamination	2014/2015	2015/2016	2016/2017	2017/2018	2018/2019
Apr	12.5%	11.2%	13.2%	15.6%	14.1%
May	15.9%	10.8%	12.7%	11.9%	12.8%
Jun	14.1%	13.6%	17.9%	15.4%	14.1%
Jul	9.8%	12.1%	16.4%	16.2%	15.1%
Aug	13.7%	14.1%	16.1%	16.8%	14.8%
Sep	10.7%	12.5%	14.3%	11.3%	14.1%
Oct	18.5%	12.5%	14.3%	15.4%	14.1%
Nov	17.1%	12.2%	12.2%	16.0%	14.1%
Dec	15.6%	18.0%	13.3%	14.9%	14.1%
Jan	14.0%	17.4%	16.3%	14.4%	14.1%
Feb	12.6%	17.2%	16.1%	12.2%	14.1%
Mar	16.2%	19.0%	13.9%	17.5%	14.1%
Average	14.2%	14.3%	14.7%	14.8%	14.1%
				Budget	14.8%

Working Days	2017/2018	2018/2019	2019/2020	2020/2021	2021/2022
Total	254	253	254	253	253
Diff from Year before		-1	1	-1	0
Change		-0.39%	0.40%	-0.39%	0.00%

General Waste Tonnes	2017/2018	2018/2019	Difference	
Apr	5,907	6,373	466	7.88%
May	7,006	7,097	91	1.30%
Jun	6,843	6,391	- 452	-6.61%
Jul	6,556	6,685	129	1.97%
Aug	6,630	6,422	- 208	-3.13%
Sep	6,408	6,268	- 141	-2.20%
Oct	6,732	6,584	- 148	-2.20%
Nov	6,577	6,433	- 144	-2.20%
Dec	6,191	6,055	- 136	-2.20%
Jan	6,627	6,481	- 146	-2.20%
Feb	5,521	5,400	- 121	-2.20%
Mar	6,253	6,116	- 137	-2.20%
Total	77,251	76,305	- 947	-1.23%

Co-Mingled Tonnes	2017/2018	2018/2019	Difference	
Apr	1,459	1,587	127	8.72%
May	1,707	1,819	111	6.53%
Jun	1,761	1,694	- 68	-3.86%
Jul	1,646	1,754	108	6.55%
Aug	1,609	1,526	- 83	-5.13%
Sep	1,622	1,623	1	0.07%
Oct	1,628	1,629	1	0.07%
Nov	1,737	1,738	1	0.07%
Dec	1,776	1,777	1	0.07%
Jan	1,937	1,938	1	0.07%
Feb	1,464	1,465	1	0.07%
Mar	1,553	1,554	1	0.07%
Total	19,900	20,104	204	1.03%

Detritus Waste Tonnes	2017/2018	2018/2019	Difference	
Apr	170	235	65	38.24%
May	194	273	79	40.99%
Jun	175	231	56	32.20%
Jul	183	284	101	55.03%
Aug	165	265	100	60.53%
Sep	190	270	80	41.97%
Oct	263	374	111	41.97%
Nov	336	477	141	41.97%
Dec	244	346	102	41.97%
Jan	242	344	102	41.97%
Feb	167	238	70	41.97%
Mar	209	296	88	41.97%
Total	2,539	3,633	1,095	43.12%

Co-mingled Contamination Tonnes	2017/2018	2018/2019	Difference	
Apr	227	224	- 3	-1.20%
May	203	257	54	26.47%
Jun	272	239	- 33	-11.95%
Jul	267	248	- 19	-7.11%
Aug	270	216	- 54	-19.97%
Sep	183	229	46	25.33%
Oct	251	230	- 21	-8.24%
Nov	277	246	- 32	-11.40%
Dec	264	251	- 13	-4.91%
Jan	280	274	- 6	-2.01%
Feb	179	207	28	15.69%
Mar	272	220	- 52	-19.24%
Total	2,946	2,843	- 103	-3.50%

Green Waste Tonnes	2017/2018	2018/2019	Difference	
Apr	14	15	1	7.95%
May	32	14	- 19	-57.72%
Jun	26	12	- 14	-55.11%
Jul	22	14	- 8	-37.78%
Aug	19	11	- 8	-41.60%
Sep	23	13	- 10	-43.67%
Oct	26	15	- 11	-43.67%
Nov	40	23	- 18	-43.67%
Dec	62	35	- 27	-43.67%
Jan	205	115	- 89	-43.67%
Feb	23	13	- 10	-43.67%
Mar	12	7	- 5	-43.67%
Total	503	285	- 218	-43.37%

Wood Waste Tonnes	2017/2018	2018/2019	Difference	
Apr	-	-	-	0.00%
May	-	-	-	0.00%
Jun	-	-	-	0.00%
Jul	-	-	-	0.00%
Aug	-	-	-	0.00%
Sep	-	-	-	0.00%
Oct	-	-	-	0.00%
Nov	-	-	-	0.00%
Dec	-	-	-	0.00%
Jan	-	-	-	0.00%
Feb	-	-	-	0.00%
Mar	-	-	-	0.00%
Total	-	-	-	0.00%

Household Waste & Recycling Centre & Charity	After	5	months of	2018/2019	Printed 03/09/2018 14:45
	= Forecast Figures				

Tonnage	2017/2018 Outturn	2018/2019 Budget	2018/2019 Forecast	Difference to Budget Tonnes	Difference to Budget Percentage	2018/2019 £/Tonne	Budget 2018/2019 Cost £	Projected 2018/2019 Cost £	Projected 2018/2019 Variance £
Batteries	22	26	7	- 19	-75%	57.50	1,495	374	- 1,121
Clinical Waste	-	-	-	-		552.00	-	-	-
Co-Mingled	437	393	750	357	90.8%	27.00	10,611	20,243	9,632
Detritus Waste	-	-	-	-		78.50	-	-	-
Electricals	738	729	736	7	0.9%	51.00	37,179	37,529	350
Fridges	65	75	57	- 18	-24.2%	48.50	3,638	2,755	- 882
Gas Bottles	19	19	-	- 19	-100.0%	130.00	2,470	-	- 2,470
General Waste	10,749	11,267	9,078	- 2,189	-19.4%	147.50	1,661,883	1,339,077	- 322,805
Glass Mixed	-	-	-	-		36.50	-	-	-
Green Waste	3,065	3,209	3,018	- 191	-5.9%	88.00	282,392	265,602	- 16,790
Inert Waste	1,212	1,075	1,585	510	47.4%	30.00	32,250	47,537	15,287
Oil & Paint	15	16	16	0	0.9%	124.50	1,992	2,010	18
Paper & Cardboard	827	886	653	- 233	-26.3%	- 13.00	- 11,518	- 8,490	3,028
Scrap Metals	687	707	707	0	0.0%	7.50	5,303	5,303	0
Textiles & Carpets	205	200	393	193	96.7%	- 180.00	- 36,000	- 70,802	- 34,802
Tyres	-	-	0	0		280.50	-	17	17
Wood	3,165	3,231	3,064	- 167	-5.2%	123.00	397,413	376,848	- 20,565
Grand Total	**21,208**	**21,833**	**20,064**	**- 1,769**	**-8.1%**	**Sub-Total**	**2,389,107**	**2,018,004**	**- 371,103**
Contamination	64	58	106	48	82.4%	147.50	8,573	15,637	7,064
						Grand Total	**2,397,680**	**2,033,641**	**- 364,039**

Forecast Tonnes	2019/2020	2020/2021	2021/2022
Batteries	7	7	7
Clinical Waste	-	-	-
Co-Mingled	753	750	750
Detritus Waste	-	-	-
Electricals	739	736	736
Fridges	57	57	57
Gas Bottles	-	-	-
General Waste	9,114	9,078	9,078
Glass Mixed	-	-	-
Green Waste	3,030	3,018	3,018
Inert Waste	1,591	1,585	1,585
Oil & Paint	16	16	16
Paper & Cardboard	656	653	653
Scrap Metals	710	707	707
Textiles & Carpets	395	393	393
Tyres	0	0	0
Wood	3,076	3,064	3,064
Grand Total	**20,143**	**20,064**	**20,064**
Contamination	106	106	106

Co-Mingled Contamination	2014/2015	2015/2016	2016/2017	2017/2018	2018/2019
Apr	14.8%	12.6%	12.6%	15.0%	14.0%
May	15.6%	13.8%	12.6%	14.3%	12.2%
Jun	14.7%	13.2%	14.8%	13.2%	13.9%
Jul	12.8%	13.3%	12.9%	16.6%	15.1%
Aug	16.2%	12.7%	13.2%	16.9%	14.8%
Sep	13.1%	13.8%	13.5%	12.5%	14.1%
Oct	17.0%	13.1%	12.9%	14.3%	14.1%
Nov	17.5%	13.2%	13.7%	14.0%	14.1%
Dec	15.3%	16.5%	13.4%	15.4%	14.1%
Jan	15.2%	16.1%	15.1%	14.5%	14.1%
Feb	14.0%	16.1%	14.3%	13.4%	14.1%
Mar	14.9%	16.0%	14.8%	14.6%	14.1%
Average	15.0%	14.2%	13.6%	14.6%	14.1%
				Budget	14.8%

Working Days	2017/2018	2018/2019	2019/2020	2020/2021	2021/2022
Total	254	253	254	253	253
Diff from Year before		-1	1	-1	0
Change		-0.39%	0.40%	-0.39%	0.00%

General Waste Tonnes	2017/2018	2018/2019	Difference	
Apr	1,196	975	- 221	-18.45%
May	1,141	1,029	- 112	-9.85%
Jun	1,007	949	- 57	-5.70%
Jul	1,100	891	- 209	-19.01%
Aug	1,078	871	- 206	-19.16%
Sep	913	762	- 151	-16.54%
Oct	865	722	- 143	-16.54%
Nov	706	589	- 117	-16.54%
Dec	728	608	- 120	-16.54%
Jan	698	582	- 115	-16.54%
Feb	638	532	- 106	-16.54%
Mar	681	568	- 113	-16.54%
Total	**10,749**	**9,078**	**- 1,671**	**-15.54%**

Co-Mingled Tonnes	2017/2018	2018/2019	Difference	
Apr	30	46	17	56.76%
May	29	39	9	31.42%
Jun	23	49	26	111.07%
Jul	33	63	30	93.60%
Aug	32	59	27	82.16%
Sep	30	52	21	70.07%
Oct	34	58	24	70.07%
Nov	41	70	29	70.07%
Dec	57	98	40	70.07%
Jan	38	65	27	70.07%
Feb	52	89	37	70.07%
Mar	37	63	26	70.07%
Total	**437**	**750**	**312**	**71.40%**

Detritus Waste Tonnes	2017/2018	2018/2019	Difference	
Apr	-	-	-	0.00%
May	-	-	-	0.00%
Jun	-	-	-	0.00%
Jul	-	-	-	0.00%
Aug	-	-	-	0.00%
Sep	-	-	-	0.00%
Oct	-	-	-	0.00%
Nov	-	-	-	0.00%
Dec	-	-	-	0.00%
Jan	-	-	-	0.00%
Feb	-	-	-	0.00%
Mar	-	-	-	0.00%
Total	**-**	**-**	**-**	**0.00%**

Co-mingled Contamination Tonnes	2017/2018	2018/2019	Difference	
Apr	4	6	2	46.36%
May	4	5	1	12.20%
Jun	3	7	4	121.87%
Jul	5	9	4	76.07%
Aug	5	9	3	59.00%
Sep	4	7	4	91.98%
Oct	5	8	3	67.70%
Nov	6	10	4	71.73%
Dec	9	14	5	55.72%
Jan	6	9	4	65.38%
Feb	7	13	6	78.81%
Mar	5	9	3	64.77%
Total	**64**	**106**	**42**	**66.07%**

Green Waste Tonnes	2017/2018	2018/2019	Difference	
Apr	385	309	- 76	-19.75%
May	407	497	90	21.97%
Jun	366	429	63	17.34%
Jul	311	276	- 35	-11.31%
Aug	359	306	- 53	-14.78%
Sep	281	273	- 8	-2.88%
Oct	284	276	- 8	-2.88%
Nov	198	192	- 6	-2.88%
Dec	118	115	- 3	-2.88%
Jan	116	112	- 3	-2.88%
Feb	112	109	- 3	-2.88%
Mar	129	126	- 4	-2.88%
Total	**3,065**	**3,018**	**- 47**	**-1.53%**

Wood Waste Tonnes	2017/2018	2018/2019	Difference	
Apr	348	304	- 44	-12.71%
May	300	312	12	4.04%
Jun	290	301	11	3.91%
Jul	306	309	3	0.95%
Aug	280	267	- 13	-4.71%
Sep	252	241	- 11	-4.26%
Oct	270	258	- 11	-4.26%
Nov	223	214	- 10	-4.26%
Dec	209	200	- 9	-4.26%
Jan	228	218	- 10	-4.26%
Feb	220	211	- 9	-4.26%
Mar	238	228	- 10	-4.26%
Total	**3,165**	**3,064**	**- 101**	**-3.19%**

Western Riverside Waste Authority	After	5	months of	2018/2019	Printed	03/09/2018 14:45
	= Forecast Figures					

Tonnage	2017/2018 Outturn	2018/2019 Budget	2018/2019 Forecast	Difference to Budget Tonnes	Difference to Budget Percentage	2018/2019 £/Tonne	Budget 2018/2019 Cost £	Projected 2018/2019 Cost £	Projected 2018/2019 Variance £
Batteries	23	27	7	-20	-76%	57.50	1,553	374	-1,178
Clinical Waste	95	93	95	2	2.6%	552.00	51,336	52,649	1,313
Co-Mingled	67,433	67,738	67,599	-139	-0.2%	27.00	1,828,926	1,825,183	-3,743
Detritus Waste	4,381	4,134	5,763	1,629	39.4%	78.50	324,519	452,381	127,862
Electricals	962	906	876	-30	-3.3%	51.00	46,206	44,699	-1,507
Fridges	502	527	460	-67	-12.7%	48.50	25,560	22,310	-3,249
Gas Bottles	28	28	5	-23	-83.8%	130.00	3,640	590	-3,050
General Waste	295,659	297,183	289,475	-7,708	-2.6%	147.50	43,834,493	42,697,537	-1,136,956
Glass Mixed	-	-	-	-		36.50	-	-	-
Green Waste	4,368	4,791	4,536	-255	-5.3%	88.00	421,608	399,197	-22,411
Inert Waste	1,235	1,098	1,585	487	44.3%	30.00	32,940	47,545	14,605
Oil & Paint	15	16	16	0	1.8%	124.50	1,992	2,027	35
Paper & Cardboard	1,311	1,438	1,098	-340	-23.6%	-13.00	-18,694	-14,276	4,418
Scrap Metals	818	845	782	-63	-7.5%	7.50	6,338	5,861	-476
Textiles & Carpets	205	200	393	193	96.7%	-180.00	-36,000	-70,802	-34,802
Tyres	13	13	19	6	46.4%	280.50	3,647	5,339	1,693
Wood	3,411	3,470	3,308	-162	-4.7%	123.00	426,810	406,898	-19,912
Grand Total	**380,462**	**382,507**	**376,018**	**-6,489**	**-1.7%**	**Sub-Total**	**46,954,872**	**45,877,511**	**-1,077,361**
Contamination	9,821	9,946	9,431	-515	-5.2%	147.50	1,467,017	1,391,113	-75,904
						Grand Total	**48,421,888**	**47,268,624**	**-1,153,264**

Forecast Tonnes	2019/2020	2020/2021	2021/2022
Batteries	7	7	7
Clinical Waste	96	95	95
Co-Mingled	67,867	67,599	67,599
Detritus Waste	5,786	5,763	5,763
Electricals	880	876	876
Fridges	462	460	460
Gas Bottles	5	5	5
General Waste	290,619	289,475	289,475
Glass Mixed	-	-	-
Green Waste	4,554	4,536	4,536
Inert Waste	1,591	1,585	1,585
Oil & Paint	16	16	16
Paper & Cardboard	1,103	1,098	1,098
Scrap Metals	785	782	782
Textiles & Carpets	395	393	393
Tyres	19	19	19
Wood	3,321	3,308	3,308
Grand Total	**377,504**	**376,018**	**376,018**
Contamination	9,469	9,431	9,431

Co-Mingled Contamination	2014/2015	2015/2016	2016/2017	2017/2018	2018/2019
Apr	14.8%	12.6%	12.6%	15.0%	14.0%
May	15.6%	13.8%	12.6%	14.3%	12.2%
Jun	14.7%	13.2%	14.8%	13.2%	13.9%
Jul	12.8%	13.3%	12.9%	16.6%	15.1%
Aug	16.2%	12.7%	13.2%	16.9%	14.8%
Sep	13.1%	13.8%	13.5%	12.5%	14.1%
Oct	17.0%	13.1%	12.9%	14.3%	14.1%
Nov	17.5%	13.2%	13.7%	14.0%	14.1%
Dec	15.3%	16.5%	13.4%	15.4%	14.1%
Jan	15.2%	16.1%	15.1%	14.5%	14.1%
Feb	14.0%	16.1%	14.3%	13.4%	14.1%
Mar	14.9%	16.0%	14.8%	14.6%	14.1%
Average	15.0%	14.2%	13.6%	14.6%	14.1%
				Budget	14.8%

Working Days	2017/2018	2018/2019	2019/2020	2020/2021	2021/2022
Total	254	253	254	253	253
Diff from Year before		-1	1	-1	0
Change		-0.39%	0.40%	-0.39%	0.00%

General Waste Tonnes	2017/2018	2018/2019	Difference	
Apr	23,094	24,372	1,277	5.53%
May	26,527	26,665	137	0.52%
Jun	26,148	24,846	-1,302	-4.98%
Jul	25,637	25,675	39	0.15%
Aug	25,526	24,220	-1,305	-5.11%
Sep	24,570	23,816	-754	-3.07%
Oct	25,979	25,196	-783	-3.01%
Nov	25,274	24,530	-743	-2.94%
Dec	23,938	23,226	-713	-2.98%
Jan	24,742	24,014	-727	-2.94%
Feb	20,718	20,102	-616	-2.97%
Mar	23,507	22,812	-695	-2.96%
Total	**295,660**	**289,475**	**-6,185**	**-2.09%**

Co-Mingled Tonnes	2017/2018	2018/2019	Difference	
Apr	5,030	5,371	341	6.79%
May	5,890	5,976	85	1.45%
Jun	5,922	5,674	-248	-4.19%
Jul	5,624	5,964	340	6.04%
Aug	5,314	5,217	-97	-1.83%
Sep	5,561	5,518	-43	-0.78%
Oct	5,696	5,653	-43	-0.76%
Nov	5,812	5,773	-38	-0.66%
Dec	5,950	5,922	-28	-0.47%
Jan	6,164	6,121	-43	-0.69%
Feb	4,950	4,929	-20	-0.41%
Mar	5,522	5,482	-40	-0.72%
Total	**67,433**	**67,599**	**166**	**0.25%**

Detritus Waste Tonnes	2017/2018	2018/2019	Difference	
Apr	283	420	137	48.44%
May	351	470	119	33.94%
Jun	326	388	62	18.86%
Jul	337	435	99	29.38%
Aug	320	410	90	28.05%
Sep	337	433	96	28.54%
Oct	400	525	125	31.20%
Nov	511	679	168	32.90%
Dec	406	547	141	34.71%
Jan	433	569	135	31.16%
Feb	316	415	99	31.32%
Mar	361	473	112	31.11%
Total	**4,380**	**5,763**	**1,382**	**31.56%**

Co-mingled Contamination Tonnes	2017/2018	2018/2019	Difference	
Apr	753	750	-2	-0.30%
May	841	728	-113	-13.39%
Jun	781	786	6	0.71%
Jul	932	899	-33	-3.56%
Aug	900	772	-129	-14.31%
Sep	697	768	71	10.26%
Oct	817	786	-30	-3.73%
Nov	814	805	-9	-1.12%
Dec	919	826	-93	-10.12%
Jan	896	857	-39	-4.38%
Feb	666	688	23	3.39%
Mar	806	765	-41	-5.08%
Total	**9,821**	**9,431**	**-390**	**-3.97%**

Green Waste Tonnes	2017/2018	2018/2019	Difference	
Apr	415	358	-56	-13.56%
May	479	562	83	17.37%
Jun	429	493	65	15.08%
Jul	364	337	-27	-7.38%
Aug	414	375	-39	-9.39%
Sep	367	388	21	5.67%
Oct	407	468	61	15.00%
Nov	397	502	105	26.56%
Dec	234	241	7	2.98%
Jan	530	475	-55	-10.33%
Feb	166	171	6	3.40%
Mar	169	166	-3	-1.66%
Total	**4,368**	**4,536**	**168**	**3.85%**

Wood Waste Tonnes	2017/2018	2018/2019	Difference	
Apr	378	327	-51	-13.40%
May	323	339	16	4.85%
Jun	312	317	5	1.73%
Jul	327	335	7	2.21%
Aug	299	291	-7	-2.47%
Sep	270	259	-11	-4.12%
Oct	292	280	-12	-4.10%
Nov	244	234	-10	-4.08%
Dec	230	221	-9	-4.07%
Jan	245	235	-10	-4.12%
Feb	235	225	-10	-4.14%
Mar	256	245	-11	-4.12%
Total	**3,411**	**3,308**	**-103**	**-3.01%**

After 5 months of 2018/2019

General Waste Delivered (Tonnes)

	2014/2015	2015/2016	2016/2017	2017/2018	TO DATE 2018/2019	FORECAST 2018/2019	Annual Change Tonnes	Annual Change Percent	2018/2019 Budget Tonnes	Budget Change Tonnes	Budget Change Percent
HF	61,279	61,562	60,602	58,478	24,761	57,036	-1,443	-2.47%	58,842	-1,806	-3.07%
KC	60,789	61,110	60,292	59,730	25,135	59,096	-634	-1.06%	59,884	-788	-1.32%
LA	94,025	93,483	92,784	89,451	38,199	87,960	-1,491	-1.67%	89,819	-1,859	-2.07%
WA	77,825	79,542	79,034	77,251	32,968	76,305	-947	-1.23%	77,371	-1,066	-1.38%
WRWA	12,908	12,355	11,792	10,749	4,715	9,078	-1,671	-15.54%	11,267	-2,189	-19.42%
Total	306,826	308,051	304,504	295,660	125,778	289,475	-6,185	-2.09%	297,183	-7,708	-2.59%
Change		1,224	-3,547	-8,844		-6,185					
Percentage Change		0.40%	-1.15%	-2.90%		-2.09%					

Co-Mingled Waste Delivered (Tonnes)

	2014/2015	2015/2016	2016/2017	2017/2018	TO DATE 2018/2019	FORECAST 2018/2019	Annual Change Tonnes	Annual Change Percent	2018/2019 Budget Tonnes	Budget Change Tonnes	Budget Change Percent
HF	11,811	11,463	11,520	11,305	4,638	11,155	-150	-1.33%	11,279	-124	-1.10%
KC	16,997	16,711	16,307	15,889	6,604	15,837	-52	-0.33%	15,960	-123	-0.77%
LA	18,759	18,379	18,388	19,902	8,324	19,754	-148	-0.74%	20,142	-388	-1.93%
WA	19,583	19,699	20,180	19,900	8,379	20,104	204	1.03%	19,964	140	0.70%
WRWA	442	379	339	437	256	750	312	71.40%	393	357	90.77%
Total	67,593	66,630	66,733	67,433	28,201	67,599	166	0.25%	67,738	-139	-0.20%
Change		-962	103	700		166					
Percentage Change		-1.42%	0.15%	1.05%		0.25%					

Co-Mingled Contamination (Percentage)

	2014/2015	2015/2016	2016/2017	2017/2018	TO DATE 2018/2019	FORECAST 2018/2019	Change in Percentage Point
HF	15.84%	14.41%	14.02%	14.09%	14.02%	14.02%	-0.08%
KC	14.76%	14.10%	11.86%	12.23%	11.74%	11.74%	-0.49%
LA	15.75%	14.17%	13.90%	16.46%	15.49%	15.49%	-0.97%
WA	14.24%	14.29%	14.73%	14.80%	14.14%	14.14%	-0.66%
WRWA	15.02%	14.24%	13.64%	14.59%	14.14%	14.14%	-0.45%

Co-Mingled Contamination (Tonnes)

	2014/2015	2015/2016	2016/2017	2017/2018	TO DATE 2018/2019	FORECAST 2018/2019	Annual Change Tonnes	Annual Change Percent	2017/2018 Budget Percentage	2018/2019 Budget Tonnes	Budget Change Tonnes	Budget Change Percent
HF	1,871	1,652	1,616	1,593	650	1,564	-29	-1.85%	14.1%	1,595	-31	-1.94%
KC	2,510	2,357	1,934	1,943	775	1,859	-83	-4.29%	12.7%	2,027	-168	-8.27%
LA	2,954	2,604	2,556	3,276	1,289	3,060	-216	-6.60%	16.4%	3,307	-248	-7.49%
WA	2,788	2,816	2,973	2,946	1,185	2,843	-103	-3.50%	14.8%	2,959	-116	-3.92%
WRWA	66	54	46	64	36	106	42	66.07%	14.8%	58	48	82.39%
Total	10,189	9,482	9,124	9,821	3,936	9,431	-390	-3.97%	14.7%	9,946	-515	-5.17%
Change		-707	-358	697		-390						
Percentage Change		-6.93%	-3.78%	7.64%		-3.97%						

Green Waste Delivered (Tonnes)

	2014/2015	2015/2016	2016/2017	2017/2018	TO DATE 2018/2019	FORECAST 2018/2019	Annual Change Tonnes	Annual Change Percent	2018/2019 Budget Tonnes	Budget Change Tonnes	Budget Change Percent
HF	97	75	114	115	27	139	23	20.35%	207	-68	-32.95%
KC	634	494	359	387	143	432	46	11.77%	423	9	2.18%
LA	638	323	241	298	75	662	364	122.09%	380	282	74.33%
WA	506	483	552	503	65	285	-218	-43.37%	572	-287	-50.23%
WRWA	2,908	2,749	3,217	3,065	1,816	3,018	-47	-1.53%	3,209	-191	-5.95%
Total	4,784	4,124	4,483	4,368	2,125	4,536	168	3.85%	4,791	-255	-5.32%
Change		-660	359	-115		168					
Percentage Change		-13.80%	8.72%	-2.57%		3.85%					

Appendix A

Clinical Waste Delivered (Tonnes)

	2014/2015	2015/2016	2016/2017	2017/2018	TO DATE 2018/2019	FORECAST 2018/2019	Annual Change Tonnes	Annual Change Percent	2018/2019 Budget Tonnes	Budget Change Tonnes	Budget Change Percent
HF	39	34	30	27	10	22	- 5	-19.21%	27	- 5	-18.07%
KC	2	4	3	2	1	1	- 1	-48.87%	2	- 1	-43.75%
LA	2	2	2	1	1	2	1	62.68%	1	1	131.00%
WA	53	58	60	65	28	70	5	8.02%	63	7	10.83%
WRWA	-	-	-	-	-	-	-	0.00%	-	-	0.00%
Total	96	98	95	96	39	95	- 0	-0.27%	93	2	2.56%
Change		1	- 3	1		- 0					
Percentage Change		1.52%	-2.74%	0.57%		-0.27%					

Detritus Waste Delivered (Tonnes)

	2014/2015	2015/2016	2016/2017	2017/2018	TO DATE 2018/2019	FORECAST 2018/2019	Annual Change Tonnes	Annual Change Percent	2018/2019 Budget Tonnes	Budget Change Tonnes	Budget Change Percent
HF	576	951	813	733	293	695	- 38	-5.22%	695	0	0.01%
KC	624	650	536	499	196	451	- 47	-9.51%	474	- 23	-4.80%
LA	593	678	587	610	346	983	373	61.25%	556	427	76.83%
WA	2,683	2,609	2,482	2,539	1,288	3,633	1,095	43.12%	2,409	1,224	50.82%
WRWA	-	-	-	-	-	-	-	0.00%	-	-	0.00%
Total	4,476	4,888	4,418	4,380	2,122	5,763	1,382	31.56%	4,134	1,629	39.40%
Change		413	- 470	- 38		1,382					
Percentage Change		9.22%	-9.62%	-0.85%		31.56%					

Battery Waste Delivered (Tonnes)

	2014/2015	2015/2016	2016/2017	2017/2018	TO DATE 2018/2019	FORECAST 2018/2019	Annual Change Tonnes	Annual Change Percent	2018/2019 Budget Tonnes	Budget Change Tonnes	Budget Change Percent
HF	1	2	1	1	-	-	- 1	-100.00%	1	- 1	-100.00%
KC	-	-	-	-	-	-	-	0.00%	-	-	0.00%
LA	-	-	-	-	-	-	-	0.00%	-	-	0.00%
WA	-	-	0	-	-	-	-	0.00%	-	-	0.00%
WRWA	23	28	25	22	3	7	- 16	-70.44%	26	- 19	-74.97%
Total	23	30	25	23	3	7	- 16	-71.70%	27	- 20	-75.89%
Change		7	- 5	- 2		- 16					
Percentage Change		29.09%	-15.60%	-9.16%		-71.70%					

Electrical Waste Delivered (Tonnes)

	2014/2015	2015/2016	2016/2017	2017/2018	TO DATE 2018/2019	FORECAST 2018/2019	Annual Change Tonnes	Annual Change Percent	2018/2019 Budget Tonnes	Budget Change Tonnes	Budget Change Percent
HF	26	45	44	15	4	7	- 9	-56.80%	17	- 10	-61.17%
KC	10	37	49	27	18	51	24	86.73%	25	26	104.65%
LA	200	196	194	172	37	80	- 92	-53.54%	125	- 45	-35.94%
WA	1	3	3	10	1	3	- 8	-73.66%	10	- 7	-72.56%
WRWA	834	858	806	738	321	736	- 2	-0.32%	729	7	0.94%
Total	1,071	1,139	1,095	964	383	876	- 87	-9.05%	906	- 30	-3.26%
Change		67	- 44	- 131		- 87					
Percentage Change		6.30%	-3.89%	-11.96%		-9.05%					

Fridge Waste Delivered (Tonnes)

	2014/2015	2015/2016	2016/2017	2017/2018	TO DATE 2018/2019	FORECAST 2018/2019	Annual Change Tonnes	Annual Change Percent	2018/2019 Budget Tonnes	Budget Change Tonnes	Budget Change Percent
HF	80	93	101	94	39	84	- 11	-11.18%	101	- 17	-17.02%
KC	51	60	64	61	28	61	0	0.56%	69	- 8	-11.39%
LA	193	207	212	182	78	167	- 15	-8.48%	177	- 10	-5.67%
WA	110	128	123	100	44	91	- 9	-9.14%	105	- 14	-13.07%
WRWA	66	59	86	65	30	57	- 8	-12.92%	75	- 18	-24.25%
Total	500	548	587	503	219	460	- 43	-8.60%	527	- 67	-12.71%
Change		48	39	- 83		- 43					
Percentage Change		9.57%	7.12%	-14.19%		-8.60%					

Gas Bottle Waste Delivered (Tonnes)

							Annual		2018/2019	Budget	
					TO DATE	FORECAST	Change	Change	Budget	Change	Change
	2014/2015	2015/2016	2016/2017	2017/2018	2018/2019	2018/2019	Tonnes	Percent	Tonnes	Tonnes	Percent
HF	1	1	1	2	0	1	- 1	-66.38%	2	- 1	-68.73%
KC	1	1	0	1	1	1	0	14.55%	1	- 0	-31.27%
LA	4	4	2	4	1	3	- 2	-36.84%	4	- 1	-34.63%
WA	1	3	1	2	0	1	- 1	-65.84%	2	- 1	-69.60%
WRWA	-	-	-	19	-	-	- 19	-100.00%	19	- 19	-100.00%
Total	6	9	5	27	3	5	- 23	-83.33%	28	- 23	-83.80%
Change		3	- 5	22		- 23					
Percentage Change		47.04%	-48.73%	461.98%		-83.33%					

