Waste & Recycling Services Support to Staffordshire Waste Partnership

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Front cover photography: Newcastle-under-Lyme recycling and food collection vehicle

Executive summary

This report considers the options for the future shape and delivery of the household waste collection services in Staffordshire. Ricardo Energy & Environment provided this support to the Partnership, on behalf of WRAP, and this report details the findings of the Options' review and modelling.

The project is part of an overall programme of work WRAP is conducting with local authorities to examine the business case for greater consistency in household recycling in England[1].

The objectives of this project were to:

- assess the business case for the introduction of countywide separate weekly food waste collections alongside both existing and reduced residual waste collections;
- assess the opportunities for the member authorities of the SWP to access a county wide food waste treatment contract;
- assess the implications for household waste disposal contracts and 'whole system costs';
- Enable the Business Case for greater consistency in waste and recycling service provision in England to be tested at the local level.

A range of options and sensitivities have been assessed to investigate the impact on both the collection authorities and the Partnership as a whole. These options are shown in the following table.

Table ES 1 Options

Authority	Option	Residual	Recycling	Garden	Food
All	0 (Baseline)	Fortnightly	As current	As current	As current
All (except NuLBC)	1	Fortnightly	As current	Fortnightly (no food included)	Collected separately every week using fleet of dedicated 7.5 tonne collection vehicle
All (except NuLBC)	2	Reduced frequency (either 3 or 4 weekly)	As current	Fortnightly (no food included)	Collected separately every week using fleet of dedicated 7.5 tonne collection vehicle
All (except NuLBC)	3	Fortnightly	As current	Fortnightly (no food included)	Separate weekly collections within a 'Pod' attached to a RCV. Collected alongside residual one week and & garden/dry the next
All	4	Fortnightly	Weekly Multi-stream	Fortnightly (no food included)	Separate weekly co-collected with multi-stream dry recycling

[1] *http://static.wrap.org.uk/consistancy/Read_more_about_the_framework.pdf*

All	5	Reduced frequency (either 3 or 4 weekly)	Weekly Multi-stream	Fortnightly (no food included)	Separate weekly co-collected with multi-stream dry recycling
All (except NuLBC)	1a	Fortnightly	As current	Chargeable Service (65% take up) Fortnightly (no food included)	Collected separately every week using fleet of dedicated 7.5 tonne collection vehicle
All	0a	Fortnightly	As current	Chargeable service (65% take up) Fortnightly (no food included)	None
All	0b	Fortnightly	As current	Chargeable service (30% take up) Fortnightly (no food included)	None

The key finding from the work are:

- Introducing a food waste collection across the Partnership could drive up recycling rates and reduce residual waste. However, the costs increase, irrespective of how the food is collected, for both collection authorities and from a whole system basis.
- Collecting food waste as part of a multi-stream service results in marginally lower costs than a dedicated service or a pod vehicle but would require significant service changes for all authorities except Newcastle-under-Lyme.
- Moving to a three weekly residual collection reduces costs and can help improve overall recycling rates, however, the costs do not offset the introduction of a food waste scheme.
- Operating a shared food waste collection service could reduce front line collection costs but only in the order of £40k per authority per annum.
- There appears to be significant potential food waste treatment facilities within and surrounding the Partnership.
- Introducing food waste and moving to three weekly residual collections can reduce residual waste, whilst a chargeable garden scheme has the potential to increase residual waste at the kerbside.
- The only options that consistently reduce costs compared to current costs, across each authority, are those that introduce chargeable garden schemes. However, this reduces recycling rates significantly.
- The potential saving and drop in recycling rate from chargeable garden schemes will be dependent on the uptake by householders.
- The introduction of a food waste collection and a chargeable garden waste scheme has the potential to reduce costs but also maintain or increase recycling rates.

The overall trend of the options, as shown by the following table, indicates that to hit high recycling rates additional expenditure is required compared to the Baseline. Equally to reduce costs it will typically require a change in service that will reduce the recycling rate. The option of introducing a food waste scheme and charging for garden waste may offer a balance between cost savings and maintaining recycling rates, however, the actual performance will depend on the level of uptake on the chargeable scheme.

Table ES 2 Cost and recycling performance [2]

Option	Total SWP costs (£k)	Total SWP costs (RANK)	Recycling Rate	Recycling Rate (RANK)
Op0 Baseline	£36,700	4	48%	7
Op1 + FW	£42,300	8	54%	5
Op2 + FW & 3wk RES	£39,500	6	59%	2
Op3 + FW & Pod RCV	£43,500	9	54%	4
Op4 Multi-stream & FW	£40,400	7	54%	3
Op5 Multi-stream & FW & 3wk RES	£36,900	5	60%	1
Op1a + FW + CG (65%)	£29,800	3	50%	6
Op0a + CG (65%)	£23,900	1	43%	8
Op0b + CG (30%)	£25,900	2	36%	9

Following the initial option modelling described above, chargeable garden waste schemes were identified as an area to investigate further. In order to assess the implications of introducing a chargeable garden scheme, a range of assumptions were developed with the project steering group. The areas of investigation are identified below:

- Uptake of the scheme – modelling has been undertaken on 30% and 65% of households taking part.
- Charge for scheme – analysis has looked at the impact of charging £35 per bin and £45 per bin.
- Increased HWRC garden waste – the modelling has investigated the impact of 5% and 15% of the current garden waste collected entering HWRC sites upon the introduction of a chargeable garden scheme. The cost per tonne at HWRC sites for processing garden waste has been set at £35 per tonne, based on information provided by Staffordshire County Council.
- Residual waste – modelling has been undertaken on the impact of 5% and 15% of the current garden waste collected entering the residual bin upon the introduction of a chargeable garden scheme.

The additional analysis on chargeable garden waste options identified that even when varying some of the assumptions, a chargeable garden scheme would appear to still offer significant costs saving. However, this is to the detriment of the overall recycling and composting rate. The main cost savings are from reduced vehicle and staff requirements and the income from the charges. Based on the worse case set of assumptions the total SWP cost with a chargeable garden waste collection is estimated to be £29million and £35 million with a food waste collection, this is compared to current costs estimated to be £37million.

The analysis would suggest that once a chargeable garden scheme is chosen to be introduced, the next two most important factors are the level of uptake and level of charge, both of which influence each other and the overall service performance.
Further research is recommended, potentially through consultation with the public, to identify an optimum charge to encourage high uptake but also ensure the costs of providing the service are appropriately covered.

[2] *The total out-turns for these options are based on the original modelling and do not incorporate the additional sensitivities conducted in Section 11*

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The Partnership	Staffordshire Waste Partnership

Acknowledgements

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1.0 Introduction

This report considers the options for the future shape and delivery of the household waste collection services in Staffordshire. It has been undertaken on behalf of WRAP and Staffordshire Waste Partnership (SWP). The project is part of an overall programme of work WRAP is conducting with local authorities to examine the business case for greater consistency in household recycling in England[3]. The framework for greater consistency developed by WRAP intends to increase recycling, improve the quality of recycled materials, save money and offer a good service. In particular, the introduction of the collection of a consistent suite of materials from all households as outlined within the Framework, namely:

- paper
- card
- glass
- plastics
- metals
- food

The objectives of this work were to:

- assess the business case for the introduction of countywide separate weekly food waste collections alongside both existing and reduced residual waste collections;
- assess the opportunities for the member authorities of the SWP to access a county wide food waste treatment contract;
- assess the implications for household waste disposal contracts and 'whole system costs'; and
- enable the Business Case for greater consistency in waste and recycling service provision in England to be tested at the local level.

2.0 Current Situation

This section provides information about the Waste Partnership and their current services.

2.1 The Partnership

The SWP is a collaboration of the ten councils in Staffordshire working together on waste management issues.

- Cannock Chase District Council
- East Staffordshire Borough Council
- Lichfield District Council
- Newcastle-under-Lyme Borough Council
- South Staffordshire District Council
- Stafford Borough Council
- Staffordshire Moorlands District Council
- Stoke-on-Trent City Council
- Tamworth Borough Council
- Staffordshire County Council.

[3] *http://static.wrap.org.uk/consistancy/Read_more_about_the_framework.pdf*

Staffordshire (excluding the city of Stoke-on-Trent) is a two tier administrative area comprising 8 district or borough councils and Staffordshire County Council.

The district and borough councils are Waste Collection Authorities (WCAs), meaning they are each responsible for the collection of Municipal Solid Waste (MSW) in their area.

Staffordshire County Council is a two tier authority which acts as the Waste Disposal Authority (WDA) for the entire county, meaning it is responsible for the management and disposal of the waste collected by the WCAs.
Stoke-on-Trent is a Unitary Authority (UA), meaning it is both a WCA and WDA.

SWP was established in 2001 to provide a platform for collaborative working between the WCAs and WDA. SWP provides a consistent framework for waste management in the county through the production of a strategy, offers knowledge sharing opportunities and enables efficiency savings through consortium agreements.

SWP is operates through collaborative working between Waste Managers from each authority. Between 2009 and 2012, the main role of SWP was to highlight awareness of waste issues within the communities of the county. In 2013, SWP changed focus to adapt to changing legislation by concentrating on the strategic development of SWP. This was through the management of key projects and facilitation of the required changes to meet the core objectives of this refreshed strategy.

2.2 Rurality

Three boroughs in the Staffordshire Waste Partnership are classed as mixed urban/rural with higher deprivation, with a rurality index of 3 (Cannock Chase DC, East Staffordshire BC and Newcastle under Lyme BC); three others (Lichfield (with Tamworth in a Joint Waste Service), Stafford BC and South Staffordshire DC) are predominantly rural authorities, with lower deprivation, with a rurality index of 6; whilst Staffordshire Moorlands DC is predominantly rural with higher deprivation (rurality index 5) and both Tamworth (joined with Lichfield as a waste service) and Stoke on-Trent City Council are predominantly urban with a higher deprivation (rurality index 1). This is shown in Table 1.

Table 1. Rurality indices of each authority

Authority	Rurality	Rurality index	Deprivation index
Cannock Chase	3	Mixed urban/rural, higher deprivation	20.65
East Staffordshire	3	Mixed urban/rural, higher deprivation	19.14
Lichfield	6	Predominantly rural, lower deprivation	12.74
Newcastle-under-Lyme	3	Mixed urban/rural, higher deprivation	29.74
South Staffordshire	6	Predominantly rural, lower deprivation	11.94
Stafford	6	Predominantly rural, lower deprivation	13.08
Staffordshire Moorlands	5	Predominantly rural, higher deprivation	16.04
Stoke-on-Trent	1	Predominantly urban, higher deprivation	35.32
Tamworth	1	Predominantly urban, higher deprivation	19.66

2.3 Household Numbers

The Councils have provided data on the number of households in each area. The baseline models exclude flats from non-standard kerbside service rounds where possible.

The number of households that were modelled for each authority is listed in Table 2, below:

Table 2. Number of households modelled for each waste collection authority

District	Number of households served (street level)	Number of households receiving garden collection
Cannock Chase	41,319 (excludes 929 flats)	41,319
East Staffordshire	47,280 (excludes 2,450 flats)	47,280 garden 46,320 food
Lichfield & Tamworth JWS	76,231	76,231
Newcastle-under-Lyme	48,910 (excludes 2,800 flats)	48,710
South Staffordshire	46,320	43,820
Stafford BC	55,000 (excludes 1,000 flats)	55,000
Staffordshire Moorlands	37,728	37,728
Stoke-on-Trent	85,736 (excludes the terraced and flats who receive weekly collections)	85736

2.4 The current service delivery

The councils currently operate the following collection schemes for refuse, dry recycling, food and garden waste, outlined in Table 3 to Table 10.

Table 3. Current collection system – Cannock Chase District Council

	Residual waste	Dry recycling	Garden and food waste
Container	240ltr wheeled bin	240ltr wheeled bin	240ltr wheeled bin
Materials	Refuse	Co-mingled paper, card, glass bottles and jars, tins and cans, plastic bottles	Garden waste (no food)
Collection frequency	Fortnightly	Fortnightly	Fortnightly

Table 4. Current collection system – East Staffordshire

	Residual waste	Dry recycling	Garden and food waste
Container	180ltr wheeled bin (black sacks for difficult to access areas)	240ltr wheeled bin for co-mingled and 34ltr sack for paper (clear sacks for difficult to access properties)	240ltr wheeled bin; small number with 140ltr bin
Materials	Refuse	2-stream (co-mingled for difficult to access properties)	Mixed garden and food waste
Collection frequency	Fortnightly	Fortnightly	Fortnightly for 48,961 properties; weekly for 769

East Stafford will shortly be removing the food waste from the mixed food and garden waste collection. Accordingly, the modelling has assumed a similar situation and transferred 5% of the current mixed food and garden tonnage to the residual waste stream.

Table 5. Current collection system – Lichfield & Tamworth

	Residual waste	Dry recycling	Garden and food waste
Container	Depends on household size 240, 180l, 140l with additional capacity for larger families and those with medical needs	240ltr wheeled bin	240ltr wheeled bin
Materials	Refuse	Comingled	Garden waste (no food)
Collection frequency	Fortnightly	Fortnightly	Fortnightly

Table 6. Current collection system – Newcastle-under-Lyme

	Residual waste	Dry recycling	Garden and food waste
Container	180ltr wheeled bin	3 x 55ltr box	240ltr wheeled bin for garden; 23ltr kerbside caddy for food (and 5ltr kitchen caddy)
Materials	Refuse	Multi-stream	Separate garden and food waste collection
Collection frequency	Fortnightly	Weekly	Garden fortnightly; food separate weekly

Table 7. Current collection system – South Staffordshire

	Residual waste	Dry recycling	Garden and food waste
Container	240ltr wheeled bin	240ltr wheeled bin	140ltr wheeled bin
Materials	Refuse	Co-mingled (paper, cardboard, glass, cans, plastics (bottles and PTTS), cartons)	Garden waste (no food)
Collection frequency	Fortnightly	Fortnightly	Fortnightly

Table 8. Current collection system – Stafford

	Residual waste	Dry recycling	Garden and food waste
Container	180ltr wheeled bin	240ltr wheeled bin for co-mingled and 40ltr bin insert for paper	240ltr wheeled bin
Materials	Refuse	2-stream	Garden waste (no food)
Collection frequency	Alternate weekly	Alternate weekly	Alternate weekly

Table 9. Current collection system – Staffordshire Moorlands

	Residual waste	Dry recycling	Garden and food waste
Container	180ltr wheeled bin	240ltr wheeled bin for co-mingled (plastic, glass, metal, cardboard); reusable sack for paper and another for textiles	240ltr wheeled bin
Materials	Refuse	2-stream	Mixed garden and food waste
Collection frequency	Fortnightly	Fortnightly	Fortnightly

Table 10. Current collection system – Stoke-on-Trent

	Residual waste	Dry recycling	Garden and food waste
Container	240ltr wheeled bin	240ltr wheeled bin for co-mingled and box for paper	240ltr wheeled bin
Materials	Refuse	2-stream	Mixed garden and food waste
Collection frequency	Fortnightly	Fortnightly	Fortnightly for 85,000; weekly for 3,000

2.5 Waste Arisings

The amount of waste included in the baseline models has been modified to reflect the proportion of households on standard (core) kerbside collections, as shown in Table 11.

Table 11. Kerbside waste tonnages modelled

Collection	Households	Refuse (tonnes)	Co-mingled recycling (tonnes)	Separate paper (tonnes)	Garden waste (tonnes)	Food waste (tonnes)
Cannock Chase	41,319	17,825	10,558	N/A	8,453	N/A
East Staffordshire	47,837	22,151	8,769	1,658	11,712	
Lichfield & Tamworth	76,231	35,318	20,276	N/A	11,077	N/A
Newcastle-under-Lyme	48,710	21,547	8,039		10,446	2,709
South Staffordshire	46,820	20,451	11,334	N/A	12,805	N/A
Stafford	55,000	24,161	13,063		15,518	N/A
Staffordshire Moorlands	43,728	16,934	8,082		14,168	
Stoke-on-Trent	113,698 (88,742 for garden)	39,374	12,520		12,576	

2.6 Waste Composition

The Councils have not conducted a full waste composition analysis in recent years. Therefore, it was agreed with the project team that the 2007 Entec waste composition study would be used as a proxy for total waste composition. The composition has been adjusted using the data on the current collection tonnages for dry recyclate, food and green waste. This data is shown in Table 12. This approach is suitable for conducting the high level analysis within the project but we would recommend a composition study is conducted in the near future to better estimate the type and quantity of waste produced.

Table 12. Estimated waste composition for Staffordshire Waste Partnership

Material Category	Cannock Chase (wt%)	East Staffs (wt%)	Lichfield Tamworth (wt%)	Newcastle (wt%)	South Staffs (wt%)	Stafford (wt%)	Staffs Moorlands (wt%)	Stoke (wt%)
Newspaper and magazines	14.00%	7.68%	10.33%	13.04%	11.88%	10.15%	10.68%	9.64%
Other Paper	4.44%	5.05%	4.98%	5.28%	4.05%	5.30%	4.26%	7.60%
Corrugated Card	3.20%	3.24%	3.05%	1.83%	2.07%	3.65%	1.85%	1.90%
Non corrugated Card	3.28%	3.88%	2.75%	3.32%	2.68%	2.79%	3.06%	3.00%
Plastic film	5.25%	6.69%	5.27%	4.88%	3.74%	3.53%	6.01%	4.55%
Plastic bottles	2.43%	2.97%	2.23%	2.71%	2.38%	2.49%	2.25%	2.20%
Plastic - other	3.83%	3.49%	3.29%	3.27%	3.37%	3.05%	2.60%	3.12%
Glass flint	6.00%	6.73%	4.94%	7.98%	6.07%	6.00%	6.20%	4.50%
Glass brown	0.90%	1.21%	1.09%	1.12%	1.19%	0.97%	1.23%	0.85%
Glass green	3.06%	3.41%	3.01%	3.32%	3.33%	3.31%	3.18%	2.54%
Steel cans	3.35%	2.45%	1.93%	2.32%	1.91%	1.72%	1.81%	1.44%
Aluminium cans	0.67%	0.77%	0.43%	0.59%	0.84%	0.69%	0.39%	0.29%
Foil	0.37%	0.63%	0.47%	0.30%	0.30%	0.52%	0.43%	0.43%
Textiles	1.84%	2.21%	2.03%	3.02%	1.57%	2.46%	1.85%	2.69%
Soil and other organic	1.97%	1.26%	4.94%	0.25%	2.72%	1.05%	2.45%	2.74%
Food	15.13%	15.76%	12.30%	13.05%	13.58%	16.65%	11.46%	21.70%
Garden	23.19%	26.17%	31.69%	25.57%	29.56%	30.94%	36.63%	17.45%
Other	7.14%	6.95%	5.31%	8.19%	8.80%	4.74%	3.68%	13.36%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

2.7 Set-out Rates

Set-out rates have been provided by the majority of WCAs (set-out is the average percentage of household setting out containers for collection on any collection day). Estimates have been made for those where not data was available. The rates set out below are for household that receive the service. For the mixed organics this is averaged out over the year, to accommodate for the summer peaks and winter lows.

Table 13. Set-out rates as provided

Authority	Residual waste	Dry recycling	Mixed organic waste
Cannock Chase	97%	97% (modelled 95%)	80% summer; winter currently unknown
East Staffordshire	91%	98% (modelled 95%)	60-80% (seasonal variances)
Lichfield & Tamworth	85%	85%	Varies according to season
Newcastle-under-Lyme	96%	85%	92%
South Staffordshire	100%	95%	90% peak (summer); 30% non-peak
Stafford	80%	75%	65%
Staffordshire Moorlands	95% (estimate)	90-95% (estimate) Modelled 90%	70-80% estimate
Stoke-on-Trent	95-100%	95-100% (modelled 90%)	75-80%

Further information on the modelling assumptions and baselines for each authority is provided within the appendices.

3.0 Benchmarking Performance

Benchmarking for each Council's performance is shown in Sections 3.1 and 3.2. This highlights the potential to increase the collection of certain recyclable materials. The information is taken from WRAP's Local Authority Waste and Recycling Information Portal (LA Portal). It is important to recognise that waste composition varies 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. This can lead to some anomalies particularly for twin stream collections where the actual tonnage for the separately collected stream can be measured.

3.1 Dry Recycling

A headline review of each authority's waste and recycling performance for 2014/15 is shown below. The basis for the review is the WRAP online benchmarking tool. The tool provides performance benchmarks to allow the user to see how each local authority's kerbside dry recycling and residual waste schemes are performing in the UK.

The tables below display the kerbside dry recycling yield for each of the main materials collected (paper, card, cans, glass, plastic bottles, mixed plastic packaging, textiles) and a total yield for these materials.

The yield for each material is compared against benchmark tables to show in which quartile it resides (as shown by the key below). These tables relate to the UK, local authority region, Office for National Statistics (ONS) area group and Urban-Rural Index of Multiple Deprivation (IMD) classification.

3.1.1 Cannock Chase DC

The level of recycling in Cannock is within the upper quartile for all categories and materials, except for when compared against other West Midland authorities, where it drops into the upper middle quartile. The residual waste produced is relatively low and in the top 50% across all categories, despite no food waste collection.

Figure 1 Cannock Chase recycling benchmarking (WRAP LA portal, 2014/15)

Category	Detail	Paper	Card	Cans	Glass	Plastic bottles	Mixed plastic packaging	Textiles	All 5 'Widely Recycled' materials
Cannock Chase District Council	Yield (kg/hhd/yr)	106.6	39.5	12.9	67.0	17.5	6.9	0.0	243.6
How you compare against other UK Authorities									
How you compare against other authorities in the same region	West Midlands								
How you compare against other authorities with similar characteristics - ONS area classification	Manufacturing Towns								
How you compare against other authorities in the same rurality	3) Mixed urban/rural, higher deprivation								

Figure 2 Cannock Chase residual benchmarking (WRAP LA portal, 2014/15)

Category	Detail	Household Residual Waste collected at kerbside (kg/hhd/yr)
Cannock Chase District Council	Yield (kg/hhd/yr)	427.3
How you compare against other UK Authorities		
How you compare against other authorities in the same region	West Midlands	
How you compare against other authorities with similar characteristics - ONS area classification	Manufacturing Towns	
How you compare against other authorities in the same rurality	3) Mixed urban/rural, higher deprivation	

3.1.2 East Staffordshire BC

The level of recycling within East Staffordshire is within the upper quartile for all categories and materials, except for paper, where it appears in the lower quartile. The residual waste produced is in the bottom 50% across all categories except for other Manufacturing Towns, and despite food waste being collected mixed with garden waste.

Figure 3 East Staffordshire recycling benchmarking (WRAP LA portal, 2014/15)

Category	Detail	Paper	Card	Cans	Glass	Plastic bottles	Mixed plastic packaging	Textiles	All 5 'Widely Recycled' materials
East Staffordshire Borough Council	Yield (kg/hhd/yr)	36.7	48.6	15.8	82.6	21.7	8.9	0.0	205.5
How you compare against other UK Authorities									
How you compare against other authorities in the same region	West Midlands								
How you compare against other authorities with similar characteristics - ONS area classification	Manufacturing Towns								
How you compare against other authorities in the same rurality	3) Mixed urban/rural, higher deprivation								

Figure 4 East Staffordshire residual benchmarking (WRAP LA portal, 2014/15)

Category	Detail	Household Residual Waste collected at kerbside (kg/hhd/yr)
East Staffordshire Borough Council	Yield (kg/hhd/yr)	441.7
How you compare against other UK Authorities		
How you compare against other authorities in the same region	West Midlands	
How you compare against other authorities with similar characteristics - ONS area classification	Manufacturing Towns	
How you compare against other authorities in the same rurality	3) Mixed urban/rural, higher deprivation	

3.1.3 Lichfield and Tamworth JWS

The level of recycling within Lichfield is within the upper quartile for all categories and materials that are collected. The residual waste produced is in the upper quartile or upper middle quartile across all categories, despite there being no food waste collection available.