Mixed Glass Waste Delivered (Tonnes)

							Annual		2018/2019	Budget	
					TO DATE	FORECAST	Change	Change	Budget	Change	Change
	2014/2015	2015/2016	2016/2017	2017/2018	2018/2019	2018/2019	Tonnes	Percent	Tonnes	Tonnes	Percent
HF	-	-	-	-	-	-	-	0.00%	-	-	0.00%
KC	-	-	-	-	-	-	-	0.00%	-	-	0.00%
LA	3	-	-	-	-	-	-	0.00%	-	-	0.00%
WA	-	-	-	-	-	-	-	0.00%	-	-	0.00%
WRWA	-	-	-	-	-	-	-	0.00%	-	-	0.00%
Total	3	-	-	-	-	-	-	0.00%	-	-	0.00%
Change		- 3	-	-		-					
Percentage Change		-100.00%									

Inert Waste Delivered (Tonnes)

							Annual		2018/2019	Budget	
					TO DATE	FORECAST	Change	Change	Budget	Change	Change
	2014/2015	2015/2016	2016/2017	2017/2018	2018/2019	2018/2019	Tonnes	Percent	Tonnes	Tonnes	Percent
HF	-	-	-	-	-	-	-	0.00%	-	-	0.00%
KC	-	-	2	-	-	-	-	0.00%	-	-	0.00%
LA	2	13	10	-	-	-	-	0.00%	-	-	0.00%
WA	1	12	4	23	0	0	- 23	-98.83%	23	- 23	-98.83%
WRWA	790	830	1,061	1,212	758	1,585	373	30.75%	1,075	510	47.40%
Total	794	855	1,076	1,235	758	1,585	350	28.35%	1,098	487	44.34%
Change		62	221	158		350					
Percentage Change		7.78%	25.83%	14.72%		28.35%					

Oil/Paint Waste Delivered (Tonnes)

							Annual		2018/2019	Budget	
					TO DATE	FORECAST	Change	Change	Budget	Change	Change
	2014/2015	2015/2016	2016/2017	2017/2018	2018/2019	2018/2019	Tonnes	Percent	Tonnes	Tonnes	Percent
HF	-	-	-	-	0	0	0	0.00%	-	0	0.00%
KC	-	-	-	-	-	-	-	0.00%	-	-	0.00%
LA	-	-	-	-	-	-	-	0.00%	-	-	0.00%
WA	-	-	-	0	-	-	- 0	-100.00%	-	-	0.00%
WRWA	10	9	17	15	6	16	1	4.43%	16	0	0.90%
Total	10	9	17	15	7	16	1	5.20%	16	0	1.78%
Change		- 1	8	- 1		1					
Percentage Change		-9.60%	86.28%	-8.08%		5.20%					

Paper/Cardboard Waste Delivered (Tonnes)

							Annual		2018/2019	Budget	
					TO DATE	FORECAST	Change	Change	Budget	Change	Change
	2014/2015	2015/2016	2016/2017	2017/2018	2018/2019	2018/2019	Tonnes	Percent	Tonnes	Tonnes	Percent
HF	-	-	-	-	-	-	-	0.00%	-	-	0.00%
KC	-	-	-	-	-	-	-	0.00%	-	-	0.00%
LA	281	255	321	484	194	445	- 39	-8.04%	552	- 107	-19.36%
WA	-	-	-	-	-	-	-	0.00%	-	-	0.00%
WRWA	590	713	806	827	317	653	- 174	-21.07%	886	- 233	-26.29%
Total	871	968	1,127	1,311	511	1,098	- 213	-16.26%	1,438	- 340	-23.63%
Change		97	159	185		- 213					
Percentage Change		11.12%	16.42%	16.39%		-16.26%					

Scrap Metal Waste Delivered (Tonnes)

							Annual		2018/2019	Budget	
					TO DATE	FORECAST	Change	Change	Budget	Change	Change
	2014/2015	2015/2016	2016/2017	2017/2018	2018/2019	2018/2019	Tonnes	Percent	Tonnes	Tonnes	Percent
HF	5	8	11	13	3	4	- 9	-71.66%	16	- 12	-77.26%
KC	1	3	1	1	1	4	3	329.41%	1	3	269.29%
LA	114	128	150	115	37	67	- 48	-41.52%	120	- 53	-44.06%
WA	-	-	0	2	-	-	- 2	-100.00%	1	- 1	-100.00%
WRWA	487	573	697	687	346	707	20	2.86%	707	0	0.01%
Total	608	711	859	818	387	782	- 36	-4.42%	845	- 63	-7.51%
Change		103	148	- 42		- 36					
Percentage Change		16.99%	20.80%	-4.86%		-4.42%					

Textile Waste Delivered (Tonnes)

	2014/2015	2015/2016	2016/2017	2017/2018	TO DATE 2018/2019	FORECAST 2018/2019	Annual Change Tonnes	Annual Change Percent	2018/2019 Budget Tonnes	Budget Change Tonnes	Budget Change Percent
HF	-	-	-	-	-	-	-	0.00%	-	-	0.00%
KC	-	-	-	-	-	-	-	0.00%	-	-	0.00%
LA	-	-	-	-	-	-	-	0.00%	-	-	0.00%
WA	-	-	-	-	-	-	-	0.00%	-	-	0.00%
WRWA	178	204	209	205	179	393	189	92.31%	200	193	96.67%
Total	178	204	209	205	179	393	189	92.31%	200	193	96.67%
Change		26	5	- 5		189					
Percentage Change		14.88%	2.49%	-2.25%		92.31%					

Tyre Waste Delivered (Tonnes)

	2014/2015	2015/2016	2016/2017	2017/2018	TO DATE 2018/2019	FORECAST 2018/2019	Annual Change Tonnes	Annual Change Percent	2018/2019 Budget Tonnes	Budget Change Tonnes	Budget Change Percent
HF	0	1	0	0	0	0	0	1000.00%	-	0	0.00%
KC	0	-	0	0	-	0	- 0	-2.27%	-	0	0.00%
LA	14	11	8	12	7	18	6	51.70%	11	7	59.98%
WA	2	1	2	1	1	1	- 0	-3.76%	2	- 1	-48.03%
WRWA	-	0	-	-	0	0	0	0.00%	-	0	0.00%
Total	16	13	11	13	8	19	6	48.47%	13	6	46.42%
Change		- 3	- 1	2		6					
Percentage Change		-21.19%	-11.16%	13.45%		48.47%					

Wood Waste Delivered (Tonnes)

	2014/2015	2015/2016	2016/2017	2017/2018	TO DATE 2018/2019	FORECAST 2018/2019	Annual Change Tonnes	Annual Change Percent	2018/2019 Budget Tonnes	Budget Change Tonnes	Budget Change Percent
HF	-	-	-	-	-	-	-	0.00%	-	-	0.00%
KC	-	-	-	1	1	2	1	112.82%	1	1	125.59%
LA	456	366	273	245	114	242	- 3	-1.11%	238	4	1.70%
WA	-	-	-	-	-	-	-	0.00%	-	-	0.00%
WRWA	2,860	3,022	3,223	3,165	1,493	3,064	- 101	-3.19%	3,231	- 167	-5.17%
Total	3,316	3,387	3,496	3,411	1,608	3,308	- 103	-3.01%	3,470	- 162	-4.67%
Change		72	109	- 86		- 103					
Percentage Change		2.16%	3.21%	-2.45%		-3.01%					

Total Waste Delivered (Tonnes)

	2014/2015	2015/2016	2016/2017	2017/2018	TO DATE 2018/2019	FORECAST 2018/2019	Annual Change Tonnes	Annual Change Percent	2018/2019 Budget Tonnes	Budget Change Tonnes	Budget Change Percent
HF	73,915	74,234	73,236	70,785	29,775	69,142	- 1,643	-2.32%	71,187	- 2,045	-2.87%
KC	79,110	79,068	77,613	76,597	32,127	75,936	- 661	-0.86%	76,840	- 904	-1.18%
LA	115,284	114,046	113,172	111,477	47,414	110,384	- 1,093	-0.98%	112,125	- 1,741	-1.55%
WA	100,766	102,539	102,442	100,395	42,774	100,492	96	0.10%	100,522	- 30	-0.03%
WRWA	22,096	21,778	22,277	21,208	10,241	20,064	- 1,144	-5.40%	21,833	- 1,769	-8.10%
Total	391,171	391,665	388,741	380,462	162,331	376,018	- 4,444	-1.17%	382,507	- 6,489	-1.70%
Change		494	- 2,924	- 8,279		- 4,444					
Percentage Change		0.13%	-0.75%	-2.13%		-1.17%					

Local Authority Collected Waste (Tonnes)

Forecast after 5 months of 2018/2019 | Printed 03/09/2018 14:33

	HF	KC	LA	WA	HWRC	Total	Share	Adjusted for Contamination	Share
Co-Mingled Recyclables	11,155	15,837	19,754	20,104	750	67,599	18%	58,168	15%
Detritus Waste	695	451	983	3,633	-	5,763	2%	5,763	2%
General Waste	57,036	59,096	87,960	76,305	9,078	289,475	77%	298,906	79%
Green Waste	139	432	662	285	3,018	4,536	1%	4,536	1%
Wood Waste	-	2	242	-	3,064	3,308	1%	3,308	1%
Other Waste	117	118	782	166	4,153	5,336	1%	5,336	1%
TOTAL WASTE	69,142	75,936	110,384	100,492	20,064	376,018	100%	376,018	100%
Co-Mingled Contamination	1,564	1,859	3,060	2,843	106	9,431			

Local Authority Collected Waste (£)

	£/T	HF	KC	LA	WA	HWRC	Total	Share	Adjusted for Contamination	Share
Co-Mingled Recyclables	27.00	301,198	427,591	533,356	542,796	20,243	1,825,183	4%	1,825,183	4%
Detritus Waste	78.50	54,561	35,423	77,178	285,219	-	452,381	1%	452,381	1%
General Waste	147.50	8,412,741	8,716,655	12,974,138	11,254,925	1,339,077	42,697,537	93%	44,088,650	93%
Green Waste	88.00	12,214	38,034	58,295	25,052	265,602	399,197	1%	399,197	1%
Wood Waste	123.00	-	277	29,772	-	376,848	406,898	1%	406,898	1%
Other Waste		16,800	6,346	13,450	43,488	16,234	96,316	0%	96,316	0%
SUB-TOTAL COST		9,028,181	9,498,570	14,137,465	12,570,766	2,033,641	45,877,511	100%	47,268,624	100%
Co-Mingled Contamination	147.50	230,669	274,244	451,277	419,286	15,637	1,391,113			
						TOTAL COST	47,268,624			

Local Authority Collected Waste (Tonnes) Adjusted for Contamination

	HF	KC	LA	WA	HWRC	WRWA
Co-Mingled Recyclables	9,592	13,977	16,694	17,261	644	58,168
Detritus Waste	695	451	983	3,633	-	5,763
General Waste	58,599	60,955	91,020	79,147	9,185	298,906
Green Waste	139	432	662	285	3,018	4,536
Wood Waste	-	2	242	-	3,064	3,308
Other Waste	117	118	782	166	4,153	5,336
TOTAL WASTE	69,142	75,936	110,384	100,492	20,064	376,018

Local Authority Collected Waste (Tonnes) Other Estimated Adjustments

	HF	KC	LA	WA	HWRC	WRWA
HWRC Recycling Tonnage assigned to Councils	2,052	2,540	2,841	3,446	- 10,879	
Mixed Food & Garden Waste			4,500			4,500
Other Third Party Recycling	350	250	2050	500		3,150
TOTAL Local Authority Collected Waste	71,544	78,726	119,774	104,438	9,185	383,668

Household Waste Data from Waste DataFlow

Forecast after 4 Quarters of 2017/2018

* Allocated to Consituent Councils

	HF	KC	LA	WA	HWRC	WRWA
Residual Household Waste	36,666	38,560	58,450	73,955	9,185	216,815
HH Dry Recycling Tonnage	10,467	12,395	19,150	18,954	*	60,966
HH Compost Tonnage	895	1,278	5,672	1,978	*	9,824
Total Household Waste	48,028	52,233	83,272	94,887	9,185	287,605
HH Waste Sent for Recycling or Composting	11,362	13,673	24,822	20,932	*	70,790
Non-Household Residual Waste	21,934	22,396	32,569	5,192	-	82,091
Non-Household Recycling & Composting	1,583	4,097	3,933	4,359	-	13,972
Total Non-Household Waste	23,516	26,493	36,502	9,551	-	96,063
Total Local Authority Collected Waste	71,544	78,726	119,774	104,438	9,185	383,668

Demographics

	HF	KC	LA	WA	HWRC	WRWA
Population	182,998	156,726	327,910	323,257	990,891	990,891
Number of Households	87,380	88,720	140,260	142,720	459,080	459,080
Persons per Household	2.09	1.77	2.34	2.26	2.16	2.16
HH Waste per HH (kg/week)	10.6	11.3	11.4	12.8	0.4	12.0
Residual HH Waste per HH (kg/week)	8.1	8.4	8.0	10.0	0.4	9.1
Recycled/Composted HH Waste per HH (kg/week)	2.5	3.0	3.4	2.8	*	3.0
HH Waste per Resident (kg/week)	5.0	6.4	4.9	5.6	0.2	5.6
Residual HH Waste per Resident (kg/week)	3.9	4.7	3.4	4.4	0.2	4.2
Recycled/Composted HH Waste per Resident (kg/week)	1.2	1.7	1.5	1.2	*	1.4

Recycling Performance

	HF	KC	LA	WA	HWRC	WRWA
HH Dry Recycling %	21.8%	23.7%	23.0%	20.0%	*	21.2%
HH Compost %	1.9%	2.4%	6.8%	2.1%	*	3.4%
HH Recycling/composting %	23.7%	26.2%	29.8%	22.1%	*	24.6%
Municipal Recycling/composting %	18.1%	22.6%	24.0%	24.2%	*	22.1%

WESTERN RIVERSIDE WASTE AUTHORITY and CORY RIVERSIDE ENERGY

A JOINT RESPONSE TO THE LOCAL GOVERNMENT ASSOCIATION REPORT THAT ONLY A THIRD OF PLASTIC POTS, TUBS AND TRAYS ARE RECYCLED.

The Western Riverside Waste Authority and Cory Riverside Energy, like the Local Government Association, are committed to increasing recycling levels and fully support calls to make the recycling of all materials, including plastics, much simpler.

The Western Riverside Waste Authority is the waste disposal authority covering the London Boroughs of Hammersmith & Fulham, Lambeth, Wandsworth and the Royal Borough of Kensington and Chelsea. It contracts all its waste management services to Cory Riverside Energy, including the operation of its Materials Recycling Facility (MRF)at Smugglers Way in Wandsworth. This MRF, which is one of the most technologically advanced and efficient in Europe, processes all of the co-mingled "clear sack" recyclables collected from residents from these four boroughs.

The MRF separates and sorts the co-mingled material into individual waste streams for sale to reputable re-processors in the UK and the EU. None of the material is exported to China or the Far East. Gate fees in the UK and the EU for energy from waste plants are considerably higher than the cost of recycling which means that recycling is the cheaper, and always the preferred option.

Due to the high performance of the MRF, residents in the WRWA boroughs can be assured that c. 87% of the co-mingled recyclate which is sent to the facility is ultimately recycled. Unfortunately, around 13% of the tonnage received from the public isn't the targeted material and cannot be recycled. Materials which we are able to recycle include paper, card and cardboard, glass bottles and jars, plastic bottles, pots, tubs and trays, cartons, cans and tins**.** More detail can be found on the Authority website here.

Food is the most frequent contaminant, but there are other waste materials and even recyclables that the MRF isn't designed to capture such as textiles, which are not recyclable once they've been through the MRF but would have been recyclable had they been given to a charity. All the non-recyclable material is sent by river to an Energy from Waste Facility which generates enough electricity to power 160,000 homes and supplies 210,000 tonnes of aggregate and building blocks to the construction industry each year.

We are producing a detailed fact sheet on what happens to all the materials received at the MRF but this note concentrates on the plastics bottles, tubs and trays and film highlighted by the LGA and which account for 5% of the clear sack material received by weight.

Plastic bottles are relatively easily recycled and are very valuable, with a strong market demand for them. The only plastic film we can recycle is the clear recycling sacks themselves – this is much less valuable and can be difficult to find markets for at times. Where we are able to recycle this film, it is done in the UK and this has been the case for several years. Plastic pots, tubs and trays are similarly less valuable, and some of the material is less easy to recycle. Again, any of this material which can be recycled is recycled in the UK.

Black plastic trays make up a very small proportion of the throughput of the MRF by weight and the MRF equipment can't specifically identify it. However, whilst most black plastic is sent for energy recovery, a small amount will be recycled with other plastic pots, tubs and trays.

The Authority and Cory Riverside Energy fully support the aims of the LGA to make plastics recycling simpler for Londoners. Manufacturers also have an important role to play, and we would urge them to do all they can do reduce the amount of non-recyclable plastic which they use as packaging. In particular, the sooner that we can switch to alternatives to black plastic the better.

About the MRF

- The Materials Recycling Facility (MRF) is owned by **Western Riverside Waste Authority** (the Authority) and operated by **Cory Riverside Energy** (Cory) as part of their 30-year contract with the Authority.
- The MRF **processes mixed recycling** from four London boroughs: Hammersmith & Fulham, Lambeth, Wandsworth, and the Royal Borough of Kensington and Chelsea.
- The MRF can process up to **84,000 tonnes** of recyclables every year.

Recycling facts and figures

The average split (by weight) of the target materials we receive is:

- Paper 45.24%
- Plastic 9.20%
- Glass 29.71%
- Cardboard 13.04%
- Cans and Tins 2.82%

The MRF can separate mixed recycling into up to **fifteen different categories** depending on available markets. For example, the plastics get separated into **five different types of plastic.**

The **value of recyclable materials fluctuates** as market conditions change in response to normal supply and demand pressures and/or wider economic and political factors.

It takes around **six minutes** for a bag of recycling to be **fully processed and sorted**.

We recycle an average of **85% of all the materials** sent to us.

We are **unable to recycle** the **remaining 15%** as it consists of **contamination** (material that should not be placed in the recycling bags/bins). In the MRF examples of contamination include; garden waste, clinical waste, dirty nappies, wood, textiles, electrical items, general rubbish and food waste –**contamination like this damages the sorting equipment in the MRF and is it unsafe for the staff to handle it.** This percentage could be much lower if the correct materials were put out for recycling.

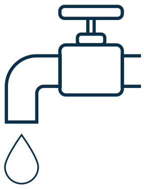
Food waste contamination can make the rest of your recycling **unusable**.

Any **material we cannot recycle is sent to an Energy from Waste (EfW) facility** where it is turned into electricity for the National Grid.

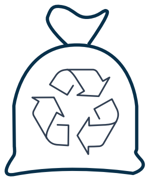
Process

1. **Residents** put their mixed recycling out for collection.
2. The council collection contractor c**ollects the recycling and delivers it to the MRF** at Smugglers Way, Wandsworth. The recycling is then tipped into a big bunker.
3. A **giant grab/claw crane** picks up the mixed recycling material from the bunker and places it onto a conveyor belt where it is taken through a **'bag splitter' which opens the sacks** ready for the material to be inspected in the quality control cabin where most contaminants and non-recyclables are removed.
4. The remaining materials then travel up a series of ballistic screens (with rotating discs) which **separate the 2D material (paper & card) from the heavier 3D material (plastics, glass & metal)**
5. **Glass is broken into small pieces** and is removed when it passes through a series of screens and is then sent to a bunker ready to be collected and taken to the processing facility.
6. **Magnets** remove the ferrous (magnetic) steel cans and **eddy current separators** remove the non-ferrous aluminium cans.
7. **Optical/thermal sorters** then separate the plastics and paper by measuring the rate at which light beams are absorbed by the material.
8. The Plastics are then sent through **other optical sorters to separate them into different plastic types** (PET, HDPE, PP, LDPE*), and different colour types, natural (transparent) or coloured (opaque, green, blue etc.)
9. All the **separated materials are then compressed** into large bales and stacked ready to be taken to the processing facilities to be made into new items.

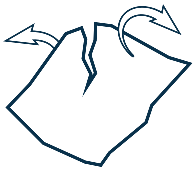
What residents can do to maximise the proportion of material which is recycled



Please **rinse out food and drink containers** (including ready meal trays, yoghurt pots, plastic and glass bottles) to remove any food residues that can contaminate other recyclables and leave them to dry before putting them into the recycling bin.



If you need to use plastic bags for your recycling, then **use your clear recycling sacks** so the collectors can see what is inside them. Please do not put recycling into black bags as it will not be recycled.



Not all wrapping paper is recyclable as it is made of multiple materials (paper, foil and plastic), to test this **try the 'tear test'**. Tear the paper, if it tears easily without any effort then you can recycle it. If it takes some effort to tear it, then it will need to go in with the black bag waste.

A lot of people only think about recycling items from the kitchen, but please try not to forget about the rest of the house. **All household bottles can be recycled,** including shampoo, mouthwash and shower gel bottles, along with toilet roll tubes and empty bleach bottles. Please make sure bottles are rinsed out first.

Flatten your cardboard boxes – this not only makes it easier to sort your recycling, but also means that you can fit more into your recycling bag.

Food waste and nappies are the most problematic contaminants received in the MRF and can cause whole vehicle loads to be rejected and sent to Energy from Waste.

Aerosols are a fire hazard when going through the MRF as they can contain pressurised and flammable chemicals – these should go in with the black bag waste.

Myth busting

There is a lot of confusion about what can and can't be recycled and how much of what you put in your recycling bins or bring to us is recycled.

Here are some of the myths and the facts relating to recycling in your area:

MYTH: Only a third of plastics collected are recycled

FACT: The MRF is one of the most modern in the UK, it is equipped with advanced technology including optical and thermal sorting equipment to maximise the recovery of plastics for recycling. Consequently, approximately 85% of all material, including plastic, delivered to the MRF Is recycled.

MYTH: Black plastic is not recycled

FACT: Some types of black plastic can be recycled, but sorting black plastics is very challenging in the MRF as the optical readers cannot detect the black plastic against the black background of the conveyor systems. This is a common problem at all MRFs, which is why manufacturers and retailers that produce and use black plastic should be encouraged or regulated to use only materials that can be easily sorted and recycled.

MYTH: All plastic is sent abroad to be processed, or ends up in landfill

FACT: Most plastics have value and consequently are sold to reprocessors to be manufactured into new products. Cory sells the recycled plastics to reprocessors based in the UK and EU. It is also important to understand that it does not make financial sense for reprocessors to buy recyclable materials and then pay to send them to landfill. Recycling is the most cost-effective option.

MYTH: I need to spend ages sorting my recycling

FACT: The four boroughs covered by WRWA (the London Boroughs of Hammersmith & Fulham, Lambeth, Wandsworth and the Royal Borough of Kensington and Chelsea) all collect mixed recycling to make it easy for residents to store and separate their recycling. This means that residents can combine all of the targeted recyclables in one clear sack, green bin (Lambeth residents) or in communal bins.

MYTH: Energy from Waste (EfW) operators want to burn plastics

FACT: Burning plastic accelerates the damage to equipment in an EfW plant and therefore operators, such as Cory, want to see a significant reduction in plastics in the waste stream sent to the EfW Plant. The only plastic sent to an EfW plant by Cory is material that cannot be recycled or where people have placed it in black bin bags. EfW is a more environmentally-friendly method of disposal than landfill. Cory completed a study, endorsed by the Carbon Trust, that sending waste to the Cory EFW saves 200kg of CO_2 compared to landfill. If you want to read more on the report please click here. The four boroughs are financially incentivised to recycle as it is 75% cheaper for them to send recycling to the MRF compared to sending it to the EFW plant.

MYTH: Dirty material can be placed in the recycling bin and still be recycled

FACT: All recycling material placed out for collection needs to be clean and dry. Recyclable material that is placed out covered in food or other waste will not be recycled. The best way to ensure we can make the most of your recycling is to ensure it is clean and dry.

Introduction

Before sending any recyclable material to a third party, in addition to the "Duty of Care" checks it is legally required to carry out, Cory also carries out its own extensive due diligence process to ensure that, as far as is reasonably possible, all of its material will be subsequently manged legally and in an environmentally responsible manner.

Mixed Paper (white and brown paper, cereal packages, envelopes, and other smaller items of paper)

Cory sends material to four paper mills based in the UK, Holland and Belgium.

- Bales of mixed paper are put into an articulated lorry at the MRF in Smugglers Way and taken to one of the facilities by road.
- Bales are off-loaded and visually inspected for high levels of contaminants. The bales will be re-sorted again into separate grades of paper (i.e. white, brown, card, etc.) and be processed at the mill or sold to other local European mills.
- The separate grades of materials are shredded, cleaned and pulped with a whisk-like machine that pulls any remaining contaminants out.
- The pulp is then dried and rolled to make sheets which is then used to make new packaging and various paper products like printing paper, tissue paper, cereal packets, packaging and card.
- Any contaminants will either be recycled (in the case of metals and baling wire) and the remainder sent to Energy from Waste

Cardboard (Old Corrugated Cardboard (OCC))

OCC is sent to facilities in Belgium. Because the fibre lengths in cardboard are longer, the material is stronger and can be recycled more times than paper or newspaper:

- Bales of cardboard are put into an articulated lorry at the MRF in Smugglers Way and taken to the facility.
- Bales are off-loaded and visually inspected for high levels of contaminants.
- Material is shredded, cleaned and pulped, with a whisk-like machine pulling any remaining contaminants out.
- The pulp is then dried and rolled to make sheets which are then used to make new cardboard packaging.

News & Pams (Newspapers, Periodicals and Magazines)

Separated News & Pams go to mills in Belgium and Norway. The process is very similar to that of the mixed paper/OCC described above:

- Bales of News & Pams are put into an articulated lorry at the MRF in Smugglers Way and taken to the facility.
- Bales are off-loaded and visually inspected for high levels of contaminants.
- The material is shredded, cleaned, pulped and de-inked, with a whisk-like machine pulling any remaining contaminants out.

- The pulp is then dried and rolled to make sheets which are then used to make new newspapers.

Recycling Sacks and Film Packaging

Film is a low-quality plastic grade and is not accepted as a recyclable material at the MRF, with the exception of the **clear recycling sacks** that the mixed recycling is collected in. Over the last three years, due to the lack of reprocessing plants available to recycle this material, it has not always been possible to send this material to be recycled and, when that is the case, the film is sent to Energy from Waste to be converted to electricity.

Steel Cans

Steel cans are processed in the UK.

- Bales of steel are put into an articulated lorry at the MRF in Smugglers Way and taken to the facility.
- Bales are off-loaded at a bulking yard, where the bales are broken down and any contaminants removed.
- Material is then taken to a UK-based furnace where it is smelted into sheets that are used to make new cans, car or plane parts or anything else that is manufactured from steel.

Aluminium Cans

Aluminium cans are taken directly to a German aluminium recycling plant.

- Bales of aluminium cans are put into an articulated lorry at the MRF in Smugglers Way and taken to the facility in Germany.
- Bales are off-loaded and inspected for contaminants.
- The bales are loaded into a furnace and smelted into sheets
  The sheets are then made into new cans, car parts or anything else that is made from aluminium.

High-density polyethylene (HDPE) Natural (Milk bottles)

HDPE natural plastics are processed locally in the south east of England.

- Bales are put into an articulated lorry at the MRF in Smugglers Way and taken to the facility.
- The material is shredded and put on conveyor belts and any contaminants removed before being but through a sink tank (to separate out any unwanted plastic types, e.g. bottle tops). These plastics are then sold locally in the UK and Europe to be made into new products.
- Bottle tops are separated from the natural HDPE at the reprocessing centre in the sink tank and are sent to a secondary facility to be recycled.
- The HDPE flakes are washed, dried, melted and pelletised before being mixed with some virgin material and made back into milk bottles.

HDPE Coloured (Detergent, cleaning and shampoo bottles)

HDPE coloured plastics are processed in the UK to make a range of products such as new bottles, bag for life shopping bags and furniture.

- Bales are put into an articulated lorry at the MRF in Smugglers Way and taken to the facility.
- Material is shredded and put on conveyors and any contaminants removed before being but through a sink tank (to separate out any unwanted plastic types, e.g. bottle tops). These plastics are then sold locally in the UK and Europe to be recycled.
- The HDPE flakes are washed, dried, melted and pelletised before being mixed with virgin material and made into various products, including piping, detergent bottles and bag for life shopping bags.

Polyethylene terephthalate (PET)'Clear'– Drink and water bottles, sandwich trays, fruit punnets

PET 'clear' natural is currently sent to a plastic reprocessing plant in Germany and is processed in the same way as HDPE.

The PET natural is processed into food grade plastics (drinks bottles, sandwich trays and salad trays, etc).

PET Coloured

PET coloured is also currently sent to the same plant as PET 'clear' in Germany and is processed in the same way.
The PET coloured is processed into food grade plastics (drinks bottles, ready meal trays, etc.), and potentially clothing (such as fleece jackets). The sustainability of making clothes from plastics is under review due to the risk of micro plastics entering the water ecosystems during the washing process of the clothes.

Mixed Plastics (Pots, Tubs and Trays)

- Bales are put into an articulated lorry at the MRF in Smugglers Way and taken to the facility.
- The mixed plastics are shredded and placed into a sink tank to separate the plastics into the different grades (i.e. PP, PS, PET, HDPE LDPE).
- These flakes are then washed and dried before being bagged up and sent to the processing facility.
- At the processing facility, the flakes are pelletised, mixed with virgin material (dependent on specification requirement or what is being made) and moulded into new products, such as wheeled bins and storage containers.
- Dependent on the market, pellets can also be sold to other plastic manufacturers around Europe.
- Any contaminants are sent to Energy from Waste Facilities in the UK.

Glass

Glass is processed in the UK.

- As glass cannot be baled it is collected loose in bulker trucks at the Smugglers Way MRF and taken to the sorting facility.
- At the facility contaminants (non-glass materials, such as metals, paper labels and plastics) are removed. Metals are sent on to further facilities to be recycled, whilst other materials are send to landfill.
- Metal bottle caps are filtered out at the front end of the MRF process with the glass due to their small size. These caps are a contaminant and therefore are removed by magnets, etc., and sent for recycling where markets can be found. However, as they are a composite item (i.e. they have a plastic disk stuck to the inside of them), they can be difficult to separate and recycle.
- Glass is then sorted into the different colours (using light refraction) and then graded by size using numerous vibrating plates that act like a sieve.
- The sorted contaminant-free cullet is then send to glass smelting plants in the UK and Europe to be recycled into new bottles, windows, other glass products or used as an aggregate material.

Joint Waste Strategy Analysis

Interim Report – Data Analysis

Report for Western Riverside Waste Authority

ED 11299 | Issue Number 5 | Date 28/08/2018

Customer:

Western Riverside Waste Authority

Customer reference:

Waste Strategy Analysis

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John Woodruff

Date:

28 August 2018

Ricardo Energy & Environment reference:

Ref: ED11299- Issue Number 5

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1 Executive Summary

Ricardo Energy & Environment (Ricardo) were commissioned by Western Riverside Waste Authority (WRWA) to undertake a thorough strategic review of their services, including those of their constituent councils, to determine how the current joint waste policy should be updated in the light of current and potential developments in strategic, legislative and environmental drivers. To ensure the evidence-based nature of the policy direction, a thorough review of the data utilised by the Authority to analyse historical performance was required. The aim of this exercise was to examine the accuracy of the data utilised and to confirm the reasonableness of the conclusions drawn from it. The exercise also takes account of any retrospective adjustments in information sourced from external datasets, and also updates the data to fully include 2016/17 information.