Figure 5 Lichfield recycling benchmarking (WRAP LA portal, 2014/15)

Category	Detail	Paper	Card	Cans	Glass	Plastic bottles	Mixed plastic packaging	Textiles	All 5 'Widely Recycled' materials
Lichfield District Council	Yield (kg/hhd/yr)	111.8	41.4	13.6	70.3	18.4	7.3	0.0	255.4
How you compare against other UK Authorities									
How you compare against other authorities in the same region	West Midlands								
How you compare against other authorities with similar characteristics - ONS area classification	Prospering Smaller Towns								
How you compare against other authorities in the same rurality	6) Predominantly Rural, lower deprivation								

Figure 6 Lichfield residual benchmarking (WRAP LA portal, 2014/15)

Category	Detail	Household Residual Waste collected at kerbside (kg/hhd/yr)
Lichfield District Council	Yield (kg/hhd/yr)	382.5
How you compare against other UK Authorities		
How you compare against other authorities in the same region	West Midlands	
How you compare against other authorities with similar characteristics - ONS area classification	Prospering Smaller Towns	
How you compare against other authorities in the same rurality	6) Predominantly Rural, lower deprivation	

The level of recycling within Tamworth is within the upper quartile for all categories and materials that are collected. The residual waste produced is generally in the top 50%, except when compared to all UK authorities. When compared to other Rurality 1 authorities it is in the upper quartile, despite no food waste collection being available.

Figure 7 Tamworth recycling benchmarking (WRAP LA portal, 2014/15)

Category	Detail	Paper	Card	Cans	Glass	Plastic bottles	Mixed plastic packaging	Textiles	All 5 'Widely Recycled' materials
Tamworth Borough Council	Yield (kg/hhd/yr)	108.4	40.1	13.1	68.2	17.8	7.0	0.0	247.7
How you compare against other UK Authorities									
How you compare against other authorities in the same region	West Midlands								
How you compare against other authorities with similar characteristics - ONS area classification	Manufacturing Towns								
How you compare against other authorities in the same rurality	1) Predominantly urban, higher deprivation								

Figure 8 Tamworth residual benchmarking (WRAP LA portal, 2014/15)

Category	Detail	Household Residual Waste collected at kerbside (kg/hhd/yr)
Tamworth Borough Council	Yield (kg/hhd/yr)	435.0
How you compare against other UK Authorities		
How you compare against other authorities in the same region	West Midlands	
How you compare against other authorities with similar characteristics - ONS area classification	Manufacturing Towns	
How you compare against other authorities in the same rurality	1) Predominantly urban, higher deprivation	

3.1.4 Newcastle under Lyme BC

The level of recycling within Newcastle under Lyme varies across categories and materials. For cans, textiles and plastics it is in the top 50%. For the other materials it is in the lowest two quartiles, in particular paper. The residual waste produced is generally in the top two upper quartiles; the collection of food is likely to play a part in this, especially with recycling yields being typically low. It should be noted that since 2014/15 there has been a major service change and that recycling rates have significantly increased as detailed in section 4.2.

Figure 9 Newcastle under Lyme recycling benchmarking (WRAP LA portal, 2014/15)

Category	Detail	Paper	Card	Cans	Glass	Plastic bottles	Mixed plastic packaging	Textiles	All 5 'Widely Recycled' materials
Newcastle-under-Lyme Borough Council	Yield (kg/hhd/yr)	46.3	24.9	10.7	46.3	14.7	0.0	1.2	142.9
How you compare against other UK Authorities									
How you compare against other authorities in the same region	West Midlands								
How you compare against other authorities with similar characteristics - ONS area classification	Manufacturing Towns								
How you compare against other authorities in the same rurality	3) Mixed urban/rural, higher deprivation								

Figure 10 Newcastle under Lyme residual benchmarking (WRAP LA portal, 2014/15)

Category	Detail	Household Residual Waste collected at kerbside (kg/hhd/yr)
Newcastle-under-Lyme Borough Council	Yield (kg/hhd/yr)	418.3
How you compare against other UK Authorities		
How you compare against other authorities in the same region	West Midlands	
How you compare against other authorities with similar characteristics - ONS area classification	Manufacturing Towns	
How you compare against other authorities in the same rurality	3) Mixed urban/rural, higher deprivation	

3.1.5 South Staffordshire DC

The level of recycling within South Staffordshire is typically within the lower upper quartile and a significant proportion of the categories and materials are in the upper quartile. The residual waste produced is generally in the bottom 50%, which could be due to no food waste collections, given relatively high recyclate collections.

Figure 11 South Staffordshire recycling benchmarking (WRAP LA portal, 2014/15)

Category	Detail	Paper	Card	Cans	Glass	Plastic bottles	Mixed plastic packaging	Textiles	All 5 'Widely Recycled' materials
South Staffordshire District Council	Yield (kg/hhd/yr)	103.4	38.3	12.5	65.0	17.0	6.7	0.0	236.3
How you compare against other UK Authorities									
How you compare against other authorities in the same region	West Midlands								
How you compare against other authorities with similar characteristics - ONS area classification	Prospering Smaller Towns								
How you compare against other authorities in the same rurality	6) Predominantly Rural, lower deprivation								

Figure 12 South Staffordshire residual benchmarking (WRAP LA portal, 2014/15)

Category	Detail	Household Residual Waste collected at kerbside (kg/hhd/yr)
South Staffordshire District Council	Yield (kg/hhd/yr)	431.5
How you compare against other UK Authorities		
How you compare against other authorities in the same region	West Midlands	
How you compare against other authorities with similar characteristics - ONS area classification	Prospering Smaller Towns	
How you compare against other authorities in the same rurality	6) Predominantly Rural, lower deprivation	

3.1.6 Stafford BC

The level of recycling within Stafford is in the upper quartile except for paper and the combined yields. The residual waste produced is generally in the upper lower quartile, which could be due to no food waste collections, given relatively high recyclate collections.

Figure 13 Stafford recycling benchmarking (WRAP LA portal, 2014/15)

Category	Detail	Paper	Card	Cans	Glass	Plastic bottles	Mixed plastic packaging	Textiles	All 5 'Widely Recycled' materials
Stafford Borough Council	Yield (kg/hhd/yr)	39.1	47.1	15.3	79.9	21.0	8.6	0.0	202.4
How you compare against other UK Authorities									
How you compare against other authorities in the same region	West Midlands								
How you compare against other authorities with similar characteristics - ONS area classification	Prospering Smaller Towns								
How you compare against other authorities in the same rurality	6) Predominantly Rural, lower deprivation								

Figure 14 Stafford residual benchmarking (WRAP LA portal, 2014/15)

Category	Detail	Household Residual Waste collected at kerbside (kg/hhd/yr)
Stafford Borough Council	Yield (kg/hhd/yr)	433.6
How you compare against other UK Authorities		
How you compare against other authorities in the same region	West Midlands	
How you compare against other authorities with similar characteristics - ONS area classification	Prospering Smaller Towns	
How you compare against other authorities in the same rurality	6) Predominantly Rural, lower deprivation	

3.1.7 Staffordshire Moorlands DC

The level of recycling within Staffordshire Moorland is in the upper quartile except for paper and the combined yields. The residual waste produced is generally in the upper quartile, this may be due to good recycling performance and having a food waste collection mixed with garden waste. This could be because the authority already collects food waste.

Figure 15 Staffordshire Moorland recycling benchmarking (WRAP LA portal, 2014/15)

Category	Detail	Paper	Card	Cans	Glass	Plastic bottles	Mixed plastic packaging	Textiles	All 5 'Widely Recycled' materials
Staffordshire Moorlands District Council	Yield (kg/hhd/yr)	39.9	37.7	12.3	63.9	16.8	6.9	0.2	170.6
How you compare against other UK Authorities									
How you compare against other authorities in the same region	West Midlands								
How you compare against other authorities with similar characteristics - ONS area classification	Prospering Smaller Towns								
How you compare against other authorities in the same rurality	5) Predominantly Rural, higher deprivation								

Figure 16 Staffordshire Moorlands residual benchmarking (WRAP LA portal, 2014/15)

Category	Detail	Household Residual Waste collected at kerbside (kg/hhd/yr)
Staffordshire Moorlands District Council	Yield (kg/hhd/yr)	345.9
How you compare against other UK Authorities		
How you compare against other authorities in the same region	West Midlands	
How you compare against other authorities with similar characteristics - ONS area classification	Prospering Smaller Towns	
How you compare against other authorities in the same rurality	5) Predominantly Rural, higher deprivation	

3.1.8 Stoke-on-Trent City Council

The level of recycling within Stoke-on-Trent varies when compared against the different categories but for urban areas it is in the upper quartile except for paper and the combined yields. The residual waste produced is generally in the bottom 50%, which could be due to no food waste collections, given relatively high recyclate collections.

Figure 17 Stoke-on-Trent recycling benchmarking (WRAP LA portal, 2014/15)

Category	Detail	Paper	Card	Cans	Glass	Plastic bottles	Mixed plastic packaging	Textiles	All 5 'Widely Recycled' materials
Stoke on Trent City Council	Yield (kg/hhd/yr)	14.1	33.9	11.1	57.5	15.1	6.1	0.8	131.7
How you compare against other UK Authorities									
How you compare against other authorities in the same region	West Midlands								
How you compare against other authorities with similar characteristics - ONS area classification	Industrial Hinterlands								
How you compare against other authorities in the same rurality	1) Predominantly urban, higher deprivation								

Figure 18 Stoke-on-Trent residual benchmarking (WRAP LA portal, 2014/15)

Category	Detail	Household Residual Waste collected at kerbside (kg/hhd/yr)
Stoke on Trent City Council	Yield (kg/hhd/yr)	477.8
How you compare against other UK Authorities		
How you compare against other authorities in the same region	West Midlands	
How you compare against other authorities with similar characteristics - ONS area classification	Industrial Hinterlands	
How you compare against other authorities in the same rurality	1) Predominantly urban, higher deprivation	

4.0 Collection options modelled

Analysing the costs and resources associated with different waste and recycling collection options (Options) allows the Councils to make informed decisions regarding the delivery of the collection service.

In order to determine the scenarios as Options for modelling, detailed discussions were held between Ricardo Energy & Environment, WRAP and Staffordshire Waste Partnership at the Project Inception Meeting. These were then finalised and confirmed via email and telephone correspondence.

The scenarios were selected to test a range of potential service changes, focussing on the Partnership's desire to investigate:

- Food waste collections;
- Multi-stream services;
- Chargeable garden waste scenarios; and
- The impact of changing collection frequency;

The Options agreed upon are shown in Table 14. These are identified as the Baseline (Option 0), five main model Options (Options 1-5) and three sensitivities based on other options (Option 0a, 1a and 1b)

Table 14. Options modelled in KAT

Authority	Option	Residual	Recycling	Garden	Food
All	0 (Baseline)	Fortnightly	As current	As current	As current
All (except NuLBC)	1	Fortnightly	As current	Fortnightly (no food included)	Collected separately every week using fleet of dedicated 7.5 tonne collection vehicle
All (except NuLBC)	2	Reduced frequency (either 3 or 4 weekly)	As current	Fortnightly (no food included)	Collected separately every week using fleet of dedicated 7.5 tonne collection vehicle
All (except NuLBC)	3	Fortnightly	As current	Fortnightly (no food included)	Separate weekly collections within a 'Pod' attached to a RCV. Collected alongside residual one week and & garden/dry the next
All	4	Fortnightly	Weekly Multi-stream	Fortnightly (no food included)	Separate weekly co-collected with multi-stream dry recycling
All	5	Reduced frequency (either 3 or 4 weekly)	Weekly Multi-stream	Fortnightly (no food included)	Separate weekly co-collected with multi-stream dry recycling
All (except NuLBC)	1a **Sensitivity on Option 1**	Fortnightly	As current	Chargeable Service (65% take up) Fortnightly (no food included)	Collected separately every week using fleet of dedicated 7.5 tonne collection vehicle
All	0a **Sensitivity on Option 0**	Fortnightly	As current	Chargeable service (65% take up) Fortnightly (no food included)	None
All	0b **Sensitivity on Option 0**	Fortnightly	As current	Chargeable service (30% take up) Fortnightly (no food included)	None

Additional analysis investigating the potential of a jointly operated food waste service was conducted and this is discussed within the results section.

Following modelling and analysis of the initial set of options it became apparent that chargeable garden options were a key interest to the Partnership, therefore additional options modelling and analysis on Option 0 and Option 1 and was conducted. This can be found in Sections 5.6 to 5.8.

The vehicles and containers used in each of the modelling options were agreed during discussion held at the interim meetings with WRAP and the Partnership. Further details can be found within the assumptions detailed within the appendices (see Appendix 1 and 2).

4.1 Modelling methodology

The modelling has been undertaken using WRAPs Kerbside Analysis Tool (KAT). KAT is a Microsoft Excel™ model that allows local authorities to make projections of the resource requirements associated with different kerbside recycling collections. It provides relative comparisons between the costs of implementing and running those different service types.

4.2 Year of Modelling

All Baseline models are based on the April 2015 to March 2016 tonnages as provided by the Councils. The same arisings and number of households as the Baseline have been assumed for all future waste and recycling collection options. Tonnage data was adjusted for Newcastle-under Lyme, as they have recently amended their service and the performance has significantly increased. A full year of data was not available, so dry recycling has been assumed to rise by 20% and residual waste drop a corresponding amount.

4.2.1 Baseline/Option 0 model

In order to accurately model the resource requirements and costs of the different Options, it is essential to firstly model the Baseline Service (current situation) correctly. This is important, as the Options modelling is built on the data used in the Baseline. Any inaccuracies in the Baseline will, therefore, skew the results of the Options modelling. This requires two types of input:

- Operational data; and
- Cost data.

KAT data sheets pertaining to this information were completed by the Councils, prior to project commencement. The data collated included specific inputs regarding the Councils' service and situation, e.g. number of households served, current service profile, travel times, tipping times and vehicle configuration.

The Baseline model is a close approximation to the current service and forms a sound basis for comparing alternative collection methods.

The Baseline model and a comparison to the current service is provided within the individual authority appendices.

4.2.2 Options modelling

Once the Baseline models were set up, these were then used as the basis for modelling the Options set out in Section 4.0. The Baseline model is presented in the options modelling as Option 0.

A number of assumptions were then used in the Options modelling, many of which used information from WRAP in order to benchmark and compare the performance of different collection types and ensure the use of appropriate data in the models. The key assumptions are discussed in the following section.

It should be noted that throughout this section, the differences between the resource requirements and costs of the Options should be used to assess the relative and proportionate differences in costs of future collection options against the current baseline, rather than be used for budgetary purposes.

4.2.2.1 Food Waste Yields

In order to calculate the expected food yields for a separate food waste collection for each of the councils, we have used the WRAP Ready Reckoner. Where a separate food waste service is introduced (all options), we assumed the yield to be in-line with WRAP's ready reckoner for separate weekly collections of food. The predicted yields per household served per week are (given that refuse is currently collected every fortnight):

$$= 2.1614 - (\%\ \text{Social Groups D and E} \times 2.2009) \pm 0.40\ \text{kg/hh/week}$$

In our experience on similar projects, we have found the reckoner to over-estimate food tonnages, and therefore we have included more conservative estimates, based on the lower range value. Newcastle-under-Lyme are the only authority collecting food waste separately within the partnership and their yield (1.07 kg/hh/wk) is slightly under the Ready Reckoner lower range estimate for the authority (1.13 kg/hh/wk). Recent data from Newcastle, since a service change, has resulted in an increase and the current level is estimated to be 1.17 kg/hh/wk. The quantity of food waste collected within mixed food and green waste is believed to be minimal for the authorities within the partnership. An estimate for the authorities with mixed food and green has been provided, based on an assumed 5% of the tonnage collected being food. The kg per household per week is small and below the WRAP typical values of 0.5 kg/hh served/week. The following two tables (16 & 17) show the yields on a weekly and yearly basis for current collections, yields suggested by the Ready Reckoner and the yields proposed for the modelling.

Table 15. Food yield estimates per week

Authority	Food Waste Ready Reckoner			Currently collected food waste		Suggested values for modelling kg/hh/wk
	Lower range (-0.40)	Prediction kg/hh/wk	Upper range (+0.40)	Food waste only kg/hh/wk	Mixed FW/GW (5%) kg/hh/wk	
Cannock Chase	1.12	1.52	1.92			1.12
East Staffordshire	1.07	1.47	1.87		0.25	1.07
Lichfield	1.32	1.72	2.12			1.32
Newcastle-under-Lyme	1.13	1.53	1.93	1.17		1.17
South Staffordshire	1.35	1.75	2.15			1.35
Stafford	1.29	1.69	2.09			1.29
Staffordshire Moorlands	1.23	1.63	2.03		0.31	1.23
Stoke-on-Trent	0.91	1.31	1.71		0.14	0.91
Tamworth	1.10	1.50	1.90			1.10

Table 16. Food yield estimates per year

Authority	Food Waste Ready Reckoner			Currently collected food waste		Suggested values for modelling kg/hh/yr
	Lower range (-0.40)	Prediction kg/hh/yr	Upper range (+0.40)	Food waste only kg/hh/yr	Mixed FW/GW (5%) kg/hh/yr	
Cannock Chase	58	79	100			58
East Staffordshire	56	76	97		13	56
Lichfield	69	90	110			69
Newcastle-under-Lyme	59	80	100	61		61
South Staffordshire	70	91	112			70
Stafford	67	88	109			67
Staffordshire Moorlands	64	85	106		16	64
Stoke-on-Trent	47	68	89		7	47
Tamworth	57	78	99			57

Key assumptions used for modelling options:

- a 60% participation, the upper limit of current separate food waste collections, given the recycling performance of the partnership;
- a continual supply of liners, along with a kitchen caddy and a 23ltr food waste container, included in the costings;
- delivery locations for separate garden waste continuing to current locations:
    - East Staffordshire – Biffa at Etwall (IVC)
    - Stoke and Staffordshire Moorlands – Vital Earth at Ashbourne (IVC)
    - Newcastle – Veolia at Acton, Newcastle (windrow)
    - South Staffordshire – Veolia at Lawn Lane, Coven (windrow)
    - Stafford – Ainsworth at Chebsey (windrow)
    - Cannock – Bloomfield at Huntington (windrow)
    - Lichfield and Tamworth – Rymans at Atherston
- delivery locations for separate food waste based on all waste going to a single facility in the south:
    - Cannock Chase, South Staffordshire and Lichfield and Tamworth all direct deliver;
    - remaining authorities are assumed to bulk at depot and haul to facility in the south.

4.2.2.2 Multi-stream collections

In order to assess the relative performance of the authorities moving to a multi-stream collection, an estimate of performance has been created using WRAP's Indicative Cost and Performance (ICP) online tool.

The tool originates from the 2008 published WRAP report Kerbside Recycling: Indicative Costs and Performance (ICP). The report provided a systematic appraisal of the characteristics of the principal kerbside recycling collection systems looking at both their cost and effectiveness. The latest update and the basis for the tool is based on improved knowledge around scheme performance and costs collated by WRAP. The aim of the update is to produce a series of benchmark costs and standard operational data, through service modelling, that local authorities can use when evaluating their current recycling service and considering service changes. The resultant benchmarks are based on the rurality index and expected yields of food and dry recycling.

Data has been collated from the model for each authority on the relative yields of a co-mingled, two stream and multi-stream service for dry recycling. This data has been used to estimate the approximate yield change of moving from their current scheme type to a multi-stream service (Table 17).

Authorities on a co-mingled service show an approximate 15% drop in yield, whilst for two-stream the drop is approximately 3-5%. The data suggests Stoke-on-Trent would actually increase recycling yields by 5% by moving to a multi-stream service. Newcastle-under-Lyme are the only partnership authority currently on a multi-stream service and accordingly no change in yield is predicted.

Table 17 Impact of moving to a multi-stream service (Current service highlighted green)

Authority	Current service/reference	Fortnightly co-mingled, fortnightly residual waste, food collected separately (kg/hh/yr)	Fortnightly Two Stream (fibres: containers) on split vehicle, fortnightly residual waste, food collected separately (kg/hh/yr)	Weekly multi-stream, fortnightly residual waste, food collected on dry recycling vehicle (kg/hh/yr)	Change in recycling yield by moving to multi-stream
Cannock Chase	Fortnightly co-mingled, fortnightly residual waste, fortnightly garden, no food	246	216	210	85%
East Staffordshire	Fortnightly two-stream, fortnightly residual waste, fortnightly garden with food	246	216	210	97%
Lichfield	Fortnightly co-mingled, fortnightly residual waste (with textiles?), fortnightly garden, no food	294	263	250	85%
Newcastle-under-Lyme	Fortnightly multi-stream, fortnightly residual waste, fortnightly garden, weekly separate food	225	196	192	100%
South Staffordshire	Fortnightly co-mingled, fortnightly residual waste, fortnightly garden, no food	294	263	250	85%
Stafford	Fortnightly 2-stream, fortnightly residual waste, fortnightly garden, no food	294	263	250	95%
Staffordshire Moorlands	Fortnightly 2-stream, fortnightly residual waste, fortnightly garden with food	246	216	210	97%
Stoke-on-Trent	Fortnightly 2-stream, fortnightly residual waste, fortnightly garden with food	190	164	173	105%
Tamworth	Fortnightly co-mingled, fortnightly residual waste (with textiles?), fortnightly garden, no food	247	219	212	86%

The table below shows the yields used for the multi-stream scenario 4. The required yields were created by adjusting the participation and capture rates.

Table 18 Multi-stream dry recycling yields

Authority	Change in recycling yield by moving to multi-stream	Current yields	Multi-stream yields
Cannock Chase	85%	256	218
East Staffordshire	97%	218	212
Lichfield & Tamworth	86%	266	227
Newcastle-under-Lyme	100%	197	197
South Staffordshire	85%	245	208
Stafford	95%	238	226
Staffordshire Moorlands	97%	185	180
Stoke-on-Trent	105%	125	132

A key element of a successful collection scheme is understanding and reducing contamination. Dry recycling is the principal service of concern and there can be quite a variation in contamination, both across similar schemes operated by different authorities and also different types of scheme.

The table below show typical values for contamination, sourced from a number of studies and also data from working with a similar authority who operates a twin-stream service.

Table 19 Typical contamination rates.

Service Type	Material	WRAP (2010)	WRAP (2009)	ZWS (2013)	LA 1 data
Co-mingled		5% - 10%	13.0%		
Twin-stream		5.0%	13% Mixed, 7%fibre		7 % mixed stream, 5% fibre
Kerbside sort	News and PAMS	0.5% - 1%	0.5%	1.6%	
	Paper				
	Card			8.1%	
	Paper & Card			1.8%	
	Mixed Glass			0.7%	
	Mixed Plastic				
	HDPE Natural			5.5%	
	PET Coloured				
	Aluminium			9.1%	
	Steel				

As well as yields, the other major impact of moving to a multi-stream service is reduced contamination. The modelling will assume that contamination for a multi-stream service is

2%, this is significantly less than the levels identified by a number of authorities and above the 1% currently estimated by Newcastle-under Lyme, who operate a multi-stream service.

The delivery location for the multi stream collections will be as per current arrangements, with material bulked at a depot or MRF, before onward travel to reprocessors:

- Cannock, South Staffordshire, Lichfield & Tamworth Biffa's direct to Aldridge;
- East Staffordshire bulked at current waste transfer station;
- Stafford bulked at current depot;
- Stoke bulked at current depot at Federation Road;
- Staffordshire Moorlands bulked at current depot in Leek; and
- Newcastle bulked at current depot

No additional bulking costs, either for capital expenditure or ongoing operations have been included.

4.2.2.3 Three weekly residual collections

The move to three and four weekly residual waste collections has been trialled in a number of authorities, across England, Scotland and Wales. At present it is believed that in the order of thirteen have rolled out three weekly collections or are in the process of doing so, to all households (Bury MBC, Oldham, Rochdale, Falkirk, Blaenau Gwent, Gwynedd, Powys, Argyll & Bute, Clackmannanshire, East Renfrewshire, East Ayrshire and the Isle of Anglesey all have a scheme in place. Daventry Councillors agreed in July 2016 that they will move to three-weekly). The primary aim is to reduce costs, which are achieved by a combination of reduced number of collections, improved recycling and composting performance and reduced residual waste.

The following provides some information on a number of the trials, collated from news articles and authority papers.

Somerset Waste Partnership Trial

This was launched as part of the 'Recycle More' Trials (September 2014). As part of trials, the collection of residual waste was moved to every three weeks alongside weekly recycling and food collections. The trial was provided to 1,231 households for 12 weeks. Analysis of the trial found the following results:

- Residual waste declined 27%, while food and recycling increased by 45% and 27% respectively;
- Participation rates in recycling schemes increased by 3%;
- Recyclate within the residual waste varied from 51% in non-recycling households to 28% in mid-recycling households;
- 80% thought the trial was 'better' or 'much better' than the previous collection, with only 7% saying 'worse' or 'much worse';
- 90% said that their residual bin was the 'right size' or 'too big';
- Average satisfaction levels approximately increased with the number of occupants, with households with 5 occupants reporting a 100% satisfaction level; and
- 46% of those who left comments asked for the trial to be continued.

East Devon

In September 2015, East Devon Council trialled collecting general (residual) waste bins once every 3 weeks in two areas, the Colony in Exmouth and Feniton, covering around 1,800 households. Residents of the trial areas were given plenty of notice (from June 2015) prior

to the start of the trial in September 2015 and district council officers also put on events in public areas around the two trial areas to help educate residents on how to reduce, re-use and recycle their waste. Letters and leaflets were distributed to households in the trial areas and there was also a comprehensive media campaign.

The council continued to provide recycling collections on a weekly basis and also increased food waste recycling collections from fortnightly to weekly. Residents involved in the trial were also able to recycle a wider range of materials such as cardboard egg boxes and toilet roll tubes as well as mixed plastics pots, tubs and trays, which were not previously accepted in the co-mingled stream. Each household also received an additional 70 litre re-usable sack to increase the volume of recycling they could put out each week.

The trial has been hailed as a "great success" by Councillors, as recycling rates have improved dramatically alongside a marked reduction in waste being sent to landfill. Additionally, there has been no increase in fly-tipping.

The results of the trial showed an increase in dry recycling rates from 39% to 56%, and a decrease in residual waste by 19%. Food waste collections saw a significant increase, however analysis of the residual waste stream collected from the trial areas indicated that there was still a large proportion that consisted of food.

Rochdale

Rochdale trialled moving from a fortnightly service for residual waste collection to a three-weekly service that sits alongside a three weekly collection of recyclable waste in separate blue and green wheeled bins (green for plastics, cans, tins, foil and glass, and blue for paper and card) and a weekly collection service for food and garden waste. According to the council, recycling rates rose from around 31% in January 2015 to 49% in January 2016. Rochdale have since rolled out a three-weekly collection across the borough.

WRAP research

As part of this project, WRAP have provided some initial observations that have been used to better define the assumptions for the options modelling. The following information provided is just an initial observation, as detailed evidence is presently not available on the true impact of extending residual collection frequencies:

- Overall reduction in all household waste arisings of ~4%;
- Reductions in kerbside collected residual waste typically ~10 – 25%;
- Evidence from Wales suggests that the reduction in residual waste has been more important to the increase in recycling % than any actual increase in recycling itself (although dry recycling increases typically 2 – 15%);
- Evidence for increases in food waste recycling is inconclusive since not enough datasets. However, all those looked at were above the median Ready Reckoner and approaching the upper level.

General observations:

- Marginal gross cost savings from moving to 3 weekly collections;
- Drop in refuse crews and round sizes depending on rurality (urban authorities benefit more);
- Additional recycling costs;
- Quartile change reductions for residual arisings;

- Overall financial gains mainly from avoided residual disposal savings;
- Decrease in available productive time for refuse crews to collect;
- Increase in both participation and capture of recycling;
- Average % yield change not so important (as it will depend on the starting point);
- Starting point determines the scale of any savings;
- Optimum starting position is where there is a comprehensive service in place and where that service is under-performing;

Modelled assumptions for three weekly collections

Based on the initial observations and limited data available about the impact of extended residual waste collection frequencies, the following set of assumptions are proposed:

Waste reduction

The modelling will assume a 4% reduction on overall kerbside waste collected. The composition will remain the same but the overall quantity will decrease. This will be applied across each authority.

Food waste yields

It is assumed that moving to a three weekly residual collection will push people towards using the food waste scheme more, increasing both yields and participation.

Participation will be modelled to rise 5%, to 65%, and the yields are assumed to move from the lower range limit to the median yields, as shown in the following table.

Table 20 Proposed food waste yields

Authority	Lower range kg/hh/wk	Median kg/hh/wk
Cannock Chase	1.12	1.52
East Staffordshire	1.07	1.47
Lichfield	1.32	1.72
Newcastle-under-Lyme	1.17	1.53
South Staffordshire	1.35	1.75
Stafford	1.29	1.69
Staffordshire Moorlands	1.23	1.63
Stoke-on-Trent	0.91	1.31
Tamworth	1.1	1.5

Dry recycling yields

With the exception of Stoke-on-Trent, the levels of dry recycling collected are in the upper performance boundary when compared against each authority's rurality index. As such, the impact of three weekly recycling is assumed to only increase yields by 5% across all materials. The table below shows the revised yields for the current service scenario and the multi stream scenario, for both fortnightly (current) and three weekly residual waste collections.

Table 21 Dry recycling yields

Authority	Current yields	Current service with three weekly collections	Multi-stream yields	Multi stream yields with three weekly collections
Cannock Chase	256	269	218	229
East Staffordshire	218	229	212	223
Lichfield & Tamworth	266	279	227	238
Newcastle-under-Lyme	197	207	197	207
South Staffordshire	245	257	208	218
Stafford	238	250	226	237
Staffordshire Moorlands	185	194	180	189
Stoke-on-Trent	125	131	132	139

4.2.3 Chargeable Garden waste

Councils now have much smaller budgets for providing household waste services than they did before Britain entered the recession in 2010, according to Association for Public Service Excellence some areas, have faced up to 40% of cuts to budgets. As a consequence, increasing numbers of local authorities have, over recent years, introduced a charge for garden waste collections from households.

In 2015/16 45% of English authorities were charging for their organics collection, and over 40% were doing so in Wales, as shown in the table below.

Table 22 Proportion of all authorities operating a green waste scheme that charge

Country	Proportion
England	45%
Northern Ireland	4%
Scotland	0%
Wales	41%
Grand Total	38%

Charging for garden waste collections can aid cost reduction and is potentially a fairer system, as only those who have a garden and use the service pay for it.

Other local authorities that have already introduced a charge for their garden waste collections have found that residents who have gardens either pay for the service, or choose to compost at home or take their garden waste to their nearest household waste and recycling centre.

The number of households that choose to pay for garden waste collections will vary depending of the number with gardens, the charge and their willingness to subscribe.

In the UK charges for garden waste schemes range from £14 – £96, with the average £41 per bin[4].

[4] *CIWN on-line article, http://www.ciwm-journal.co.uk/42-councils-britain-charge-garden-waste-collection/*

In Fenland, approximately 40% of residents have taken up the scheme; whilst in Craven this figure is 56% of those who previously used the scheme (before it was charged for).

Whilst there is a concern that charging for garden waste collections will lead to an increase in fly tipping, figures have shown only a minimal increase, with most authorities noting no increase at all. Defra's 2006 report, '*Modelling the Impact of Household Charging for Waste in England'* comments that, *"Generally, it is held that charging schemes are less likely to lead to illegal dumping where recycling schemes are convenient and broad in the scope of materials they cover*". It continues on to comment that "*Tellingly, where charging is concerned, relatively few municipalities introduce charging systems then withdraw them*".

If dumping were a major problem, charging systems would probably be introduced and then terminated, as the costs of dealing with fly-tipped waste would be a significant burden since clearing illegally dumped waste is one of the most expensive ways to collect waste.

On the introduction of charges, some organic waste is diverted to HWRCs. The Forest of Dean, which introduced a charge for garden waste collections in 2012/13, recorded the following figures, which indicate a 31% drop at kerbside, a 35% increase in waste going to the HWRCs and an overall reduction in garden waste collected of 25%. The following year, once the scheme was better established, there was an increase compared to 2012/13.

Table 23 Changes to garden waste collection tonnages in Forest of Dean

Year	Tonnage collected at kerbside	% change to 2011/12	Tonnage going into HWRC	% change to 2011/12	Total Tonnage	% change to 2011/12
2011-12	8,775		834		9,609	
2012-13	6,082	69%	1,125	135%	7,207	75%
2013-14	6,584	75%	1,220	146%	7,804	81%

Craven, after moving to a chargeable garden waste collection in July 2013, had a 35% drop in usage, although the material collected only dropped about 30%. However, figures suggest that those households that did stop receiving a garden waste collection diverted their organic waste to their residual bin, as shown in Table 24, below:

Table 24 Percentages and kg/hh/wk of garden waste in the residual bin once garden waste collection charges were implemented in Craven

Household type	Percentage of garden waste in the residual	kg/hh/wk
Opt-in households	<2	0.12
Opt-out households	5.6	0.5
Households not serviced by a garden waste collection	7.7	0.34
Average	5.1	0.32

WRAP Research

To support the project WRAP provided some additional information that investigated the nearest neighbours (based on authority characteristics). It identified 6 'near neighbours' that operate a chargeable garden waste scheme. The level of household subscribing to a chargeable garden scheme ranges from 17% to 43%.

Chargeable garden waste assumptions

There is not currently a significant body of evidence around the impact of moving to a chargeable garden waste service but general observations and various data points suggest the following:

- The number of households subscribing, when moving to a chargeable service, drops in the region of 35-83% compared to a free service;
- The quantity of waste per household placed out by those subscribing increases;
- There is often a bounce back effect, with uptake dropping as the scheme is introduced, before a steady increase as households recognise the scheme as convenient way of a managing garden waste;
- A proportion of waste is diverted to HWRC sites;
- A proportion of garden waste does not enter the collection systems and is composted at home; and,
- A proportion of garden waste is transferred to the residual bin.

An estimate of the likely impact is provided below. These figures assume that there has been an increase following an initial drop as residents recognise the convenience factor.

Key assumptions:

- A charge of £35 per bin is sued for the modelling;
- Uptake of the chargeable scheme has been varied across the sensitivity options, with values of 30% and 65% used to gauge the impact;
- It is believed higher uptake is possible in some of the SWP authorities given the performance of recycling and with a charge of £35;
- The yields per household subscribing increases by 15% compared to the current levels;
- 5% of garden waste is transferred to the residual bin;
- The remaining material is either diverted to HWRC sites or home composted.
- The households participating in the chargeable garden scheme are likely to be more disperse, although the scheme is likely to be taken up by households in certain areas more than others i.e. rural areas versus town centres. The modelling has not amended the productivity and as such the chargeable garden modelling may overestimate the saving in vehicles. We would recommend more research is conducted to inform the detailed business case for chargeable garden and based on an authority by authority basis.

5.0 Modelling results

This section details the results of the modelling exercise. The results are bottom up estimates and designed to compare options rather than set budgets. The key is identifying the relative trends between the options and the scale of any change against the current service.

They are presented in the following structure:

- Impact of each Option in the WCAs (includes results for all authorities);
- Summary of WCA results for all options;
- Shred service review;
- Impact on WDA; and
- Whole system performance.

Individual authority analysis is provided within the Appendices 2 – 10.

5.1 Option 1

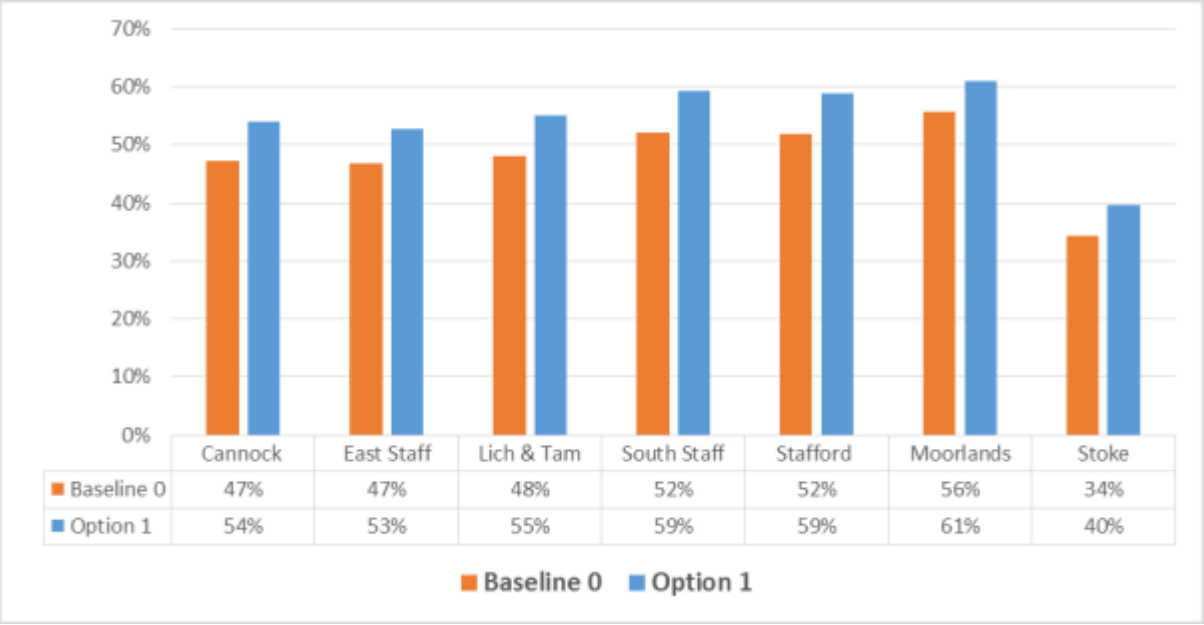
This Option's key element:

- Maintain current dry recycling scheme;
- Introduce a food waste collection using a dedicated 7.5t collection vehicle.

5.1.1 Option1 Recycling rate

The chart below shows how the recycling rate compares with the recycling rate of the baseline option. Introducing a food waste collection increases the recycling rate for each authority by 6-7 percentage points.

Figure 19 Option 1 recycling percentage



	Cannock	East Staff	Lich & Tam	South Staff	Stafford	Moorlands	Stoke
Baseline 0	47%	47%	48%	52%	52%	56%	34%
Option 1	54%	53%	55%	59%	59%	61%	40%

5.1.2 Option 1 WCA cost categories

This section provides an estimate of the WCA costs for each authority, which includes:

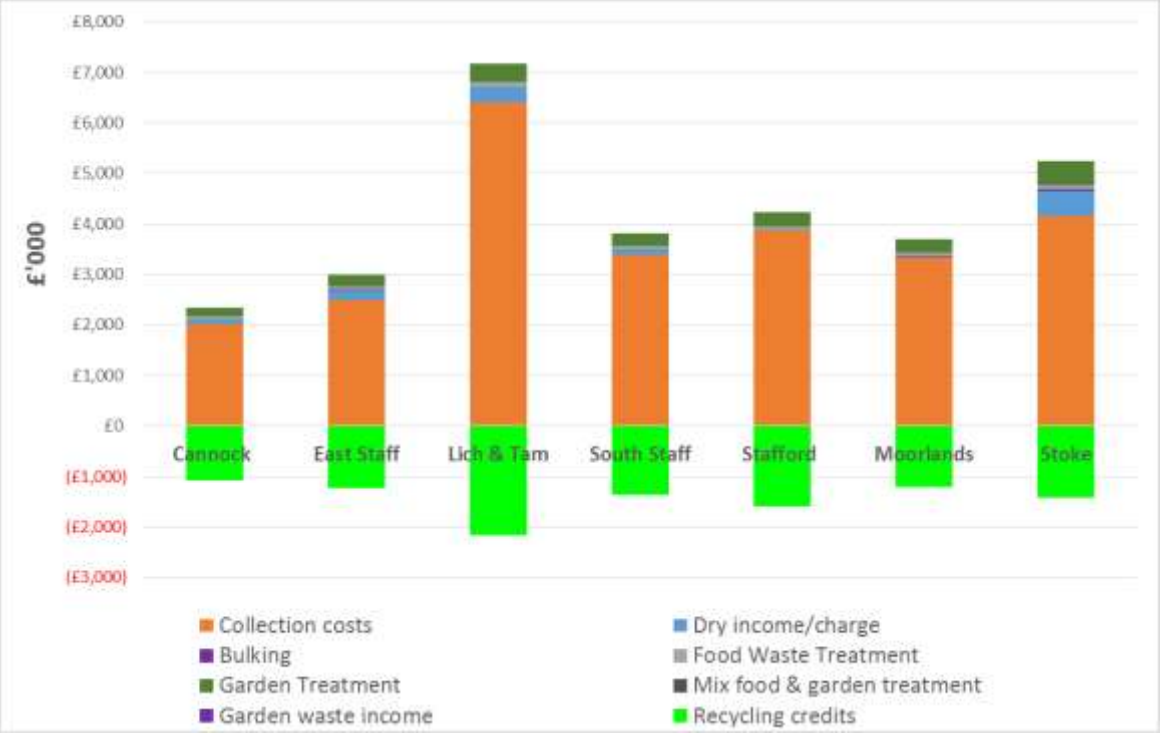
- The gross collection costs (vehicles, staff, fuel, containers, etc.);
- MRF gates fees and any material income from recycled materials;
- Garden and food waste treatment costs;
- Bulking of food waste where not able to direct deliver; and
- Recycling credits.

The chart below shows the main cost categories for each authority. Only recycling credits are income generating, this is negative and appears below the y axis.

Observations:

- The collection costs are the dominant category, followed by recycling credits;
- Using a MRF to sort material typically results in additional costs;
- The garden, food and mixed organic processing costs make up only a small part of the costs compared to most of the other categories.

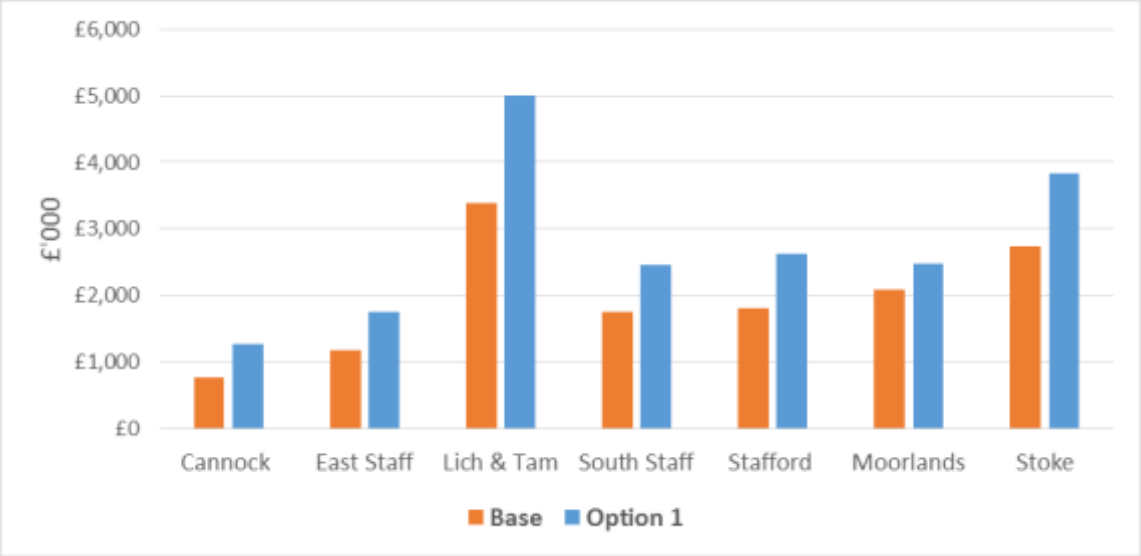
Figure 20 Option 1 WCA cost categories



5.1.3 Option 1 Net WCA costs

The chart below shows the net WCA costs for each authority and compares the value against the baseline. For all authorities the overall net costs increase due to additional collection vehicles, staff and fuel to collect the food waste. There are also additional food waste treatment costs, but these are minor compared to the associated vehicles costs. The additional costs are offset in part by the increased recycling credit payments, but not sufficiently to bring the Option 1 costs below the Baseline.

Figure 21 Net WCA costs for Option 1



5.2 Option 2

This Option's key elements:

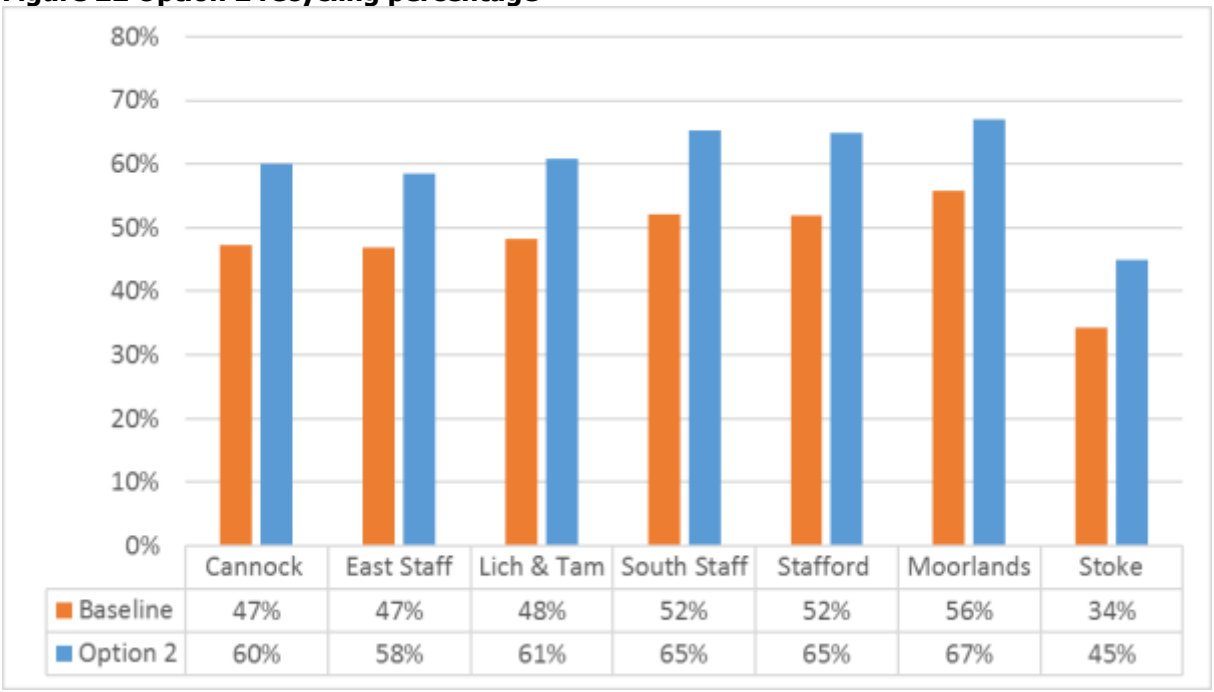
- Maintain current dry recycling scheme;
- Introduce a food waste collection using a dedicated 7.5t collection vehicle;
- Reduce the frequency of residual waste collection to three-weekly.