Ricardo have undertaken an extensive analysis of both the data recorded by WRWA and the manner in which it has been utilised. Commencing with the raw data, the methodology and the formulae behind the calculations utilised to generate the performance of the constituent authorities have been thoroughly assessed, cross-referenced and checked for accuracy. This was followed by a benchmarking exercise, comparing the performance of the Boroughs to inner and outer London boroughs, along with authorities across England as a whole.

This exercise confirms the accuracy of the data, provides confidence that the conclusions expressed represent an accurate summary of the tonnage-based performance interpretation, and confirms the assumptions regarding the changes to waste composition incorporated within the conclusions derived from this data by WRWA.

This report summarises the findings from the initial review of the data held by WRWA. It also considers WRWA's conclusions regarding the options for alternative methodologies for assessing and measuring environmental performance, and confirms the current comparative performance of the constituent authorities, benchmarking this against a range of comparators. The analysis confirms, among other things, that:

- The lack of garden waste available constrains WRWA's overall recycling rate, which is a combination of dry and organic recycling. As a result, the level of recycling performance contrasts poorly with outer London and England, where garden waste tonnages are more easily available.
- Analysis by the Waste Resource Action Programme's (WRAP) suggests an average contamination rate for co-mingled collections of 16%. The overall WRWA contamination rate of 13% thus represents above average performance.
- The 2015 'At This Rate' report by SITA noted that the highest reported recycling rate for authorities with a proportion of multi-occupancy dwellings of above 50% was 39%. In 2016/17 WRWA recorded a capture rate of 34% with a multi-occupancy rate of 73%.
- Utilising WRAP's mean capture rate for food, which evidence suggests would be difficult to achieve in the WRWA area, the current recycling rate would still only increase from 26.52% to 31.73%
- This analysis demonstrates that the conclusions drawn by WRWA, as published in PAPER NO. WRWA 832, published on 28th June 2017 that, despite the operational and demographic constraints impacting on WRWA's current and achievable recycling rates, the current performance in terms of the proportion of recyclable material in the waste stream captured for recycling is in line with the average across England as a whole.

This report concludes that consideration of an alternative methodology for measuring the best environmental option for each material stream would enable more appropriate targets to be set which would better reflect the performance in the WRWA area, whilst also demonstrating environmental best practice.

New metrics will be designed to sit alongside existing weight-based recycling targets; this will allow for the ongoing need for reporting performance in the format required by the government, but offers the opportunity for a phased introduction of a more environmentally coherent approach as policies allow.

This approach should be in conformity with the Mayor of London's Environment Strategy and in line with the key themes from current and upcoming UK policy such as the 25 year Environment Plan, the EU Circular Economy Package and (provisionally) Defra's Resource & Waste Strategy, due to be published towards the end of the year.

The next stage of the project will thus be the development of a set of metrics that are easily measurable, simple to monitor, easy to communicate to a variety of stakeholders and that best drive an environmental approach to performance.

2 Methodology

WRWA provided Ricardo with disposal data and tonnages from 2013/14 to 2016/17, with the latter being the latest complete dataset available at the time. This information comprised tonnages for each of the constituent boroughs:

- Hammersmith & Fulham;
- Kensington & Chelsea;
- Lambeth; and
- Wandsworth

In addition to the information provided for the boroughs as the Waste Collection Authorities (WCAs) responsible for collecting waste and recycling at the kerbside, we were also provided with the tonnages for WRWA themselves as a Waste Disposal Authority (WDA), tonnages collected through the Smuggler's Way Household Waste Recycling Centre (HWRC) and Lambeth's tonnages collected from their Vale Road HWRC.

The initial review by Ricardo comprised a thorough check of the data provided by WRWA by comparing the datasets for each of the four preceding years against the data submitted on WasteDataFlow, which is the online reporting tool through which local authorities submit their waste data to DEFRA. Since WasteDataFlow is the benchmark for all Local Authority reported data, this information has been utilised to carry out a comprehensive analysis of the data utilised by WRWA to analyse historical performance and to confirm or correct the accuracy of both the methodology and the calculations contained within the model. This was followed by utilising WRAP's online portal and our own in-house tool to undertake a benchmarking exercise for each of the constituent Boroughs, examining relative performance to comparator authorities, London authorities and England as a whole. The results and conclusions of this review are presented below along with commentary on waste composition, food waste collections and carbon impact.

3 Waste Model Review

Ricardo carried out a thorough review of the information recorded on WasteDataFlow, comparing the information against the records kept by WRWA. No disparities were found.

Ricardo then conducted a thorough review of WRWA's model, which contains all waste and tonnage information and generates statistics on performance. Our review comprised a full audit of all figures and formulae used to process the information, using our in-house modelling quality assurance process as developed by Ricardo's cross-practice modelling team. There were no errors or issues found within any of the Authority's modelling.

Our comprehensive analysis and audit of the data within the model demonstrates that the outputs generated by the model are accurate. This means that the figures and conclusions that WRWA have reached are underpinned by a model that contains no errors within the formulae used to calculate the outputs. This audit demonstrates the robustness and integrity of both the model itself and the figures that comprise the outputs.

4 Benchmarking

WRWA have utilised the tonnage data to draw conclusions regarding the performance of the WRWA area (i.e. the Authority and its constituent Authorities) in relation to both London and England. To confirm the assessment of how the four constituent boroughs are performing in comparison with other inner London boroughs, we used WRAP's Local Authority Portal and our own in-house benchmarking tool. This section summarises the findings of a benchmarking exercise carried out in order to review each Boroughs' waste collection and management performance. Data used in this analysis was obtained from WRAP's Local Authority Waste and Recycling Information Portal (LA Portal). It should be noted that the analysis undertaken using our in-house benchmarking tool excluded food and garden waste collections from the comparison, as including these two waste streams significantly reduced the number of available comparator authorities. It should also be noted that as Royal Borough of Kensington & Chelsea have a greater than weekly residual collection frequency, this benchmarking is not a true comparison due to the difference in service level. This has been necessary to compare the four constituent Boroughs in this benchmarking exercise. The full analysis of each Borough's performance can be found at Appendix 1.

It should also be noted that waste composition can vary significantly between authorities, as does the range of recyclable materials accepted in a kerbside collection scheme. Therefore, a specific authority may not be able to achieve the performance attained by other authorities. It should also be noted that for co-mingled collections in the LA Portal, the apportionment of materials between waste streams is based on a standard ratio rather than recorded weights.

The benchmarking exercise comprised two stages:

1. Firstly, a review of the Council's performance against all UK LAs and those with similar characteristics (i.e., ONS area classification) was undertaken; and
2. Secondly, our in-house benchmarking tool was used to review the Council's performance against LAs with similar waste collection services as well as LAs with similar schemes proposed for future scenarios.

For the purposes of the benchmarking exercise, 'London Cosmopolitan' is an Office for National Statistics (ONS) definition that comprises 19 London boroughs, including the four constituent boroughs of WRWA. It is because of the wide variance when comparing WRWA to this range of London boroughs that we undertook the more detailed benchmarking utilising our own tool, comparing the boroughs solely to inner London authorities with similar collection schemes.

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

Figure 1: Quartile Description

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

Figure 2: Inner London Comparison - Hammersmith & Fulham

kg/household/year	Paper	Card	Cans	Glass	Plastics (inc. bottles)	Residual waste
Q1 bottom quartile	54	20	7	34	9	580
Q2 lower quartile	57	21	7	36	9	549
Q3 upper quartile	61	23	7	39	10	478
Q4 top quartile	73	27	9	46	12	423
Hammersmith and Fulham LB	55	20	7	34	9	427

Figure 3: Inner London Comparison - Kensington & Chelsea

kg/household/year	Paper	Card	Cans	Glass	Plastics (inc. bottles)	Residual waste
Q1 bottom quartile	49	18	6	31	9	510
Q2 lower quartile	52	19	6	33	12	456
Q3 upper quartile	55	20	7	35	12	432
Q4 top quartile	61	22	7	38	14	421
Royal Borough of Kensington & Chelsea	62	23	8	39	14	437

Figure 4: Inner London Comparison – Lambeth

kg/household/year	Paper	Card	Cans	Glass	Plastics (inc. bottles)	Residual waste
Q1 bottom quartile	55	20	7	34	12	519
Q2 lower quartile	61	22	7	38	14	510
Q3 upper quartile	62	23	8	39	14	437
Q4 top quartile	73	27	9	46	17	427
Lambeth LB	55	20	7	35	13	419

Figure 5: Inner London Comparison - Wandsworth

kg/household/year	Paper	Card	Cans	Glass	Plastics (inc. bottles)	Residual waste
Q1 bottom quartile	54	20	7	34	12	580
Q2 lower quartile	55	20	7	34	13	499
Q3 upper quartile	60	22	7	38	14	432
Q4 top quartile	73	27	9	46	17	421
Wandsworth LB	61	22	7	38	14	510

Figure 6 below summarises the constituent Boroughs' performance against their respective comparator authorities. Individual Borough performance and differences between results will be explored more fully in the 'Performance Results' paper, to follow this interim report.

Figure 6: Benchmarking Summary

kg/household/year	Paper	Card	Cans	Glass	Plastics (inc. bottles)	Residual waste
Hammersmith and Fulham LB	55	20	7	34	9	427
Royal Borough of Kensington & Chelsea	62	23	8	39	14	437
Lambeth LB	55	20	7	35	13	419
Wandsworth LB	61	22	7	38	14	510

It should be noted that across the WRWA area, 73% of properties are flats, either purpose built or conversions, compared to a national average of approximately 20%; in addition, 52% of all properties are rented rather than owned and there is a very high level of transience. These factors are industry acknowledged as being major constraints on recycling performance.

A full analysis of the benchmarking exercise for each Borough can be found at Appendix 1. From this analysis it is clear that, given their built environment and demographics, WRWA and its constituent councils generally perform well in comparison to London as a whole and the rest of the UK in terms of dry recycling performance.

4.1 Garden Waste Tonnages

As identified above, direct comparators for the WRWA are limited, due to the intensely urban nature of the locality. As a result, the volume of garden waste available to WRWA is low; this can be seen from the low proportion of garden waste in the residual stream (7%) identified by the waste composition analysis (Table 5 of 'Paper No. WRWA 832').

The lack of garden waste available constrains WRWA's overall recycling rate, which is a combination of dry and organic recycling. As a result, the level of recycling performance contrasts poorly with outer London and England, where garden waste tonnages are more easily available.

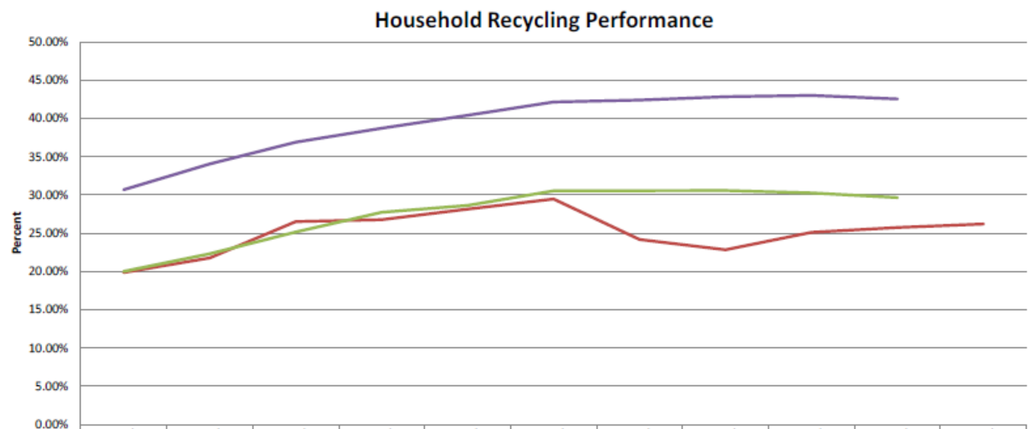
This reflects the nature of the current weight-based recycling targets, whereby LA recycling performance is solely based on the weight of waste they reuse, recycle or compost/digest as a percentage of the total weight of waste they collect. This system encourages councils to "chase" the heavier waste materials, regardless of the overall environmental benefit, seen most clearly in the expansion of garden waste collections. This approach has impacted on the promotion of home composting (the most environmentally beneficial and cost-effective way of dealing with this material) and has led to a situation where the majority of authorities with 'high-performing' recycling schemes actually collect more garden waste than dry recyclate. Patently, the housing mix in the WRWA's constituent authorities precludes the generation of significant tonnages of garden waste.

The practical and economic constraints of collecting garden waste, combined with the evidence of low arisings of this material stream confirm WRWA's approach that *'the inclusion of Garden Waste in weight based recycling targets distorts comparisons between the performance against urban and rural authorities and even between central and outer London boroughs.'*

5 Recycling Performance Figures

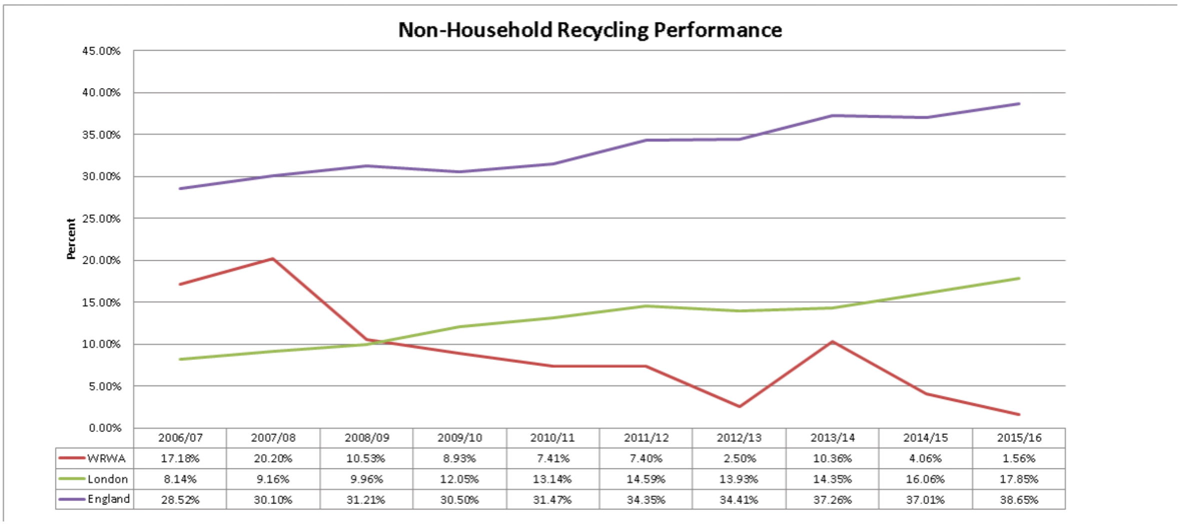
Historic recycling performance figures for London and England formed part of the information presented in 'PAPER NO. WRWA 832'. Figure 7 and Figure 8 below replicate 'Graph 8' and 'Graph 10' respectively from paper 832.

Figure 7: 'Graph 8' - Household recycling performance



	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
WRWA	19.86%	21.75%	26.51%	26.75%	28.13%	29.45%	24.17%	22.82%	25.10%	25.74%	26.19%
London	20.00%	22.30%	25.14%	27.73%	28.63%	30.53%	30.55%	30.56%	30.26%	29.64%	
England	30.66%	34.04%	36.88%	38.71%	40.41%	42.14%	42.38%	42.84%	43.00%	42.54%	

Figure 8: 'Graph 10' - Non-household recycling performance



	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
WRWA	17.18%	20.20%	10.53%	8.93%	7.41%	7.40%	2.50%	10.36%	4.06%	1.56%
London	8.14%	9.16%	9.96%	12.05%	13.14%	14.59%	13.93%	14.35%	16.06%	17.85%
England	28.52%	30.10%	31.21%	30.50%	31.47%	34.35%	34.41%	37.26%	37.01%	38.65%

Ricardo have examined the figures used for London and England performance in 'Graph 8' and 'Graph 10' to establish their accuracy. This comprised a comparison between the UK Government's statistical data[1] and those figures used by WRWA in the paper.

Both sets of data have been compared to the UK Government's statistical data[2] and we can confirm that the figures used by WRWA in the paper are correct. Any very minor variances between the two sets of data can be attributed to the numbers being rounded, and the impact of this is negligible.

Our analysis and audit of the data utilised to generate the recycling performance figures and the conclusions drawn from them confirm their accuracy, demonstrating the robustness and integrity of both the model itself and the figures and commentary that comprise the outputs.

6 Waste Composition Assumptions

We have utilised WRWA's latest waste composition analysis to estimate what proportion of recyclable material remains in the residual waste stream. Table 1 below shows the results of this composition analysis undertaken in 2014/15.

[1] https://www.gov.uk/government/statistical-data-sets/env18-local-authority-collected-waste-annual-results-tables

[2] https://www.gov.uk/government/statistical-data-sets/env18-local-authority-collected-waste-annual-results-tables

Table 1: Household residual waste composition results - 2014/15

Component	Percentage (%)
Paper/card	14.0%
Plastic film	7.4%
Dense plastic	7.1%
Textiles	3.1%
Misc. Comb	12.1%
Misc. non Comb	1.5%
Glass	4.2%
Putrescible (food waste)	44.9%
Ferrous Metal	1.5%
Non Ferrous Metal	1.0%
WEEE	1.2%
Pot Hazard	0.9%
Fines	1.1%
Total	100%

To estimate how many tonnes of recyclable material remain within the residual waste stream in 2016/17, we applied the proportions of material identified within the waste composition study to the latest tonnage figures for household waste, as presented in Table 2 below:

Table 2: 2016/17 Household residual waste tonnages by Borough

	Hammersmith & Fulham	Kensington & Chelsea	Lambeth	Wandsworth
Residual waste (tonnes)	36,943	38,636	58,330	71,795
Total households	86,457	88,527	141,256	142,714
Residual waste per household (kg/hh/year)	427.30	436.43	412.94	503.07

Utilising the residual household waste composition analysis, the calculated proportion of each material stream for the most recent 2016/17 tonnages are presented in Figure 9 below:

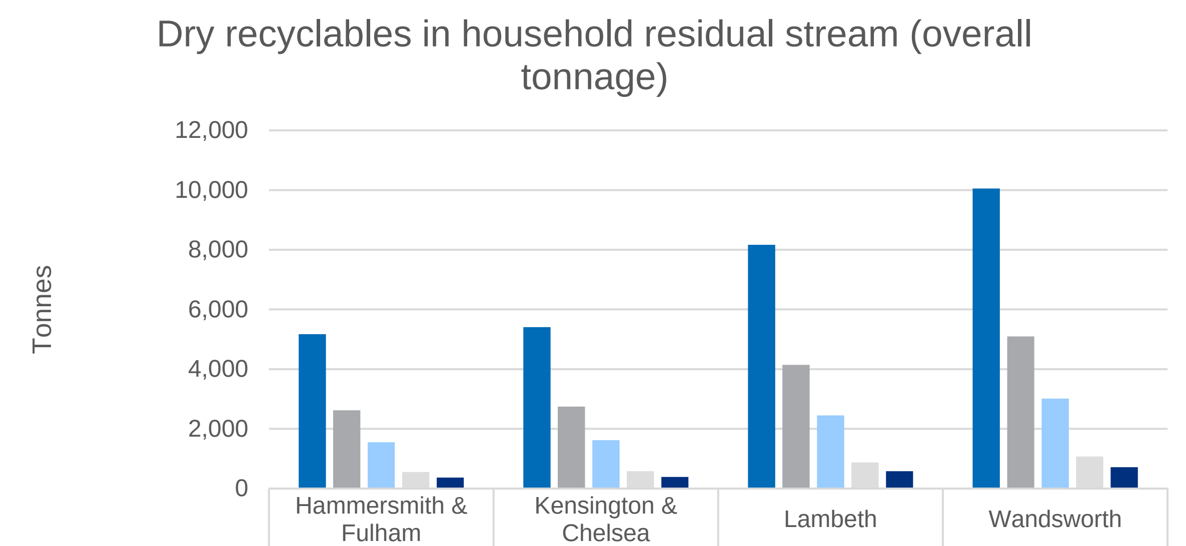
Figure 9: 2016/17 Material present in household residual waste (tonnes)

Material	Hammersmith & Fulham	Kensington & Chelsea	Lambeth	Wandsworth
Paper/card	5,172	5,409	8,166	10,051
Plastic film	2,734	2,859	4,316	5,313
Dense plastic	2,623	2,743	4,141	5,097
Textiles	1,145	1,198	1,808	2,226
Misc. Comb	4,470	4,675	7,058	8,687
Misc. non Comb	554	580	875	1,077
Glass	1,552	1,623	2,450	3,015
Putrescibles (inc. food waste)	16,587	17,348	26,190	32,236
Ferrous Metal	554	580	875	1,077
Non Ferrous Metal	369	386	583	718
WEEE	443	464	700	862
Pot Hazard	332	348	525	646
Fines	406	425	642	790
Total	36,943	38,636	58,330	71,795

6.1 Material remaining in the household residual waste (2016/17 tonnages)

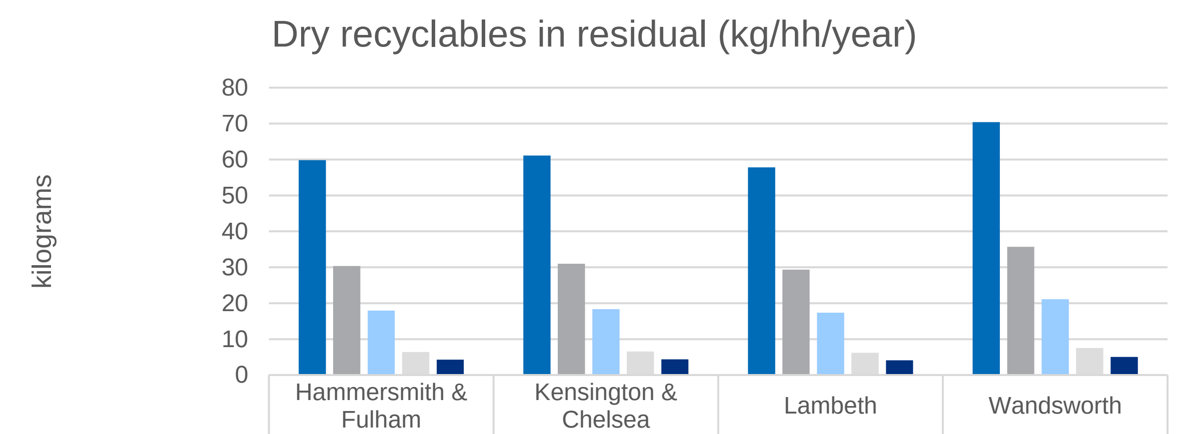
The figures below indicate the comparative performance of the constituent boroughs when the composition study (Table 1) is applied to the 2016/17 tonnages (Table 2).

Figure 10: Dry recyclables in household residual stream (overall tonnage for 2016/17)



	Hammersmith & Fulham	Kensington & Chelsea	Lambeth	Wandsworth
Paper/card	5,172	5,409	8,166	10,051
Dense plastic	2,623	2,743	4,141	5,097
Glass	1,552	1,623	2,450	3,015
Ferrous Metal	554	580	875	1,077
Non Ferrous Metal	369	386	583	718

Figure 11: Dry recyclables in household residual stream (kg/hh/year for 2016/17)



	Hammersmith & Fulham	Kensington & Chelsea	Lambeth	Wandsworth
Paper/card	60	61	58	70
Dense plastic	30	31	29	36
Glass	18	18	17	21
Ferrous Metal	6	7	6	8
Non Ferrous Metal	4	4	4	5

Paper/card Dense plastic Glass Ferrous Metal Non Ferrous Metal

Figure 12: Textiles in the household residual waste stream (overall tonnage for 2016/17)

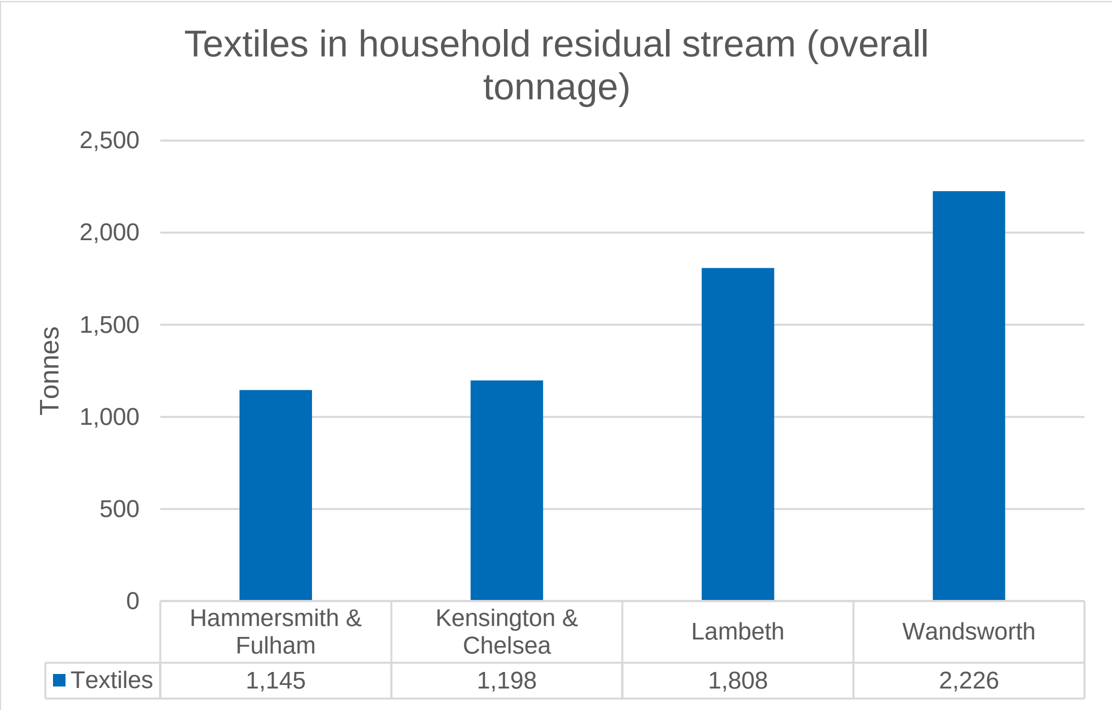
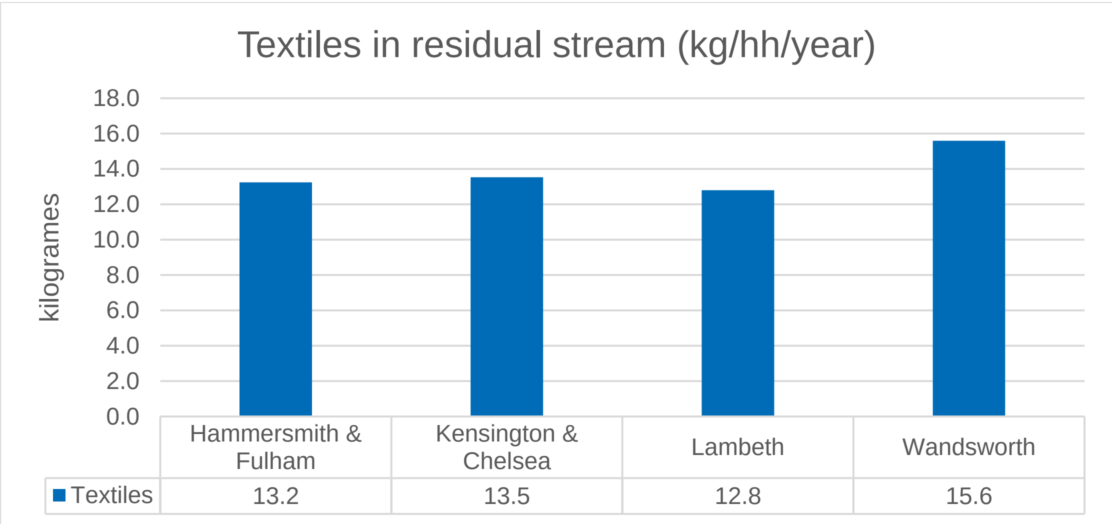


Figure 13: Textiles in the household residual stream (kg/hh/year for 2016/17)



Although textiles are not included within the dry recyclable collections, each constituent borough promotes third sector free collection and/or donation points for textiles. While the proportion of textiles that remain within the residual waste stream is ~3% of the total, textiles have a high carbon impact and a relatively high financial value, and the constituent boroughs and WRWA may wish to consider further promoting or targeting of this waste stream.

The proportion of major recyclables remaining in the residual stream is likely to evolve over time, due to changes in the composition of domestic waste. This can be seen in the relative changes in tonnage of kerbside recyclate (-1,605) and residual waste (-25,906) between 2014/15 and 2016/17. Until further waste composition is carried out it is difficult to fully assess the relative changes in the proportions of recyclables being separated out by residents. However, section 7 summarises the factors influencing the ongoing changes in waste composition, in addition to the wider, economy related issue of overall waste arisings.

7 Waste Composition Considerations

An array of factors influence waste arisings in domestic residual and recycling, including attitudes towards goods and waste prevention, product design and local, national and international policy amongst other factors. These factors typically could impact either the overall tonnage of waste arisings or the composition of waste being sent for treatment. For example, the rise of Amazon and home delivery, in general, in the last decade has driven up the amount of cardboard exchanged between businesses and households, and is thus found in increasing volumes in both residual and recycling bins across the country. The trend in recent years has been for the proportion of plastic containers disposed of by the public to increase; the move from glass to plastic containers for drinks, condiments and other consumables and the increasing popularity of ready meals leading to increasing volumes of plastic bottles, trays, pots and tubs, whilst glass, aluminium and metal can tonnages have further declined due to the light-weighting of containers. Mixed paper tonnages have declined with the move from printed to online news, with local press, leaflets and free publications also in decline.

To add to the uncertainty involved in comparing waste performance, 248 out of the 326 local authorities in England have moved to fortnightly residual collections (of whom 6 have moved to 3-weekly waste collection).

The resultant impact on both waste arisings and recycling tonnages makes historical comparison difficult to maintain. The reduction in residual waste capacity (ie smaller waste containers or less frequent collection) has an effect both on residual waste tonnages and overall waste arisings. Whilst there is a logical diversion of waste from residual to recycling (due to the reduced residual capacity), there is also a trend for overall waste arisings to decrease.

The impact of contamination on recyclate quantity and quality is an increasing factor in overall performance, and varies depending on the type of collection scheme utilised. The constituent Councils all operate a co-mingled recycling service; while this is recognised as maximising tonnages collected for recycling (due to the optimal ease of use for residents), it can also increase the level of contamination. WRAP’s analysis suggests an average contamination rate for co-mingled collections of 16%. The overall WRWA contamination rate of 13% thus represents above average performance and ensures that the WRWA recycling rate represents an accurate representation of the volume of material actually recycled.

The factors above indicate that the range of factors influencing waste arisings, recycling rates and waste composition are a reflection of national drivers, rendering the impact of local initiatives relatively limited.

Since the economic slowdown in 2008, national austerity initiatives have seen a slowing of the economy in general, leading to fluctuating, but falling, levels of waste arisings nationwide. The particular challenges facing recycling performance in WRWA’s constituent authorities in terms of housing type and density and the associated operational constraints further render comparison impractical and potentially misleading.