5.2.1 Option 2 Recycling rate

The chart below shows how the recycling rate compares with the recycling rate of the Baseline option. Introducing a food waste collection and reducing the collection frequency of the residual waste increases the recycling rate for each authority by 11-13 percentage points. This is due to three main influences:

- food waste collections;
- recycling increase caused by three-weekly collections; and,
- a reduction in overall tonnage caused by three-weekly collections.

Figure 22 Option 2 recycling percentage



	Cannock	East Staff	Lich & Tam	South Staff	Stafford	Moorlands	Stoke
Baseline	47%	47%	48%	52%	52%	56%	34%
Option 2	60%	58%	61%	65%	65%	67%	45%

5.2.2 Option 2 WCA cost categories

This section provides an estimate of the WCA costs for each authority, which includes:

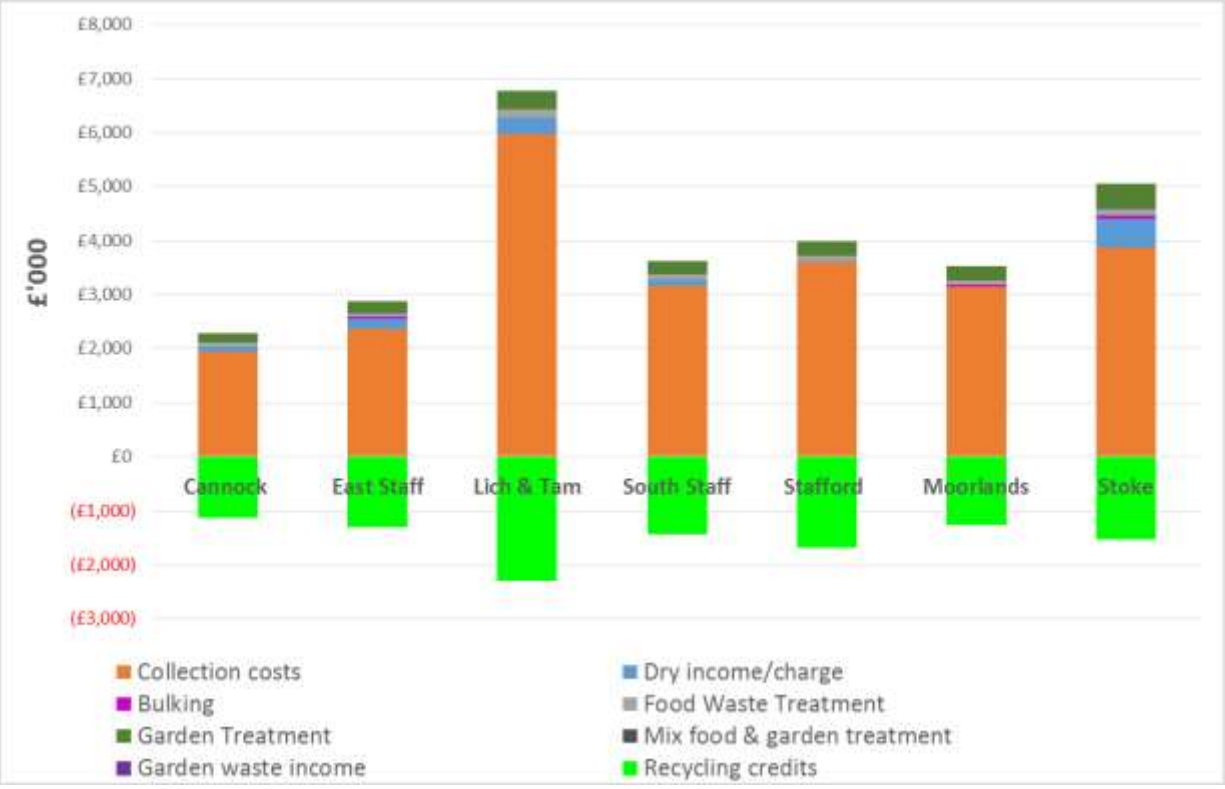
- The gross collection costs (vehicles, staff, fuel, containers, etc.);
- MRF gates fees and any material income from recycled materials;
- Garden and food waste treatment costs;
- Bulking of food waste where not able to direct deliver;
- Recycling credits; and

The chart below shows the main cost categories for each authority. Only recycling credits are income generating, this is negative and appears below the y axis.

Similar to Option 1, the observations are:

- The collection costs are the dominant category, followed by recycling credits;
- Collecting co-mingled and using a MRF to sort materials typically results in additional costs rather than an income;
- The garden, food and mixed organic processing costs make up only a small part of the costs compared to most of the other categories.

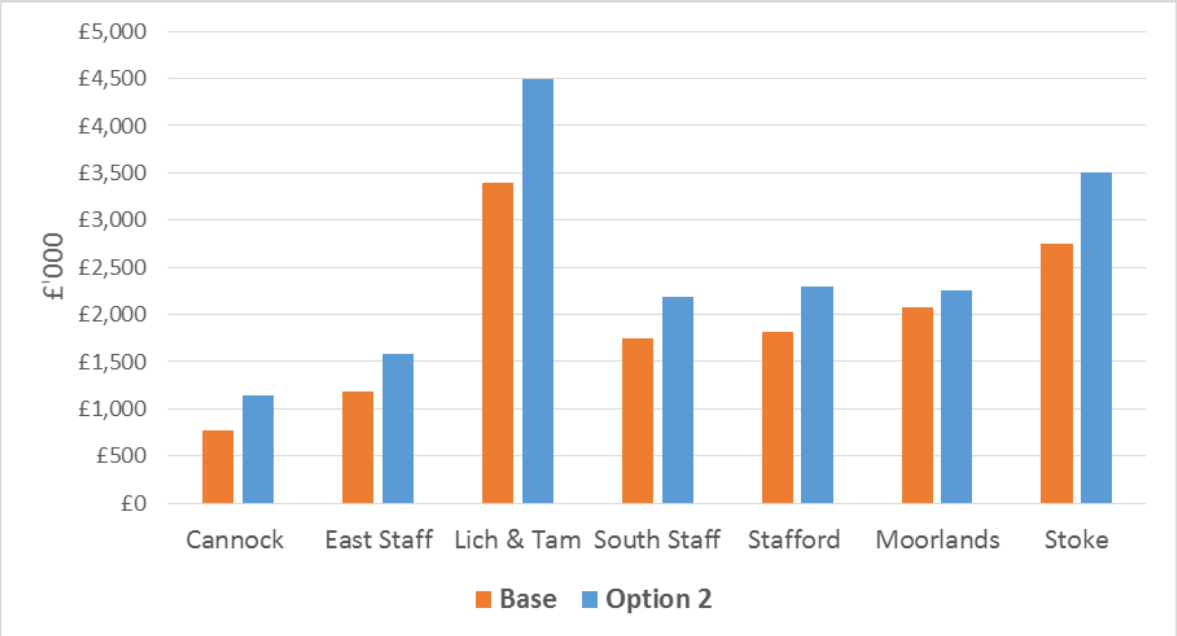
Figure 23 Option 2 WCA cost categories



5.2.3 Option 2 Net WCA costs

The chart below shows the net WCA costs for each authority and compares the value against the Baseline. For all authorities the overall net costs are higher than the Baseline due to increased numbers of collection vehicles, staff and fuel required with the introduction of a weekly food waste collection. There are also additional food waste treatment costs, but these are minor compared to the associated vehicles costs. The additional costs are offset in part by the increased recycling credit payments and reduced collection costs from moving to a three weekly residual waste collection, but not sufficiently to bring the Option 2 costs below the Baseline.

Figure 24 Net WCA costs for Option 2



5.3 Option 3

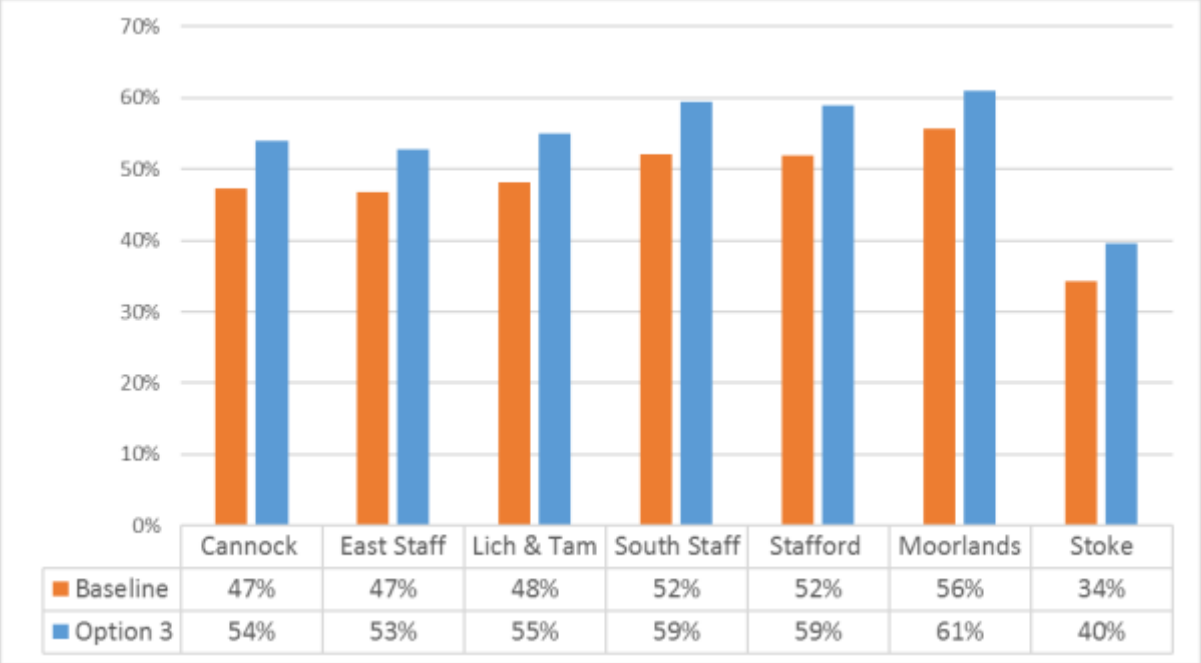
This Option's key elements:

- Maintain current dry recycling scheme;
- Introduce a food waste collection using a vehicle with a 'Pod' alongside the residual waste and garden/dry recycling collections.

5.3.1 Option3 Recycling rate

The chart below shows how the recycling rate compares with the recycling rate of the baseline option. Introducing a food waste collection increases the recycling rate for each authority by 5-7 percentage points. The tonnage of food waste is the same as Option 1 as from the perspective of the householder the food waste collection is the same i.e. food waste placed out every week.

Figure 25 Option 3 recycling percentage



	Cannock	East Staff	Lich & Tam	South Staff	Stafford	Moorlands	Stoke
Baseline	47%	47%	48%	52%	52%	56%	34%
Option 3	54%	53%	55%	59%	59%	61%	40%

5.3.2 Option 3 WCA cost categories

This section provides an estimate of the WCA costs for each authority, which includes:

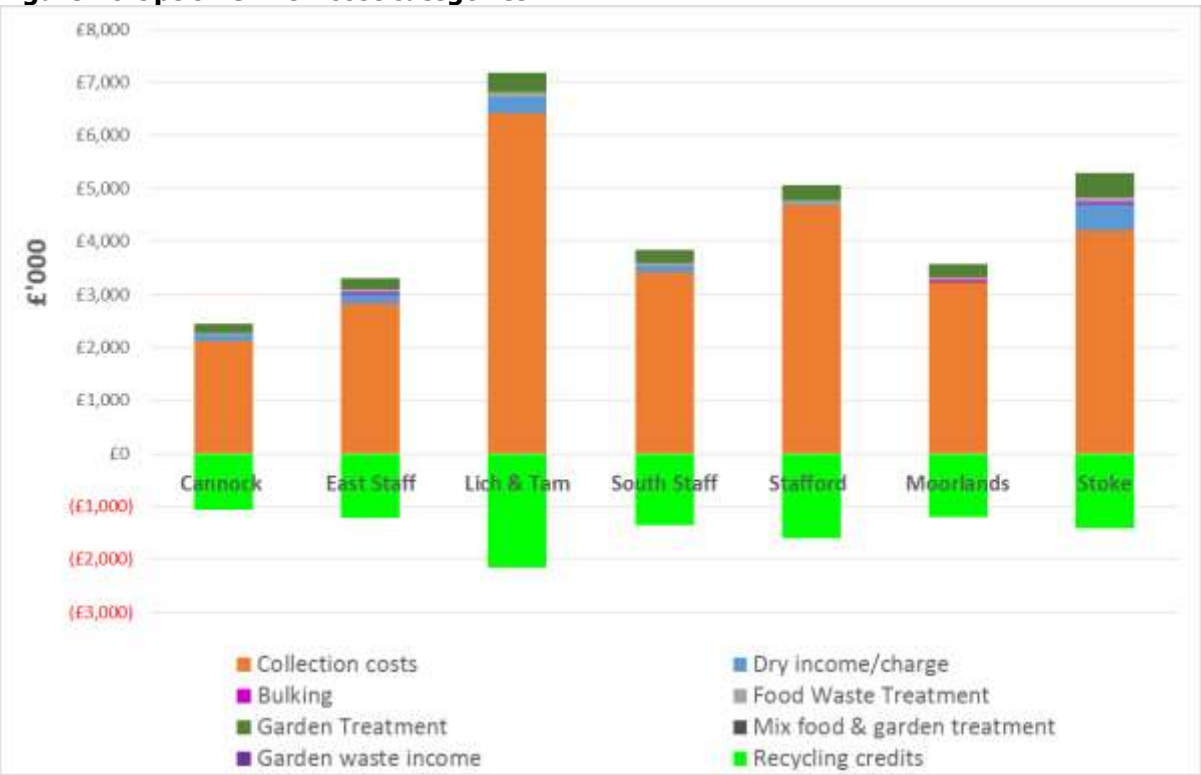
- The gross collection costs (vehicles, staff, fuel, containers, etc.);
- MRF gates fees and any material income from recycled materials;
- Garden and food waste treatment costs;
- Bulking of food waste where not able to direct deliver;
- Recycling credits; and

The chart below shows the main cost categories for each authority. Only recycling credits are income generating, this is negative and appears below the y axis.

Observations:

- The collection costs are the dominant category, followed by recycling credits;
- Collecting co-mingled and using a MRF to sort materials typically results in additional costs rather than an income;
- The garden, food and mixed organic processing costs make up only a small part of the costs compared to most of the other categories.

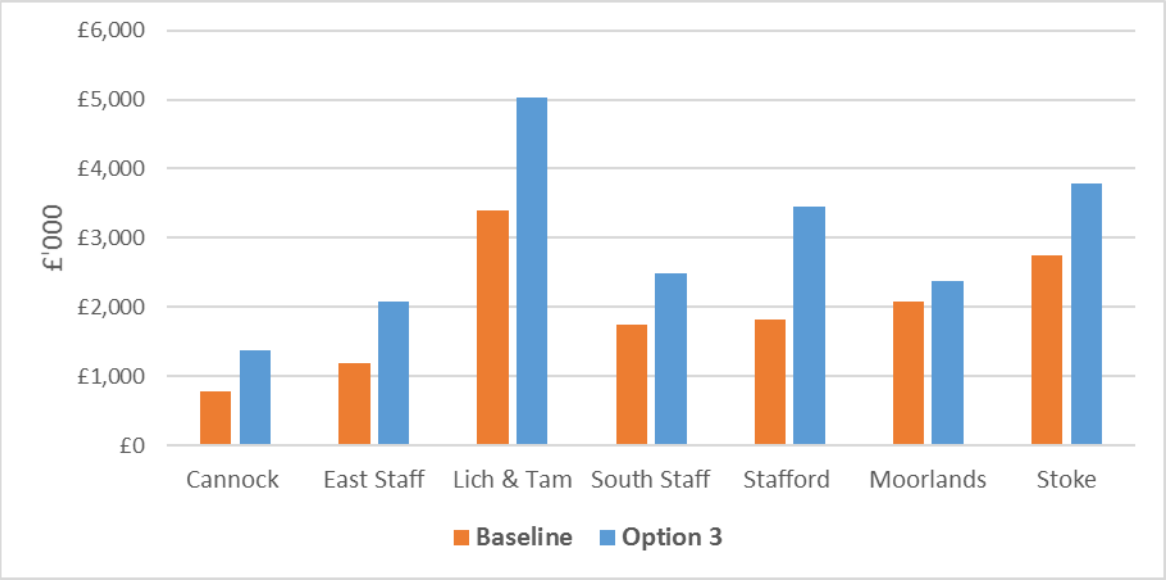
Figure 26 Option 3 WCA cost categories



5.3.3 Option 3 Net WCA costs

The chart below shows the net WCA costs for each authority and compares the value against the baseline. For all authorities the overall net costs are higher than the Baseline due to additional collection vehicles compared to the current service. This is because the pod RCVs have a smaller main compartment capacity (because space is used for the food pod) and thus, more vehicles are required to perform their main collection service (residual/ dry/garden). The additional vehicles result in extra staff and fuel requirement, adding further costs. There are also supplementary food waste treatment costs, but these are minor compared to the associated vehicles costs. The additional costs are offset in part by the increased recycling credit payments, but not sufficiently to bring the Option 3 costs for any authority below the Baseline.

Figure 27 Net WCA costs for Option 3



5.4 Option 4

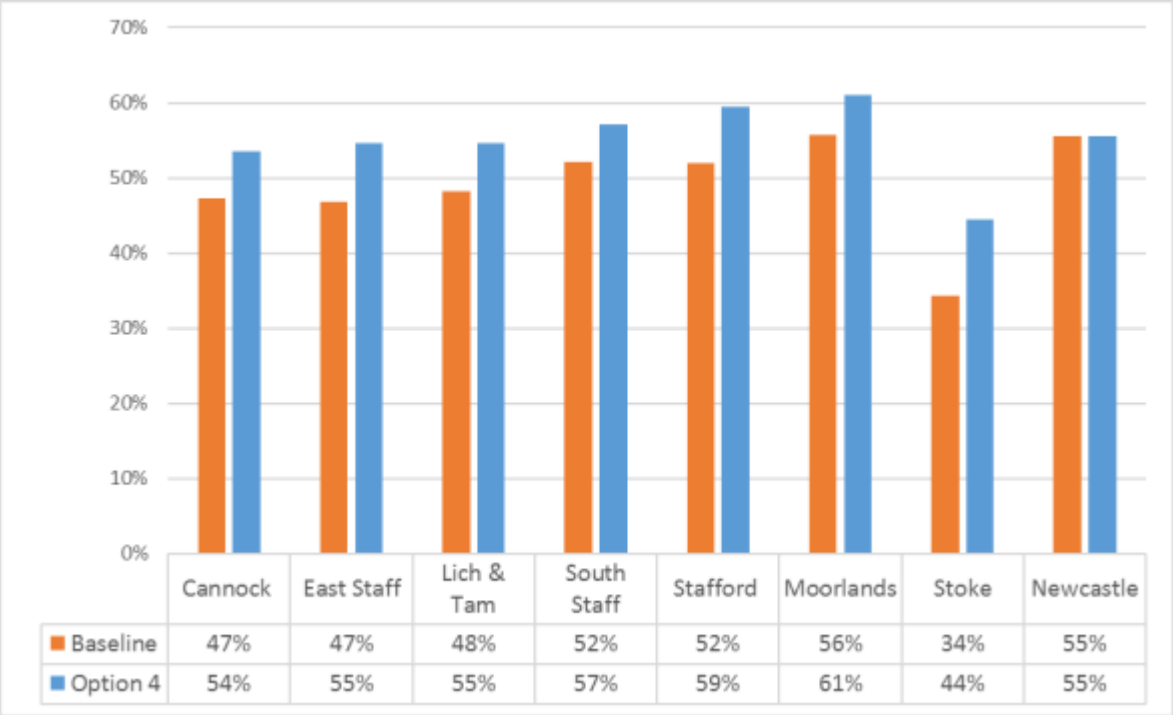
This Option's key elements:

- Introduce a weekly multi-stream dry recycling collection;
- Introduce a weekly food waste collection co-collected with dry recycling.

5.4.1 Option 4 Recycling rate

The chart below shows how the recycling rate compares with the recycling rate of the baseline option. Introducing food waste collection increases the recycling rate for each authority by 0-10 percentage points. Newcastle shows no change as they currently have a multi-stream and food waste collection service.

Figure 28 Option 4 recycling percentage



	Cannock	East Staff	Lich & Tam	South Staff	Stafford	Moorlands	Stoke	Newcastle
Baseline	47%	47%	48%	52%	52%	56%	34%	55%
Option 4	54%	55%	55%	57%	59%	61%	44%	55%

5.4.2 Option 4 WCA cost categories

This section provides an estimate of the WCA costs for each authority, which includes:

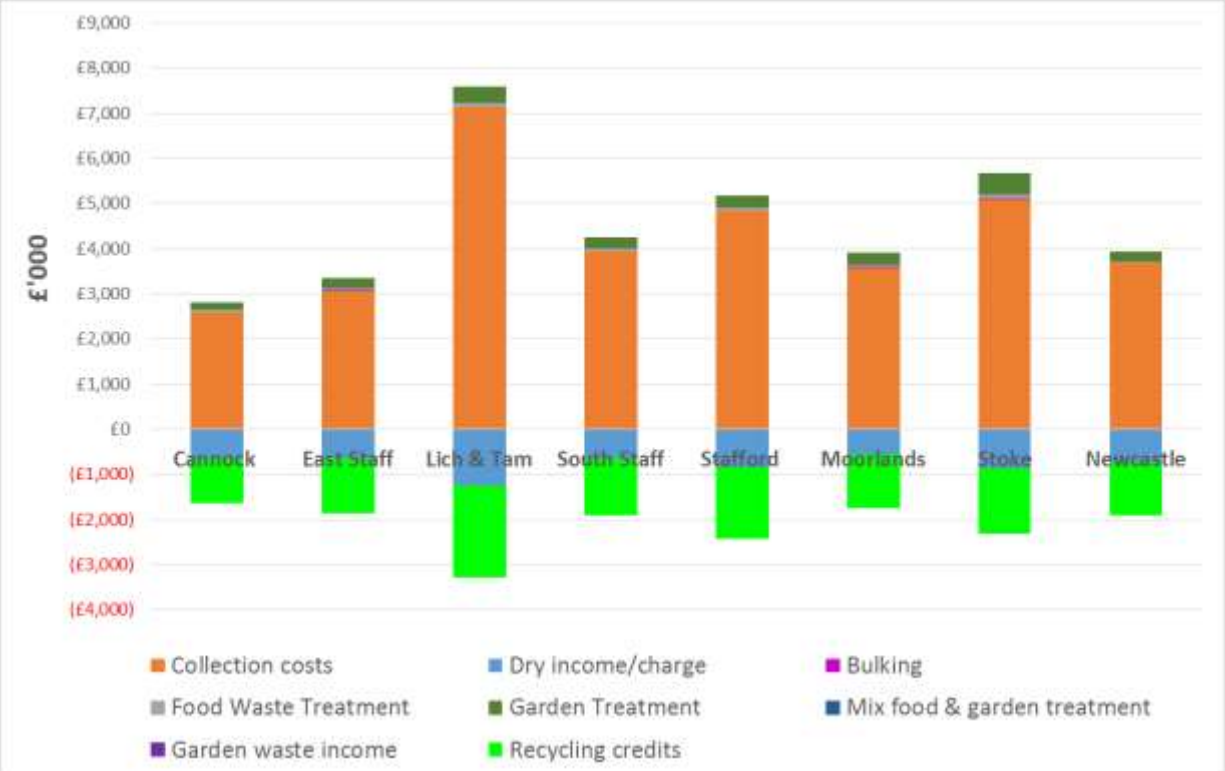
- The gross collection costs (vehicles, staff, fuel, containers, etc.);
- Material income from recycled materials;
- Garden and food waste treatment costs;
- Bulking of food waste where not able to direct deliver;
- Recycling credits; and

The chart below shows the main cost categories for each authority. There are a number of categories that are income generating, such as recycling credits and income from materials sales, these are negative and appear below the y axis.

Observations:

- The collection costs are the dominant category, followed by recycling credits and dry recycling income;
- Dry recycling has moved from incurring a charge in Options 1 to 3 to bringing in an income, as the material has been sorted at the kerbside (removing MRF costs) and is consequently of a higher quality and thus sold for a higher price;
- The garden, food and mixed organic processing costs make up only a small part of the costs compared to most of the other categories.

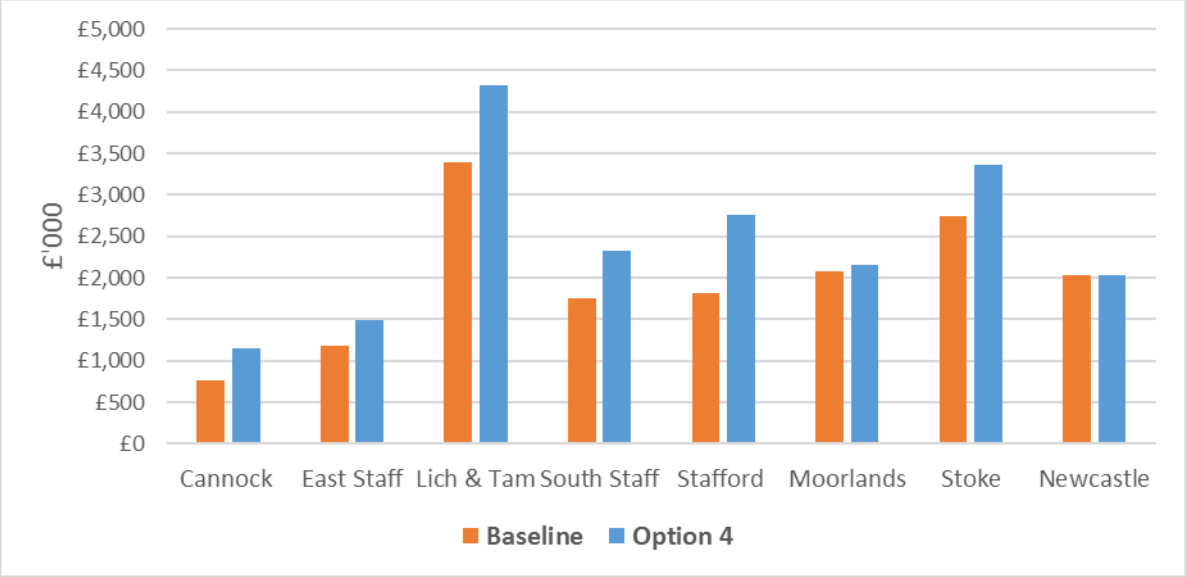
Figure 29 Option 4 WCA cost categories



5.4.3 Option 4 Net WCA costs

The chart below shows the net WCA costs for each authority and compares the value against the Baseline. For all authorities the overall net costs increase due to additional collection vehicles, staff and fuel to collect the food waste and the additional costs of more vehicles and operatives with the move to a weekly multi-stream dry recycling collection. There are also additional food waste treatment costs, but these are minor compared to the associated vehicle costs. The additional costs are offset in part by the increased recycling credit payments and income from the high quality recyclate, but not sufficiently to bring the Option 4 costs below the Baseline. Although the costs for some authorities are close to the baseline even with the additional food waste collection stream.

Figure 30 Net WCA costs for Option 4



5.5 Option 5

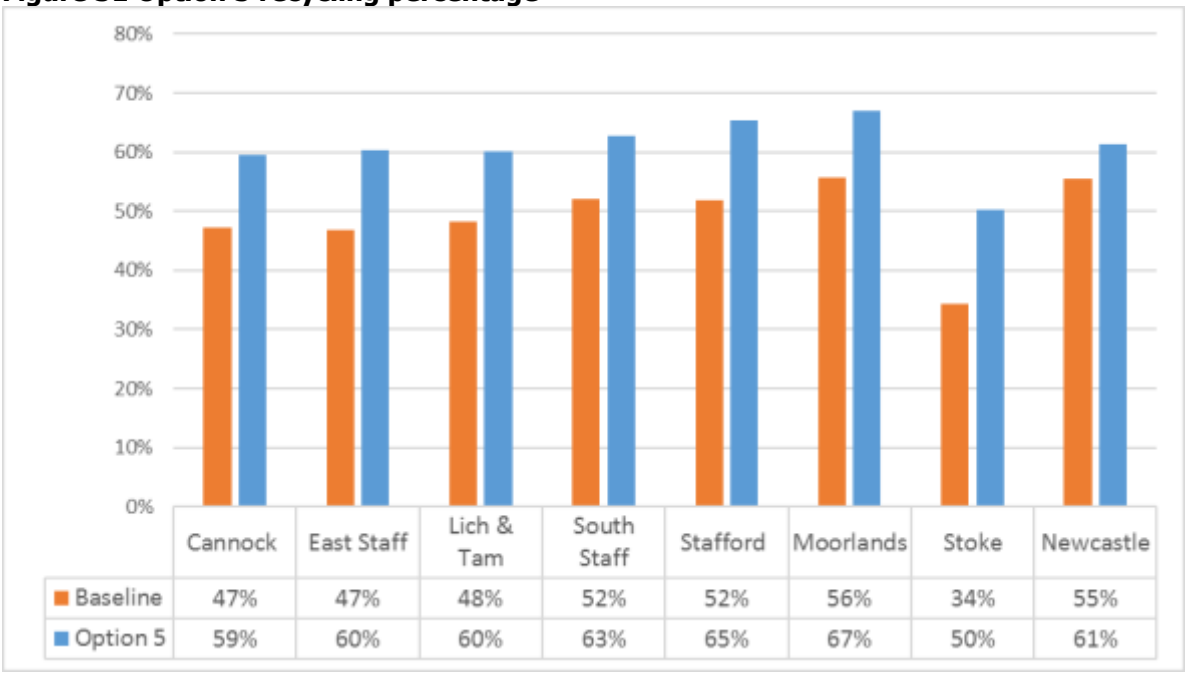
This Option's key elements:

- Introduce a weekly multi-stream dry recycling collection;
- Introduce a weekly food waste collection co-collected with dry recycling; and,
- Reduce the frequency of residual waste collection to three-weekly.

5.5.1 Option 5 Recycling rate

The chart below shows how the recycling rate compares with the recycling rate of the baseline option. Introducing a food waste collection and a three weekly residual service increases the recycling rate for each authority by 11-16 percentage points (only 6 percentage points for Newcastle as they have an established food waste collection). There is greater variation in authority performance than Option 2, due to how they are estimated to perform when a multi-stream service is introduced.

Figure 31 Option 5 recycling percentage



	Cannock	East Staff	Lich & Tam	South Staff	Stafford	Moorlands	Stoke	Newcastle
Baseline	47%	47%	48%	52%	52%	56%	34%	55%
Option 5	59%	60%	60%	63%	65%	67%	50%	61%

5.5.2 WCA cost categories

This section provides an estimate of the WCA costs for each authority, which includes:

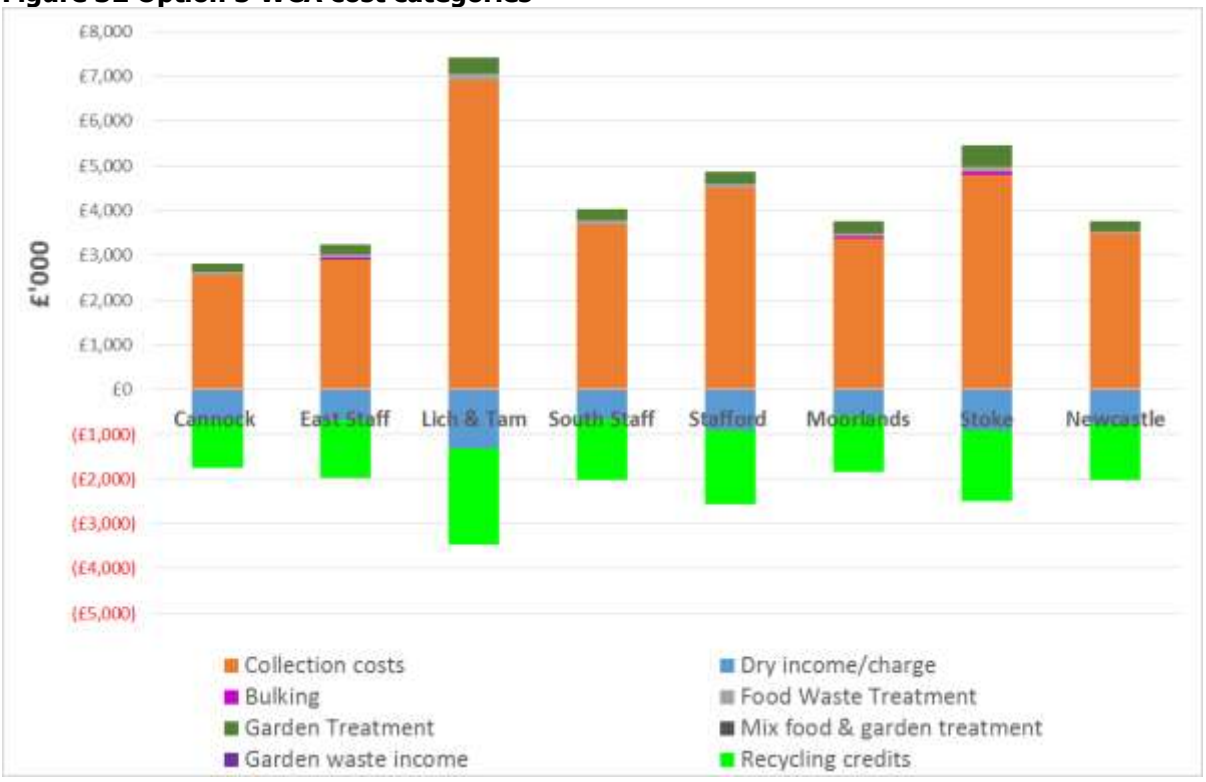
- The gross collection costs (vehicles, staff, fuel, containers, etc.);
- Material income from recycled materials;
- Garden and food waste treatment costs;
- Bulking of food waste where not able to direct deliver;
- Recycling credits; and

The chart below shows the main cost categories for each authority. There are a number of categories that are income generating, such as recycling credits and income from materials sales, these are negative and appear below the y axis.

Observations:

- The collection costs are the dominant category, followed by recycling credits and dry income/charge;
- Collecting the recycling separately at the kerbside results in the recyclate being of a higher quality, and therefore bringing in an income, rather than incurring a cost;
- The garden, food and mixed organic processing costs make up only a small part of the costs compared to most of the other categories.

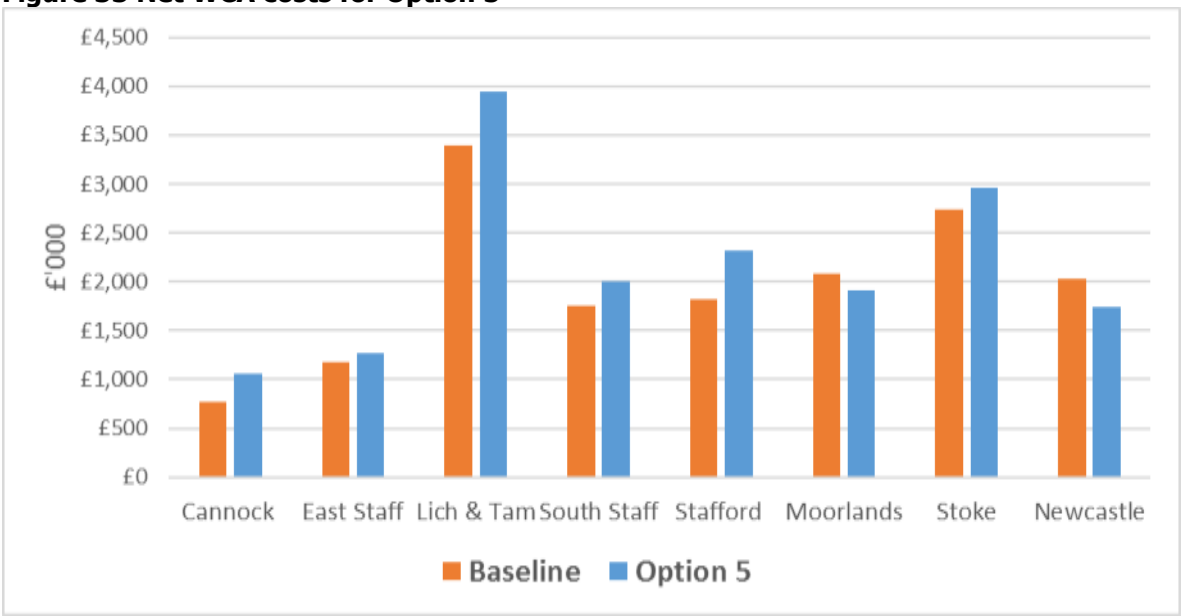
Figure 32 Option 5 WCA cost categories



5.5.3 Option 5 Net WCA costs

The chart below shows the net WCA costs for each authority and compares the value against the Baseline. For all authorities the overall net costs increase due to additional collection vehicles, staff and fuel to collect the food waste and the separated recycling on a weekly basis. There are also additional food waste treatment costs, but these are minor compared to the associated vehicles costs. The additional costs are offset in part by the increased recycling credit payments and income from the dry recycling. The net overall costs for Staffordshire Moorland and Newcastle are below current costs. For a number of other authorities, the costs are similar to the Baseline.

Figure 33 Net WCA costs for Option 5



5.6 Option 1a

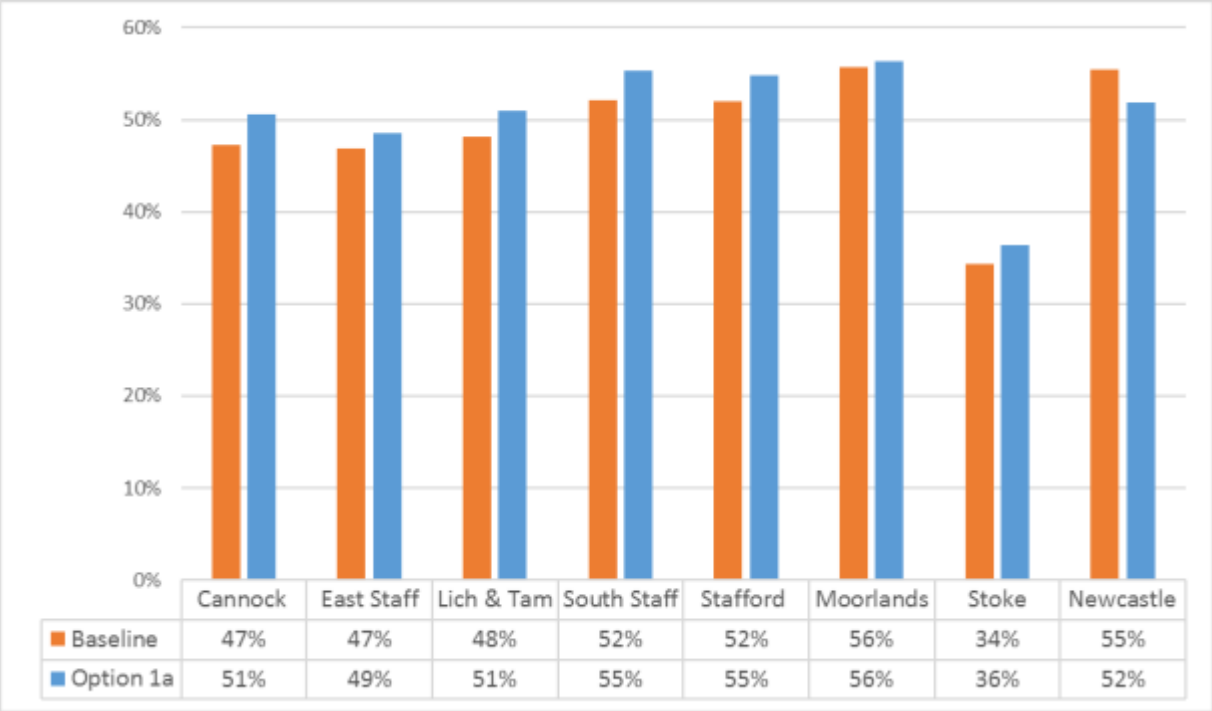
This is a sensitivity option based on Option 1 but with a chargeable garden waste scheme added, as such the Option's key elements are:

- Maintain current dry recycling scheme;
- Introduce a food waste collection using a dedicated 7.5t collection vehicle;
- Introduce a charge for garden waste collections (assumed to be 65% uptake).

5.6.1 Option 1a Recycling rate

The chart below shows how the recycling rate compares with the recycling rate of the Baseline option. Introducing a food waste collection and a charge for garden waste collection increased the recycling rate for each authority by 3-4 percentage points, except for Newcastle where the recycling rate dropped 3 percentage points. This is due to Newcastle already having an established food waste collection in place and the chargeable garden element of the option resulting in a reduction of garden waste tonnage and thus recycling rate.

Figure 34 Option 1a recycling percentage



	Cannock	East Staff	Lich & Tam	South Staff	Stafford	Moorlands	Stoke	Newcastle
Baseline	47%	47%	48%	52%	52%	56%	34%	55%
Option 1a	51%	49%	51%	55%	55%	56%	36%	52%

5.6.2 Option 1a WCA cost categories

This section provides an estimate of the WCA costs for each authority, which includes:

- The gross collection costs (vehicles, staff, fuel, containers, etc.);
- MRF gates fees and any material income from recycled materials;
- Garden and food waste treatment costs;
- Bulking of food waste where not able to direct deliver;
- Recycling credits

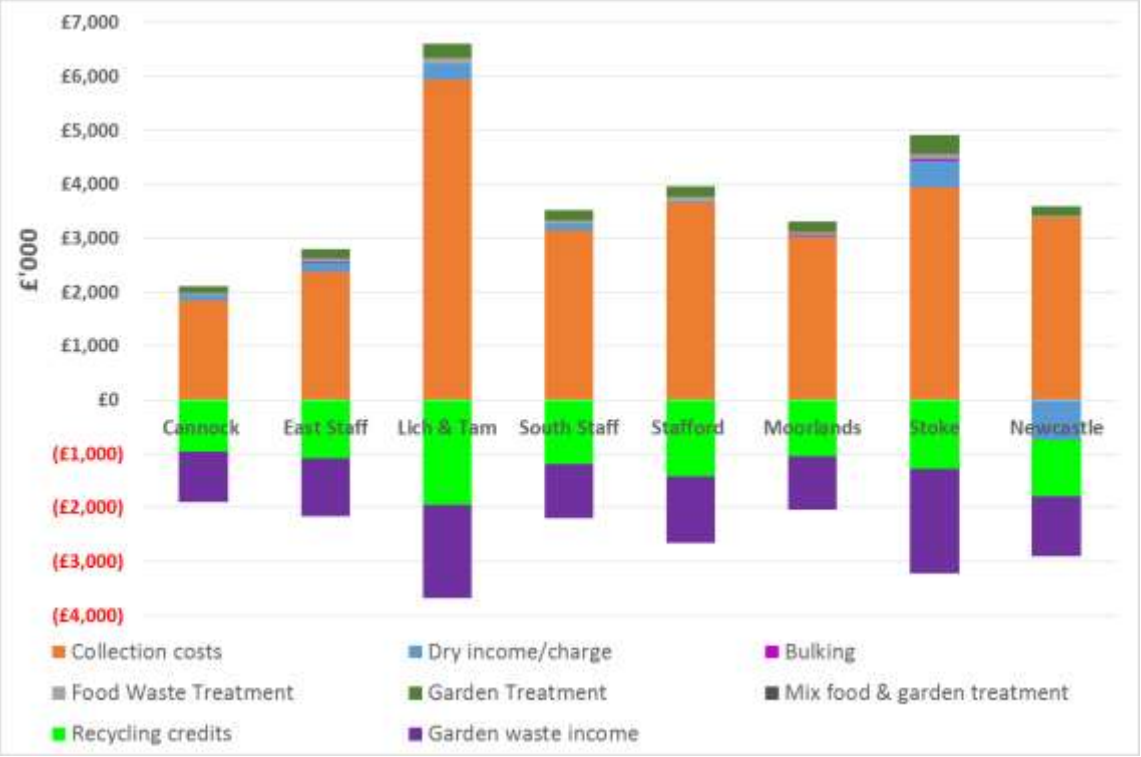
The following chart shows the main cost categories for each authority. There are a number of categories that are income generating, such as recycling credits, garden waste charges and income from materials sales, these are negative and appear below the y axis.

Observations:

- The collection costs are the dominant category, followed by recycling credits and the income from charging for garden waste collections;

- The income level is a much more significant amount due to the income from the chargeable garden waste collections being of a similar scale to the recycling credits (N.B. income from the chargeable garden waste service will be dependent on % uptake);
- The garden, food and mixed organic processing costs make up only a small part of the costs compared to most of the other categories.

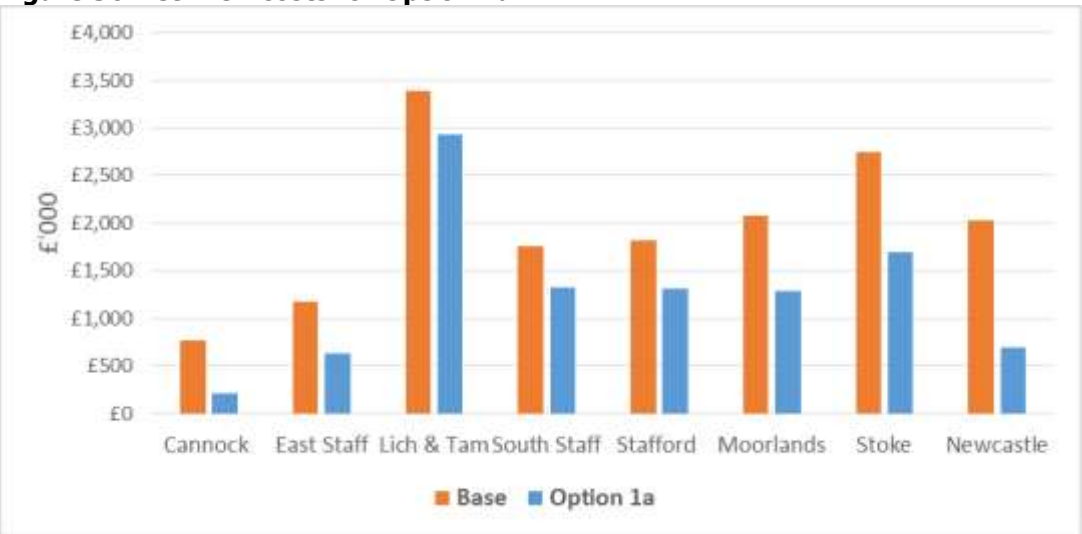
Figure 35 Option 1a WCA cost categories



5.6.3 Option 1a Net WCA costs

The chart below shows the net WCA costs for each authority and compares the value against the Baseline. For all authorities the overall net costs reduce, due to the additional income from the garden waste collections and the reduction in the number of vehicles and crew required for the chargeable garden waste collections, resulting in lower costs. This income and reduction in garden waste collection costs offsets the additional costs of the food waste collection for all authorities.