8 Food Waste Assessment

Figure 14: Putrescible waste in household residual stream (overall tonnage for 2016/17)

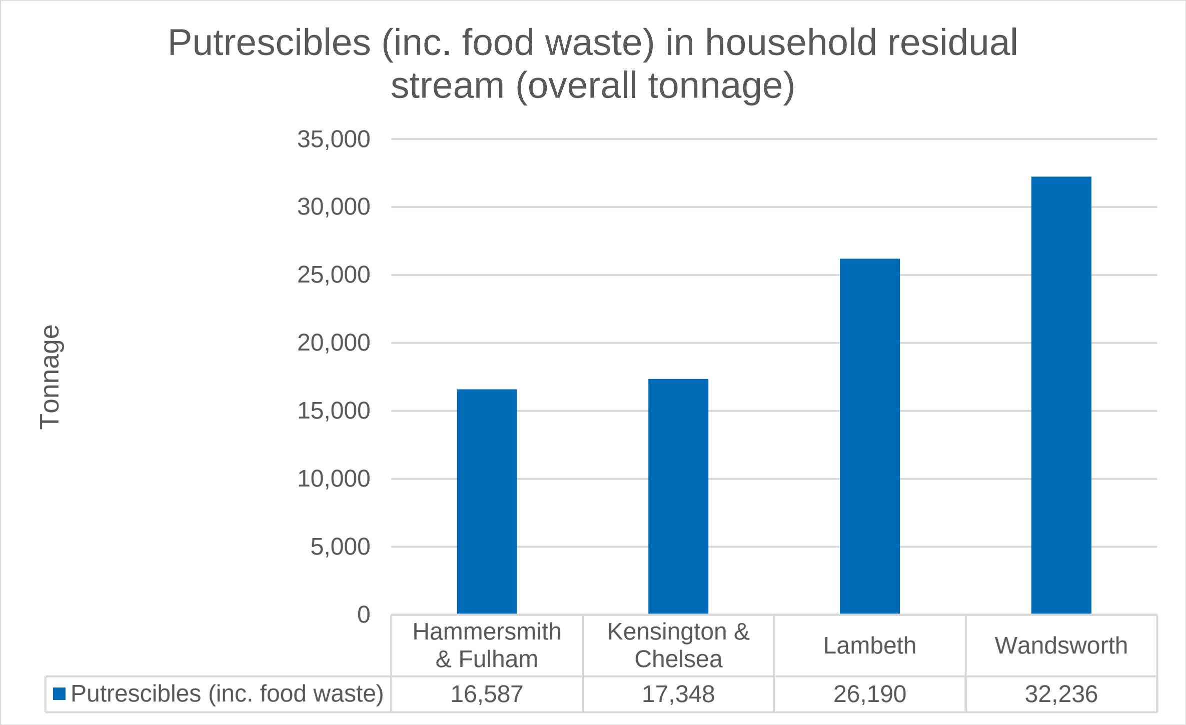
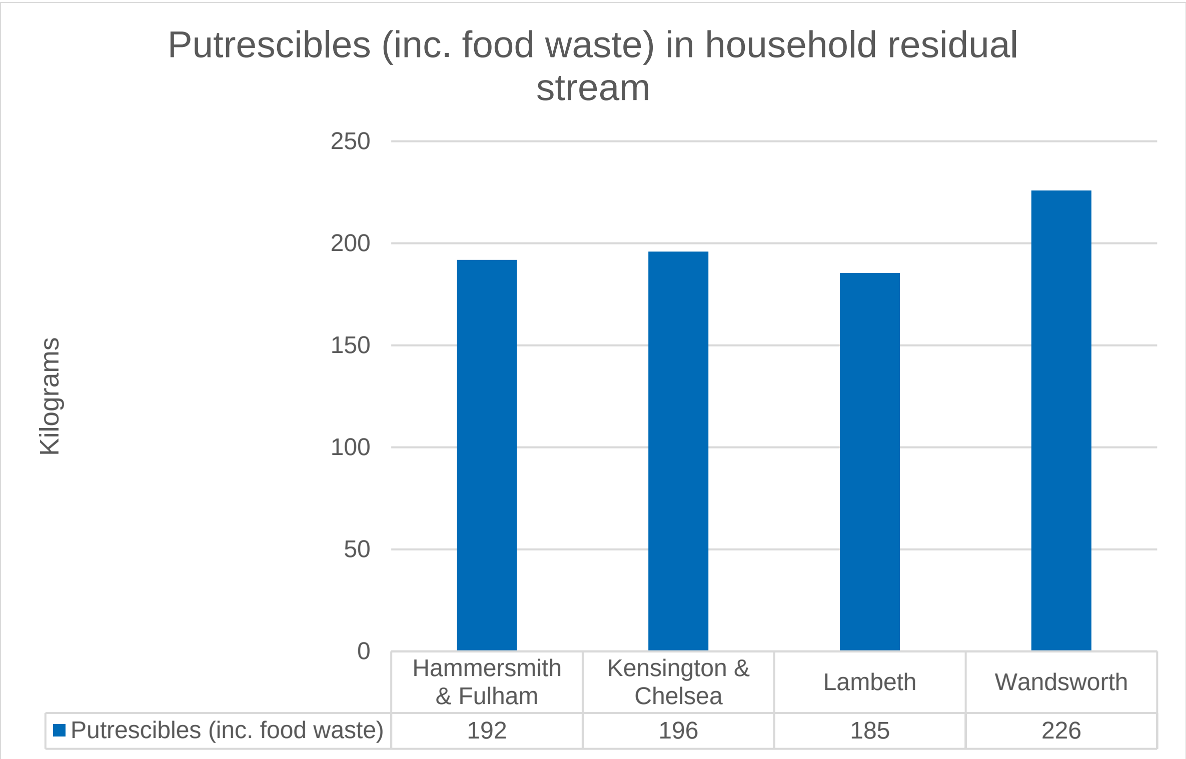


Figure 15: Putrescible waste in household residual stream (kk/hh/yr for 2016/17)



The waste composition analysis in 2014 demonstrated that 44.9% of the kerbside collected household waste delivered to the WTS consists of putrescible waste with 37% estimated as being food waste, representing an annual tonnage of 84,788 tonnes. There is a natural expectation that if this material were separately collected and subsequently composted, this would represent an improvement in both environmental and economic outcomes. This will be explored more fully in the 'Performance Report'.

The WRWA report analysed the impact on its overall recycling rate should recycling rates of either 40% or 13% of its household food waste be achieved, with these figures being thought to be representative of the best and the average capture rates achieved by local authorities in the UK as described in a 2015 WRAP report. These percentages resulted in estimated annual tonnages of 33,915 tonnes and 11,022 tonnes of food waste being recycled respectively. Based on the 434,020 households in the WRWA area, this would represent a range of around 1.5 to 0.5 kg per household per week.

To assess these assumptions, we have utilised the most recent WRAP methodology for assessing the impact of introducing food waste collections, developed to assist with the introduction of the Framework for Greater Consistency in Household Collections[3].

WRAP have utilised their analysis of authorities where food waste collections have been introduced to develop a 'ready reckoner tool', which provides an indication of the likely average yields of separated food waste. The outputs from the use of this tool suggest that the predicted yields per household served per week would be (on the assumption that refuse is collected every week) calculated as follows:

= 2.1614 – (% Social Groups D and E x 2.2009) ± 0.40 kg/hh/week[4]

The input data on the proportion of population in social groups D&E are included within the table below. Utilizing this data alongside WRAP's 'ready reckoner' calculation allows the calculation of the indicative food waste yields per household. This is accompanied by upper and lower thresholds around the predicted average household yield.

Figure 16: WRAP 'ready reckoner' input data and estimated food waste yields[5]

Local authority	Approximated social grade DE (%)	Residual waste collection system	Average food waste yield kg/hh/wk.	Lower limit food waste yield kg/hh/wk.	Upper limit food waste yield kg/hh/wk.
WRWA	17%	Weekly	1.343	1.093	1.593

The WRAP ready reckoner, whilst assuming a mix of property types, does not take into account this uniquely high proportion of flats in the WRWA area, and therefore the range of 1.5kg per week to 0.5kg per household per week utilised in the WRWA report does not seem unrealistic. This is borne out by the food waste collection trial involving 1,700 low rise properties in RBKC, currently in operation and collecting between 0.87 and 1.56 kg/hh/week.

We can thus confirm that the methodology utilised by WRWA to assess the potential outputs from the introduction of food waste collections accurately reflects the projections calculated utilising the best available information from WRAP. However, we would note that the unique nature of the housing mix in the WRWA area makes direct comparison unreliable, and that it would be more realistic to consider future projections based on differing outputs for the differing housing types involved.

[3] http://www.wrap.org.uk/collections-and-reprocessing/consistency

[4] WRAP's food waste ready reckoner based on factors derived from statistical analysis of multiple implemented food waste schemes in the UK

[5] Averages taken of the four constituent boroughs

9 Incinerator Bottom Ash (IBA)

The calculation of recycling rates follows Defra's current requirement to exclude the inclusion of any material recycled following its processing through the Belvedere EfW Plant. The report, Paper No. WRWA 832, identifies correctly that in reality a substantial proportion of the output from the incineration of municipal waste is physically recycled, with metals being extracted from the bottom ash and the remainder of the bottom ash being processed into an aggregate, which is predominantly utilised for use in the road construction industry.

Approximately 28% of the residual waste tonnage delivered to the Belvedere EfW plant is recycled in this manner. Whilst Defra does not currently allow this recyclate to be included in the calculation of either household or municipal recycling rates (since it considers this material stream to be outside the parameters of the EU Recycling Target), this approach is by no means unique; among other EU states, the reported recycling rates of Wales, Germany, Austria, Belgium and the Netherlands include elements of this recyclate stream in their reported recycling performance.

Were this reporting methodology to be utilised in England, this would represent an additional 57,611 tonnes of recyclate diverted from the household residual waste stream by WRWA in 2016/17. **This would increase the current recycling rate by 28.76 % resulting in a total recycling rate of 55.28%**

We can thus confirm WRWA's contention that the government's current approach to the calculation of recycling rates disadvantages WRWA, and fails to reflect the true level of material being physically recycled as a result of the Authorities waste management activities.

10 Percentage of Waste Being Captured

Figure 17 below updates Table 4 in '**PAPER NO. WRWA 832**', utilising the 2016/17 tonnage figures:

Figure 17: 2016/17 Recycling stream capture rate

	Residual Waste		Co-mingled Recycling		Other Recycling		Household Waste Stream		Total Recycled		Capture Rate
Component	**%**	**Tonnes**	**%**	**Tonnes**	**%**	**Tonnes**	**Tonnes**	**%**	**Tonnes**	**%**	**%**
Paper/card	14.00%	28,806	64.60%	42,628	n/a	185	71,619	25.58%	42,813	57.67%	59.78%
Plastic film	7.40%	15,226			n/a		15,226	5.44%	0	0.00%	0.00%
Dense plastic	7.10%	14,609	7.80%	5,147	n/a		19,756	7.06%	5,147	6.93%	26.05%
Textiles	3.10%	6,378			n/a	889	7,267	2.60%	889	1.20%	12.23%
Misc. Comb	12.10%	24,896			n/a		24,896	8.89%	0	0.00%	0.00%
Misc. non Comb	1.50%	3,086			n/a		3,086	1.10%	0	0.00%	0.00%
Glass	4.20%	8,642	24.50%	16,167	n/a		24,809	8.86%	16,167	21.78%	65.17%
Putrescible (inc. fd/waste)	44.90%	92,384			n/a	698	93,082	33.24%	698	0.94%	0.75%
Ferrous Metal	1.50%	3,086	1.70%	1,122	n/a	15	4,223	1.51%	1,137	1.53%	26.92%
Non Ferrous Metal	1.00%	2,058	1.00%	660	n/a		2,717	0.97%	660	0.89%	24.28%
WEEE	1.20%	2,469	4.00%	2,640	n/a	545	5,654	2.02%	3,185	4.29%	56.33%
Pot Hazard	0.90%	1,852			n/a		1,852	0.66%	0	0.00%	0.00%
Fines	1.10%	2,263			n/a		2,263	0.81%	0	0.00%	0.00%
Other					n/a	3546	3,546	1.27%	3,546	4.78%	
Total	**100%**	**205,754**		**65,988**		**5878**	**279,996**	**100.00%**	**74,242**	**26.52%**	**100.00%**

In order to consider the potential for improving the current level of recycling, it is useful to benchmark the current levels of performance against performance by other authorities, to put the current WRWA's performance into perspective.

Sita's 'At This Rate' report[6], published in 2015, incorporated an extensive analysis of the percentage of each material stream being collected from the household waste stream across England. The average capture rates by material stream are shown in Figure 18 below, along with the 2016/17 WRWA capture rates:

Figure 18: Sita 'At This Rate' - capture rates

Material	Sita Average	WRWA
Paper & Card	55%	60%
Glass	71%	65%
Metals	54%	51%
Textiles	16%	12%
Plastics	15%	26%
Food	10%	N/A
WEEE	46%	56%

The SITA report also notes that the highest reported recycling rate for authorities with a proportion of multi-occupancy dwellings of above 50% was 39% which compares a WRWA overall capture rate of 34% % in 2016/17 with a multi-occupancy rate of 73%%.

Bearing these parameters in mind, consideration of WRWA's performance can be put into perspective. In terms of the primary recycling streams, the WRWA performance for paper/card, plastics and WEEE exceeds the national average.

Whilst this is impressive, it should be tempered by consideration of the composition of the overall waste stream; this will differ significantly from the national average as a result of the preponderance of multi-occupancy dwellings. Ultimately, the improvement in the capture rate reflects the fall in overall waste tonnages, demonstrating the over-arching benefit of waste minimisation in terms of both perceived performance and cost benefit.

This analysis impacts on the potential for methodologies to increase the current recycling rate. 'PAPER NO. WRWA 832' considered a scenario where a 73% recycling rate could be achieved if 90% of the population recycled 90% of the recyclable material, 90% of the time.

This ambitious consideration does, however, need to be tempered by the consideration of current performance levels. Considering the current performance against national trends for dry recyclable capture rates, no template exists for increasing capture rates by the significant degree required to achieve current recycling targets. Combined with the limitations on garden waste collection options considered at 4.1, we would thus confirm WRWA's suggestion that *"on the current method of calculation (without widespread food waste collection and recognition of IBAA recycling), it could be extremely difficult for the Authority to achieve a Municipal recycling rate far in excess of 30%."*

[6] Sita - At This Rate (September 2015)

The following section considers the potential impact of separate food waste collections in a similar manner, in terms of the potential volume of material available tempered with the capture rates achieved by other authorities.

10.1 Expansion of Food Waste

An option for the improvement of the recycling rate is the introduction of food waste collections across the constituent authorities.

As considered in Section 8, at present, other than a trial in RBKC, separate food waste collections are not operated in the WRWA area (although Lambeth runs a combined garden/food service from kerbside properties). The RBKC trial is collecting between 0.87 and 1.56 kg/hh/week, averaging 1.2 kg/hh/wk, in line with the projections from WRAP. However, whilst the trial covers 1,700 properties, these are exclusively low rise, and thus only represent a potential 27% of properties in the WRWA area.

Were the current trial to be extended across all 117,185 (27% of the 434,020 WRWA properties) low rise properties, at the WRAP lower yield of 1.093 kg/hh/wk, potentially 6,660 tonnes of food waste could be diverted.

However, it is unlikely that this level of diversion could be achieved from the remaining 316,835 multi-occupancy dwellings. To consider the likely diversion rate, WRAP's report on collecting food waste from flats[7] measured the tonnages collected from communal food waste recycling containers across eight local authorities. This recorded yields ranging from 0.26 to 0.98 kg/hh/wk. The average (mean) yield was 0.63 kg/hh/wk.

WRAP's report accepts the limited nature of the evidence gathered, primarily due to the difficulty of separating dedicated flats recycling tonnages from the wider schemes operated by councils, limiting the range of dedicated information available.

It must also be recognised that the range of property types, space constraints for container provision, operational difficulties and the issues of communication with residents and the transient population in the WRWA area represent a more challenging environment than the WRAP report covers.

However, utilising WRAP's mean figure would suggest a collection of a further 10,380 tonnes of food waste per annum could potentially be collected from the multi-occupancy properties in the WRWA area.

These projections would thus suggest a projected annual food waste collection tonnage of 17,040 tonnes across the WRWA area.

This would increase the current recycling rate by 5.21% resulting in a total recycling rate of 31.73%

The WRWA report analysed the impact on its overall recycling rate of recycling 40% and 13% of its household food waste, resulting in estimated annual tonnages of 33,915 tonnes and 11,022 tonnes respectively. Based on the projections and analysis from the WRAP and Sita reports, the higher range modelled would be unlikely to be achieved. Our analysis, however, suggests that the lower rate modelled is achievable when compared against WRAP's analysis of average capture rates achieved by other local authorities. However, as previously noted, this is in line with the potential recycling rate considered achievable in '**PAPER NO. WRWA 832**', and we can thus confirm our agreement with the conclusions reached by WRWA.

[7] Food Waste Collections Guide Section 8 Collecting From Flats

11 Weight-Based Targets

In light of the issues identified through their analysis, WRWA have considered the issue of the current weight-based approach to recycling targets and the manner in which it disadvantages urban areas and distorts the reporting of environmental performance. This is an issue being considered as an integral element of the wider Circular Economy approach to resource management, one aspect of which is the exploration of whether recycling activities should be more focussed on those materials whose recycling represents the maximum environmental benefit, rather than simply collecting the heaviest elements of the waste stream. Under this approach, instead of an absolute target for recycling, individual material streams would have their own target, which could include packaging waste. The streams would be linked to the best environmental option for that particular material. Metrics such as carbon or residual waste production would provide a fairer reflection of environmental performance.

Development of this agenda would need a clear policy framework from central government, Therese Coffey, Parliamentary Secretary of State at DEFRA, has confirmed that they note the limitations of weight based targets, and the reliance of recycling rates on garden waste collections. The overarching CE premise is one of minimising the use of resources, keeping them in use for as long as possible, extracting the maximum value from them whilst in use, and recovering or recycling them only when they can no longer be repaired or reused, thus providing alternatives to raw materials. This approach means that resources are used as efficiently as possible, and when products reach the end of their life, they are used instead of finite raw materials to create further value.

This naturally leads to the consideration of a more sophisticated approach to measuring recycling performance and the impact of waste management activities.

The use of carbon metrics would allow authorities to make more holistic decisions regarding recycling and reuse, and to prioritise overall environmental performance and the capture of resources which represent the best environmental outcome. This would resolve the current situation where local authority recycling performance is solely based on the weight of waste they reuse, recycle or compost/digest as a percentage of the total weight of waste they collect. This system encourages councils to “chase” the heavier waste materials, regardless of the overall environmental benefit, seen most clearly in the expansion of garden waste collections. As outlined in 4.1, this approach would also help to level the playing field between urban and rural authorities, resolving the issue whereby WRWA’s recycling rate is compromised due to the lack of availability of garden waste (and would also act as a driver towards reinvigorating the ‘home composting’ approach and its associated waste minimisation benefits).This could result in a major revision of the collection services offered by local authorities.

Taking this further, with emissions from waste services contributing in the region of 35% of an authority’s total carbon emissions, reviewing the carbon contribution of a total waste service could become an appropriate measure of environmental benefit. Carbon is often used as a proxy for environmental impact, particularly because materials and processes that have a high carbon footprint often involve wider environmental impacts due to high energy consumption, e.g. mining, processing, transport, etc.

This would require the carbon impact of waste collection methodologies to be incorporated, incentivising the use of low-carbon vehicles powered by electricity, gas or other technological solutions. The use of low-carbon vehicles would also assist with improving air quality which is another pressing environmental issue in inner London. Air quality generally and the level of nitrogen oxides emitted when fuel is being burned e.g. in transport, industrial processes and power generation will also need to be considered when comparing the relative impact of differing waste collection and management options. Our WRATE model, which will be utilised as part of the carbon assessment, examines the Human Toxicity Potential of substances released as part of the waste collection and disposal process, highlighting the impact the operation has on air quality.

12 Conclusions

Ricardo's analysis has audited and thoroughly 'sense-checked' the data utilised by WRWA to establish historical performance regarding municipal waste collected by WRWA and its constituent authorities. Our analysis has been carried out utilising the tonnage data provided by WRWA, cross-referenced against the data reported on WasteDataFlow.

Our analysis and audit of the data within the model demonstrates that the outputs generated by the model are accurate. This means that the figures and conclusions that WRWA have reached are underpinned by a model that contains no errors within the formulae used to calculate the outputs. This audit demonstrates the robustness and integrity of both the model itself and the figures that comprise the outputs.

We note the methodology whereby WRWA apportion the tonnage of materials (residual and recyclate) delivered to their HWRC to the four constituent authorities, in the proportion represented by the default levy % for each borough.

We can also confirm our agreement with the assumptions made regarding the composition of the municipal waste stream, and the manner in which it has changed significantly over the last 10 years; our assessment of these factors is shown at Section 7.

Our analysis and audit of the data utilised to generate the recycling performance figures and the conclusions drawn from them confirm their accuracy, demonstrating the robustness and integrity of both the model itself and the figures and commentary that comprise the outputs.

With these methodologies taken into account, our analysis demonstrates that the calculations utilised to analyse and demonstrate historical and comparative data are entirely accurate, and thus represent a realistic version of the performance of WRWA and its constituent authorities, as published in **PAPER NO. WRWA 832**, published on 28th June 2017.

We have updated the capture rates of recyclables across the WRWA area utilising the latest tonnage figures available, from 2016/17. We have compared the performance this represents, both by benchmarking the recycling performance against appropriate comparator authorities and by comparing capture rates against England-wide research. Potential food waste capture rates have been explored utilising data developed by WRAP from their experience of assessing existing food waste collection schemes. This analysis demonstrates that the conclusions drawn by WRWA regarding the practical levels of recycling rates achievable through the current system of weight-based targets represent an accurate assessment. Additionally, WRWA's analysis demonstrates that, despite the operational and demographic constraints impacting on current and achievable recycling rates, the current performance in terms of the proportion of recyclable material in the waste stream captured for recycling is in line with the average across England as a whole.

As outlined in section 11, the consideration of an alternative methodology for measuring the best environmental option for each material stream would enable more appropriate targets to be set which would better reflect the performance in the WRWA area, whilst also demonstrating environmental best practice.

This approach should be conformity with the Mayor of London's Environment Strategy and in line with the key themes from current and upcoming UK policy such as the 25 year Environment Plan, the EU Circular Economy Package and (provisionally) Defra's Resource & Waste Strategy, due to be published towards the end of the year.

The next stage of the project will thus be the development of a set of metrics that are easily measurable, simple to monitor, easy to communicate to a variety of stakeholders and that best drive an environmental approach to performance. To this end, a 'dashboard' of indicators will be developed which will demonstrate and drive preferred behaviours and performance for different material streams.

Metrics such as carbon or residual waste production would provide a fairer reflection of environmental performance, and also help to level the playing field between urban and rural authorities. These metrics would incorporate the environmental impact of both collection and disposal activities.

Carbon is often used as a proxy for environmental impact, particularly because materials and processes that have a high carbon footprint often involve wider environmental impacts due to high energy consumption, e.g. mining, processing, transport, etc. Thus measuring the carbon impact of waste management methodologies would provide a more informative reflection of environmental performance, and in the longer term could lead to the setting of more appropriate targets.

An additional air quality metric will be incorporated into the 'dashboard', utilising the levels of nitrogen oxides (NOx) generated by waste activities. As NOx is emitted when fuel is being burned e.g. in transport, industrial processes and power generation, its measurement will enable the relative impact of differing waste management options to be compared. Our WRATE model, which will be utilised as part of the carbon assessment, will examine the Human Toxicity Potential of substances released as part of the waste collection and disposal process. These will be presented in the 'Performance Report'.

The metrics will be designed to sit alongside existing weight-based recycling targets; this will allow for the ongoing need for reporting performance in the format required by the government, but offers the opportunity for a phased introduction of a more environmentally coherent approach as policies allow.

The 'dashboard' approach will also enable the development of a 'ready reckoner' tool, which will enable the assessment of current and proposed waste collection methodologies in terms of the carbon/NOx impact of revised collection vehicle requirements and the impact of the disposal/reprocessing/recycling of the material streams involved.

This approach will ensure that the full environmental benefits of initiatives to reduce the volume of waste generated by residents can be assessed and communicated in a more coherent manner than the current weight based recycling targets permit.

This will enable WRWA to ensure the development of the new Joint Waste Strategy takes account of the waste management activities involved in a manner which fully recognises the environmental and financial impact of the choices to be made in their development.

Appendix 1 – Benchmarking Results

Overall Benchmarking

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

The benchmarking is conducted through various comparisons, including nearest neighbours, rurality and similarity of waste service type. As such not all comparator authorities are the same for each Borough. In the case of RBKC, who have a greater than weekly residual collection frequency, they have been compared to some authorities which do not appear within the other Borough's comparator groups. It should also be noted that this benchmarking is not a true comparison due to the difference in service level between RBKC and the other constituent Boroughs. However, to compare the four constituent Boroughs in this benchmarking exercise it has been necessary to add them to each to the other's comparator groups.

It should be noted that the analysis undertaken using our in-house benchmarking tool excluded food and garden waste collections from the comparison, as including these two waste streams significantly reduced the number of available comparator authorities.

Figure 19: Quartiles Description

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

It should be noted that this benchmarking is generic and doesn't take into consideration waste collection schemes in each LA. In order to establish a wider understanding of impacts associated with different collection schemes, we used our in-house benchmarking tool to understand how the Council is performing against LAs with the same collection schemes and those with similar schemes proposed for the future plans.

Hammersmith & Fulham

Overall benchmarking

Figure 20: WRAP Overall Benchmark Comparisons (WRAP LA portal, 2016/17) - Hammersmith & Fulham (Recycling)

Category	Detail	Paper	Card	Cans	Glass	Plastic bottles	Mixed plastic packaging	Plastic film	Textiles	All 5 'Widely Recycled' materials
Hammersmith and Fulham London Borough Council	Yield (kg/hhd/yr)	54.0	20.0	6.5	33.9	8.9	3.5	n/a	n/a	123.3
How you compare against other UK Authorities								n/a	n/a	
How you compare against other authorities in the same region	London							n/a	n/a	
How you compare against other authorities with similar characteristics - ONS area classification	London Cosmopolitan							n/a	n/a	
How you compare against other authorities in the same rurality	2) Predominantly urban, lower deprivation							n/a	n/a	

Figure 21: WRAP Overall Benchmark Comparisons (WRAP LA portal, 2016/17) - Hammersmith & Fulham (Residual)

Category	Detail	Household Residual Waste collected at kerbside (kg/hhd/yr)
Hammersmith and Fulham London Borough Council	Yield (kg/hhd/yr)	427.3
How you compare against other UK Authorities		
How you compare against other authorities in the same region	London	
How you compare against other authorities with similar characteristics - ONS area classification	London Cosmopolitan	
How you compare against other authorities in the same rurality	2) Predominantly urban, lower deprivation	

Benchmarking analysis

The service types used for benchmarking Hammersmith & Fulham's Baseline performance are:

- Residual and co-mingled dry mixed recycling
- Rurality: 2
- Comparator authorities: six (6)
    - London Borough of (LB) Camden;
    - LB Greenwich;
    - Royal Borough of Kensington & Chelsea;
    - LB Lambeth;
    - LB Lewisham; &
    - LB Wandsworth;

Figure 22: Hammersmith & Fulham benchmarking (in-house tool)

kg/household/year	Paper	Card	Cans	Glass	Plastics (inc. bottles)	Residual waste
Q1 bottom quartile	54	20	7	34	9	580
Q2 lower quartile	57	21	7	36	9	549
Q3 upper quartile	61	23	7	39	10	478
Q4 top quartile	73	27	9	46	12	423
Hammersmith and Fulham LB	55	20	7	34	9	427

Observations made are:

- All dry recyclables are in the lower quartile of LAs included in this analysis.
- Residual waste is in the upper quartile of authorities.

Kensington & Chelsea

Overall benchmarking

Figure 23: WRAP Overall Benchmark Comparisons (WRAP LA portal, 2016/17) – Kensington & Chelsea (Recycling)

Category	Detail	Paper	Card	Cans	Glass	Plastic bottles	Mixed plastic packaging	Plastic film	Textiles	All 5 'Widely Recycled' materials
Royal Borough of Kensington and Chelsea	Yield (kg/hhd/yr)	62.2	23.0	7.5	39.1	10.2	4.0	n/a	n/a	142.1
How you compare against other UK Authorities								n/a	n/a	
How you compare against other authorities in the same region	London							n/a	n/a	
How you compare against other authorities with similar characteristics - ONS area classification	London Cosmopolitan							n/a	n/a	
How you compare against other authorities in the same rurality	2) Predominantly urban, lower deprivation							n/a	n/a	

Figure 24: WRAP Overall Benchmark Comparisons (WRAP LA portal, 2016/17) - Kensington & Chelsea (Residual)

Category	Detail	Household Residual Waste collected at kerbside (kg/hhd/yr)
Royal Borough of Kensington and Chelsea	Yield (kg/hhd/yr)	437.0
How you compare against other UK Authorities		
How you compare against other authorities in the same region	London	
How you compare against other authorities with similar characteristics - ONS area classification	London Cosmopolitan	
How you compare against other authorities in the same rurality	2) Predominantly urban, lower deprivation	

Benchmarking analysis

The service types used for benchmarking Kensington & Chelsea's performance are:

- Residual and co-mingled dry mixed recycling
- Rurality: 2
- Comparator authorities: six (6)
  - LB Hammersmith & Fulham
  - LB Islington;
  - LB Lambeth
  - LB Southwark;
  - LB Wandsworth; and
  - Westminster City Council

Figure 25: Kensington & Chelsea benchmarking (in-house tool)

kg/household/year	Paper	Card	Cans	Glass	Plastics (inc. bottles)	Residual waste
Q1 bottom quartile	49	18	6	31	9	510
Q2 lower quartile	52	19	6	33	12	456
Q3 upper quartile	55	20	7	35	12	432
Q4 top quartile	61	22	7	38	14	421
Royal Borough of Kensington & Chelsea	62	23	8	39	14	437

Observations made are:

- All dry recyclables are in the top quartile of LAs included in this analysis.
- Residual waste is in upper quartile of authorities in this analysis.

Lambeth

Overall benchmarking

Figure 26: WRAP Overall Benchmark Comparisons (WRAP LA portal, 2016/17) - Lambeth (Recycling)

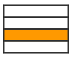
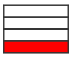
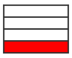
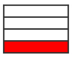
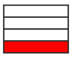
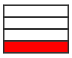
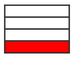
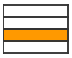
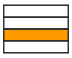
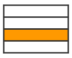
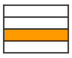
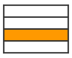
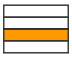
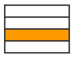
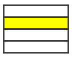
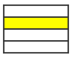
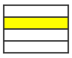
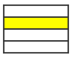
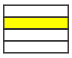
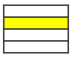
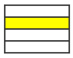
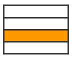
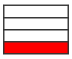
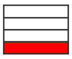
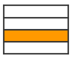
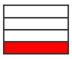
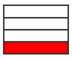
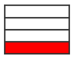
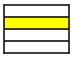
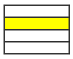
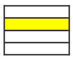
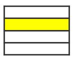
Category	Detail	Paper	Card	Cans	Glass	Plastic bottles	Mixed plastic packaging	Plastic film	Textiles	All 5 'Widely Recycled' materials
Lambeth London Borough Council	Yield (kg/hhd/yr)	55.1	20.4	6.7	34.6	9.1	3.6	n/a	n/a	125.9
How you compare against other UK Authorities								n/a	n/a	
How you compare against other authorities in the same region	London							n/a	n/a	
How you compare against other authorities with similar characteristics - ONS area classification	London Cosmopolitan							n/a	n/a	
How you compare against other authorities in the same rurality	2) Predominantly urban, lower deprivation							n/a	n/a	

Figure 27: WRAP Overall Benchmark Comparisons (WRAP LA portal, 2016/17) - Lambeth (Residual)

Category	Detail	Household Residual Waste collected at kerbside (kg/hhd/yr)
Lambeth London Borough Council	Yield (kg/hhd/yr)	418.9
How you compare against other UK Authorities		
How you compare against other authorities in the same region	London	
How you compare against other authorities with similar characteristics - ONS area classification	London Cosmopolitan	
How you compare against other authorities in the same rurality	2) Predominantly urban, lower deprivation	

Benchmarking analysis

The service types used for benchmarking Lambeth's performance are:

- Residual and co-mingled dry mixed recycling
- Rurality: 2
- Comparator authorities: five (5)
  - LB Camden;
  - LB Greenwich;
  - LB Hammersmith & Fulham
  - RB Kensington & Chelsea; &
  - LB Wandsworth

Figure 28: Lambeth benchmarking (in-house tool)

kg/household/year	Paper	Card	Cans	Glass	Plastics (inc. bottles)	Residual waste
Q1 bottom quartile	55	20	7	34	12	519
Q2 lower quartile	61	22	7	38	14	510
Q3 upper quartile	62	23	8	39	14	437
Q4 top quartile	73	27	9	46	17	427
Lambeth LB	55	20	7	35	13	419

Observations made are:

- Paper, card and cans are in the bottom quartile, with glass and plastics in the lower quartile
  - Cans and plastic bottles are in the lowest half
- Residual waste is in the top quartile of authorities in this analysis.

Wandsworth

Overall benchmarking

Figure 29: WRAP Overall Benchmark Comparisons (WRAP LA portal, 2016/17) - Wandsworth (Recycling)

Category	Detail	Paper	Card	Cans	Glass	Plastic bottles	Mixed plastic packaging	Plastic film	Textiles	All 5 'Widely Recycled' materials
Wandsworth London Borough Council	Yield (kg/hhd/yr)	60.6	22.4	7.3	38.1	10.0	3.9	n/a	2.8	138.4
How you compare against other UK Authorities								n/a		
How you compare against other authorities in the same region	London							n/a		
How you compare against other authorities with similar characteristics - ONS area classification	London Cosmopolitan							n/a		
How you compare against other authorities in the same rurality	2) Predominantly urban, lower deprivation							n/a		

Figure 30: WRAP Overall Benchmark Comparisons (WRAP LA portal, 2016/17) - Wandsworth (Residual)

Category	Detail	Household Residual Waste collected at kerbside (kg/hhd/yr)
Wandsworth London Borough Council	Yield (kg/hhd/yr)	509.7
How you compare against other UK Authorities		
How you compare against other authorities in the same region	London	
How you compare against other authorities with similar characteristics - ONS area classification	London Cosmopolitan	
How you compare against other authorities in the same rurality	2) Predominantly urban, lower deprivation	

Benchmarking analysis

The service types used for benchmarking the Council's Baseline performance are:

- Residual and co-mingled dry mixed recycling
- Rurality: 2
- Comparator authorities: six (6)
    - LB Camden;
    - LB Greenwich;
    - LB Hammersmith & Fulham
    - RB Kensington & Chelsea;
    - LB Lambeth; and
    - LB Lewisham

Figure 31: Wandsworth benchmarking (in-house tool)

kg/household/year	Paper	Card	Cans	Glass	Plastics (inc. bottles)	Residual waste
Q1 bottom quartile	54	20	7	34	12	580
Q2 lower quartile	55	20	7	34	13	499
Q3 upper quartile	60	22	7	38	14	432
Q4 top quartile	73	27	9	46	17	421
Lambeth LB	61	22	7	38	14	510

Observations made are:

- All dry recyclables are in the upper quartile LAs included in this analysis
- Residual waste is in the bottom quartile of authorities in this analysis.

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Energy & Environment

Joint Waste Strategy Analysis

Performance Report

Report for Western Riverside Waste Authority

ED 11299 | Issue Number 1 | Date 11/09/2018

Customer:

Western Riverside Waste Authority

Customer reference:

Joint Waste Strategy Analysis

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John Woodruff

Date:

11 September 2018

Ricardo Energy & Environment reference:

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1 Executive Summary

WRWA have appointed Ricardo Energy & Environment to undertake a thorough strategic review of their services, including those of their constituent councils, to determine how the current joint waste policy should be updated in the light of current and potential developments in strategic, legislative and environmental drivers.

An important aspect of strategy development is the consideration of how performance should be measured. The current weight-based recycling targets have served us well to date, but it can be argued that we have reached a stage where the race to improve perceived performance can drive perverse behaviours. The waste prevention message can get lost amongst messaging that recycling is the right thing to do. Heavier materials such as garden waste can be targeted for collection whereas the better environmental option could be home composting. For garden waste in particular this creates a performance divide between urban and rural authorities, making performance comparison unreliable. The focus on quantity can mean that quality is compromised, with low quality / contaminated materials sent to be recycled. Importantly, end of life targets also fail to create any drive for producers to design products that are more durable or easier to reuse or recycle. Our understanding of product lifecycles has become more sophisticated, and an updated approach would ensure that our actions and priorities are geared towards achieving the best environmental outcomes, and that all stakeholders are involved in the process.

From this perspective, reflecting a Circular Economy approach, recycling activities could be more focussed on those materials whose recycling represents the maximum environmental benefit, rather than simply collecting the heaviest elements of the waste stream. Under this approach, instead of an absolute target for recycling, individual material streams would have their own target, which could include packaging waste. The streams would be linked to the best environmental option for that particular material. Metrics such as carbon, residual waste production and air quality would provide a fairer reflection of environmental performance, and also help to level the playing field between urban and rural authorities. However, all of these metrics, including weight based recycling targets, need to be balanced against economic cost in order to determine affordability by means of a cost benefit analysis.

This report thus explores the relative performance of the constituent authorities in terms of the yield of recyclate generated by their kerbside recycling collection services and also the quantities of recyclate not recycled – i.e. the material remaining in the residual waste.

This provides a performance indicator for the volume of additional recyclate potentially available from households.

The report then considers the carbon impact of each element of the waste stream for each potential treatment methodology and the carbon impact of both the disposal/recycling and collection operations expressed as a 'carbon impact per tonne', providing potential alternative metrics which could be utilised to make more holistic decisions regarding recycling and reuse. This analysis also generates a metric enabling the collection services to be considered in terms of air quality impact.

The key findings from the report are:

- Given their built environment and demographics, WRWA and its constituent councils generally perform well in comparison to London as a whole and the rest of the UK in terms of dry recycling performance. However, the differences between the constituent Boroughs in terms of housing mix, demographics and operational constraints make direct comparison of performance difficult.
- Despite the relatively high capture rate for recyclables, the proportion of potential recyclables in the residual stream remains high, particularly textiles (3.1%), WEEE (1.2%) food waste (37%) and garden waste (7%). This reflects the WRWA conclusions in PAPER NO. WRWA 832 that more attention should be given to the non-targeted recyclable material in the waste stream, in

terms either of targeted waste minimisation/prevention activities to reduce the volume of waste being produced, or through the addition of additional kerbside recycling facilities to enable these materials to be captured.

- The climate change, or Global Warming Potential (GWP), impact of each waste activity in terms of kg or tonnes of carbon dioxide (CO2) equivalent demonstrates that, whilst incineration has a positive carbon impact, it can only mitigate the carbon footprint of the waste to a limited extent. The analysis demonstrates that recycling is far more effective from a carbon perspective, as the use of recyclate as a substitute for raw materials can minimize the requirements for the extraction of raw materials, reduce the amount of fossil fuel burnt in their extraction and transport and reduce the energy required in the manufacturing process. Waste prevention/minimisation, including reuse, is patently even more effective, since, by removing or reducing the demand for goods, it maximises the reduction in demand for raw materials and the associated environmental impact of their production.
- The negative carbon impact of the collection services is relatively minor in comparison with the carbon benefit of WRWA's methodology for treating the waste.
- The NOx emissions caused by each Borough's waste collection activities can be considered in perspective. Effectively, their impact represents 0.09% of the NOx emissions in each Borough. However, congestion caused by collection activities may cause emissions from other vehicles not captured by this analysis. Similarly, the tipping facilities at Smugglers Way and Cringle Dock will be visited by the majority of collection vehicles on multiple occasions, and will thus have a concentrated local impact on air quality.
- The analysis shows the relative carbon impact of road and river options for the transportation of the residual waste. This impact is not factored in the carbon impact assessments in this report, but demonstrates the positive environmental benefit of WRWA's transportation methodology.
- The major carbon benefit is achieved through the recycling of co-mingled dry recycling.
- A separate Options Assessment would be required to enable consideration of the operational cost of collection, the infrastructure required (containers, food waste liners, communications etc), the benefits in terms of reduced disposal costs, and the carbon and air quality implications of the collection of food, WEEE, textiles or garden waste.
- The WRWA proposal for the consideration of material specific campaigns to minimise the volume of these wastes (and others) discarded by residents (as outlined in PAPER NO. WRWA 842), would reduce not only the level of material wasted by residents, but would also represent a saving for residents against the purchasing costs involved. This approach would reduce the carbon impact of these wastes whether introduced as stand-alone initiatives or in conjunction with the introduction of dedicated collection services.
- A variety of factors may influence the waste landscape in the short term. These include the impacts of emergent government policy (particularly the Resource & Waste Strategy), the introduction of the EU Circular Economy Package, Brexit impacts, the introduction of Deposit Return Schemes and the London Mayor's Environment Strategy. These factors are addressed in Appendix 1.

2 Methodology

WRWA provided Ricardo with disposal data and tonnages from 2013/14 to 2016/17, with the latter being the latest complete dataset available. This information comprised tonnages for each of the constituent boroughs:

- Hammersmith & Fulham;
- Kensington & Chelsea;
- Lambeth; and
- Wandsworth

WRWA also provided the most recent waste composition analysis for both the residual waste and the co-mingled recycling collected by the four authorities. This has allowed us to estimate what proportion of recyclable material remains in the residual waste stream. Each of the materials collected by the kerbside schemes has been considered separately.

To enable comparisons to be drawn, the yields have been expressed in kilogrammes per household per year (kg/hh/yr). Across the WRWA area, 73% of properties are flats, either purpose built or conversions; in addition, 52% of all properties are rented rather than owned and there is a very high level of transience. These factors are industry acknowledged as being major constraints on recycling performance.

Given their built environment and demographics, WRWA and its constituent councils generally perform well in comparison to London as a whole and the rest of the UK in terms of dry recycling performance. However, the differences between the constituent Boroughs in terms of housing mix, demographics and operational constraints make direct comparison of performance difficult.

3 Yield Performance Results

3.1 Current performance

Table 1 below summarises the comparison between the constituent Boroughs' current performance using 2016/17 data, ranked in line with Figure 1

.

Figure 1: Performance Key

Highest performing
Lowest performing

Table 1 combines two elements. Firstly, it utilises the waste composition analysis to demonstrate the average tonnage per household of each element of the recycling stream remaining in the residual waste collected. This shows the potential material which would be available for collection if participation in the recycling service could be increased.

The second element uses the co-mingled recycling composition to demonstrate the average tonnage of recyclables collected per household.

In both cases, only the dry recyclables currently collected by the Boroughs are included.

The results are shown by authority, enabling comparison of both elements of the findings.

Table 1: Current Performance Comparison (2016/17)

Authority	Hammersmith & Fulham	Kensington & Chelsea	Lambeth	Wandsworth
Number of households	86,457	88,527	141,256	142,714
of which flats[1] (%)	73%	83%	74%	66%
Residual waste yield by material (kg/hh/yr)				
Paper	30	31	29	35
Card	30	31	29	35
Cans	11	11	10	13
Glass	18	18	17	21
Mixed plastic	30	31	29	36
Non targeted material (waste)	309	315	298	363
Total	**427**	**436**	**413**	**503**
Comingled recycling yield by material (kg/hh/yr)				
Paper	48	67	46	51
Card	18	25	17	19
Cans	6	8	6	6
Glass	30	42	29	32
Plastic bottles	8	11	8	8
Mixed plastic	3	4	3	3
Total	**113**	**157**	**107**	121
Relative recycling rate	**21%**	**26%**	**21%**	**19%**
Relative recycling rate (WRWA)	**22%**			

3.1.1 Observations

It can be seen that, despite the relatively high capture rate for recyclables (compared to a weighted average of collection schemes elsewhere in England), the proportion of non-targeted material remains high. Table 5 in Section 4.1 below identifies the proportion of materials in the residual waste stream – it can be seen that materials currently not collected by the Boroughs represent a substantial proportion of the waste stream. Textiles represent 3.1% of the waste stream (6,377 tonnes pa), demonstrating that, even allowing for the recycling activities carried out by the 3rd Sector, substantial levels of this material are not being recycled or re-used. WEEE makes up 1.2% of the residual waste (2,468 tonnes pa), and represents a valuable recycling stream. Of the 45% of putrescible waste, it is estimated that food waste accounts for 37% of the residual waste, with garden waste representing 7%. The annual tonnage of 76,110 tonnes of food waste is addressed at Section 7- Food Waste Assessment.

This reflects the WRWA conclusions in **PAPER NO. WRWA 832** that more attention should be given to the non-targeted recyclable material in the waste stream, focussing on food, garden waste, nappies, WEEE and textiles. This focus could be in terms either of targeted waste minimisation/prevention activities to reduce the volume of waste being produced, or through the addition of additional kerbside recycling facilities to enable these materials to be captured.

In terms of recyclable content in the residual waste stream, Lambeth's residents perform best for all recycling streams. However, their yield for the co-mingled recycling service represents the lowest performance. This indicates that the actual composition of household waste in Lambeth may differ from the average, containing a lower proportion of recyclables than the other boroughs.

[1] Housing split derived from the Borough 'Fact Sheets' where current information is not available

Kensington & Chelsea have the highest performance per household in terms of co-mingled recycling. However, the volume of recyclate remaining in the residual stream suggests that participation could be improved.

Wandsworth's performance is compromised by the high level of residual waste collected. We understand that Wandsworth does not collect commercial waste but we would suggest that further analysis of their collection tonnages is undertaken to ensure that commercial waste is not somehow entering their household waste stream, as the higher residual waste levels are impacting on both their recorded waste arisings (and therefore costs) and their recycling rate.

3.2 Potential future performance

To consider the potential for potential performance levels, two examples have been utilised; the first considers the impact if the highest recycling yield performance were replicated across all four Boroughs. The second considers the impact if the lowest residual waste yield was replicated across all four boroughs.

Table 2 thus utilises Kensington & Chelsea's current recycling yield to explore the impact of replicating this performance across the WRWA area. The recycling yield for all Boroughs has been adjusted to match K&C's performance. The increase in recyclate collected means that more material is diverted from the residual stream, thus lowering the overall tonnage of residual waste.

It can be seen that this increases the recycling rate whilst lowering the overall residual waste tonnage. However, a substantial element of recyclate remains in the residual stream across all four Boroughs, with card in particular demonstrating low capture rates; across the WRWA area, on average more card is placed in the residual waste than is recycled. With card and plastic still be the two most abundant co-mingled recyclable elements of the residual waste stream, it appears likely that the growing trend of online deliveries is contributing to a change in waste composition.

This analysis demonstrates the relative capture rates of each recyclable material stream, indicating potential areas for action to improve resident awareness and participation – for example, dedicated communications regarding the recycling of cardboard containers and packaging. However, it doesn't reflect the differences between the constituent Boroughs in terms of housing mix, demographics and operational constraints.

Table 2: Future Performance Comparison – matching recycling yield

Authority	Hammersmith & Fulham	Kensington & Chelsea	Lambeth	Wandsworth
Number of households	86,457	88,527	141,256	142,714
of which flats[2] (%)	73%	83%	74%	66%
Residual waste yield by material (kg/hh/yr)				
Paper	11	31	8	20
Card	23	31	21	29
Cans	8	11	8	11
Glass	6	18	4	11
Mixed plastic	29	31	28	35
Non targeted material (waste)	309	315	298	363
Total	**383**	**436**	**363**	**466**
Comingled recycling yield by material (kg/hh/yr)				
Paper	67	67	67	67
Card	25	25	25	25
Cans	8	8	8	8
Glass	42	42	42	42
Plastic bottles	11	11	11	11
Mixed plastic	4	4	4	4
Total	**157**	**157**	**157**	**157**
Relative recycling rate	**29%**	**26%**	**30%**	**25%**
Relative recycling rate (WRWA)	**28%**			

Table 3 considers the impact if the lowest level of recyclate remaining in the residual stream was replicated across all four boroughs.

Table 3 thus utilises Lambeth's current level of recyclate yield in the residual stream to explore the impact of replicating this performance across the WRWA area. The residual waste yield for all Boroughs has been adjusted to match Lambeth's performance. The increase in recyclate collected means that more material is diverted from the residual stream, thus lowering the overall tonnage of residual waste.

It can be seen that, whilst this also increases the recycling rate and lowers the overall residual waste tonnage, the impact is not as pronounced as that achieved by increasing the recycling yield.

This demonstrates that, whilst improving the capture rate of the materials currently remaining in the waste stream has a positive benefit, the level of residual waste compromises the recycling performance.

It can thus be seen that the most effective means of improving the recycling rate, and to deal with the volume of residual waste, would be the development of waste minimisation/prevention schemes and the introduction of schemes to collect additional recyclable material currently not targeted for collection and thus remaining in the residual waste. This is addressed in sections 7 - 11.

[2] Housing split derived from the Borough 'Fact Sheets' where current information is not available

Table 3 : Matching residual waste yield

Authority	Hammersmith & Fulham	Kensington & Chelsea	Lambeth	Wandsworth
Number of households	86,457	88,527	141,256	142,714
of which flats[3] (%)	73%	83%	74%	66%
Residual waste yield by material (kg/hh/yr)				
Paper	29	29	29	29
Card	29	29	29	29
Cans	10	10	10	10
Glass	17	17	17	17
Mixed plastic	29	29	29	29
Non targeted material (waste)	309	315	298	363
Total	423	430	413	478
Comingled recycling yield by material (kg/hh/yr)				
Paper	49	69	46	58
Card	19	26	17	25
Cans	6	9	6	8
Glass	31	43	29	36
Plastic bottles	8	11	8	8
Mixed plastic	4	6	3	10
Total	117	164	107	146
Relative recycling rate	22%	28%	21%	23%
Relative recycling rate (WRWA)	23%			

[3] Housing split derived from the Borough 'Fact Sheets' where current information is not available

4 Carbon Benefit Analysis

Carbon is widely used as a proxy for environmental impact, particularly because materials and processes that have a high carbon footprint often involve wider environmental impacts due to high energy consumption, e.g. mining, processing, transport, etc.

For the purposes of this report, we have thus described the climate change, or Global Warming Potential (GWP), impact of each waste activity in terms of kg or tonnes of carbon dioxide (CO_2) equivalents. This is because expressing climate change impact in terms of CO_2 emissions is relatively widely understood by stakeholders compared to other emissions and impacts.

Carbon impact is measured by assessing the carbon emissions saved by the chosen waste management process, either through energy generated by incineration or Anaerobic Digestion (based on the saving against the carbon emissions generated by other energy sources ie coal or gas) and the carbon saving made by using recyclables instead of virgin raw materials (based on the avoidance of the carbon generated in the extraction, transport, processing and manufacturing involved).

Effectively, it represents the carbon impact of treating waste in a particular manner; each type of treatment involves a different level of impact. This is usually shown as the weight of carbon (in kg) per tonne of waste dealt with (kg/CO_2/tonne). Where a carbon reduction is achieved, this is shown as a negative figure, to indicate the carbon saving.

Taking this further, with emissions from waste services contributing in the region of 35% of an authority's total carbon emissions, reviewing the carbon contribution of a total waste service could become an appropriate measure of environmental benefit. In addition to exploring the carbon impact of disposal and recycling methodologies, this would require the carbon impact of waste collection methodologies to be incorporated, incentivising the use of low-carbon vehicles powered by electricity, gas or other technological solutions.

We have utilised a carbon metric which can demonstrate the carbon emissions involved in the household waste management process. The metric measures the carbon generated by the collection activities for refuse and recycling, by analysing the fuel used to collect the waste and deliver it to the disposal/reprocessing facility. This provides a 'carbon impact per tonne collected' for each authority.

We have analysed the tonnage collected by each authority, both residual and recycling. We have also analysed the data provided by each of the constituent authorities for their collection activities. We have analysed the vehicle types and numbers, overall distances travelled during the collection service and the split of residual and recyclable waste collected.

We have carried out a similar analysis of the carbon impact of each of the disposal options utilised by WRWA, again bringing this down to a per tonne level of measurement. This means that the total carbon and NOX impact of the collection and disposal of each tonne of household waste can be measured, providing an alternative option for measuring environmental benefits. This methodology enables analysis of the environmental impact of the Authority and constituent councils' waste activities both holistically, by individual waste streams and by Council.

The use of carbon metrics would allow the authorities to make more holistic decisions regarding recycling and reuse, and to prioritise overall environmental performance and the capture of resources which represent the best environmental outcome.

This would result in a more sensitive analysis of the performance of the WRWA and the constituent Boroughs, through the consideration of the carbon impact of the current, and any proposed, services. This analysis reflects the current capture rates of the recyclable materials captured, utilising the 2016/17 tonnages and the waste composition analyses for residual waste and co-mingled recyclables provided by WRWA.Table 4 shows the carbon impact of each of the disposal options for the primary waste streams. 'Household and similar mixed residual wastes' refers to household residual waste. Of the options available, the carbon impact of landfilling this waste is a net carbon increase of 458 kg of carbon per tonne of waste dealt with. This is because the landfill gasses created as landfill decomposes create carbon. Sending the material to an Energy from Waste plant represents a reduction in carbon of 17 kg of carbon per tonne incinerated; this is because the energy generated from the incineration of the waste replaces energy from more carbon intensive options (i.e. coal or gas-fired energy generation). The same approach applies to the materials which can be recycled. Generally, the waste hierarchy still applies, with landfill the most carbon negative option.

Please note that the Table incorporates the carbon benefit of extracting metals following incineration. Ricardo's in-house carbon model takes into consideration all post-incineration stages (i.e., bottom ash recycling, APC disposal and metal recovery). The impacts are not reported separately due to their insignificant impacts in comparison with the overall incineration impacts.

Table 4: Carbon Impact of Disposal / Reprocessing Options (kg/CO_2/tonne)[4]

Material type	Anaerobic Digestion	Composting	Recycling	Incinerated	Landfilled
Glass wastes			- 218	69	5
Household and similar mixed residual wastes				- 17	458
Metallic wastes, ferrous			- 1,735		
Metallic wastes, mixed			- 3,926		
Metallic wastes, non-ferrous			- 9,285		
Food waste	- 169	- 46		-62	977
Food & garden waste	- 133	- 49		-49	977
Garden waste		- 49		-49	58
Paper and cardboard wastes			- 337	- 180	498
Plastic wastes			- 695	1,665	5
Textile wastes			- 5,941	216	599
WEEE			- 192		

[4] Source: Ricardo in-house Carbon model (2016 data), Incineration: ZWS Carbon metric 2014/2016

4.1 Residual Waste

It should be noted that this section considers the impact of disposing of the waste delivered to the WRWA by the collection activities of the constituent Boroughs. The analysis considers the carbon impact of the disposal of this waste, which is carried out through incineration of the waste to generate heat and electricity.

Whilst this methodology represents a carbon benefit (particularly if contrasted with landfilling the waste), the position of incineration and other energy recovery methods such as anaerobic digestion in the waste hierarchy reflects their relatively poor carbon impact compared with other means of dealing with household waste.

The consumption of material goods involves the extraction and harvesting of raw materials from the earth, followed by the processing, manufacturing, transporting, packaging and delivery of the subsequent products. All of these elements have a carbon footprint (often also including wider environmental impacts) due to the energy consumption involved in these processes.

Thus, whilst energy recovery has a positive carbon impact, it can only mitigate the carbon footprint of the waste to a very limited extent. The analysis demonstrates that recycling is far more effective from a carbon perspective, as the use of recyclate as a substitute for raw materials can minimize the requirements for the extraction of raw materials and reduce the amount of fossil fuel burnt in their extraction and transport and reduce the energy required in the manufacturing process. Waste prevention/minimisation, including reuse, is patently even more effective, since, by removing or reducing the demand for goods, it maximises the reduction in demand for raw materials and the associated environmental impact of their production.

Table 5 shows the composition of the residual waste delivered to WRWA for disposal. This has been used to calculate the carbon impact of each element of the waste stream dealt with through incineration.

Table 5: Residual waste composition

Component	Percentage (%)
Paper/card	**14%**
Plastic film	**7.40%**
Dense plastic	**7.10%**
Textiles	**3.10%**
Misc. Combustible	**12.10%**
Misc. non Combustible	**1.50%**
Glass	**4.20%**
Putrescible (inc. food waste)	**44.90%**
Ferrous Metal	**1.50%**
Non Ferrous Metal	**1.00%**
WEEE	**1.20%**
Pot Hazard	**0.90%**
Fines	**1.10%**

Table 6 shows the annual tonnage of residual waste delivered to WRWA by each of the constituent authorities, with the tonnage broken down into the constituent elements as analysed by the waste composition survey. The carbon impact of incineration of each element of the waste is shown as a total annual tonnage of carbon impact for each material stream. The total carbon impact of each Borough's residual waste is shown as an annual tonnage.

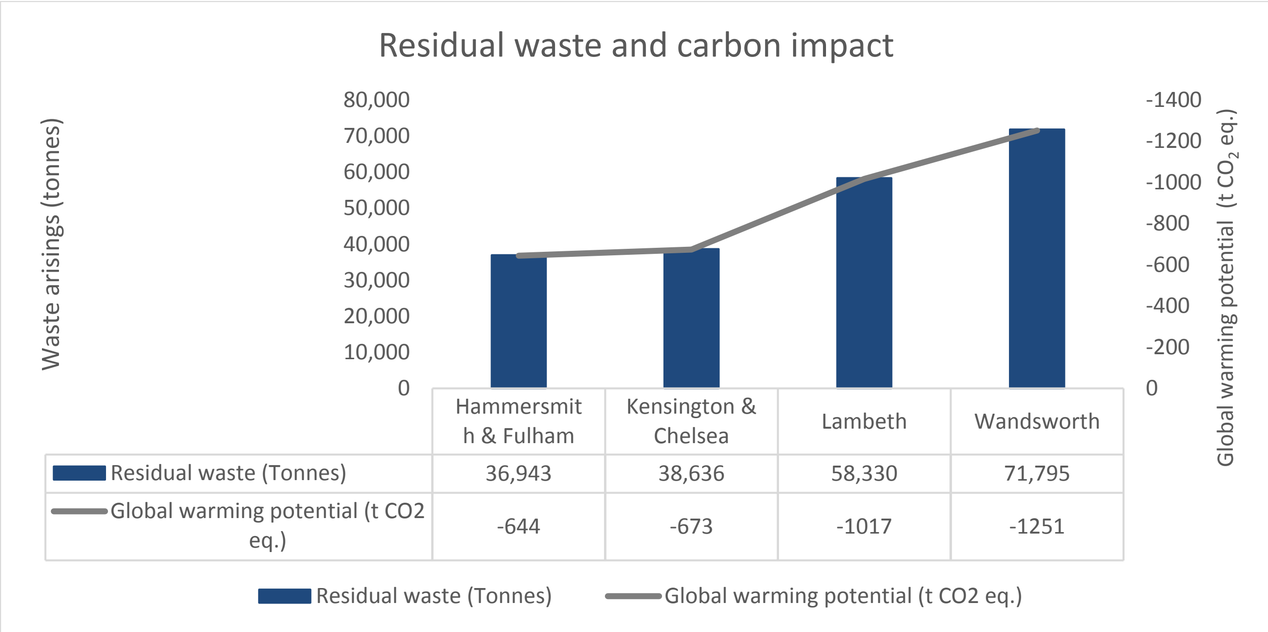
Table 6: Residual waste composition and carbon impact

Component	Hammersmith & Fulham		Kensington & Chelsea		Lambeth		Wandsworth	
	Tonnes	Global warming potential (tonnes CO2 eq)	Tonnes	Global warming potential (tonnes CO_2 eq)	Tonnes	Global warming potential (tonnes CO_2 eq)	Tonnes	Global warming potential (tonnes CO_2 eq)
Paper/card	5,172	*-90.15*	5,409	*-94.28*	8,166	*-142.34*	10,051	*-175.20*
Plastic film	2,734	*-47.65*	2,859	*-49.84*	4,316	*-75.24*	5,313	*-92.61*
Dense plastic	2,623	*-45.72*	2,743	*-47.82*	4,141	*-72.19*	5,097	*-88.85*
Textiles	1,145	*-19.96*	1,198	*-20.88*	1,808	*-31.52*	2,226	*-38.79*
Misc. Comb	4,470	*-77.92*	4,675	*-81.49*	7,058	*-123.02*	8,687	*-151.42*
Misc. non Comb	554	*-9.66*	580	*-10.10*	875	*-15.25*	1,077	*-18.77*
Glass	1,552	*-27.05*	1,623	*-28.29*	2,450	*-42.70*	3,015	*-52.56*
Putrescible (food waste)	16,587	*-289.13*	17,348	*-302.38*	26,190	*-456.51*	32,236	*-561.89*
Ferrous Metal	554	*-9.66*	580	*-10.10*	875	*-15.25*	1,077	*-18.77*
Non Ferrous Metal	369	*-6.44*	386	*-6.73*	583	*-10.17*	718	*-12.51*
WEEE	443	*-7.73*	464	*-8.08*	700	*-12.20*	862	*-15.02*
Pot Hazard	332	*-5.80*	348	*-6.06*	525	*-9.15*	646	*-11.26*
Fines	406	*-7.08*	425	*-7.41*	642	*-11.18*	790	*-13.77*
Totals	**36,943**	***-643.94***	**38,636**	***-673.45***	**58,330**	***-1,016.72***	**71,795**	***-1,251.43***

Figure 2 shows the annual tonnage of residual waste delivered by each Borough and the associated carbon impact. Please note that the carbon impact is shown as a positive figure for simplicity, but represents a positive carbon impact.

As a result of the positive carbon impact of incineration, the higher the tonnage of waste, the greater the positive carbon impact. However, as previously noted, whilst incineration has a positive carbon impact, it can only mitigate the carbon footprint of the waste to a very limited extent. Both recycling and waste minimisation are far more effective from a carbon perspective, due to the reduction in the use of raw materials, the associated reduced impact of their extraction, and the energy required in the manufacturing process.