Figure 36 Net WCA costs for Option 1a



5.7 Option 0a

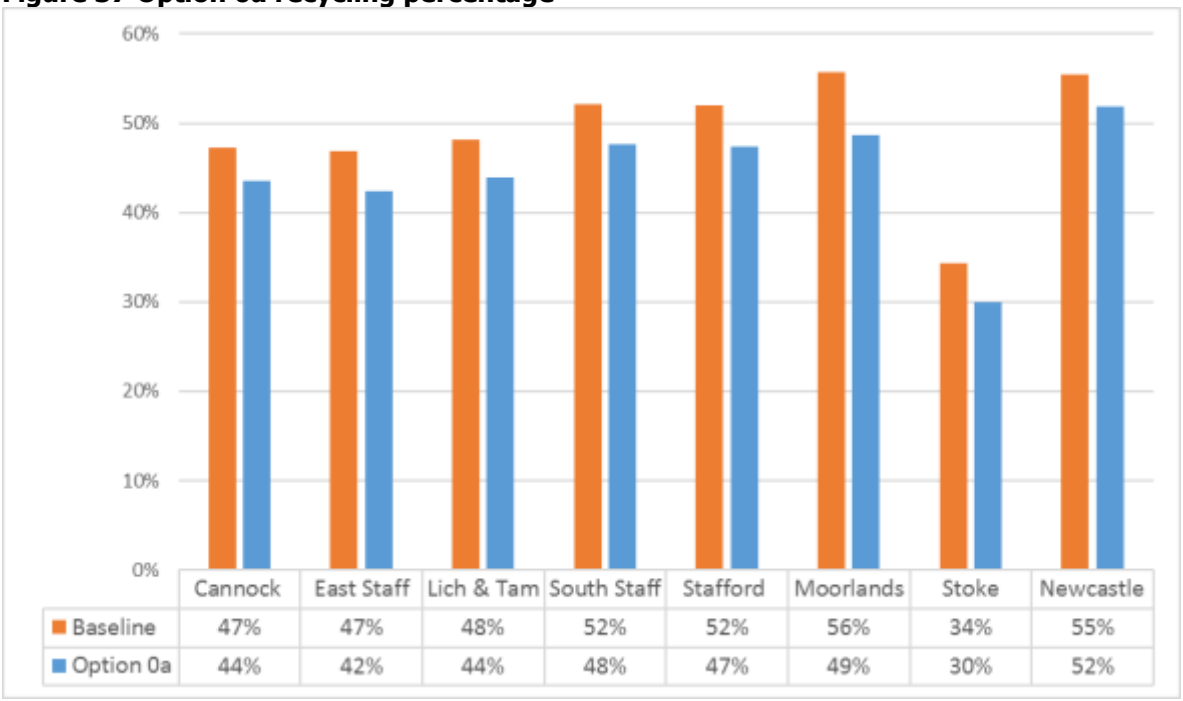
This is a sensitivity option based on Option 0 but with a chargeable garden waste scheme added, as such the option's key elements are:

- Maintain the recycling and refuse collections as they are;
- Introduce a charge for garden waste collections (with 65% uptake assumed).

5.7.1 Option 0a Recycling rate

The chart below shows how the recycling rate compares with the recycling rate of the Baseline option. Introducing a charge for garden waste collections (with a 65% uptake assumed) reduces the recycling rate for each authority by -7 to -3 percentage points.

Figure 37 Option 0a recycling percentage



	Cannock	East Staff	Lich & Tam	South Staff	Stafford	Moorlands	Stoke	Newcastle
Baseline	47%	47%	48%	52%	52%	56%	34%	55%
Option 0a	44%	42%	44%	48%	47%	49%	30%	52%

5.7.2 Option0a WCA cost categories

This section provides an estimate of the WCA costs for each authority, which includes:

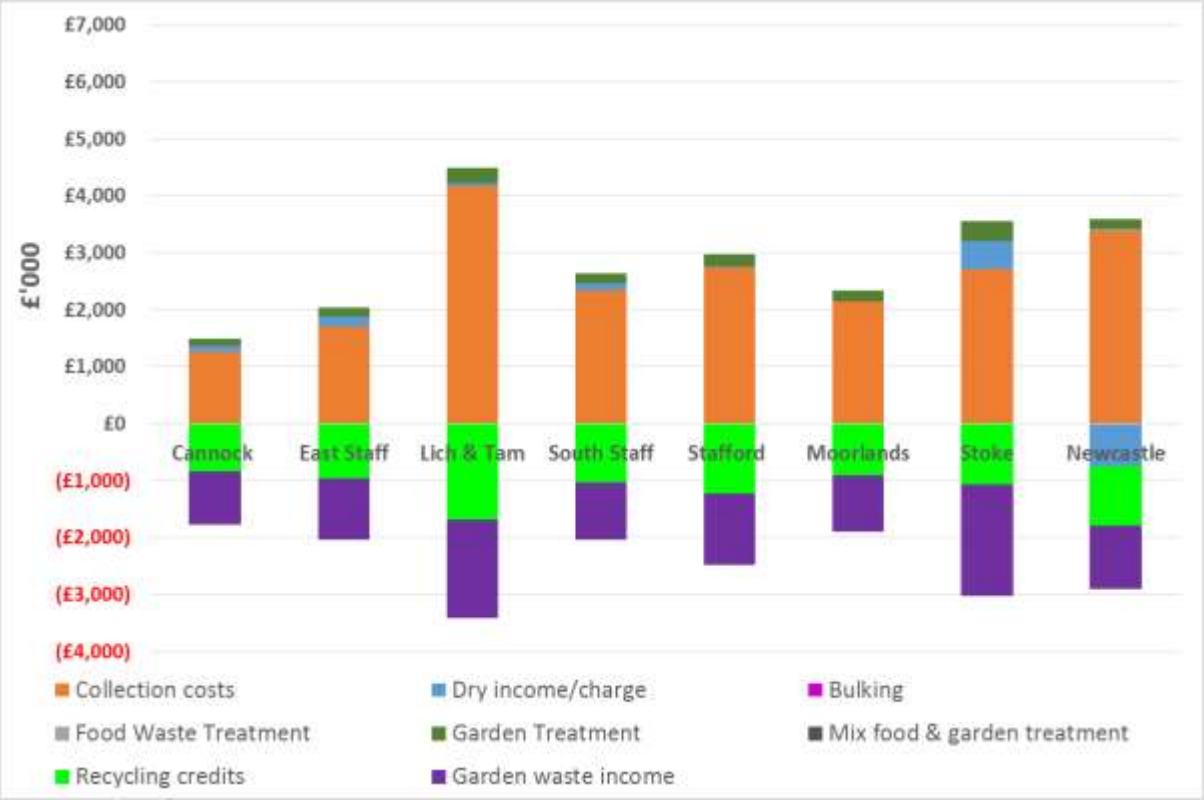
- The gross collection costs (vehicles, staff, fuel, containers, etc.);
- MRF gates fees and any material income from recycled materials;
- Garden and food waste treatment costs;
- Bulking of food waste where not able to direct deliver;
- Recycling credits

The following chart shows the main cost categories for each authority. There are a number of categories that are income generating, such as recycling credits, garden waste charges and income from materials sales, these are negative and appear below the y axis.

Observations:

- The collection costs are the dominant category, followed by recycling credits and the income from charging for garden waste collections;
- The income level is a much more significant amount due to the income from the chargeable garden waste collections in addition to the recycling credits (N.B. income from the chargeable garden waste service will be dependent on % uptake);
- The garden, food and mixed organic processing costs make up only a small part of the costs compared to most of the other categories.

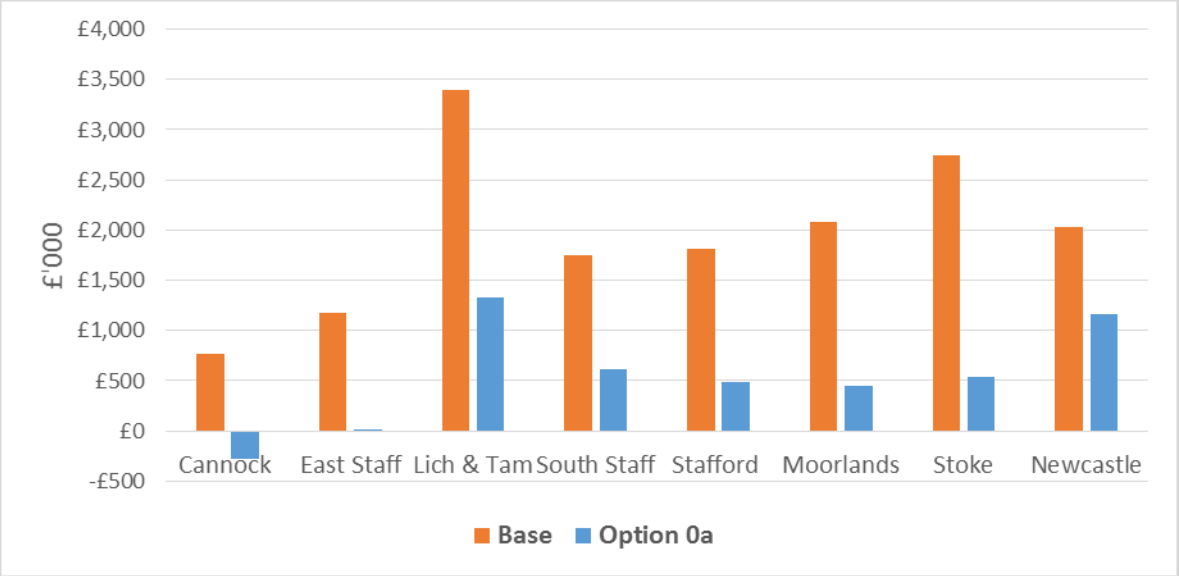
Figure 38 Option 0a WCA cost categories



5.7.3 Option 0a Net WCA costs

The chart below shows the net WCA costs for each authority and compares the value against the Baseline. For all authorities the overall net costs reduce due to no additional services being added (and consequently no additional costs) and an income stream being created by charging for garden waste collections. With 65% uptake of garden waste collections fewer vehicles are also required, which reduces collection costs to a small degree, compared to the Baseline. Cannock Chase's Waste and Recycling Service actually becomes negative but it should be remembered the analysis has not included all costs associated with providing a household waste collection service, such as central charges and spare vehicles.

Figure 39 Net WCA costs for Option 0a



5.8 Option 0b

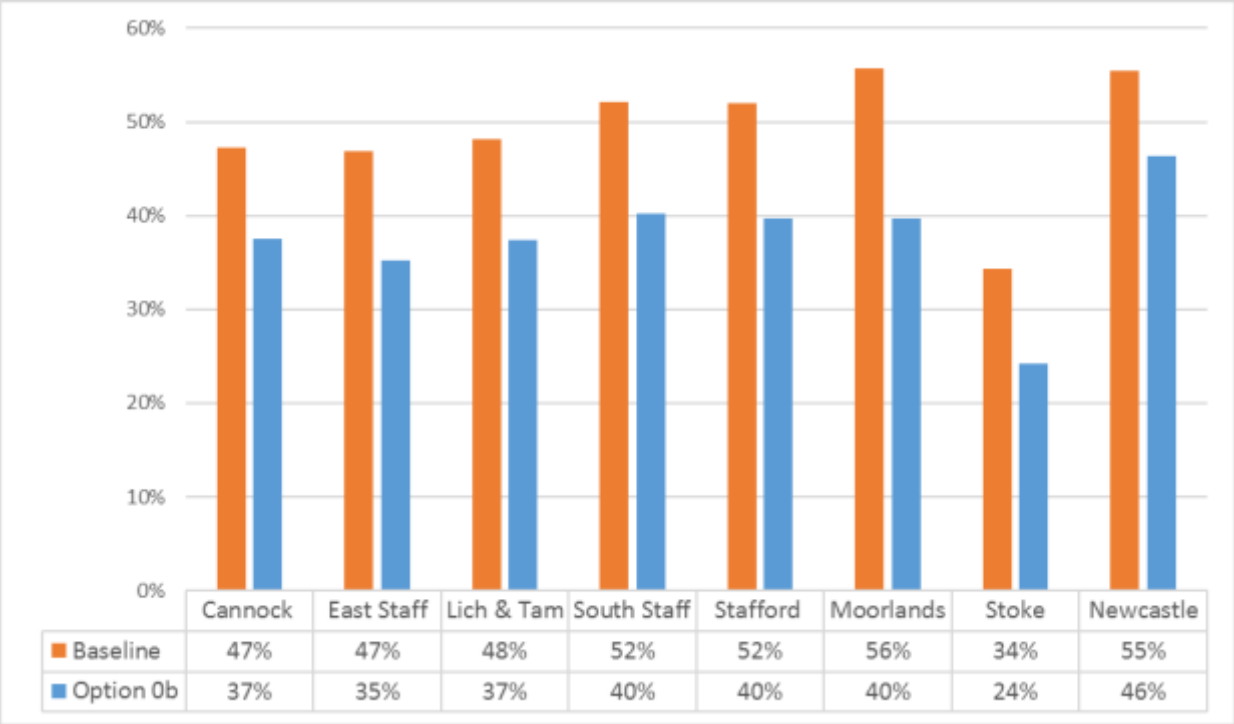
This is a sensitivity option based on Option 0 but with a chargeable garden waste scheme added, as such the option's key elements are:

- Maintain the recycling and refuse collections as they are;
- Introduce a charge for garden waste collections (with 30% uptake assumed).

5.8.1 Option 0b Recycling rate

The chart below shows how the recycling rate compares with the recycling rate of the Baseline option. Introducing a garden waste collection charge (with 30% uptake assumed) reduces the recycling rate for each authority by -16 to -9 percentage points.

Figure 40 Option 0b recycling percentage



	Cannock	East Staff	Lich & Tam	South Staff	Stafford	Moorlands	Stoke	Newcastle
Baseline	47%	47%	48%	52%	52%	56%	34%	55%
Option 0b	37%	35%	37%	40%	40%	40%	24%	46%

5.8.2 Option 0b WCA cost categories

This section provides an estimate of the WCA costs for each authority, which includes:

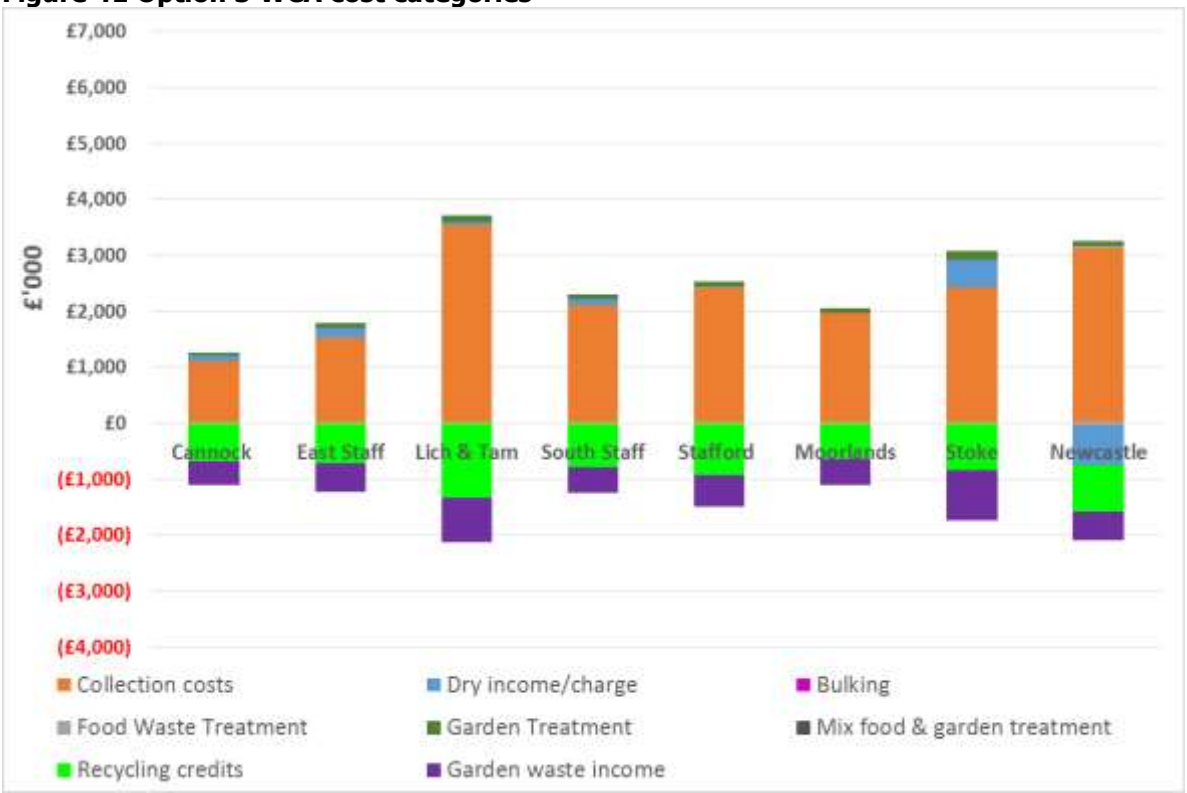
- The gross collection costs (vehicles, staff, fuel, containers, etc.);
- MRF gates fees and any material income from recycled materials;
- Garden and food waste treatment costs;
- Bulking of food waste where not able to direct deliver;
- Recycling credits;

The following chart shows the main cost categories for each authority. There are a number of categories that are income generating, such as recycling credits, garden waste charges and income from materials sales, these are negative and appear below the y axis.

Observations:

- The collection costs are the dominant category, followed by recycling credits and then income from charging for garden waste collections;
- Despite only a 30% uptake of garden waste collections the income from this service is still significant;
- The income level is a more significant amount than for the Baseline and Options 1 to 5, due to the income from the chargeable garden waste collections in addition to the recycling credits;
- The garden, food and mixed organic processing costs make up only a small part of the costs compared to most of the other categories.

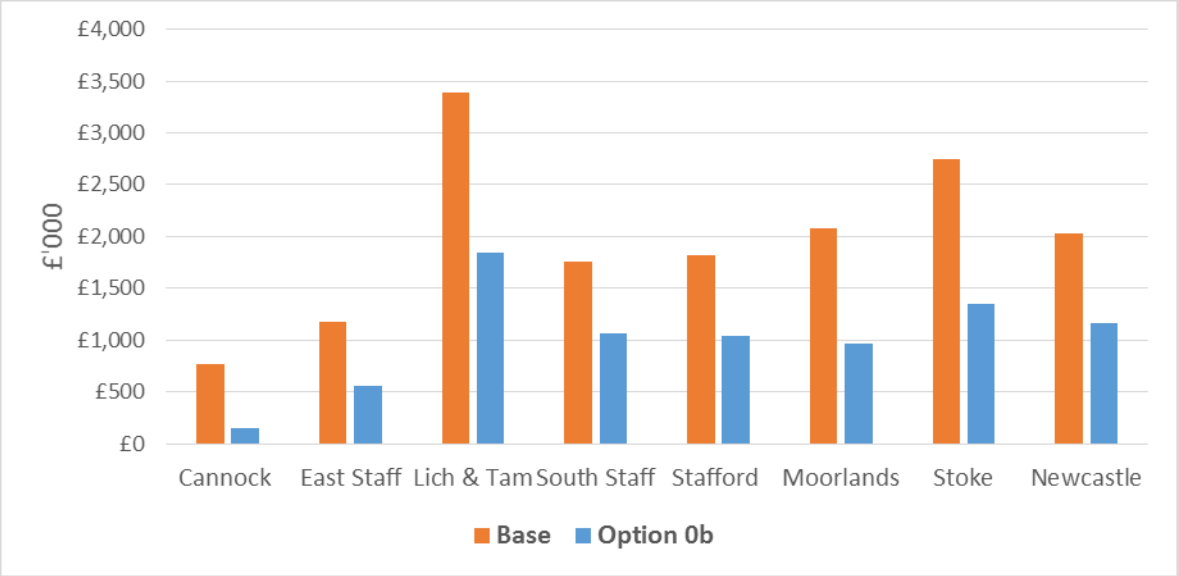
Figure 41 Option 5 WCA cost categories



5.8.3 Option 0b Net WCA costs

The chart below shows the net WCA costs for each authority and compares the value against the Baseline. For all authorities the overall net costs reduce due to no additional services being added (and consequently no additional costs) and an income stream being created by charging for garden waste collections. With only 30% uptake of garden waste collections fewer vehicles are also required, which further help reduce costs, compared to the Baseline.

Figure 42 Net WCA costs for Option 0b



6.0 Summary of WCA results for all options

The following table and chart show the net WCA costs and ranking for each authority and option. Within the table, any figures coloured red indicate that the costs are below the Baseline. With the exception of Staffordshire Moorlands and Newcastle-under-Lyme, none of the 5 core options result in net WCA costs below the baseline. Option 5 (multi-stream and 3 weekly residual) does result in a slight reduction compared to the Baseline for Staffordshire Moorlands and Newcastle-under-Lyme.

Only the chargeable garden sensitivities (Options 1a, 0a and 0b) consistently indicate a saving against the Baseline for all authorities. The three options are ranked in the top 3 for cost for each authority. The degree of saving compared to the baseline is dependent on the uptake of a chargeable garden waste collection scheme i.e. the greater the uptake the greater the potential saving.

Figure 44 shows the recycling and composting rate for each option. The five core options (Options 1 – 5) have increased recycling rates across all authorities compared to the Baseline due to the combination of food waste collections and improvements as a result of moving to a three weekly collection. The introduction of a chargeable garden waste collection scheme has the ability to reduce costs but at the same time, it also significantly lowers the recycling rate of an authority.

Only Option 1a has shown a reduction in costs but an increase in recycling rate. This is due to: the food waste collection offsetting the loss in garden waste tonnage and thus recycling rate; and the savings from chargeable garden offsetting the additional costs of introducing a food waste collection.

Observations:

- The collection of food waste increases net WCA costs, this can be only partially offset by moving to a three weekly residual collection;
- Chargeable garden waste collection schemes consistently offer reduced costs but the level of saving will be dependent on scheme uptake;
- The introduction of a separate food waste collection and a chargeable garden waste collection service has the potential to reduce costs but maintain or increase recycling rates.