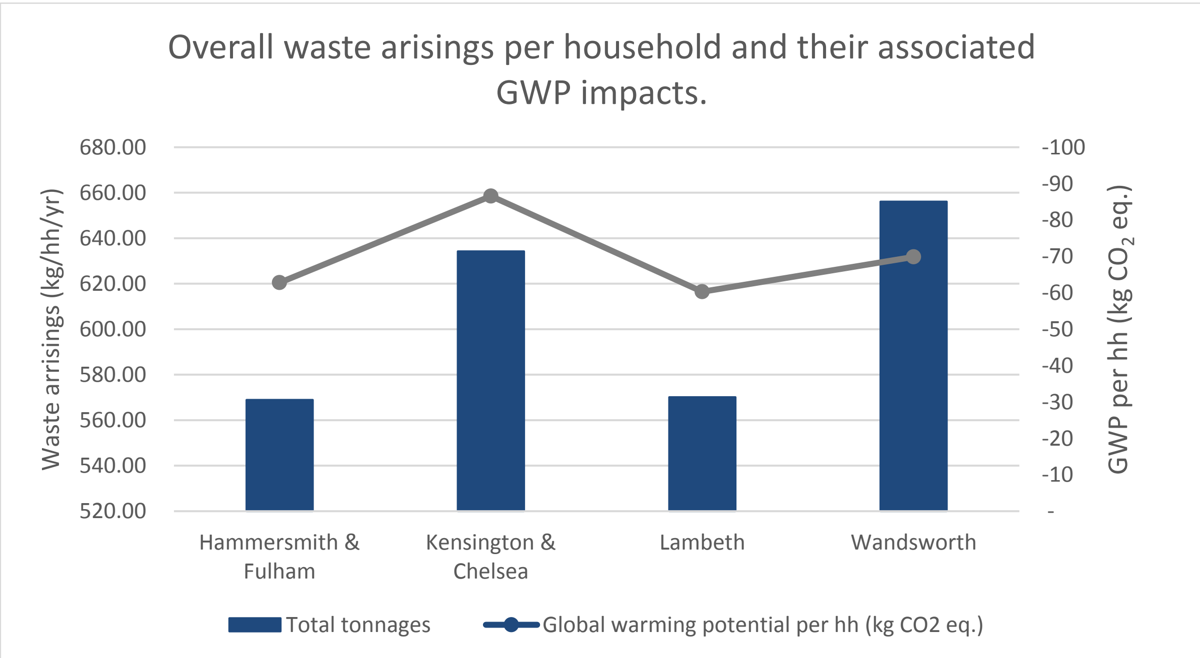
Figure 2: Total annual residual tonnage and carbon savings



	Hammersmith & Fulham	Kensington & Chelsea	Lambeth	Wandsworth
Residual waste (Tonnes)	36,943	38,636	58,330	71,795
Global warming potential (t CO2 eq.)	-644	-673	-1017	-1251

Figure 3 shows the tonnage and associated carbon impact of each Borough's residual tonnage on a per household basis, to avoid the figures being distorted by the different number of households in each Borough, which affects the total tonnage collected.

Figure 3 : Residual tonnage and carbon savings per household per year



4.1.1 River Transport

An important element to consider is the transport of the residual waste to the Cory Energy from Waste (EfW) plant at Belvedere. The waste is delivered by the constituent Boroughs to Waste Transfer Stations (WTS) at Smugglers Way and Cringle Dock. It is then transported to the EfW facility by river. The respective tonnages delivered to each WTS and their distance to the EfW plant by river and by road are shown in Table 7.

Table 7: Waste Transfer Station details

	Smugglers Way	Cringle Dock	Source
Tonnages	181,422	113,852	WRWA
Distance to Cory EfW by river (miles)	19.5	14.3	https://www.sea-seek.com/tools/tools.php
Distance to Cory EfW by land (miles)	20	18	Google Maps

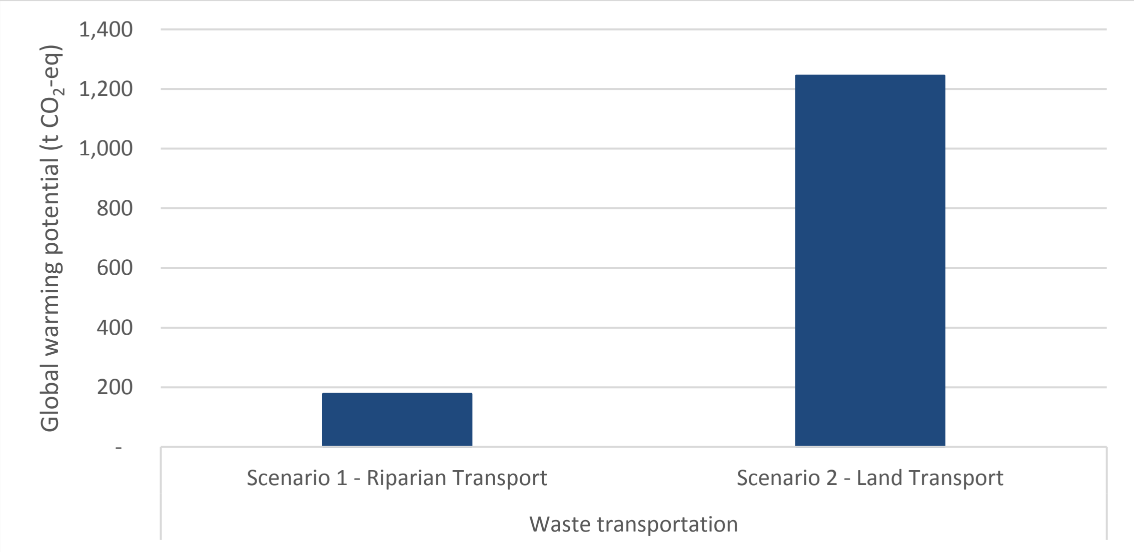
Table 8 shows the reduction in environmental indicators, including carbon impact, through the utilisation of river transport instead of transporting the waste by road in standard HGV bulk transport vehicles.

Table 8 : Relative climate change impacts of transportation by road and river

Impact Assessment	Unit	Waste transportation		Difference (%)
		Scenario 1 - Raparian Transport	Scenario 2 - Land Transport	
Climate change	kg CO_2-Eq	177,637	1,244,869	-86%
Acidification potential	kg SO_2-Eq	1,710	6,162	-72%
Eutrophication potential	kg PO_4-Eq	272	1,161	-77%
Freshwater aquatic ecotoxicity	kg 1,4-DCB-Eq	40,435	63,214	-36%
Human toxicity	kg 1,4-DCB-Eq	139,070	323,891	-57%
Depletion of abiotic resources	kg antimony-Eq	3,841	10,436	-63%

Figure 4 shows the relative carbon impact of road and river options for the transportation of the residual waste. This impact is not factored in the carbon impact assessments in this report, but demonstrates the environmental benefit of WRWA's transportation methodology. More local environmental factors will also be impacted by this methodology, such as reduced vehicle emissions, local traffic congestion and noise pollution.

Figure 4 : Annual carbon impact of waste transportation from WTS to EfW



4.2 Comingled Dry Recycling

Table 9 shows the composition of the co-mingled recyclable waste delivered to WRWA for recycling. This has been used to calculate the carbon impact of each element of the waste stream dealt with through recycling.

Table 9: Comingled recycling composition

Component	Percentage (%)
Paper/card	64.60%
Dense plastic	7.80%
Glass	24.50%
Ferrous Metal	1.70%
Non Ferrous Metal	1.00%
WEEE	0.40%

Table 10 shows the annual tonnage of recyclate delivered to WRWA by each of the constituent authorities, with the tonnage broken down into the constituent elements as analysed by the co-mingled composition survey. The carbon impact of recycling each element of the material is shown as a total annual tonnage of carbon impact for each material stream. The total carbon impact of each Borough's recyclate is shown as an annual tonnage.

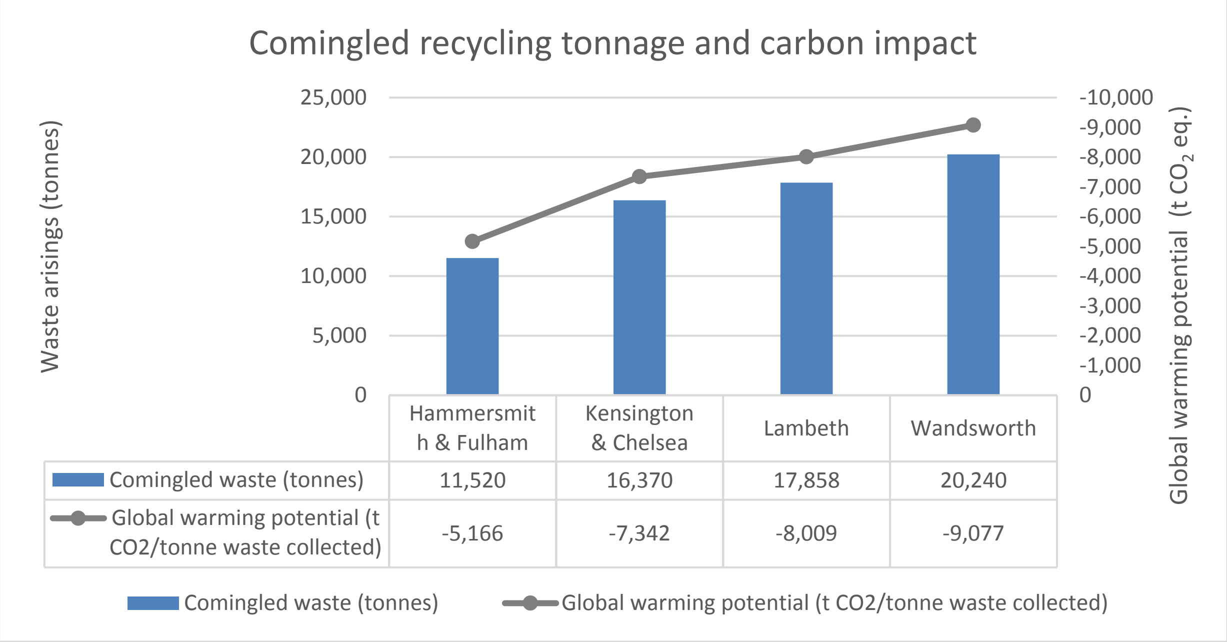
Table 10: Comingled recycling tonnage and carbon impact

Component	Hammersmith & Fulham		Kensington & Chelsea		Lambeth		Wandsworth	
	Tonnes	Global warming potential (tonnes CO2 eq)	Tonnes	Global warming potential (tonnes CO2 eq)	Tonnes	Global warming potential (tonnes CO2 eq)	Tonnes	Global warming potential (tonnes CO2 eq)
Paper/card	7,442	-2,509	10,575	-3,566	11,536	-3,890	13,075	-4,409
Dense plastic	899	-624	1,277	-887	1,393	-968	1,579	-1,097
Glass	2,822	-614	4,011	-873	4,375	-952	4,959	-1,079
Ferrous Metal	196	-340	278	-483	304	-527	344	-597
Non Ferrous Metal	115	-1,070	164	-1,520	179	-1,658	202	-1,879
WEEE	46	-9	65	-13	71	-14	81	-16
Totals	**11,520**	**-5,166**	**16,370**	**-7,342**	**17,858**	**-8,009**	**20,240**	**-9,077**

Figure 5 shows the annual tonnage of recyclate delivered by each Borough and the associated carbon impact. Please note that the carbon impact is shown as a positive figure for simplicity, but represents a positive carbon impact.

As a result of the positive carbon impact of recycling, the higher the tonnage of recyclate, the greater the positive carbon impact.

Figure 5: Comingled recycling tonnage and carbon impact



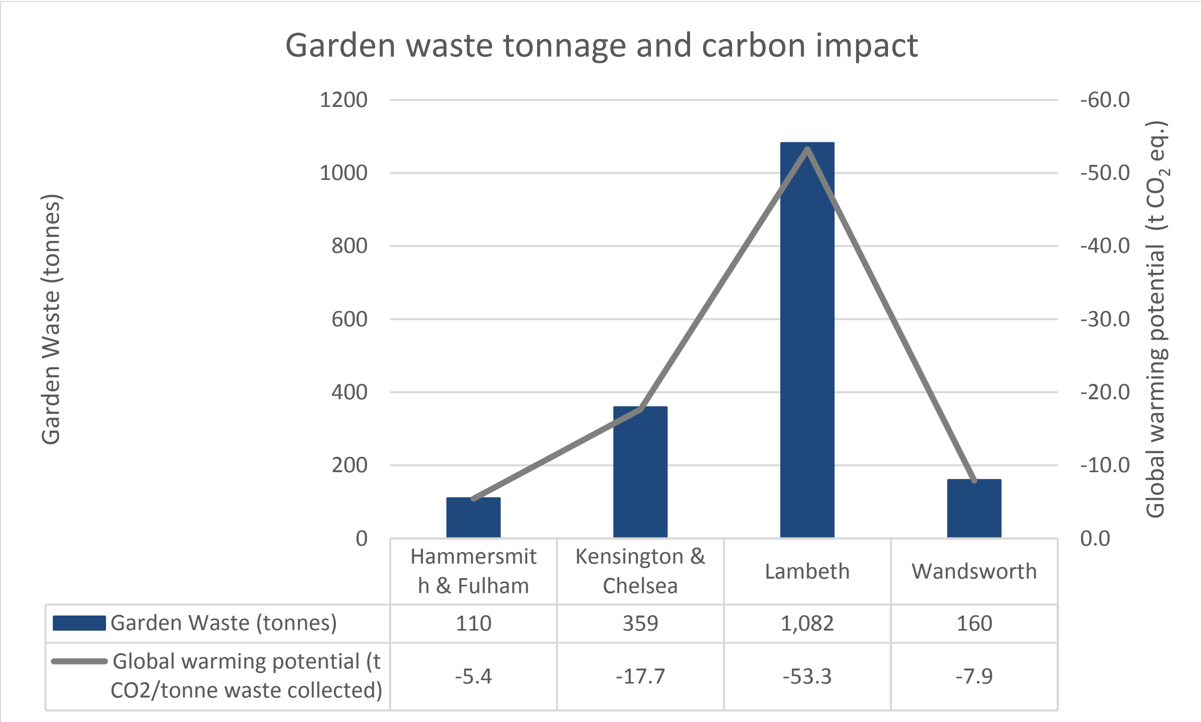
4.3 Garden Waste

Table 11 shows the annual tonnage of garden waste delivered to WRWA by each of the constituent authorities. The carbon impact of composting this waste is shown as a total annual tonnage of carbon impact for each Borough.

Table 11: Garden waste tonnage and carbon impact

Component	Hammersmith & Fulham		Kensington & Chelsea		Lambeth		Wandsworth	
	Tonnes	Global warming potential (tonnes CO2 eq)	Tonnes	Global warming potential (tonnes CO2 eq)	Tonnes	Global warming potential (tonnes CO2 eq)	Tonnes	Global warming potential (tonnes CO2 eq)
Garden Waste	110	*-5.44*	359	*-17.66*	1,082	*-53.26*	160	*-7.90*

Figure 6: Garden waste tonnage and carbon impact



Please note that this chart is set to a different scale that those for residual waste and recycling. The low tonnage of garden waste leads to the carbon impact of its recycling being relatively minor.

4.4 Food and Garden Waste

Lambeth is the only constituent borough that operates a mixed food and garden waste collections service. The carbon impact of composting this waste is shown as a total annual tonnage of carbon impact in Table 12.

Table 12: Food and garden waste tonnage and carbon impact

Component	Lambeth	
	Tonnes	**Global warming potential (tonnes CO2 eq)**
Garden Waste	4,348	*- 211*

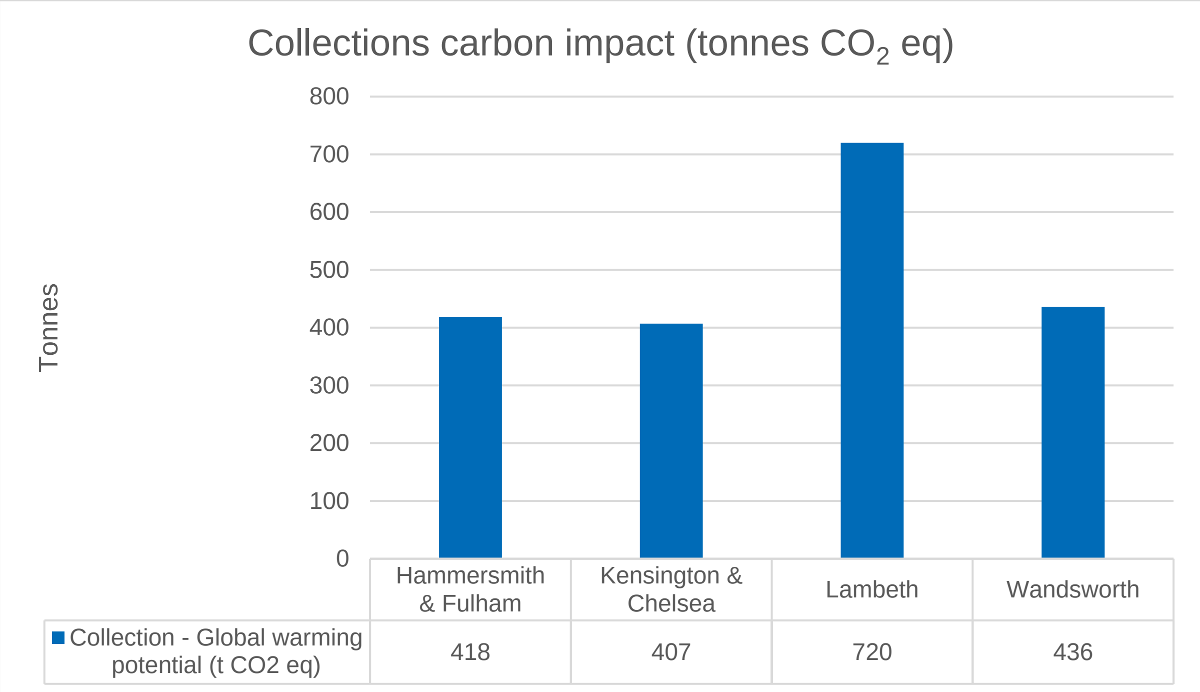
4.5 Borough waste collection operations

Table 13 below summarises the carbon impact of the constituent Boroughs' waste collection operations. The information was verified by the Boroughs before being modelled. The carbon impact includes the carbon capital incurred in the manufacture of the vehicles. The primary variable which determines the carbon impact is the number of miles travelled by each vehicle in the course of collecting waste or recyclate. This is shown graphically at Figure 7.

Table 13: Collections carbon impact summary

Waste Stream	Hammersmith & Fulham	Kensington & Chelsea	Lambeth	Wandsworth
Average annual vehicle mileage (miles)	4836	6114	6734	4420
Number of Vehicles	21	16.2	26	24
Mile per gallon factor	3.5	3.5	3.5	3.5
Fuel consumption (Gallon)	29,016	28,299	50,024	30,309
Fuel consumption (litre)	131,909	128,650	227,414	137,785
Fuel type	Diesel (average biofuel blend)			
Global warming potential (kg CO_2 eq)	417,620	407,302	719,983	436,224
Global warming potential (tonnes CO_2 eq)	417.62	407.30	719.98	436.22

Figure 7: Collections carbon impact per Borough



This provides a useful indicator for the consideration of additional collection services. However, the analysis does not incorporate the impact of increased carbon emissions due to congestion caused by collection activities which may cause emissions from other vehicles. Hence, additional collection services may have a consequential carbon impact not captured by this analysis.

4.6 Cumulative carbon impact

Table 14 combines the carbon analysis of the disposal and collection elements of the waste management service. This shows the total carbon impact of each Borough's waste management activities. This is shown graphically at Figure 8.

Table 14: Carbon impact per Borough (tonnes CO_2 eq)

Category	Hammersmith & Fulham	Kensington & Chelsea	Lambeth	Wandsworth
Residual waste	- 644	- 673	- 1,017	- 1,251
Comingled	- 5,166	- 7,342	- 8,009	- 9,077
Garden waste	-36	-56	-	-78
Food & garden waste	-	-	-212	-
Collection Services	418	407	720	436
Global warming potential (t CO2 eq.)	-5,428	-7,664	-8,517	-9,971
Total tonnages	49,185.68	56,144.17	80,535.56	93,628.57
Average GWP per tonne of waste collected (kg CO2 eq.)	-110	-137	-106	-106

Figure 8: Total carbon saving per Borough – collection and disposal (tonnes of CO_2 eq.)

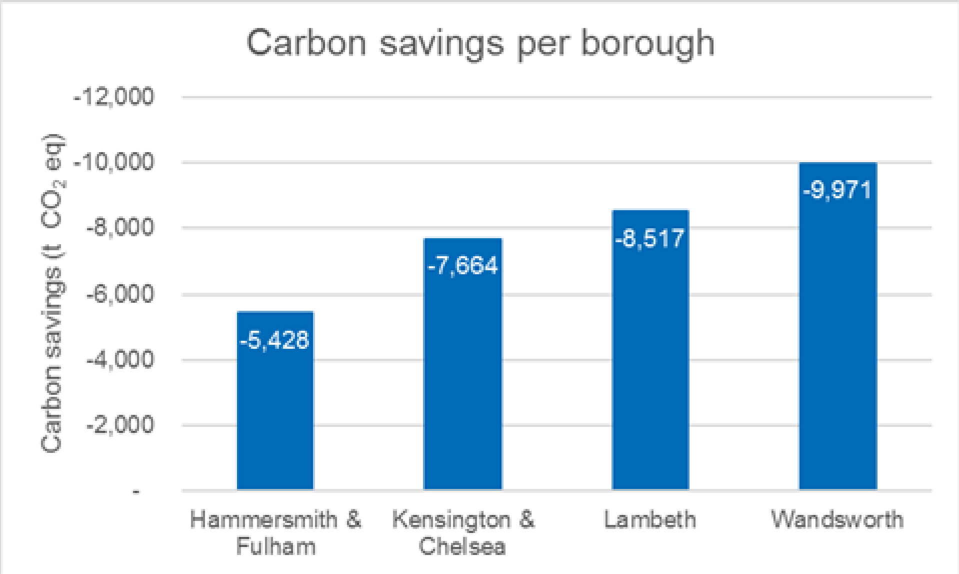
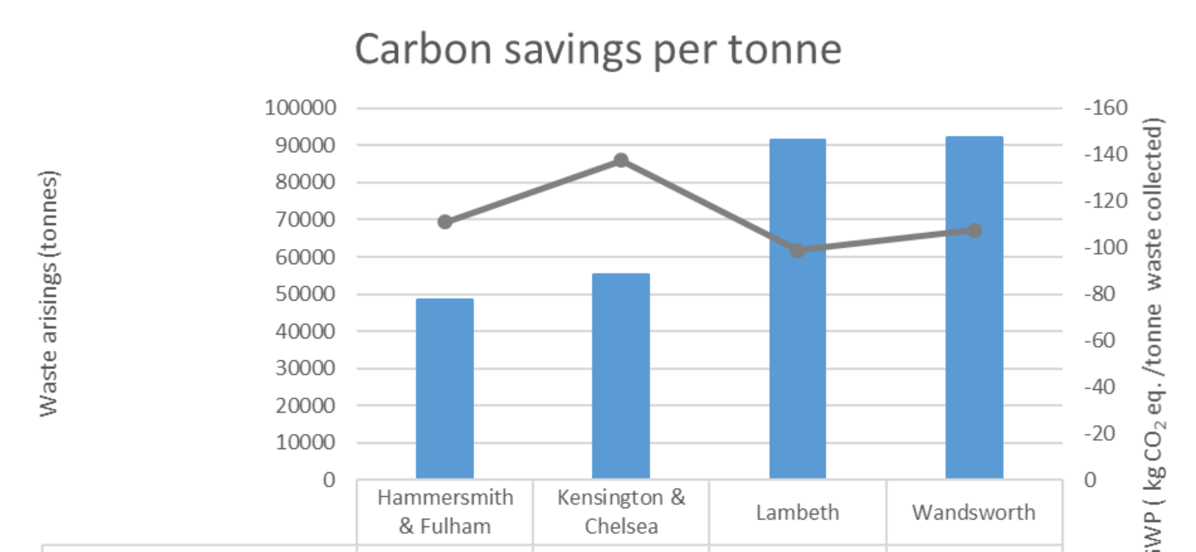


Table 15 takes the annual carbon impact of each Borough's waste management operation and simply divides it by the total annual tonnage of waste (residual and recyclate) collected. This provides an average carbon saving per tonne of waste for each Borough.

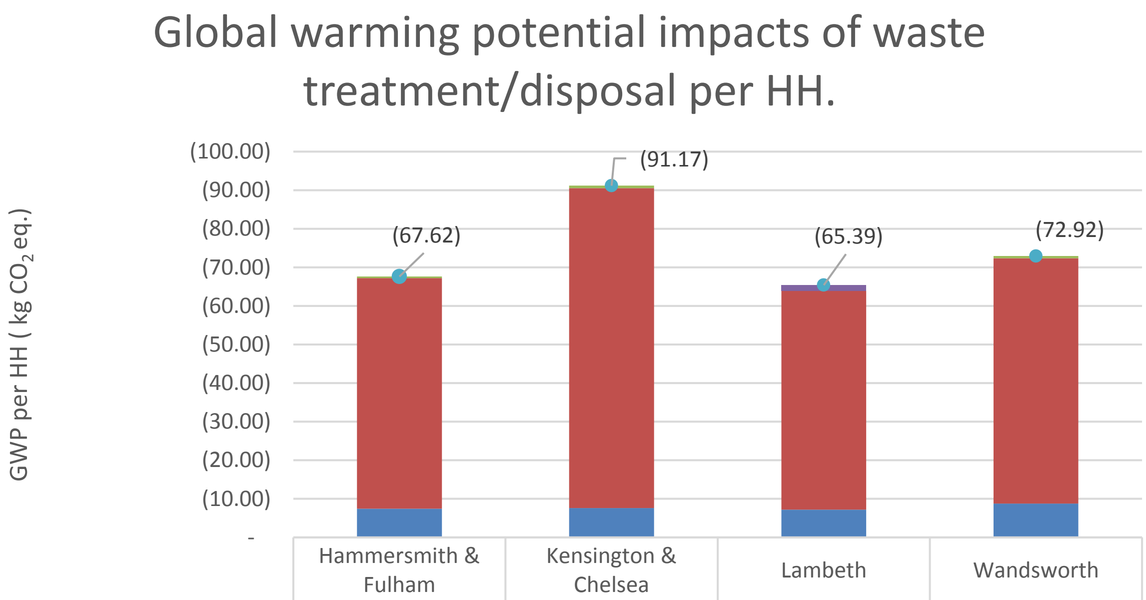
Table 15: Carbon saving per tonne - collection and disposal (kg/CO_2/tonne)



	Hammersmith & Fulham	Kensington & Chelsea	Lambeth	Wandsworth
Total tonnes	48573.12	55364.93	91567.93	92194.97
Global warming potential	-111.1	-137.7	-98.9	-107.4

Table 16 shows the tonnage and associated carbon impact of the disposal and recycling treatment of each Borough's total waste arisings on a per household basis. This demonstrates that the major carbon benefit is achieved through the recycling of co-mingled dry recycling. Recycling of garden and food waste contributes positively on a minor level, with the treatment of recycling waste through incineration providing a small, but positive impact.

Table 16: Carbon impact of disposal/treatment per household

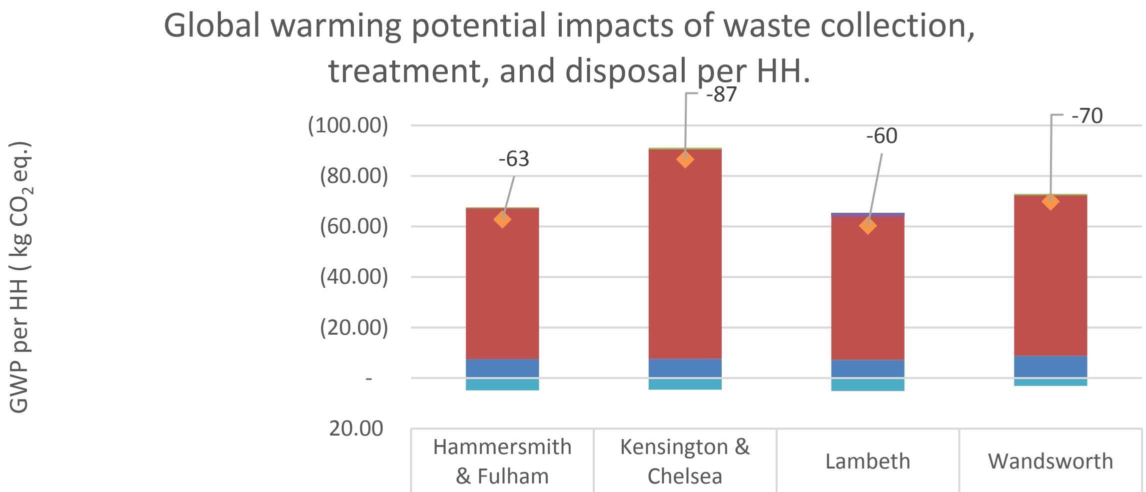


	Hammersmith & Fulham	Kensington & Chelsea	Lambeth	Wandsworth
Food & garden waste	-	-	(1.50)	-
Garden waste	(0.41)	(0.63)	-	(0.55)
Comingled	(59.76)	(82.93)	(56.70)	(63.60)
Residual waste	(7.45)	(7.61)	(7.20)	(8.77)
Total	(67.62)	(91.17)	(65.39)	(72.92)

Residual waste · Comingled · Garden waste · Food & garden waste · Total

Finally, Table 17 shows the total carbon impact per household due to the collection, disposal and recycling of their overall waste arisings. This represents the total global warming impact for each household, measured in terms of carbon savings, of the activities undertaken by WRWA and their Borough to collect and deal with their waste. This demonstrates that the negative carbon impact of the collection services are relatively minor in comparison with the carbon benefit of WRWA's methodology for treating the waste.

Table 17 : Total carbon impact per household of waste collection, disposal and recycling



	Hammersmith & Fulham	Kensington & Chelsea	Lambeth	Wandsworth
Collection - Global warming potential (t CO2 eq)	4.83	4.60	5.10	3.06
Food & garden waste	-	-	(1.50)	-
Garden waste	(0.41)	(0.63)	-	(0.55)
Comingled	(59.76)	(82.93)	(56.70)	(63.60)
Residual waste	(7.45)	(7.61)	(7.20)	(8.77)
Global warming potential per hh (kg CO2 eq.)	-63	-87	-60	-70

Residual waste
Comingled
Garden waste
Food & garden waste
Collection - Global warming potential (t CO2 eq)
Global warming potential per hh (kg CO2 eq.)

5 Air Quality Considerations

To assess the impact on air quality of the waste management operations carried out by WRWA and the constituent authorities, we have utilised an analysis tool originally developed for the England and Wales Environment Agency. The Waste and Resources Assessment Tool for the Environment (WRATE) software enables waste managers in the public and private sector to measure and improve the environmental performance of their operations, by modelling current, planned and hypothetical waste management scenarios, from collection to final disposal, thereby identifying more environmentally preferable routes for the management of their wastes.

WRATE is a specialist Life Cycle Analysis tool for the management of municipal solid waste (MSW), and therefore the system boundary is from "gate to grave". The model starts at the point when materials are discarded into a waste management system (the gate), assuming they arise at no environmental cost, and follows those materials until they are recycled, composted, recovered, "lost" (such as gaseous emissions from a thermal process or water evaporation from a biological process) or disposed in landfill (the grave).

NOx is a term used to describe a mixture of nitric oxide (NO) and nitrogen dioxide (NO_2). These are inorganic gases formed by the combination of oxygen with nitrogen from the air. NO is produced in much greater quantities than NO_2, but oxidises to NO_2 in the atmosphere. NO_2 causes detrimental effects to the bronchial system. Nitrogen dioxide concentrations frequently approach, and sometimes exceed air quality standards in many European cities including London. NOx is emitted when fuel is being burned e.g. in transport, industrial processes and power generation.

Nitrogen oxides (NOx) represents a family of seven compounds, one of which nitrogen dioxide (NO_2) is regulated by the EPA as a proxy for all the NOx compounds. Nitric oxide (NO) and nitrogen dioxide (NO_2) are the most significant forms of NOx released by combustion processes, including diesel engines. NOx reacts with carbon monoxide (CO) and Volatile Organic Compounds (VOCs) in sunlight to form tropospheric or ground-level ozone, the major component of smog, which is a significant air pollution problem.

Ozone is linked to health effects including asthma, respiratory system irritation, allergen sensitivity, respiratory infections and premature death. Particulate matter emissions, especially fine particulates that can more deeply penetrate lungs, from diesel emissions and other sources, are also linked to serious health risks and have a causal relationship with cardiovascular effects, respiratory effects, and mortality. Mobile sources (including diesel and gasoline vehicles) are currently the largest source of NOx emissions. Reducing the use of petroleum-based fuels in transportation (particularly in heavy duty vehicles which disproportionately contribute to emissions) is an important mechanism to reduce NOx emissions.

Table 18 below shows the amount of total emissions per year emitted by the waste collection activities of each Borough.

Table 18 : Annual waste collection fleet emissions (kg/year)

Borough	Ammonia	Nitrogen oxides (NO and NO2 as NO2)	Sulfur dioxide
Hammersmith & Fulham	1.95	810	234
Kensington & Chelsea	1.91	790	228
Lambeth	3.37	1396	403
Wandsworth	2.04	846	244

The London Atmospheric Emissions Inventory (LAEI)[5] 2013 database demonstrates that waste collection contributes up to 1.5% of the total NOx emissions from heavy goods vehicles (HGVs). The table below shows contribution per borough. Table 19 shows the proportion of HGV NOx emissions due to waste collection by Borough.

Table 19 : Proportion of HGV NOx emissions due to waste collection

Borough	Contribution of waste collection to total HGV NOx emissions.
Hammersmith & Fulham	1.2%
Kensington & Chelsea	1.1%
Lambeth	1.4%
Wandsworth	0.8%

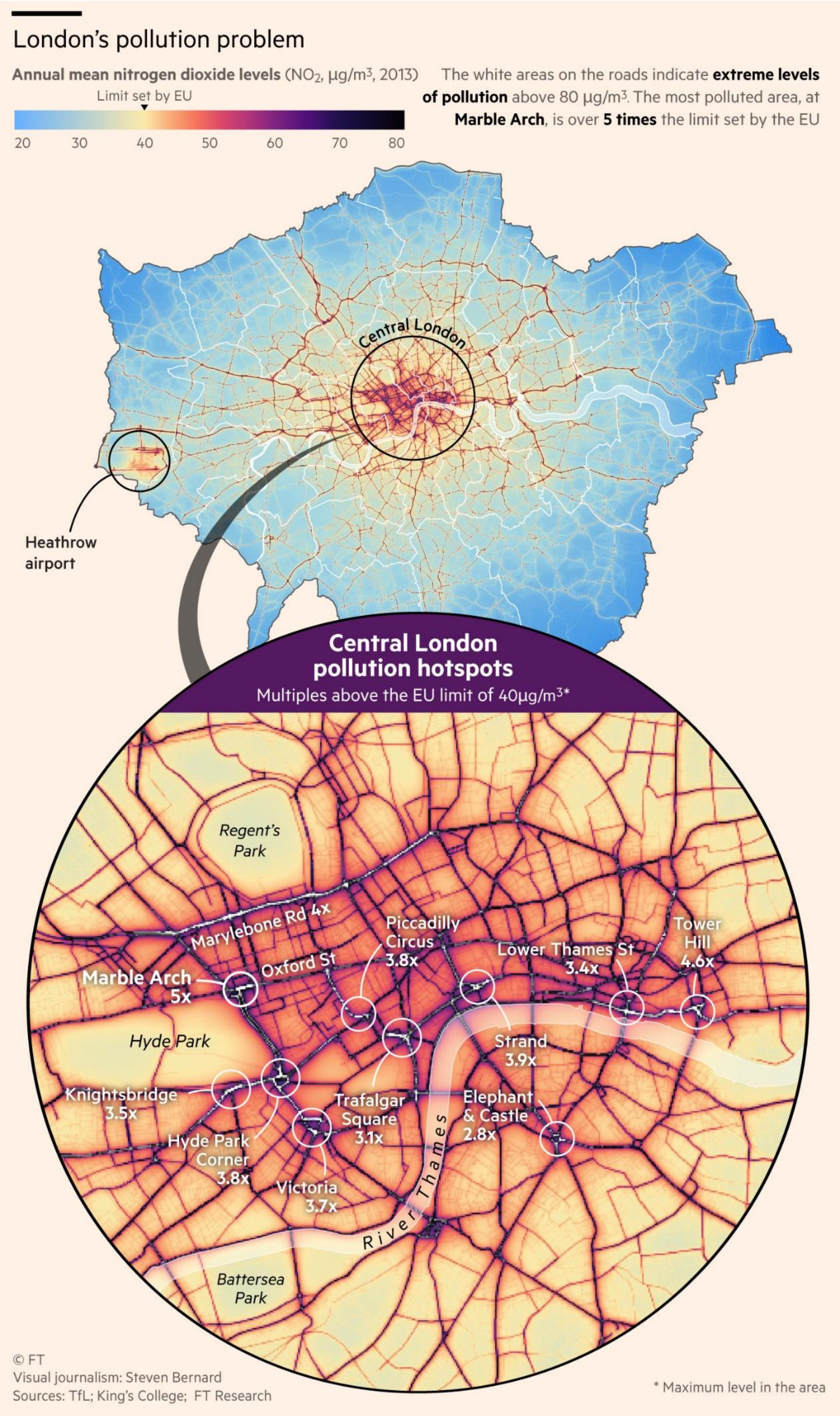
Table 20 puts the NOx emissions caused by each Borough's waste collection activities into perspective. Effectively, their impact represents 0.09% of the NOx emissions in each Borough.

Table 20 : NOx Emissions per Borough

Borough	NOx total	NOx Rigid HGV	NOx (waste collection)	Waste collection/Rigid HGV contribution (percentage)
Unit	**Mass tonne/year**	**Mass tonne/year**	**Mass tonne/year**	**Mass tonne/year**
Hammersmith & Fulham	857.29	65.75	0.81	1.2%
Kensington & Chelsea	856.84	70.33	0.79	1.1%
Lambeth	1278.00	103.29	1.396	1.4%
Wandsworth	1214.61	106.05	0.846	0.8%

It should be noted that these figures represent an average emission level, and are not representative of specific local factors. Whilst the collection service is, by its nature, visiting different streets each day, congestion caused by collection activities may cause emissions from other vehicles not captured by this analysis. Similarly, the tipping facilities at Smugglers Way and Cringle Dock will be visited by the majority of collection vehicles on multiple occasions, and will thus have a concentrated impact on local air quality.

[5] https://data.london.gov.uk/dataset/london-atmospheric-emissions-inventory-2013


London's pollution problem
Annual mean nitrogen dioxide levels (NO2, µg/m3, 2013)
Limit set by EU
20 30 40 50 60 70 80
The white areas on the roads indicate extreme levels of pollution above 80 µg/m3. The most polluted area, at Marble Arch, is over 5 times the limit set by the EU
Central London
Heathrow airport
Central London pollution hotspots
Multiples above the EU limit of 40µg/m3*
Regent's Park
Marylebone Rd 4x
Piccadilly Circus 3.8x
Tower Hill 4.6x
Lower Thames St 3.4x
Marble Arch 5x
Oxford St
Hyde Park
Strand 3.9x
Knightsbridge 3.5x
Trafalgar Square 3.1x
Elephant & Castle 2.8x
Hyde Park Corner 3.8x
Victoria 3.7x
River Thames
Battersea Park
© FT
Visual journalism: Steven Bernard
Sources: TfL; King's College; FT Research
* Maximum level in the area

6 Waste Composition Assumptions

In considering current capture rates for recycling and options for considering additional or alternative collection methodologies, consideration must be given to an array of factors influence waste arisings in domestic residual and recycling, including attitudes towards goods and waste prevention, product design and local, national and international policy amongst other factors (see Figure 9). These factors typically could impact either the overall tonnage of waste arising or the composition of waste being sent for treatment. For example, the rise of Amazon and home delivery, in general, in the last decade has driven up the amount of cardboard exchanged between businesses and households, and is thus found in increasing volumes in both residual and recycling bins across the country. This effect can be seen at Table 1, where the proportion of cardboard in the residual waste stream indicates that this increased volume has a low recycling capture rate. While it is challenging to quantify the rationale behind the changes in waste composition over the last decade, it is also important to identify existing trends that might also contribute to future changes.

Figure 9: Factors influencing waste composition and arisings

6.1 How have waste arisings changed by material?

The following section provides an overview of specific factors which have impacted waste arisings by material type. Although rationales for the changes related to each material have been included, wider policy or economic or social changes such as those arising as a result of Brexit have not been covered.

6.1.1 Plastics

Plastic waste has been increasingly featured in the news over the last few years, with growing concern over ocean plastics, microplastics and plastics in the food chain. This increased awareness of the negative impacts of plastics on the environment may lead to a reduction in the proportion of this material purchased by the public. However, the trend in recent years has been for the proportion of plastic containers disposed of by the public to increase; the move from glass to plastic containers for drinks, condiments and other consumables and the increasing popularity of ready meals leading to increasing volumes of plastic bottles, trays, pots and tubs. Valpak has predicted that plastic packaging placed on the market is forecast to remain flat at current levels of 2.3 million tonnes pa until 2020[6].

6.1.2 Mixed Paper

As the UK population continues to divert from print media to online platforms (tablets, laptops, smartphones)[7] as their preferred means of receiving their news, the decline in the proportion of mixed paper is expected to continue. In addition, as social media increasingly becomes a part of business' marketing strategy, tonnage of mixed paper collected kerbside is also likely to fall. However, flyers and promotional letters remain a part of several businesses marketing strategies, so for the short term until digital natives are in the majority within business, the ongoing decline in the levels of paper within household and commercial recycling will continue will at least be slowed.

6.1.3 Card

The continued rise of online shopping in the UK will continue to contribute to an increase in card in kerbside collection, with the proportion of paper to card in fibre collections continuing to fall[8]. This trend will continue to contribute to contamination and rejection levels, due to the increasing presence of non-target packaging such as polystyrene and plastic 'filler' packaging, along with tape, staples and other similar contaminants.

6.1.4 Glass

Light-weighting of glass packaging which has been observed in the food and drink sectors over the past 10-15 years is expected to reach its natural conclusion as the trend expands to include all glass packaging, with only some high value products, such as whisky and 'craft' gins having resisted the trend to date. However, the fall in tonnages is projected to stabilise, with UK drinking culture continuing to become more focussed on home entertainment; combined with the renaissance of craft beer, this is expected to produce a slight increase in glass available for recycling. Valpak predicts that glass packaging placed on the market will remain flat at 2.4 million tonnes until 2020.

6.1.5 Steel cans

Improvements in the strength of light-weighted steel cans have resolved the relative advantage enjoyed by aluminium cans, reducing the decline in the proportion of steel cans in post-consumer waste. However, there is a growing trend for lifestyle changes, particularly consumer interest in clean eating, to reduce the amount of steel cans in waste collection as households opt to eat more fresh goods. It is thus expected that the composition of steel cans within the recycling stream won't change greatly. Metal packaging placed on the market is forecast by Valpak to decrease slowly (~5%) to 0.7million tonnes in 2020.

6.1.6 Aluminium cans

The impact of steel can light-weighting is expected to stabilise the level of aluminium cans available for recycling. However, substantial growth of the craft beer market (with many craft beers sold in aluminium cans) has been observed in the last five years[9], and this is considered likely to increase the number of aluminium cans in kerbside collections.

[6] https://data.gov.uk/dataset/waste-data-interrogator-2016
[7] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/482255/Digest_of_waste_England_-_finalv3.pdf
[8] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/400597/ci-project-report.pdf
[9] http://ec.europa.eu/environment/waste/framework/

6.1.7 Tetrapak

Policy interest in tetrapak recycling, such as WRAP's pilot project on laminated packaging recycling[10],could result in an increase in tetrapak packaging used in industry and therefore tetrapaks available in the waste stream.

6.1.8 The Harmonisation Agenda

The methodology utilised by each local authority to collect waste and recyclate is dependent on a variety of factors, including the reprocessing facilities within practical distance and the range of materials they can accept, the operational practicalities of the local infrastructure and the demographics of the Council's housing stock. With authority areas ranging from sparsely populated rural areas to high-density urban regions, collection services have been designed to best fit constraints such as availability of bin storage, the degree to which dry recycling can be co-mingled, the availability of composting, facilities and the potential impact on the road network.

However, in light of public and political concern regarding the perceived issue of the variance in collection scheme design adversely impacting recycling participation, WRAP has published a waste collection consistency framework for English councils.

This document sets out a series of three preferred options for councils to adopt to bring about 'more harmonisation' among collection systems in English councils. However, despite having been supported by the government, councils are not obliged to follow the recommendations set out in the framework; currently, there are no plans to impose the consistency agenda, but this does represent a concern for areas with specific operational constraints.

One aspect of this agenda is the consideration of the uncertainty involved in comparing waste performance nationwide; 248 out of the 326 local authorities in England have moved to fortnightly residual collections (of whom 6 have moved to 3-weekly waste collection),

The resultant impact on both waste arisings and recycling tonnages makes historical comparison difficult to maintain. The reduction in residual waste capacity has an effect both on residual waste tonnages and overall waste arisings. Whilst there is a logical diversion of waste from residual to recycling (due to the reduced residual capacity), there is also a trend for overall waste arisings to decrease.

Further analysis is also complicated by the tendency for recycling collection systems to change over time, particularly when residual frequencies are altered. The contamination levels for differing kerbside recycling methodologies suggested by WRAP are illustrated in Figure 10 below; however, these represent average values, and are not specific to the rurality, demographics or housing type involved.

Figure 10: Rejects and un-recycled material

Option	Contamination level
Fully Comingled	16%
Separate Paper stream	3%
Separate Glass stream	1%
Comingled portion of two stream	6%
Multi-stream	3%

From this general assessment, it can be seen that, whilst Comingled schemes generate the highest participation from residents (due to the optimal ease of use for residents), requiring residents to

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

separate their recyclate improves quality, and, once contamination has been accounted for, may actually increase the tonnage of recyclable material collected.

It is therefore difficult to fully assess the relative performance of WRWA's constituent authorities. The material-specific developments listed above indicate that the range of factors influencing waste arisings, recycling rates and waste composition are a reflection of national drivers, rendering the impact of local initiatives relatively limited.

Since the economic slowdown in 2008, national austerity initiatives have seen a slowing of the economy in general, leading to fluctuating, but falling, levels of waste arisings nationwide. The particular challenges facing recycling performance in WRWA's constituent authorities in terms of housing type and density and the associated operational constraints further render comparison impractical and potentially misleading.

6.1.9 Other factors influencing municipal waste arisings

An assessment of factors likely to further influence municipal waste collections can be found at Appendix 1.

7 Food Waste Assessment

The opportunities and constraints regarding food waste collections are an aspect of municipal waste diversion which is becoming increasingly adopted as an opportunity for LAs to improve recycling performance, divert an increasing, biodegradable waste stream from landfill, whilst representing a balance to the increasing spread of reduced frequency residual waste collections, through the removal of the 'smelly' element.

The waste composition analysis demonstrates that 44.9% of the kerbside collected household waste delivered to WRWA consists of putrescible waste. There is a natural expectation that if this material were separately collected and subsequently composted, this would represent an improvement in both environmental and economic outcomes. The London Assembly's Environment Committee's "Bag it or bin it?" report certainly supports this agenda; however, its findings that "properly funded and well promoted food waste collections can actually reduce the amount of waste generated by households in the first place, potentially making the service cost-neutral" is predicated on the assumption that the waste diverted is currently sent to landfill.

The report also notes that "Participation in separate food waste recycling generally declines with rising urban density". WRWA have estimated from the waste composition survey carried out in 2014 that 44% of the total residual waste stream is putrescible waste with food waste accounting for 37% and garden waste 7%, The 37% food waste proportion represented an annual tonnage of 84,788 tonnes. The relatively low proportion of garden waste reflects the limited number of private gardens within the Authority's area.

WRAP have utilised their analysis of authorities where food waste collections have been introduced to develop a 'ready reckoner tool', which provides an indication of the likely average yields of separated food waste. The outputs from the use of this tool suggest that the predicted yields per household served per week would be (on the assumption that refuse is collected every week) calculated as follows:

= 2.1614 – (% Social Groups D and E x 2.2009) ± 0.40 kg/hh/week[11]

The input data on the proportion of population in social groups D&E are included within the table below. Utilizing this data alongside WRAP's 'ready reckoner' calculation allows the calculation of the indicative

[11] WRAP's food waste ready reckoner based on factors derived from statistical analysis of multiple implemented food waste schemes in the UK

food waste yields per household. This is accompanied by upper and lower thresholds around the predicted average household yield.

Table 21: WRAP 'ready reckoner' input data and estimated food waste yields[12]

Local authority	Approximated social grade DE (%)	Residual waste collection system	Average food waste yield kg/hh/wk.	Lower limit food waste yield kg/hh/wk.	Upper limit food waste yield kg/hh/wk.
WRWA	17%	Weekly	1.343	1.093	1.593

The WRAP ready reckoner, whilst assuming a mix of property types, does not take into account this uniquely high proportion of flats in the WRWA area, and therefore the range of 1.5kg per week to 0.5kg per household per week utilised in the WRWA report does not seem unrealistic. This is borne out by the food waste collection trial involving 1,700 low rise properties in RBKC, currently in operation and collecting between 0.87 and 1.56 kg/hh/week.

The methodology utilised by WRWA to assess the potential outputs from the introduction of food waste collections accurately reflects the projections calculated utilising the best available information from WRAP. However, we would note that the unique nature of the housing mix in the WRWA area makes direct comparison unreliable, and that it would be more realistic to consider future projections based on differing outputs for the differing housing types involved.

Table 22: Food yield estimates for WRWA

	Kg/hh/wk	Kg/hh/yr	Annual Tonnage
WRWA	1.093	56.836	24,667

However, this approach overlooks several important considerations. The first of these is the nature of the housing stock. Across the 434,020 properties in the WRWA area, 73% are flatted properties. The WRAP ready reckoner, whilst assuming a mix of property types, does not take into account this uniquely high proportion of flats in the WRWA area. The logistics of collecting food waste from flats represents a substantial range of logistical problems; collection services will experience ongoing problems with congestion, whilst the combination of a transient population, limited storage space inside and outside flats, issues with contamination, bin storage, cleanliness, odour and other practical issues would make the provision of a universal service impractical, inefficient and expensive.

At present, WRWA recognise this limitation. In order to minimise the impact of this element of the waste stream, the current policy supports the management of this material through the EfW facility, ensuring that the amount of waste going to landfill is minimised and that energy is recovered in the form of power and heat; this ensures that the treatment methodology occupies the same place in the waste hierarchy as other treatment options for waste food.

In terms of the environmental impact of this approach, both the Department of Energy & Climate Change (DECC) and the Department for Environment, Food & Rural Affairs (Defra) accept that the difference between the carbon impact of Anaerobic Digestion (AD) and EfW are relatively minor, with both options representing a carbon benefit.

Table 4 shows that the carbon benefit of recycling each tonne of food waste through AD represents a prevention of the use of 169 kg of carbon equivalent per tonne due to its beneficial use in energy production substitution. However, the utilisation of the current EfW methodology also represents a carbon saving of 62 kg per tonne.

[12] Averages taken of the four constituent boroughs

It should be noted, however, that the assessment of carbon impact is based on the material as delivered to the reprocessing facility. Hence, further analysis would be required to assess the carbon impact of additional collection services, transport from WTS to reprocessor, delivery of containers (including regular delivery of liners), and the embedded carbon in the containers provided.

This beneficial use of food waste to generate heat and power, whilst representing a substantive carbon benefit, represents an approach which recognises the potential environmental, operational and financial costs of introducing a dedicated collection system, whilst maximising the beneficial use of the material stream. The remit of this report doesn't include an assessment of the cost of introducing dedicated food waste collection services across the constituent Boroughs. A separate Options Assessment, if carried out, would enable consideration of the operational cost of collection, the infrastructure required (containers, food waste liners, communications etc), the benefits in terms of reduced disposal costs, and the carbon and air quality implications of the collection operation. This would effectively constitute a full TEEP assessment, enabling informed strategic decisions to be considered. However, WRWA have proposed the consideration of a communications campaign to minimise the volume of waste discarded by residents (as outlined in **PAPER NO. WRWA 842**), reducing not only the level of food wasted by residents, but also representing a saving against the purchasing costs involved. This approach would reduce the carbon impact of food waste whether introduced as a stand-alone initiative or in conjunction with the introduction of a dedicated collection service.

8 Textile Assessment

Table 4 demonstrates the extremely high carbon benefit of recycling textiles, while Table 5 identifies the proportion of materials in the residual waste stream – it can be seen that materials currently not collected by the Boroughs represent a substantial proportion of the waste stream. Textiles represent 3.1% of the waste stream (6,377 tonnes pa), demonstrating that, even allowing for the recycling activities carried out by the 3rd Sector, substantial levels of this material are not being recycled or re-used.

In terms of incorporating this material stream into the kerbside collection service, many authorities have introduced the addition of underbody cages to collection vehicles, providing an opportunity to add new recyclate streams to existing collection services at a minimal cost. This provides residents with a convenient way to recycle small items of household WEEE, (a difficult waste stream), small domestic batteries (a particularly difficult waste stream), and textiles (enabling residents to recycle small volumes of low quality textiles, perceived as unsuitable for donation to charity shops or textile banks).

This extension of kerbside collections would increase recycling rates whilst reducing residual waste arisings, substantially improving the carbon impact across the WRWA area, and also has the potential to generate income.

Should vehicle practicalities preclude the collection of additional recyclables, a less frequent collection could be offered, collecting materials not included in the regular kerbside recycling service. This could be offered as a quarterly or bi-annual service, enabling the collection of small household WEEE, batteries and textiles.

However, a more effective approach may be to combine a targeted communications campaign to inform residents of the benefits of minimising this element of their waste, carried out in conjunction with the Third Sector, in a manner which ensures the value of the materials is utilised to facilitate their reuse, repair or sale, all options which will improve the current level of carbon impact whilst improving recycling levels.

9 WEEE Assessment

WEEE makes up 1.2% of the residual waste (2,468 tonnes pa), and represents a valuable recycling stream. As outlined above, the possibility (and practicality) of incorporating this waste stream into the kerbside collection service can be explored. However, should this prove to be impractical, a targeted communications campaign would ensure residents are aware of the facilities available in their locality, provided at the HWRCs, by the third sector and by commercial outlets.

10 Nappies Assessment

It is estimated that 3 - 6% of the residual waste stream is made up of disposable nappies, with each child using between 4 – 7,000 nappies in the first 3 years if its life. Including the manufacturing, packaging and distribution carbon impacts of this material stream, this represents a substantial sustainability issue.

However, at present there are no recycling facilities available for disposable nappies, rendering the option of separately collecting this material stream impractical. As a result, the approach proposed by WRWA in **PAPER NO. WRWA 842**, to encourage the use of Real Nappies by building on the existing 'Real Nappy for London' initiative through the recruitment of volunteer parents and the use of social media to disseminate their experience and the cost and environmental savings achieved represents an imaginative and practical methodology for demonstrating the benefits of real nappies, leading to a reduction in this element of the waste stream.

11 Garden Waste Assessment

Of the 45% of putrescible waste in the residual waste stream, it is estimated that garden waste accounts for 7% of the tonnage. The issue of garden waste collection was addressed in the Interim Report, concluding that the practical and economic constraints of collecting garden waste, combined with the evidence of low arisings of this material stream make the introduction of a dedicated collection service impractical. The approach suggested in **PAPER NO. WRWA 842** of introducing subsidised home composting schemes (through the constituent councils) or exploring opportunities for working with Community Groups to explore the potential for community composting represent the most appropriate methodology for dealing with this waste stream.

Appendices

Appendix 1 – Potential Drivers for Change

The landscape within the wider waste industry is particularly uncertain at this time. The impact of Brexit on environmental issues is still unclear, but most current waste related legislation has its origins in various EU Directives. For example the Waste (England and Wales) Regulations 2011, which introduced the TEEP obligations, have their origins in the Waste Framework Directive (Directive 2008/98/EC of the European Parliament). Indications from DEFRA are that the current regulations will transfer into UK law, but may be subject to revision thereafter.

Ensuring that future collection arrangements comply with statutory obligations and achieve both existing and future targets is thus a challenge, heightened by the current volatility of the marketplace for waste, in terms of both value and market capacity.

Current Key Sector Drivers

Regulatory	• Landfill Directive, rWFD and TEEP • MRF code of practice • Circular Economy Package • EPA 1990 & Deregulation Act
Economic	• Government development of Deposit Return Scheme options (cherry picking best materials) • Recyclate markets and Quality agenda (Chinese Operation Sword) • Producer Responsibility Schemes for packaging
Political	• Collection Harmonisation • Government's 25 year Environment Strategy • Brexit
Social	• Blue Planet Effect – leading to less plastic packaging • Public awareness of recycling methodologies • Drive towards waste minimisation • Public engagement with Circular Economy
Environmental	• Resource depletion - move towards Circular Economy • Carbon agenda • Revision of recycling targets

A.1 Austerity considerations

Efficiency is without doubt the main driver for local authorities as budget cuts continue to apply pressure on local authority spend. As such, services and infrastructure are being shaped by austerity (three-four weekly residual collection, chargeable garden waste collections), and in some instances, this is leading to innovative service delivery models.

A.2 The Environmental Protection Act 1990 & the Deregulation Act 2015

In England and Wales, Waste Collection Authorities are obliged by law to provide a domestic waste collection service to households. The Waste Disposal Authority (WDA) is required to provide or facilitate a facility(s) for the deposit of this waste. These duties are laid out in the Environmental Protection Act (EPA) 1990 (EPA).

Councils can require occupiers of premises to present their household waste for collection in a specified way under the EPA. However, their powers to enforce this, along with being able to require residents to recycle through the specification of what can be placed in each container and where containers should be placed were substantially curtailed by Section 58 of the Deregulation Act 2015 which downgrades failure to comply with any notice from a criminal to a civil offence whilst tightening the definition of an offence to "causing a nuisance or likely to be, detrimental to any amenities of the locality"

This makes enforcement extremely difficult, undermining the ability of local authorities to enforce their collection policies.

The Deregulation Act also makes any form of enforcement activity regarding contamination of recyclate effectively impotent. The practical requirements of bringing a civil case against individual residents has yet to be fully tested, but the disproportionate effort and expenditure required is a significant disincentive to authorities. As a result, the growing issue of contamination in the kerbside recycling stream will be difficult to address. From an authority perspective, the lack of enforcement options limits any addressing of this issue to communications aimed at transgressing residents with no power to take further action. This may lead to a continuing increase in the proportion of contamination and non-target material delivered to MRFs from kerbside collection schemes, which means that MRF infrastructure may have to be flexible to deal with contamination challenges.

A.3 The Waste (England and Wales) Regulations 2011

The Waste Framework Directive (2008/98/EC) is the overarching EU policy on waste, covering recycling targets, a definition of waste and a requirement for national waste management plans and the definition of the "Waste Hierarchy". The Waste (England and Wales) Regulations (2011) (amended by the Waste (England and Wales) (Amendment) Regulations 2012) and the Environmental Permitting (England and Wales) Regulations 2010, implemented much of the directive, including the current 50% recycling target (to be achieved by 2020). These Regulations also require Waste Collection Authorities (WCAs) to separately collect paper, plastics, glass and metals. The collection of these materials either co-mingled or two-stream may be compliant, but only if it can be demonstrated that separate collection is not necessary to achieve good quality recyclables, or is not technically, environmentally or economically practical (known as TEEP). WCAs are required to carry out a 'TEEP' assessment to demonstrate that their collection system is compliant with the regulations. However, ambiguity in the detailed wording in the Waste Framework Directive, combined with a Judicial Review and a subsequent lack of clarity from Defra, means there is still a degree of uncertainty in the market as to what this means in operational terms for both commercial and domestic kerbside collections, with many authorities yet to carry out a TEEP assessment.

A.4 25 Year Environment Plan and Resources and Waste Strategy

In terms of the need for a clear policy framework from central government, Therese Coffey, Parliamentary Secretary of State at DEFRA, has confirmed that they note the limitations of weight based targets, and the reliance of recycling rates on garden waste collections. Despite the recent publication by Michael Gove, Secretary of State for the Environment, of the Government's 25 year Environment Plan, there is no additional clarity on the issue of recycling targets or wider waste policy. There thus remains a lack of clear direction on the future of waste policy in England. It appears that in the short term, local decision makers will be required to continue to concentrate on improving recycling performance and saving costs in a manner most appropriate to their imperatives.

The 25 Year Plan does state that the Government will crackdown on plastics by eliminating all avoidable plastic waste achieving zero avoidable plastic waste by the end of 2042. They identify extending the 5p plastic bag charge to small retailers, removing consumer single-use plastics from the government estate, supporting the water industry with the roll out of more public drinking fountains, and working with retailers to implement plastic free aisles in supermarkets as measures they will pursue. More detail is anticipated in the Resources and Waste Strategy which is expected to be published in the second half of 2018.

A.5 Potential impacts from the EU Circular Economy Package

The Circular Economy Package (CEP) was adopted by the European Commission in December 2015. It includes a range of policy options around waste management but also addresses product lifecycles in terms of intelligent product design, smarter use of raw materials, improved reuse and repair, increased recycling and more resilient markets for secondary raw materials. It also limits the use of landfill to 10% of municipal waste (based on the EU definition of municipal waste) by 2030.

The current proposals suggest that the recycling rate calculation will be based on material sent to final recycling or MRF outputs minus losses. MBT (Mechanical Biological treatment) output will be excluded from calculations from 2027 onwards. Strengthened TEEP provisions will extend to bio-waste from 2023 and textiles from 2025. Separate collection of hazardous waste will apply from 2025 but without the TEEP provision. The Package has now passed through the EU legislative process. Before the Circular Economy Package was passed into law, all three European institutions (the European Council, European Parliament and the European Commission) were required to have an agreed stance.

Following consideration by EU member states in February, on 18th April MEPs in the European Parliament agreed the recycling targets set out in the EU's Circular Economy Package, and these were adopted by the European Council of Ministers on 22nd May. These targets include:

- By 2025, at least 55% of municipal waste (from households and businesses) should be recycled by member states.
- The target will rise to 60% by 2030 and 65% by 2035.
- 65% of packaging materials will have to be recycled by 2025, and 70% by 2030.
- Separate targets are set for specific packaging materials, such as paper and cardboard, plastics, glass, metal and wood.
- The proportion of municipal waste sent to landfill will be limited to a maximum of 10% by 2035.
- Separate collection of textiles and hazardous waste from households will be required by 2025.
- Separate collection of biodegradable waste will be required by 2024, although this is not required where the waste is composted at home (and will be subject to a revised version of TEEP assessment).

The agreed text, having been agreed by the EU Council of Ministers for final formal approval, will be published in the Official Journal of the EU, the official record of all EU legal acts. Following this formal approval and adoption, EU members will have two years to bring the legislation into law.