Table 25 Net WCA costs and ranking for each Option and Authority (£'000)

Authority	Assessment	Option								
		Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
Cannock Chase	WCA cost (£'000)	£800	£1,300	£1,100	£1,400	£1,200	£1,100	£200	-£300	£200
	Diff. to baseline (£'000)	£0	£500	£300	£600	£400	£300	-£600	-£1,100	-£600
	Diff. to baseline (%)	0%	63%	38%	75%	50%	38%	-75%	-138%	-75%
	Rank	4	8	5	9	7	5	2	1	2
East Staffordshire	WCA cost (£'000)	£1,200	£1,800	£1,600	£2,100	£1,500	£1,300	£600	£0	£600
	Diff. to baseline (£'000)	£0	£600	£400	£900	£300	£100	-£600	-£1,200	-£600
	Diff. to baseline (%)	0%	50%	33%	75%	25%	8%	-50%	-100%	-50%
	Rank	4	8	7	9	6	5	2	1	2
Lichfield & Tamworth	WCA cost (£'000)	£3,400	£5,000	£4,500	£5,000	£4,300	£3,900	£2,900	£1,300	£1,800
	Diff. to baseline (£'000)	£0	£1,600	£1,100	£1,600	£900	£500	-£500	-£2,100	-£1,600
	Diff. to baseline (%)	0%	47%	32%	47%	26%	15%	-15%	-62%	-47%
	Rank	4	8	7	8	6	5	3	1	2
South Staffordshire	WCA cost (£'000)	£1,800	£2,500	£2,200	£2,500	£2,300	£2,000	£1,300	£600	£1,100
	Diff. to baseline (£'000)	£0	£700	£400	£700	£500	£200	-£500	-£1,200	-£700
	Diff. to baseline (%)	0%	39%	22%	39%	28%	11%	-28%	-67%	-39%
	Rank	4	8	6	8	7	5	3	1	2
Stafford	WCA cost (£'000)	£1,800	£2,600	£2,300	£3,500	£2,800	£2,300	£1,300	£500	£1,000
	Diff. to baseline (£'000)	£0	£800	£500	£1,700	£1,000	£500	-£500	-£1,300	-£800
	Diff. to baseline (%)	0%	44%	28%	94%	56%	28%	-28%	-72%	-44%
	Rank	4	7	5	9	8	5	3	1	2
Staffordshire Moorlands	WCA cost (£'000)	£2,100	£2,500	£2,200	£2,400	£2,200	£1,900	£1,300	£400	£1,000
	Diff. to baseline (£'000)	£0	£400	£100	£300	£100	-£200	-£800	-£1,700	-£1,100
	Diff. to baseline (%)	0%	19%	5%	14%	5%	-10%	-38%	-81%	-52%

Authority	Assessment	Option								
		Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
Stoke-on-Trent	Rank	5	9	6	8	6	4	3	1	2
	WCA cost (£'000)	£2,700	£3,800	£3,500	£3,900	£3,400	£3,000	£1,600	£500	£1,400
	Diff. to baseline (£'000)	£0	£1,100	£800	£1,200	£700	£300	-£1,100	-£2,200	-£1,300
	Diff. to baseline (%)	0%	41%	30%	44%	26%	11%	-41%	-81%	-48%
Newcastle-under-Lyme	Rank	4	8	7	9	6	5	3	1	2
	WCA cost (£'000)	£2,000				£2,000	£1,700		£700	£1,200
	Diff. to baseline (£'000)	£0				£0	-£300		-£1,300	-£800
	Diff. to baseline (%)	0%				0%	-15%		-65%	-40%
	Rank	4				4	3		1	2

Figure 43 Net WCA costs for each Option and Authority

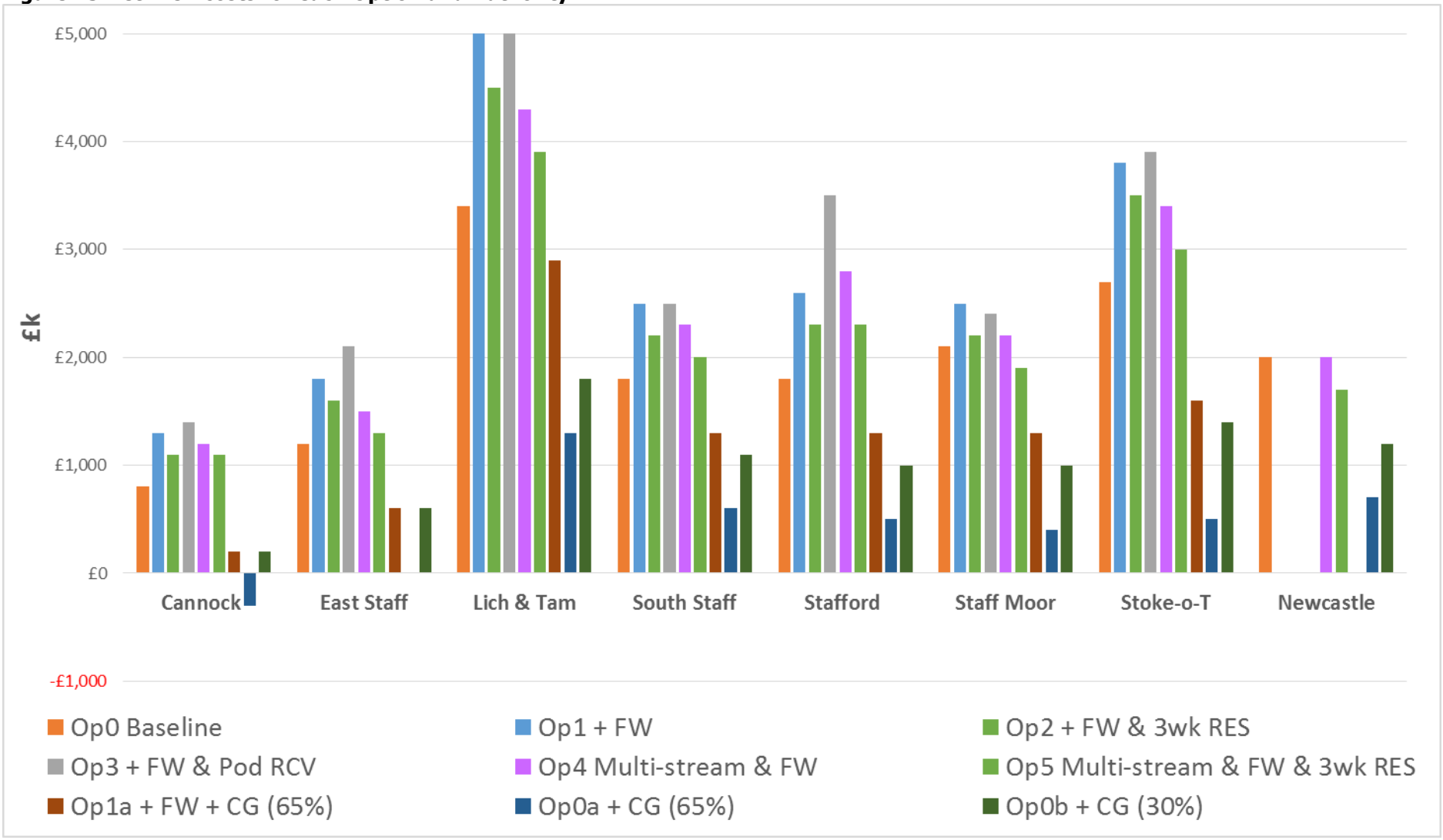
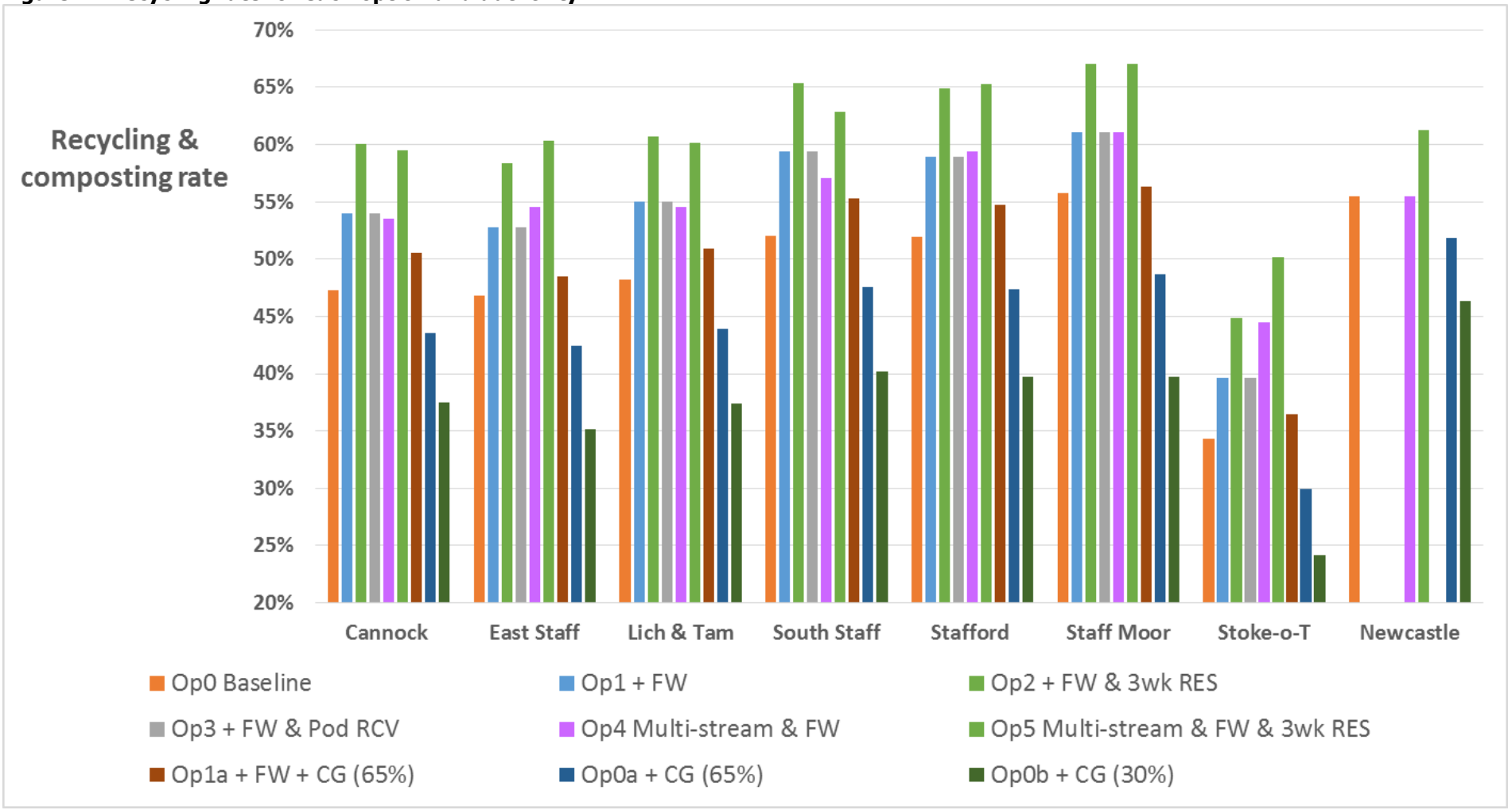


Figure 44 Recycling rate for each option and authority



7.0 Shared service review

Options 1 and 2 have examined the impact of each individual authority operating a food waste service. An alternative method could be to operate the service jointly (i.e. a shared service). In order to estimate this we have assumed that vehicles would operate out of current depots but by blurring of collection boundaries any spare collection capacity could be better utilised and collect waste from neighbours and thus result in less vehicles required.

Typically, the model estimates the number of vehicles required for each authority e.g. 4.5 food vehicles and this is rounded up to whole numbers for costing purposes e.g. 5. Where vehicles are shared this spare capacity can be better utilised. This results in less overall vehicles required across the partnership, as shown in the table below.

Table 26 Dedicated food waste vehicles required

Option	Option 1	Option 2
Unrounded	45.1	47.0
Rounded	48.0	50.0
Difference	-2.9	-3.0

The number of vehicles required to service the Partnership is primarily driven by the number of households collected from. The results suggest that sharing of the service will not significantly reduce the number of front line food waste vehicles required. For Options 1 and two this could be in the region 3 food waste vehicles. This would result in a saving of approximately £270,000 across the Partnership and in the region of £40,000 per authority based on an equal split of the savings (excluding Newcastle-under-Lyme who collect food on their recycling vehicles).

There may be additional savings from other elements required to deliver a separate food waste collection service, such as management and supervision, reduced spare vehicles, etc., but these have not been assessed as part of the study.

Observations:

- The number of vehicles saved in a shared food waste collection service is estimated at only 3 when compared to a service provided by each WCA;
- Savings based on sharing front line food waste vehicles are estimated to be in region of £40,000 per authority

8.0 Impact on WDA

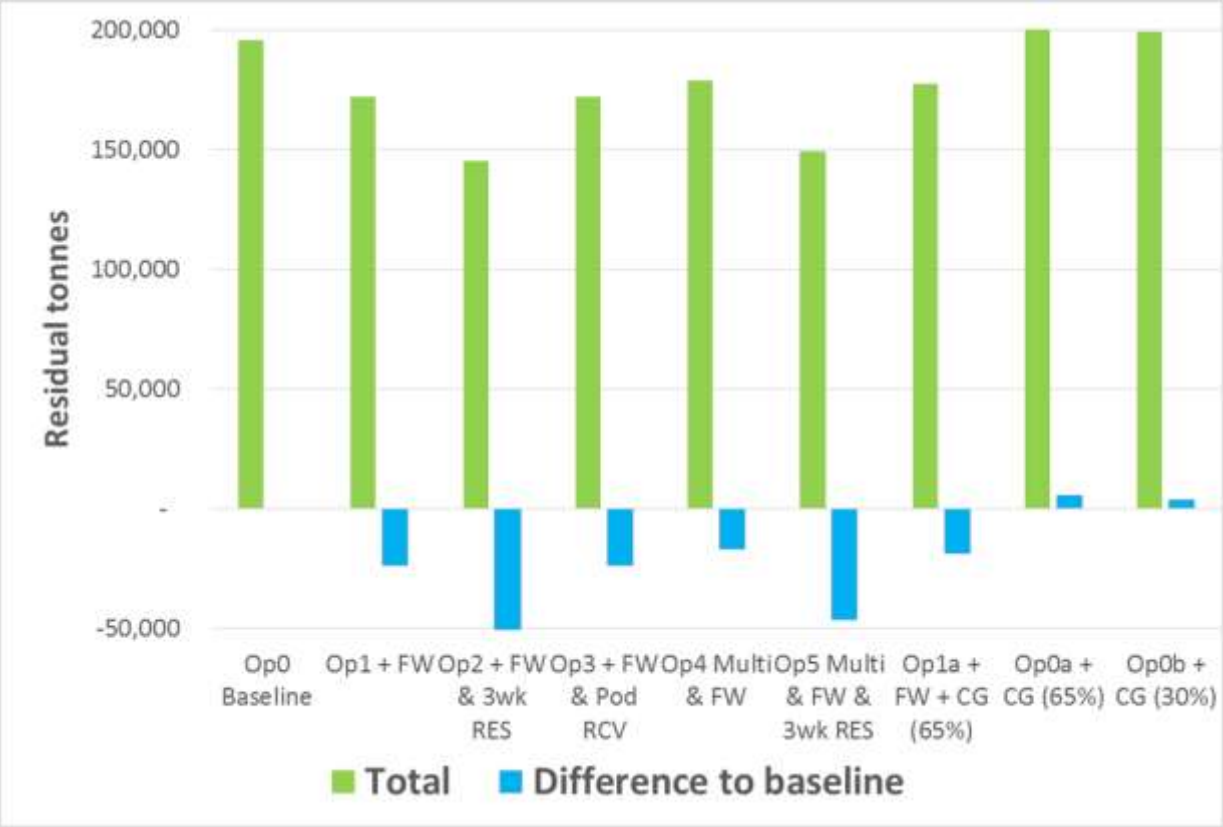
The report has, to this point, focused primarily on the collection and management of waste. However the different collection options investigated have an impact on the disposal element of waste management within the Partnership. Figure 45 shows how the residual waste tonnage varies across the options.

Introducing a food waste collection (Option 1, 3, and 4) diverts food waste reducing the residual tonnage by approximately 23,000tpa (based on core rounds modelled). The greatest impact on residual waste is from Options 2 and 5, where residual waste is reduced in the region of 50,000tpa. The impact is caused from the combination of three weekly residual collections and food waste collections, which result in increased food waste recycling, greater levels of dry recycling and a reduction in residual waste.

Introducing a chargeable garden waste collection scheme to the Baseline (Options 0a and 0b) results in increased residual tonnage (~5ktpa), as the options assumes 5% of garden waste that is currently collected free of charge ends up in the residual waste stream.

However, the combination of a separate food waste collection and a chargeable garden system (Option 1a) results in an overall drop in residual waste.

Figure 45 Residual waste tonnage



The impact of the residual waste tonnage change on disposal costs can be seen in the following table. The options that reduce residual waste result in disposal costs savings of between £0.9million and £2.8million. Options 0a and 0b, where residual waste tonnage increases, causes an increase in disposal costs of £0.2million.

Table 27 Residual disposal costs for each option (£'000)

Option	Residual treatment costs	Difference to Baseline
Op0 Baseline	£10,800	£0
Op1 + FW	£9,500	-£1,300
Op2 + FW & 3wk RES	£8,000	-£2,800
Op3 + FW & Pod RCV	£9,500	-£1,300
Op4 Multi & FW	£9,800	-£900
Op5 Multi & FW & 3wk RES	£8,200	-£2,600
Op1a + FW + CG (65%)	£9,700	-£1,100
Op0a + CG (65%)	£11,000	£200
Op0b + CG (30%)	£11,000	£200

The impact of introducing different collection schemes can have a dramatic impact on residual waste, both in terms of the quantity and composition. The analysis has shown some scheme changes can reduce residual waste, whilst others could lead to increased residual

waste. The impact of these changes on disposal costs, based on the current disposal charges, has been shown to be quite significant. However, there are wider impacts of changing residual waste quantities, such as the ramifications on existing contracts i.e. if minimum tonnage guarantees exist. These wider impacts are to be looked at further by the Partnership using data created as part of this project.

9.0 Whole system performance

The table below shows the whole system costs, which includes WCA costs and waste disposal costs but excludes recycling credits. This gives an indication of the overall whole system costs for the different options for the Partnership. The recycling performance is also shown alongside the rankings of each option for cost and recycling performance.

Table 28 Cost and recycling performance

Option	Total SWP costs (£k)	Total SWP costs (RANK)	Recycling Rate	Recycling Rate (RANK)
Op0 Baseline	£36,700	4	48%	7
Op1 + FW	£42,300	8	54%	5
Op2 + FW & 3wk RES	£39,500	6	59%	2
Op3 + FW & Pod RCV	£43,500	9	54%	4
Op4 Multi-stream & FW	£40,400	7	54%	3
Op5 Multi-stream & FW & 3wk RES	£36,900	5	60%	1
Op1a + FW + CG (65%)	£29,800	3	50%	6
Op0a + CG (65%)	£23,900	1	43%	8
Op0b + CG (30%)	£25,900	2	36%	9

The overall costs follow a similar trend to the WCA costs with the introduction of food waste collections resulting in an overall increase to the Partnership's costs. Moving to three weekly collection for residual waste does reduce cost but not sufficiently to be below the Baseline. A multi- stream service would seem to be marginally less expensive than the current schemes but would require a significant change in service across the majority of the authorities.

The options that reduce costs below the Baseline are those that involve some form of chargeable garden waste scheme. Whilst a chargeable garden waste scheme will cause recycling rates to drop, this can be offset by introducing a food waste collection, as shown by Option 1a.

The overall trend indicates that to hit high recycling rates additional expenditure is required compared to the Baseline. Equally to reduce costs it will typically cause a reduction in recycling rate.

The option of introducing a food waste scheme and charging for garden waste may offer a balance between cost savings and maintaining recycling rates. The actual performance will depend on the level of uptake of the chargeable service and this will be further explored in Section 11.0.

10.0 Food Waste Treatment

10.1 Treatment Technology

Food waste must be treated in accordance with the Animal By-Products regulations and, as such, is not suitable for treatment in open windrows. The food waste would need to be

treated via In-Vessel Composting or Anaerobic Digestion. The different types of treatment are presented in the following section with key information taken from WRAP's food waste collection guide[5]. Information on bulking of food waste is also provided. The guide provides a wide range of practical advice, from storage through to improving capture, for authorities looking to introduce or change food waste collections.

10.1.1 Anaerobic digestion (AD)

AD involves the breakdown of biodegradable material in the absence of oxygen by micro-organisms called methanogens. It is widely used to treat organic wastes, including domestic and commercial food waste, manures and biofuel crops There are two main types of AD: thermophilic and mesophilic. The primary difference between them is the temperatures reached in the process. Thermophilic processes reach temperatures of up to 60˚C and mesophilic processes normally run at about 35- 40˚C. AD sites have to comply with the ABPR, so a mesophilic site also has a pasteurisation unit to make sure the end product is safe.

The system chosen will depend largely on the feedstock to be processed. 'High solid materials', such as a garden and food waste mixture, tend to be processed at a thermophilic temperature using the batch system. 'Low solid materials', such as household food wastes, are more likely to be processed at a lower temperature using a continuous flow system. The AD process provides a source of renewable energy, since the food waste is broken down to produce biogas (a mixture of methane and carbon dioxide), which is suitable for energy production. The biogas can be used to generate electricity and heat to power on site equipment and the excess electricity can be exported to the National Grid. Other possible uses for the biogas currently being explored in the UK include injection to the gas grid and as a vehicle fuel.

A further by-product of the process is a biofertiliser which is rich in nutrients such as nitrogen, phosphorus and other elements required for healthy plant growth and fertile soil. There are strict standards governing the materials that can be used to produce quality compost and biofertiliser for use in agriculture. These are set out in the British Standards Institution's Publicly Available Specification 100 (PAS 100) for compost and PAS 110 for biofertiliser. BSI PAS 110 aims to remove the major barrier to the development of AD and its markets for digestion process outputs by creating an industry specification against which producers can verify that they are of consistent quality and fit for purpose.

10.1.2 In-vessel composting (IVC)

IVC can be used to treat food and garden waste mixtures. An IVC system ensures that composting takes place in an enclosed environment, with accurate temperature control and monitoring. There are many different systems, but they can be broadly categorised into six types:

- containers;
- silos;
- agitated bays;
- tunnels;
- rotating drums; and
- enclosed halls.

The food waste, which comes primarily from local authority waste collections, either separate or already mixed with garden waste, as well as commercial and industrial sources, is first delivered to an enclosed reception area. It is then shredded to a uniform size and loaded into what is known as the first 'barrier', which is a bay or tunnel depending on the system

[5] *http://www.wrap.org.uk/content/food-waste-collections-guide-section-7-food-waste-treatment*

used. The composting process is kick-started by naturally occurring micro-organisms already in the waste. They break down the material, releasing the nutrients and in doing so increase the temperature to the 60–70˚C needed to kill pathogens and weed seeds, and meet the regulations for processing animal by product (ABP) material.

After the first stage, which can take between seven days and three weeks, the material is transferred to the second 'barrier', where the composting process continues, usually for a similar duration. Processing in two stages ensures that all parts of the composting mass reach the required temperature.

The oxygen level, moisture and temperature are carefully monitored and controlled during both composting stages to ensure the material is fully sanitised. Screening usually takes place pre or post maturation to produce a range of product grades suitable for various end uses such as soil conditioning. Often the oversize material is fed back into the processing system to break down fully.

Facilities which process to BSI PAS 100 and the Quality Protocol for compost produce products that are no longer considered a waste by the Environment Agency.

10.1.3 Bulking and haulage of food wastes

For local authorities unable to easily deliver the collected food waste directly to an organic waste treatment facility, a food waste bulking facility to enable onward transfer may provide a range of benefits including reduced operational costs and improved service delivery.

The reasons for choosing the bulking and haulage of food waste to a treatment facility rather than a direct delivery option include:

- distance or time taken to travel to treatment facility;
- maximising the productivity of collection crews;
- cost benefits;
- environmental benefits;
- local policies or operational considerations, e.g. Waste Disposal Authority (WDA) requirements or partnership working arrangements; and
- trial schemes (testing operations prior to commissioning a local facility).

Further details on these reasons is provided within the WRAP guidance.

10.2 Potential Treatment Locations

As part of the project we have investigated the potential food waste treatment facilities within in and around the Staffordshire Waste Partnership. Using Ricardo Energy & Environment's FALCON mapping tool we have been able to identify the number of facilities and their stage of development. FALCON (Facilities Arisings Locations Contracts), is Ricardo Energy & Environment's unique and powerful data and GIS mapping system. It provides a bird's-eye view of the UK waste management landscape – now and for the foreseeable future.