It is anticipated that as the CEP has been adopted into formal EU law before the end of the two-year Brexit process it will be among the environmental legislation brought into UK law via the 'European Union (Withdrawal) Bill'.

Whilst local authorities will be expected to reflect the principles of the Circular Economy, the primary impacts will be the increased recycling rate target and the further minimisation of allowable waste to landfill. It is also possible that the Extended Producer Regulations (EPR) will impact on Local Authorities. The latter, by making producers responsible for the full cost of recycling or disposing of products they bring to the market (including those costs currently incurred by local Authorities) should incentivise them to reduce the overall environmental impact of their products and packaging, reducing overall costs whilst minimising environmental impact. Proposals on how the EPR would be introduced in contrast to the current PRN methodology are currently the subject of consultation, with the ESA, LARAC and the compliance sector holding differing views. One possibility is that the packaging industry becomes 'responsible' for the cost of collecting household packaging waste. The packaging industry is, currently, lobbying against this approach, whilst Local Authorities are concerned that it may impact adversely on their statutory duties.

A further concern regards the potential impact on collection methodologies; The Waste (England and Wales) Regulations 2011, as amended in 2012 requires WCAs to separately collect paper, plastics, glass and metals. The revised Directive states: *"Member States shall take measures to promote high quality recycling and, to this end, shall set up separate collection of waste where technically, environmentally and economically practicable and appropriate to meet the necessary quality standards for the relevant recycling sectors and to attain the targets…."*[13]. This revision of the wording of the 'TEEP' provision, along with the addition of biodegradable waste to the collection requirement may have implications on Councils' statutory collection responsibilities. Our modelling demonstrates that 'paper

[13] See https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52015PC0595 ,

out' remains the most cost effective collection option across East Kent;, our analysis has incorporated consideration of fully co-mingled, 'glass out' and full source-segregated multi-stream collections. This assessment considered the technical, environmental and economic impacts of each of these collection types.

In January 2018, the European Commission published a Strategy for Plastics which aims to protect the environment for plastic pollution whilst fostering growth and innovation. The current proposals, which are focussed on littering (marine and land) caused by plastic items such as plastic straws, cotton buds and cutlery, as well as plates, beverage stirrers and sticks used to support balloons, as the most obvious products where "suitable and more sustainable alternatives are readily available". As such, it is proposed that market restrictions will be placed on these and similar items. At this stage, no immediate impact on Local Authorities seems likely.

A.6 Potential impacts from Brexit

The Department for Exiting the European Union (DEXEU) has confirmed that all EU legislation which has not already been transposed into UK law will be transferred to UK statute, including current regulations governing waste, packaging, waste electrical and electronic equipment (WEEE) and landfill. However, DEXEU has also stated that 'Following integration into UK law upon departure, all EU environmental laws will be open to being "amended, repealed or improved"'. The UK is thus free to decide the future of its waste policy and laws.

This freedom has given rise to uncertainty over the future of environmental legislation and policy post-Brexit. This is due to the methodology which will be utilised to "amend, repeal or improve" the current Regulations, with Ministers, utilising secondary legislation to amend or repeal primary legislation without parliamentary scrutiny. This may limit the ability of the wider waste sector to influence policy decisions, and may also lead to politically motivated policies being introduced which impact on local authorities' municipal waste activities.

A further concern is that at present, the UK is reliant on enforcement from both the European Commission and the European Court of Justice (through the threat of heavy fines) to ensure that environmental standards and targets are met. The Government will thus need to consider the means by which environmental commitments are given effect in domestic law, and the scope and scale of the regulatory and accountability systems by which the UK is held to adhere to the standards set. Will this involve an enhanced role for the EA, or will a new regulatory department be created? Environment Secretary Michael Gove has recently announced plans to consult on a proposal for a new, independent body for environmental standards. The proposed consultation regarding this suggest this will be a new, independent body that will hold Government to account for upholding environmental standards post-Brexit. Further details have not yet been announced.

A further key impact of Brexit is the issue of exporting waste and recyclate to foreign markets. Currently, the adverse impact on the value of the pound has increased the cost of exporting RDF, whilst reducing the income received for recyclate. The potential impact of tariffs, dependant on the trade arrangements agreed between the UK and both the EU and the wider world have the potential to compromise the economics and/or practicalities of exporting waste.

A.7 Possible impacts from alternative recycling metrics and Carbon Impacts

One aspect of the CE approach is the exploration of whether recycling activities should be more focussed on those materials whose recycling represents the maximum environmental benefit, rather than simply collecting the heaviest elements of the waste stream. Under this approach, instead of an absolute target for recycling, individual material streams would have their own target, which could include packaging waste. The streams would be linked to the best environmental option for that particular material. Metrics such as carbon or residual waste production would provide a fairer reflection of environmental performance, and also help to level the playing field between urban and rural authorities.

The use of carbon metrics would allow authorities to make more holistic decisions regarding recycling and reuse, and to prioritise overall environmental performance and the capture of resources which represent the best environmental outcome. This would resolve the current situation where local authority recycling performance is solely based on the weight of waste they reuse, recycle or compost/digest as a percentage of the total weight of waste they collect. This system encourages councils to "chase" the heavier waste materials, regardless of the overall environmental benefit, seen most clearly in the expansion of garden waste collections.

This could result in a major revision of the collection services offered by local authorities.

Taking this further, with emissions from waste services contributing in the region of 35% of an authority's total carbon emissions, reviewing the carbon contribution of a total waste service could become an appropriate measure of environmental benefit. Carbon is often used as a proxy for environmental impact, particularly because materials and processes that have a high carbon footprint often involve wider environmental impacts due to high energy consumption, e.g. mining, processing, transport, etc. This would require the carbon impact of waste collection methodologies to be incorporated, incentivising the use of low-carbon vehicles powered by electricity, gas or other technological solutions.

The government has expressed interest in the potential for incorporating carbon measurement as an additional indicator to the current weight based target methodology. Initially, it seems likely that this will lead to a focus on expanding recycling activities to incorporate materials with a high level of embedded carbon, with textiles being a useful example. However, in the longer term, prioritising recycling collections from the perspective of carbon impact could lower or compromise the capture of low-carbon materials such as paper and garden waste.

A.8 Possible impacts from Chinese import restrictions

The current market uncertainty regarding the situation in China, following the announcement from China to ban plastic waste and unsorted paper imports (as part of a ban on the import of 24 types of recyclable material) could see the UK stockpiling waste, or having to send waste to residual disposal routes instead. Until recently, China had lower standards for receiving recyclable waste material, making it an easy choice for the UK to help reach higher recycling rates and reduce landfill. However, with a ban enforced at the end of 2017, on plastics such as polyethylene terephthalate (PET) drinks bottles and all mixed paper, including increased quality control on cardboard, pressure has been put on the British recycling industry, with the impact also affecting the rest of the EU, US, Australia, Canada and Japan. The initial impact has been the stockpiling of material while alternative markets for recyclate are explored. At present, stock levels of paper are high but appear manageable, with alternative European (ie Turkey) and far East (eg Vietnam) markets increasing their offtake of waste paper. However, low-grade plastics appear to be more problematic, with some reprocessors unable to find markets leading to this material stream being sent to Energy from Waste plants. Similarly, carton recyclers are currently unable to find markets for the plastic and aluminium separated from the waste paper.

During this period of market volatility, the consistent message remains the need for high quality materials, to maximise both the value of the recyclate and its marketability.

A.9 Possible impacts from Deposit Return Schemes

The introduction of a deposit return scheme (DRS) to increase recycling rates and reduce the amount of waste polluting land and seas was announced by the Government in March 2018, subject to consultation later in 2018. The current proposal is that the scheme will cover all single use drinks containers whether plastic, glass or metal, but the mechanism of the scheme and the level of deposit are still to be determined.

The consultation will look at the details of how the scheme would work; the Government says it "will only take forward options from the consultation which demonstrate that they offer clear benefits and are resistant to fraud, and costs on businesses, consumers and the taxpayer are proportionate".

Whilst a DRS may increase beverage container recycling rates, improve the quality of the material that is collected and reduce littering, it will have costs that will have to be borne by some or all of those involved in the production, sale and consumption of beverages, as well as inevitable and uncontrollable impacts on those that manage the resulting waste.

Similar schemes already operate in countries such as Denmark, Sweden and Germany where deposit return schemes sees consumers pay an up-front deposit when they buy a drink, ranging from 8p in Sweden to 22p in Germany, which is redeemed on return of the empty drink container. Once a container is returned, businesses are then responsible for making sure it is effectively recycled – a move that has led to a 97% recycling rate for such containers in Germany.

Depending on their contractual arrangements, Local Authorities may benefit from the savings associated with reduction in residual waste (dependent on the proportion of potentially deposit bearing containers in residual waste) but may be impacted by the reduction in revenue associated with the sale of recyclable materials. Potential savings through reduced street cleansing services and/or tonnages may also result. The actual impact will not be easily predicted until the details and timings of the implementation of the scheme and the level of deposit are confirmed, which will influence the reaction of the public to the scheme.

Such a reduction in residual waste tonnage may have an impact on resources required to collect at the kerbside. There is also likely to be a reduction in the co-collected recycling collection stream (as residents choose to return the DRS-related elements of their recyclate).

The continued presence of the elements of on-street recycling infrastructure required for the single use drink container streams may also be subject to revision.

The impact of a reduced volume and tonnage of commingled recycling for sorting could lead to a reduction in MRF gate fee costs for Councils. However, if the throughput of material at MRF's decreases, then the net sorting costs may increase where savings can't be made in the infrastructure and staffing to account for such tonnage reductions.

Whilst the impact of a DRS may be to lead to greater levels of recycling, these will not be attributable to Local Authorities, since they will not be within Councils' collection statistics. Whilst a net reduction in both residual waste and recycling tonnages may be seen following the introduction of a DRS, the proportions of the reductions in either stream may be detrimental to the perceived recycling performance of Councils.

A.10 Potential impacts from the London Mayor's Environment Strategy

For London authorities, a further layer of regulatory requirements is pertinent when new Contracts are due to be tendered. The GLA have confirmed that pre-consultation dialogue has commenced on the mayor's municipal waste strategy, which will sit within the London Environment Strategy. It is a statutory requirement that the boroughs' waste contracts are in general conformity with the London Environment Strategy, and the Mayor may use his powers to direct a borough where he considers their waste activities to be detrimental to the LES. Hence, contract documentation must be assessed and approved by the GLA before procurement processes can begin.

It is anticipated that targets in the Strategy will include London achieving 100% net self-sufficiency in waste management by 2026. This would require further revision of the waste apportionment allocations in the London Plan (which determine where waste may be disposed of), along with more detailed analysis of waste arisings. The Mayor's targets for recycling rates are likely to exceed the government's requirements. It has also been strongly suggested that the GLA believes that the introduction of more harmonised recycling schemes across the capital is required to increase London's recycling rates, and that they will continue to support WRAP's initiatives in this area.

A.11 How will the market for secondary materials change in the next 5+ years?

The secondary materials market will continue to be about:

In the short term:

- Type of materials; the expansion of food waste collections will drive increased recycling rates in the short term – with markets for this material relatively stable and the industry enthusiastic regarding additional capacity.
- Quality of materials and how they are collected – this will drive saleability, value, regulatory compliance and the development of waste as a reliable secondary material source.
- Recent trends have seen municipal composition changing dramatically, with paper reducing and cardboard increasing due to reduced newsprint uptake and increased internet shopping. However, the reduction in paper may be slowed by the recent focus on plastic packaging and single use plastics which may be replaced by paper/board based products.

In the longer term:

- Ownership of materials along the value chain will be integral to the development of a coherent supply chain; strategic collection contracts will be developed with quality-based SLAs to provide a reliable feedstock for treatment and reprocessing facilities.
- The adoption of carbon metrics would incentivise more focus on textiles and re-use, whilst the circular economy will drive Waste Electronic and Electrical Equipment (WEEE) collections to enable the extraction of critical raw materials in the longer term.
- Low-grade plastics (petroleum based) are likely to reduce in the longer term, due to EU and government minimisation initiatives. Some plastic packaging is vulnerable to the introduction of DRS initiatives and voluntary industry initiatives. It thus appears likely that this element of the municipal waste stream will reduce. The development of plant-derived cellulose packaging may replace this tonnage, and create a degree of confusion with regard to the best recycling route.
- Infrastructure; with the impact of China's import restrictions and the potential effect of Brexit, it is likely that development will focus on treatment and reprocessing capacity. This will include MRFs and 'mini MRFs' to enable sorting of materials to high quality standards, along with enhancement of waste transfer and bulking sites.
- Further reprocessing facilities for plastics and food waste will help in resolving export issues and enable the production of energy from waste.
- The export market for RDF is considered to be stable for the next 5 years, but represents a significant UK investment opportunity.

Appendix 2 – Potential Drivers for Life Cycle Assessment

The LCA tool WRATE (Waste and Resources Assessment Tool for the Environment) was chosen to perform the environmental assessment. The tool is a widely used bespoke piece of software designed specifically to assess the environmental impact of waste management options.

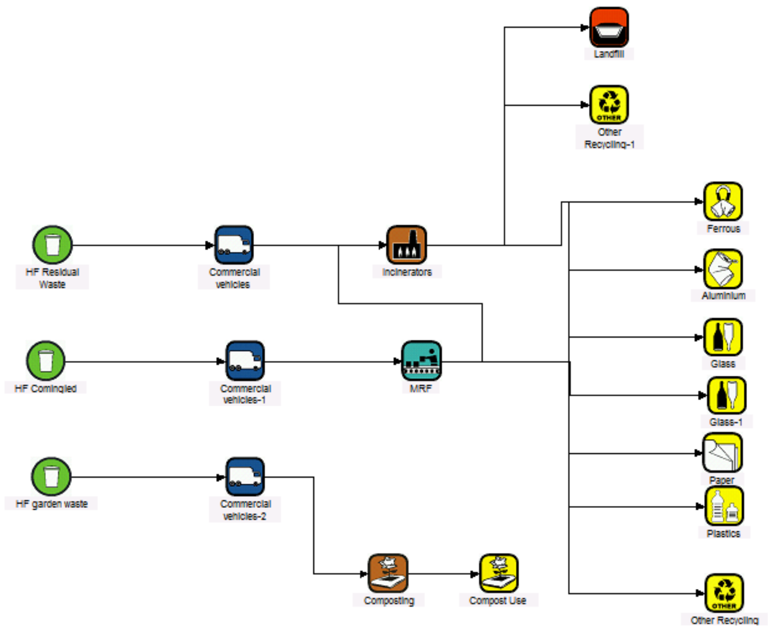
WRATE is a specialist life cycle analysis (LCA) tool for the management of municipal solid waste (MSW) and similar wastes, and therefore the system boundary is from 'gate to grave'. The model starts at the point when materials are discarded into a waste management system (the gate), and follows that material until it is recycled, composted, recovered, "lost" (such as gaseous emissions from a thermal process or water evaporation from a biological process) or disposed in landfill (the grave).

Mode details about WRATE datasets and environmental impact categories covered are available in section A 15.

For the purposes of this assessment, we have focused on reporting against the climate change (GWP 100) impact, reported in WRATE in terms of kg carbon dioxide equivalents. This is because GWP is widely accepted as the most important sustainability indicator for technology selection and additionally as climate change impact in terms of CO_2 emissions is relatively widely understood by stakeholders compared to other emissions and impacts.

Acidification potential, expressed in average European kg SO_2-Eq, has been also discussed as an indicator of air quality in Boroughs. Figure 11 shows a schematic WRATE diagram of the waste collection system modelled for Hammersmith & Fulham.

Figure 11 : Waste collection system model – Hammersmith & Fulham



A.12 Results

Table 23 shows the potential environmental impacts of the whole waste management system for each Borough. The values in the table represent levels of environmental impact, so negative numbers are most preferable (since they indicate environmental benefit, through the offsetting of potential impacts); otherwise, the smaller the positive value, the better. A detailed breakdown of the overall environmental impacts in each borough is provided in Figure 14.

Overall, results reveal that all boroughs achieve net environmental savings in five out of the six impact categories covered. Our model uses the same technology-specific assumptions (e.g., recyclate substitution rate and energy recovery rates) as WRATE, and hence the magnitude of these environmental savings are proportionate to the tonnages of waste and recyclate being collected in each borough.

Table 23 : Overall environmental impacts of waste collection, treatment and disposal by borough.

Borough	Climate change	Acidification potential	Eutrophication potential	Freshwater aquatic ecotoxicity	Human toxicity	Depletion of abiotic resources
Unit	kg CO_2-Eq	kg PO_4-Eq	kg 1,4-DCB-Eq	kg 1,4-DCB-Eq	kg antimony-Eq	kg CO2-Eq
Hammersmith & Fulham	-7,202,180	- 22,830	3,647	- 1,840,947	-22,524,798	- 181,593
Kensington & Chelsea	-9,356,415	- 35,051	2,918	- 2,054,568	-25,791,555	- 203,012
Lambeth	-11,250,175	- 34,950	6,423	- 2,897,414	-35,229,614	- 284,837
Wandsworth	-13,253,325	- 39,887	7,347	- 3,520,034	-42,662,698	- 344,900

A.13 Carbon impacts

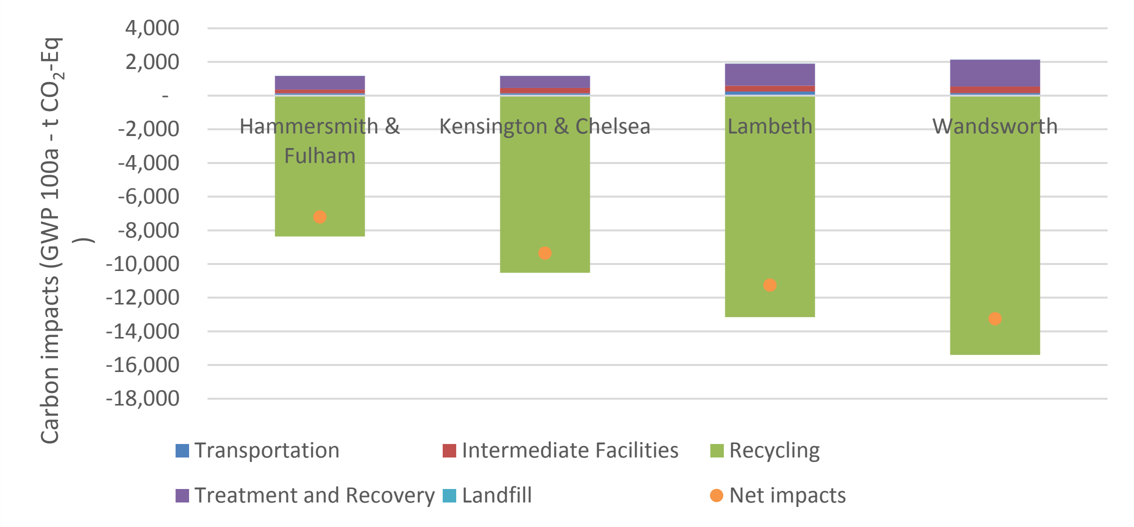
Table 24 below shows a breakdown of carbon impacts by different waste management stages. Unsurprisingly, waste collection and intermediate facilities (i.e., MRFs) have a positive carbon burden as these stage requires fuel and energy input to operate them. However, significant carbon benefits, achieved by substituting virgin material by recyclates, offset reported carbon burdens and lead to overall savings. Our analysis shows that Wandsworth has the highest carbon savings due to a higher capture rate of recyclates, compared to other boroughs. Lambeth has the highest carbon burden associated with waste transport as it has the largest fleet.

Table 24 : Carbon impacts, expressed in t CO2 eq., of waste management stages by borough.

Climate change: GWP 100a (t CO2-Eq)						
Borough	Transportation	Intermediate Facilities	Recycling	Treatment and Recovery	Landfill	**Total**
Hammersmith & Fulham	141	220	- 8,369	802	4	**- 7,202**
Kensington & Chelsea	138	313	- 10,523	712	4	**- 9,356**
Lambeth	243	341	- 13,158	1,318	6	**- 11,250**
Wandsworth	147	387	- 15,400	1,605	8	**- 13,253**

Figure 12 shows how significant carbon savings, predominantly achieved by recycling, lead to considerable carbon savings across all boroughs.

Figure 12 : Overall carbon impacts per borough.



A.14 Acidification Potential

Acidification potential has been discussed in this report due to its direct impact on local air quality. Overall, all boroughs have net positive savings due to recycling activities which offset emissions occurring further down the supply chain when new virgin material is used. However, it should be noted that these savings occur across the supply chain, and hence more attention should be given on transportation emissions.

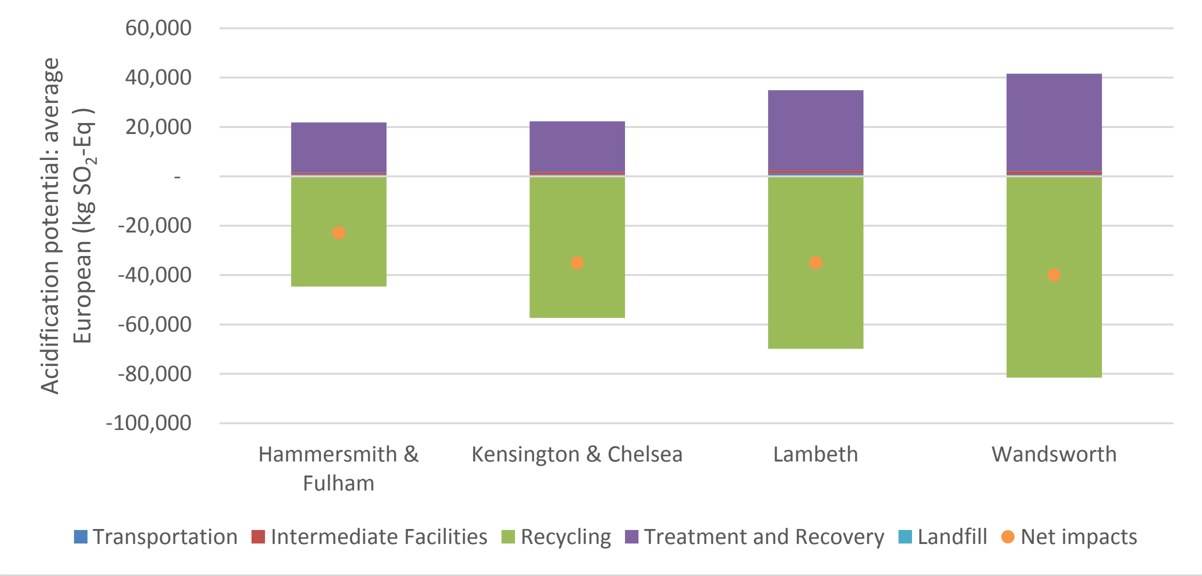
Unsurprisingly, as shown in Table 25, our results show that Lambeth, which has a fleet size of 26 vehicles, has the highest acidification burden across all boroughs.

Table 25 : Acidification potential, expressed in kg SO2-Eq., of waste management stages by borough.

	Acidification potential: average European (kg SO2-Eq)					
Borough	Transportation	Intermediate Facilities	Recycling	Treatment and Recovery	Landfill	**Total**
Hammersmith & Fulham	695	742	- 44,651	20,357	27	**- 22,830**
Kensington & Chelsea	678	1,055	- 57,330	20,519	27	**- 35,051**
Lambeth	1,198	1,148	- 69,880	32,541	43	**- 34,950**
Wandsworth	726	1,304	- 81,504	39,535	53	**- 39,887**

However, as shown in Figure 13, the negative impact of transportation is significantly outweighed by other factors representing a positive impact. In particular, with the majority of the waste arisings in the WRWA being either sent for recycling or to an EfW facility, a positive overall net impact is achieved across the WRWA constituency.

Figure 13 : Overall acidification potential per borough



A.15 WRATE LCA software

A.15.1 WRATE Datasets

Before developing the WRATE scenarios, the user enters details on three overall project parameters. Once these details have been determined and entered, WRATE has a user-friendly interface within which the user develops scenarios and enters process data (see Table A1).

For the purpose of this project, we used tonnages and composition data provided by West London Riverside authority. As we are modelling a status quo scenario, the 2018 energy mix was used in this analysis.

Table A1 Project information.

Parameter	Description
Project information	Various textual details about the project, including the municipality covered, the year of study, and any peer reviewers' comments.
Waste composition	WRATE has almost 150 waste fractions from which to select, so most municipal waste and similar commercial waste types can be modelled accurately.
Electricity mix	WRATE allows users to choose a country and a year to define the electricity generation mix. Using waste to produce electricity offsets a defined energy generation mix, depending on the country and year(s) being modelled, and is a critical factor in calculating the relative environmental impacts of waste management solutions.

A process can range from a simple process, such as producing a bin, to a much more complex process, such as a thermal treatment plant. For each process, the software includes compiled data on the resources used to operate the process and the emissions that occur into the environment when the process is operated. The software also defines a series of allocation algorithms that link the feedstock inputs to the outputs of a process (recovered product or residual waste). These algorithms can be dependent on the waste composition input (fractional or elemental composition), the total quantity of the waste, or the properties of the treatment plant.

In this way, the WRATE developers produced over 120 standardised process datasets, or allocation tables, as presented in Table A2 below.

Table A2 WRATE Default Process Datasets

Category	Examples
Containers (34)	Sacks, bins, recycling banks, etc.
Transport (26)	RCVs, ship, barge, train, car
Intermediate Facilities (14)	Transfer Stations, HWRC, Intermodal, MRF
Recycling Processes (24)	Ferrous, PAS100 Compost, Glasphalt, etc.
Treatment & Recovery…	Composting (8), Anaerobic Digestion (4), MBT-Aerobic (6), MBT-AD (4), MBT-Biodrying (4), SRF Production (2**),** Autoclave (2), Incinerators (6), Pyrolysers (2), Gasifiers (2), Cement Kiln (1)
Landfill (6)	Clay Liner, Clay cap, etc.

A.15.2 Results Process

WRATE calculates an environmental burden for the modelled system by using information on process behaviour and a series of databases on the environmental cost of using resources or recovering material and energy. The software compiles a life cycle inventory (LCI) which represents the environmental burden of the inputs and outputs that occur to and from the environment due to the existence and operation of the waste management system.

WRATE reports against six default environmental indicators:

1. Global Warming Potential (GWP) is an assessment of the amount of carbon dioxide and other gases emitted into the atmosphere and liable to cause global warming. Apart from CO_2, the other major greenhouse gas for waste management tends to be methane, which is 23-times more potent than CO_2. WRATE also weights emissions of other greenhouse gasses according to the climate change potency to produce a carbon footprint expressed in CO_2 equivalents.
2. Abiotic Resource Depletion (ARD) is related to extraction of scarce minerals and fossil fuels. The abiotic depletion factor is determined for each extraction of minerals and fossil fuels based on the remaining reserves and rate of extraction.
3. Human Toxicity Potential (HTP) is a measure of the impacts on human health. Characterisation factors describe the fate, exposure and effects of toxic substances over an infinite time horizon.
4. Freshwater Aquatic Eco Toxicity Potential (FAETP) is a measure of the adverse effects to aquatic organisms that result from being exposed to toxic substances. It is well known that fish can 'bio accumulate' concentrations of mercury and other toxins. Mobile heavy metals are extremely toxic to aquatic life, so activities that reduce releases of heavy metals will be favourable in this assessment.
5. Acidification Potential (AP) relates to the release of acidic gases, such as sulphur dioxide, which have the potential to react with water in the atmosphere to form 'acid rain' and cause ecosystem impairment.
6. Eutrophication Potential (EP) is the reflection of released nitrate and phosphate levels. Nitrates and phosphates are essential for life but increased concentrations in water can encourage excessive growth of algae, reducing the oxygen within the water and damaging ecosystems.

The results from the six criteria can be expressed in units that are specific to each criterion, such as CO_2 equivalents (CO_2 eq), or in a single normalised unit of measurement so they can be partially compared against each other. This unit is "European person equivalents", which represents the lifestyle impact one person has in Western Europe on the various criteria in a year. The number calculated is then equal to the effect of an increase/decrease in population against the six criteria. WRATE calculates results on an annual basis and for one given year only. The single normalised unit (European person equivalent) reporting is provided to show the comparison between each impact categories and should not be used for any evaluation purpose as this will not quantify the environmental impact for the population in living in Africa and there is no other comparable unit available.

Figure 14 thus shows the performance of each of the constituent authorities against the six default environmental indicators.

Figure 14 : Detailed WRATE LCA results

Borough	Impact Assessment	Unit	Total	Transportation	Intermediate Facilities	Recycling	Treatment and Recovery	Landfill
Hammersmith & Fulham	Climate change	kg CO2-Eq	- 7,202,180	141,124	220,166	- 8,369,107	801,768	3,870
	Acidification potential	kg SO2-Eq	- 22,830	695	742	- 44,651	20,357	27
	Eutrophication potential	kg PO4-Eq	3,647	127	136	- 3,357	6,718	23
	Freshwater aquatic ecotoxicity:	kg 1,4-DCB-Eq	- 1,840,947	11,632	57,514	- 1,753,672	- 199,223	42,803
	Human toxicity	kg 1,4-DCB-Eq	- 22,524,798	56,895	182,054	- 21,887,206	- 1,029,930	153,390
	Deplition of abiotic resources	kg antimony-Eq	- 181,593	1,200	1,697	- 70,078	- 114,498	86
Kensington & Chelsea	Climate change	kg CO2-Eq	- 9,356,415	137,637	312,914	- 10,522,920	712,054	3,900
	Acidification potential	kg SO2-Eq	- 35,051	678	1,055	- 57,330	20,519	27
	Eutrophication potential	kg PO4-Eq	2,918	124	193	- 4,204	6,782	23
	Freshwater aquatic ecotoxicity:	kg 1,4-DCB-Eq	- 2,054,568	11,345	81,742	- 1,989,030	- 201,765	43,140
	Human toxicity	kg 1,4-DCB-Eq	- 25,791,555	55,490	258,747	- 25,214,534	- 1,045,856	154,599
	Deplition of abiotic resources	kg antimony-Eq	- 203,012	1,171	2,411	- 90,769	- 115,911	87
Lambeth	Climate change	kg CO2-Eq	- 11,250,175	243,300	340,664	- 13,158,183	1,317,937	6,108
	Acidification potential	kg SO2-Eq	- 34,950	1,198	1,148	- 69,880	32,541	43
	Eutrophication potential	kg PO4-Eq	6,423	220	210	- 4,734	10,690	36
	Freshwater aquatic ecotoxicity:	kg 1,4-DCB-Eq	- 2,897,414	20,054	88,991	- 2,765,195	- 308,824	67,560
	Human toxicity	kg 1,4-DCB-Eq	- 35,229,614	98,088	281,693	- 34,246,963	- 1,604,543	242,110
	Deplition of abiotic resources	kg antimony-Eq	- 284,837	2,069	2,625	- 109,107	- 180,560	135
Wandsworth	Climate change	kg CO2-Eq	- 13,253,325	147,411	386,887	- 15,399,866	1,604,736	7,508
	Acidification potential	kg SO2-Eq	- 39,887	726	1,304	- 81,504	39,535	53
	Eutrophication potential	kg PO4-Eq	7,347	133	238	- 6,108	13,039	45
	Freshwater aquatic ecotoxicity:	kg 1,4-DCB-Eq	- 3,520,034	12,150	101,066	- 3,330,602	- 385,692	83,044
	Human toxicity	kg 1,4-DCB-Eq	- 42,662,698	59,430	319,914	- 41,348,054	- 1,991,586	297,598
	Deplition of abiotic resources	kg antimony-Eq	- 344,900	1,254	2,981	- 127,478	- 221,824	166