The table below shows the number and total capacity of IVC and AD facilities within proximity of the Partnership. Information on the capacity of some facilities is not known. A full list of the identified sites is provided in Appendix 5.

Table 29 IVC and AD facilities

Technology	IVC		AD	
Development stage	Number of sites	Total capacity (ktpa)	Number of sites	Total capacity (ktpa)
In Planning	2	64	2	70
Planning Granted	2	0	2	110
Commissioning	1	0	1	0
In Construction	3	0	3	139
Operational	10	80	10	202
Total	18	144	18	521

The quantity of food waste collected within the options modelled is estimated to be in the region of 24-33ktpa across the Partnership. Food waste, when not mixed with garden waste, is typically processed through an AD facility and the data suggests there is considerable treatment facility capacity within the surrounding area. The long term contracts and spare capacity at the facilities is not known, but the number and capacity would suggest treatment could be found if food waste collections were introduced across the partnership.

11.0 Additional Chargeable Garden Sensitivity Analysis

11.1 Introduction

Following the initial option modelling described in the previous chapters, chargeable garden waste schemes were identified as an area to investigate further. In order to assess the implications of introducing a chargeable garden service, a range of assumptions were developed with SWP (based on the previous modelling undertaken for the project). The areas of investigation are identified below:

- Uptake of the scheme – collection resources estimates has been undertaken on 30% and 65% of households taking part. Additional analysis has also be been assessed at 20%.
- Charge for scheme – analysis has looked at the impact of charging £35 per bin and £45 per bin.
- Increased HWRC garden waste – the modelling has investigated the impact of 5% and 15% of the current garden waste collected entering HWRC sites upon the introduction of a chargeable garden scheme. The cost per tonne at HWRC sites for processing garden waste has been set at £35 per tonne.
- Residual waste – modelling has been undertaken on the impact of 5% and 15% of the current garden waste collected entering the residual bin upon the introduction of a chargeable garden scheme.

Each of the above areas were assessed individually and then a further set of modelling was conducted creating a likely scenario based on a combination of the above and the steering group recommendations.

11.2 Modelling approach

An initial set of chargeable garden waste Reference Options have been modelled based on the information provided in Table 30. The options include the current service (Baseline), the current service with a chargeable garden scheme (Option 0) and the introduction of a dedicated food waste scheme and a chargeable garden scheme (Option 1).

Results are presented for these Reference Options and then a range of sensitivities are compared against these options to identify the factors that have the greatest influence on cost and recycling rate performance. A further SWP recommendation sensitivity, based on the parameters assessed within the other sensitivities, has then been conducted.

Table 30 Chargeable garden Reference Options

Description	Name	Household uptake of chargeable scheme	Charge for garden waste scheme	Garden waste diverted to residual bin	Garden waste diverted to HWRC site
Baseline: Current service	Baseline			0%	0%
Baseline + Chargeable Garden high uptake	Opt 0a	65%	£35	5%	5%
Baseline + Chargeable Garden low uptake	Opt 0b	30%	£35	5%	5%
Option 1 Food waste collection + Chargeable Garden High	Opt 1a	65%	£35	5%	5%
Option 1 Food waste collection + Chargeable Garden Low	Opt 1b	30%	£35	5%	5%

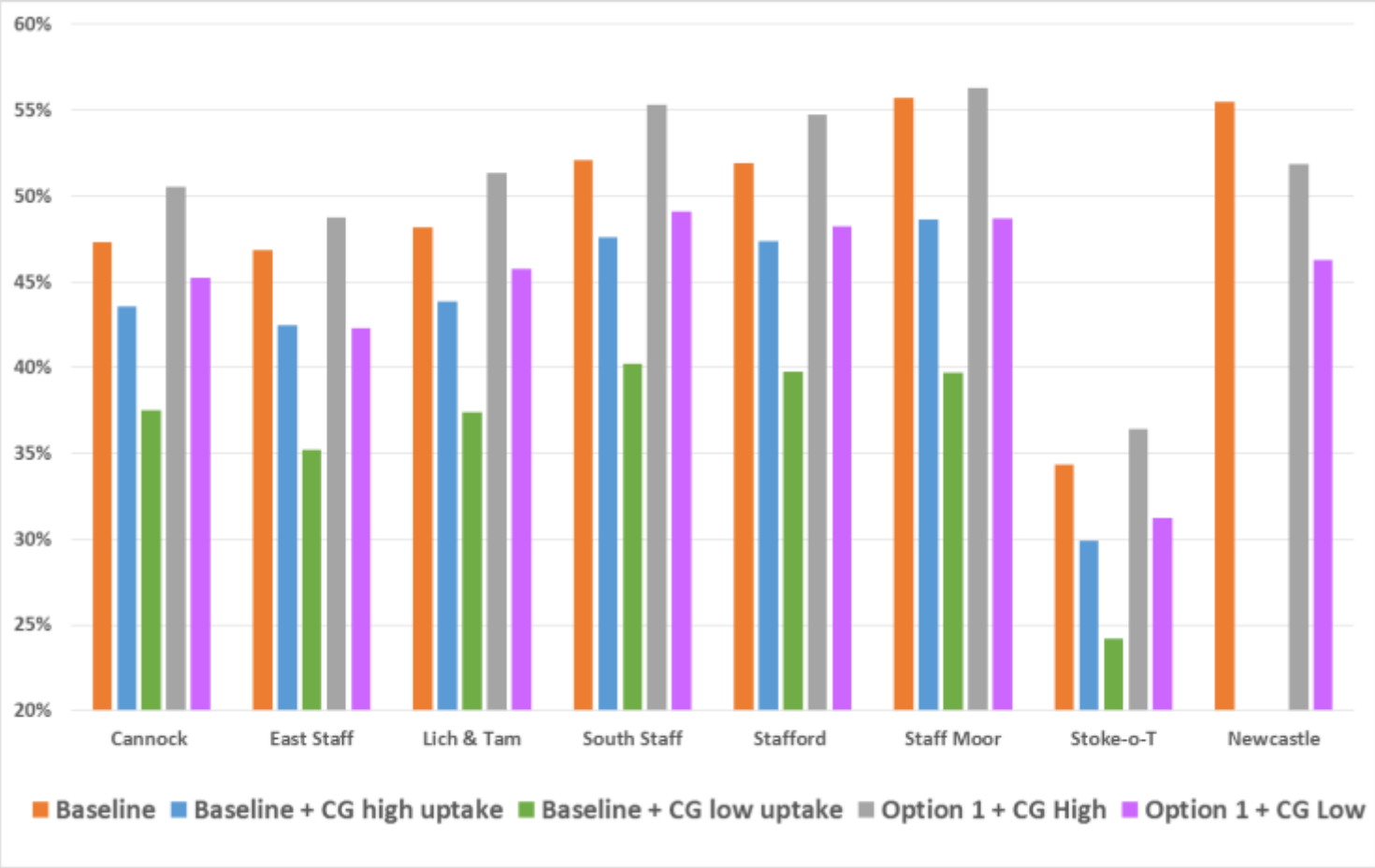
It should be noted that modelling for the chargeable garden waste service does **not** include any additional costs for promoting and administering the charging process (full details of costs not included in the modelling are noted in Appendix 4)

11.3 Results - Reference Options

11.3.1 Recycling rate

The following chart shows the recycling and composting rates of the Reference Options modelled.

Figure 46 Recycling rate for the chargeable garden Reference Options



The recycling rate analysis shows that introducing a chargeable garden waste scheme to the current service will significantly reduce rates and the level of reduction is dependent on the uptake of the service.

Introducing a food waste scheme alongside the chargeable garden scheme (Option 1a and 1b) can help offset the reduction, either in part or fully, again depending on the uptake. If there is a 30% uptake of the chargeable garden waste scheme and a food waste collection (Option 1b) then each authority will have a reduction in recycling rate of between 2 and 9 percentage points.

Newcastle shows a reduction in recycling rate as they already operate a food waste collection.

Some material will go to the HWRC sites and thus aid the WDA recycling performance figure.

11.3.2 WCA costs

Similar to the analysis presented in earlier chapters, the WCA costs are presented in the following table. These include:

- Collection costs (staff, vehicles, container, etc);
- Dry income/charge;
- Bulking;
- Food Waste Treatment;
- Garden Waste Treatment;
- Mixed food & Garden Waste Treatment;
- Recycling credits; and
- Garden waste charge.

The trend across all authorities is that introducing a chargeable garden waste service to the existing services (Options 0a and 0b) will reduce overall costs. The greater the uptake the greater the potential saving, but even at 30% uptake (Option 0b) there is a significant cost reduction. This is a combination of reduced vehicles, staffing and processing costs plus the income generation from the charges. See Table 31.

For all authorities, the introduction of a food waste scheme (Option 1a and 1b) can be offset fully or incur no additional cost by establishing a chargeable garden scheme at the same time. The greater the uptake of the chargeable scheme the greater potential cost saving.

Given Newcastle already have a food waste collection in place, they have the greatest potential cost saving identified.

Table 31 WCA costs the chargeable garden Reference Options

Authority	Assessment	Option				
		Baseline	Opt 0a	Opt 0b	Opt 1a	Opt 1b
		Baseline	Baseline + CG 65% uptake	Baseline + CG 30% uptake	Option 1 + CG 65% uptake	Option 1 + CG 30% uptake
Cannock Chase	WCA cost (£'000)	£800	-£300	£200	£200	£600
	Diff. to baseline (£'000)	£0	-£1,100	-£600	-£600	-£200
	Diff. to baseline (%)	0%	-138%	-75%	-75%	-25%
	Rank	5	1	2	2	4
East Staffordshire	WCA cost (£'000)	£1,200	£0	£600	£600	£1,200
	Diff. to baseline (£'000)	£0	-£1,200	-£600	-£600	£0
	Diff. to baseline (%)	0%	-100%	-50%	-50%	0%
	Rank	4	1	2	2	4
Lichfield & Tamworth	WCA cost (£'000)	£3,400	£1,300	£1,800	£2,900	£3,400
	Diff. to baseline (£'000)	£0	-£2,100	-£1,600	-£500	£0
	Diff. to baseline (%)	0%	-62%	-47%	-15%	0%
	Rank	4	1	2	3	4
South Staffordshire	WCA cost (£'000)	£1,800	£600	£1,100	£1,300	£1,800
	Diff. to baseline (£'000)	£0	-£1,200	-£700	-£500	£0
	Diff. to baseline (%)	0%	-67%	-39%	-28%	0%
	Rank	4	1	2	3	4
Stafford	WCA cost (£'000)	£1,800	£500	£1,000	£1,300	£1,800
	Diff. to baseline (£'000)	£0	-£1,300	-£800	-£500	£0
	Diff. to baseline (%)	0%	-72%	-44%	-28%	0%
	Rank	4	1	2	3	4
Staffordshire Moorlands	WCA cost (£'000)	£2,100	£400	£1,000	£1,300	£1,800
	Diff. to baseline (£'000)	£0	-£1,700	-£1,100	-£800	-£300
	Diff. to baseline (%)	0%	-81%	-52%	-38%	-14%
	Rank	5	1	2	3	4
Stoke-on-Trent	WCA cost (£'000)	£2,700	£500	£1,400	£1,600	£2,400
	Diff. to baseline (£'000)	£0	-£2,200	-£1,300	-£1,100	-£300
	Diff. to baseline (%)	0%	-81%	-48%	-41%	-11%
	Rank	5	1	2	3	4
Newcastle-under-Lyme	WCA cost (£'000)	£2,000	£700	£1,200	£700	£1,200
	Diff. to baseline (£'000)	£0	-£1,300	-£800	-£1,300	-£800
	Diff. to baseline (%)	0%	-108%	-67%	-108%	-67%
	Rank	5	1	3	1	3

11.3.3 WDA costs

The different collection options investigated have an impact on the disposal element of waste management within the Partnership both for residual waste and additional garden waste entering the HWRC sites. Introducing a chargeable garden waste collection scheme results in increased residual tonnage, as the options assumes 5% of garden waste that is currently collected free of charge ends up in the residual waste stream. Additionally, a further 5% of garden waste is assumed to arrive at HWRC sites and go off for treatment. The cost per tonne for processing garden waste from HWRC sites has been set at £35 per tonne.

Introducing a food waste collection (Option 1) reduces the residual tonnage by approx. 23,000tpa (based on core rounds modelled). However, the combination of a separate food waste collection and a chargeable garden system (Options 1a and 1b) results in a smaller reduction in residual waste (some of the garden waste recycled in Option 1 now ends up in the residual bin in Options 1a and 1b).

The impact of the residual waste tonnage changes and additional garden waste treatment costs at HWRC sites can be seen in the following table. Options 1a and 1b that remove food waste from the residual waste stream result in disposal costs savings of approximately £0.86million. Options 0a and 0b (no separate food waste collection), where residual waste tonnage and garden waste at HWRC sites increase, causes an increase in WDA costs of £0.45millon.

Table 32 Residual waste disposal and additional garden treatment costs for each option (£'000)

Option	Residual treatment costs	Additional garden waste treatment costs at HWRC	Total	Difference to Baseline
Baseline	£10,800	£0	£10,760	£0
Baseline + CG 65% uptake	£11,000	£180	£11,230	£470
Baseline + CG 30% uptake	£11,000	£180	£11,230	£470
Option 1 + CG 65% uptake	£9,700	£180	£9,900	-£860
Option 1 + CG 30% uptake	£9,700	£180	£9,900	-£860

11.3.4 Whole system performance

The table below shows the whole system costs, which includes WCA costs and waste disposal costs but excludes recycling credits. This gives an indication of the overall whole system costs for the different options for the Partnership. The recycling performance is also shown alongside the rankings of each option for cost and recycling performance.

Table 33 Cost and recycling performance

Option	Name	Total SWP costs (£k)	Total SWP costs (RANK)	Recycling Rate	Recycling Rate (RANK)
Baseline	Baseline	£36,690	5	48%	2
Baseline + CG 65% uptake	Opt 0a	£23,970	1	44%	4
Baseline + CG 30% uptake	Opt 0b	£26,230	2	38%	5
Option 1 + CG 65% uptake	Opt 1a	£30,000	3	50%	1
Option 1 + CG 30% uptake	Opt 1b	£32,210	4	45%	3

All the options result in an overall cost saving but the majority of the options result in a lower overall recycling rate. Only the introduction of a separate food waste collection and a high level of uptake in the chargeable scheme (Option 1a) will prevent a reduction in overall recycling rate. The options of introducing a food waste scheme and charging for garden waste (Options 1a and 1b) offer a balance between cost savings and limiting the drop in recycling rate caused by less garden waste collected.

The results indicate that increasing the uptake of the chargeable schemes creates greater savings, as the charge offsets the increased collection and treatment costs. Therefore, if a chargeable garden scheme were to be introduced, it would be beneficial on maximising its use, possibly through additional communication campaigns.

11.4 Sensitivity 1 – Charge per bin

This sensitivity varies the charge per bin from £35 to £45 for the garden waste scheme.

Table 34 Sensitivity 1 chargeable garden option assumptions

Description	Name	Household uptake of chargeable scheme	Charge for garden waste scheme	Garden waste diverted to residual bin	Garden waste diverted to HWRC site
Baseline: Current service	Baseline			0%	0%
Baseline + Chargeable Garden high uptake	Opt 0a	65%	£45	5%	5%
Baseline + Chargeable Garden low uptake	Opt 0b	30%	£45	5%	5%
Option 1 Food waste collection + Chargeable Garden High	Opt 1a	65%	£45	5%	5%
Option 1 Food waste collection + Chargeable Garden Low	Opt 1b	30%	£45	5%	5%

11.4.1 Recycling rate for Sensitivity 1 options

No change in tonnage is assumed, therefore the recycling performance is the same as the Reference Options presented in Section 11.3.1.

11.4.2 WCA costs for sensitivity 1 options

Increasing the charge for households taking part in the garden waste collection from £35 to £45 per bin equates to a 29% increase in income. This has the benefit of further reducing the WCA costs compared to the baseline, as shown in the table below.

Table 35 WCA Costs for Sensitivity 1

Authority	Assessment	Option				
		Baseline	Opt 0a	Opt 0b	Opt 1a	Opt 1b
		Baseline	Baseline + CG 65% uptake	Baseline + CG 30% uptake	Option 1 + CG 65% uptake	Option 1 + CG 30% uptake
Cannock Chase	WCA cost (£'000)	£800	-£500	£0	-£100	£500
	Diff. to baseline (£'000)	£0	-£1,300	-£800	-£900	-£300
	Diff. to baseline (%)	0%	-163%	-100%	-113%	-38%
	Rank	5	1	3	2	4
East Staffordshire	WCA cost (£'000)	£1,200	-£300	£400	£300	£1,000
	Diff. to baseline (£'000)	£0	-£1,500	-£800	-£900	-£200
	Diff. to baseline (%)	0%	-125%	-67%	-75%	-17%
	Rank	5	1	3	2	4
Lichfield & Tamworth	WCA cost (£'000)	£3,400	£800	£1,600	£2,400	£3,200
	Diff. to baseline (£'000)	£0	-£2,600	-£1,800	-£1,000	-£200
	Diff. to baseline (%)	0%	-76%	-53%	-29%	-6%
	Rank	5	1	2	3	4
South Staffordshire	WCA cost (£'000)	£1,800	£300	£900	£1,000	£1,600
	Diff. to baseline (£'000)	£0	-£1,500	-£900	-£800	-£200
	Diff. to baseline (%)	0%	-83%	-50%	-44%	-11%
	Rank	5	1	2	3	4
Stafford	WCA cost (£'000)	£1,800	£100	£900	£1,000	£1,700
	Diff. to baseline (£'000)	£0	-£1,700	-£900	-£800	-£100
	Diff. to baseline (%)	0%	-94%	-50%	-44%	-6%
	Rank	5	1	2	3	4
Staffordshire Moorlands	WCA cost (£'000)	£2,100	£200	£800	£1,000	£1,700
	Diff. to baseline (£'000)	£0	-£1,900	-£1,300	-£1,100	-£400
	Diff. to baseline (%)	0%	-90%	-62%	-52%	-19%
	Rank	5	1	2	3	4
Stoke-on-Trent	WCA cost (£'000)	£2,700	£0	£1,100	£1,100	£2,100
	Diff. to baseline (£'000)	£0	-£2,700	-£1,600	-£1,600	-£600
	Diff. to baseline (%)	0%	-100%	-59%	-59%	-22%
	Rank	5	1	2	2	4
Newcastle-under-Lyme	WCA cost (£'000)	£2,000	£400	£1,000	£400	£1,000
	Diff. to baseline (£'000)	£0	-£1,600	-£1,000	-£1,600	-£1,000
	Diff. to baseline (%)	0%	-160%	-100%	-160%	-100%
	Rank	5	1	3	1	3

11.4.3 WDA costs for sensitivity 1 options

No change in tonnage is assumed, therefore the WDA costs are the same as the Reference Options presented in Section 11.3.3

11.4.4 Whole system performance for Sensitivity 1 options

The table below shows the whole system costs, which includes WCA costs and waste disposal costs but excludes recycling credits. This gives an indication of the overall whole system costs for the different options for the Partnership. The recycling performance is also shown alongside the rankings of each option for cost and recycling performance.

Table 36 Cost and recycling performance for Sensitivity 1 options

Option	Name	Total SWP costs (£k)	Total SWP costs (RANK)	Recycling Rate	Recycling Rate (RANK)
Baseline	Baseline	£36,690	5	48%	2
Baseline + CG 65% uptake	Opt 0a	£21,090	1	44%	4
Baseline + CG 30% uptake	Opt 0b	£24,910	2	38%	5
Option 1 + CG 65% uptake	Opt 1a	£27,120	3	50%	1
Option 1 + CG 30% uptake	Opt 1b	£30,890	4	45%	3

The impact of raising the charge to £45 increases the income generation and reduces the costs of all options against the Baseline. The increased income and reduction in costs is greater on Options 0a and 1a, where there is greater uptake of the scheme and thus more households paying the higher charge.

11.5 Sensitivity 2 – Garden waste to HWRC sites

This sensitivity assumes greater garden waste is diverted from the kerbside scheme to HWRC sites. The modelling has investigated the impact of 15% of the current garden waste collected entering HWRC sites upon the introduction of a chargeable garden scheme. The cost per tonne at HWRC sites for processing garden waste has been set at £35 per tonne.

Table 37 Sensitivity 2 chargeable garden option assumptions

Description	Name	Household uptake of chargeable scheme	Charge for garden waste scheme	Garden waste diverted to residual bin	Garden waste diverted to HWRC site
Baseline: Current service	Baseline			0%	0%
Baseline + Chargeable Garden high uptake	Opt 0a	65%	£35	5%	15%
Baseline + Chargeable Garden low uptake	Opt 0b	30%	£35	5%	15%
Option 1 Food waste collection + Chargeable Garden High	Opt 1a	65%	£35	5%	15%
Option 1 Food waste collection + Chargeable Garden Low	Opt 1b	30%	£35	5%	15%

11.5.1 Recycling rate for Sensitivity 2 options

No change in WCA tonnage is assumed, therefore the recycling performance is the same as the Reference Options presented in Section 11.3.1.

11.5.2 WCA costs for Sensitivity 2 options

The sensitivity would not impact on WCA costs, therefore the WCA costs are the same as the Reference Options presented in Section 11.3.2.

11.5.3 WDA costs for Sensitivity 2 options

Compared to the Reference Options the sensitivity increases the garden waste arriving at HWRC sites and going off for treatment from 5% to 15%. This increases the WDA garden waste processing costs which are assumed to be £35 per tonne. No impact on the residual waste is assumed.

The impact of the residual waste tonnage changes and additional garden waste treatment costs at HWRC sites can be seen in the following table. The increased tonnage going to the HWRC sites increases the WDA cost compared to the Reference Options in the order of £540,000. The Option 1 scenarios still result in a saving compared to the Baseline due to the food waste collections reducing residual waste and thus residual waste treatment costs.

Table 38 Residual disposal costs for each Sensitivity 2 option (£'000)

Option	Residual treatment costs	Additional garden waste treatment costs at HWRC	Total	Difference to Baseline
Baseline	£10,800	£0	£10,760	£0
Baseline + CG 65% uptake	£11,000	£540	£11,590	£830
Baseline + CG 30% uptake	£11,000	£540	£11,590	£830
Option 1 + CG 65% uptake	£9,700	£540	£10,260	-£500
Option 1 + CG 30% uptake	£9,700	£540	£10,260	-£500

11.5.4 Whole system performance for Sensitivity 2 options

The table below shows the whole system costs, which includes WCA costs and waste disposal costs but excludes recycling credits. This gives an indication of the overall whole system costs for the different options for the Partnership. The recycling performance is also shown alongside the rankings of each option for cost and recycling performance.

Table 39 Cost and recycling performance for Sensitivity 2 options

Option	Name	Total SWP costs (£k)	Total SWP costs (RANK)	Recycling Rate	Recycling Rate (RANK)
Baseline	Baseline	£36,690	5	48%	2
Baseline + CG 65% uptake	Opt 0a	£24,330	1	44%	4
Baseline + CG 30% uptake	Opt 0a	£26,590	2	38%	5
Option 1 + CG 65% uptake	Opt 1a	£30,360	3	50%	1
Option 1 + CG 30% uptake	Opt 1b	£32,570	4	45%	3

The impact of the additional garden waste going to the HWRC sites increase the whole system costs to compared to the Reference Options by around £0.3 to £0.4 million. However, all the options are still significantly below the Baseline scenario.

11.6 Sensitivity 3 – Increased kerbside residual waste

This sensitivity assumes greater garden waste is diverted to the kerbside residual collection upon the commencement of a chargeable garden scheme. The modelling has investigated the impact of moving from 5% to 15% of the current garden waste collected, transferring to the residual bin.

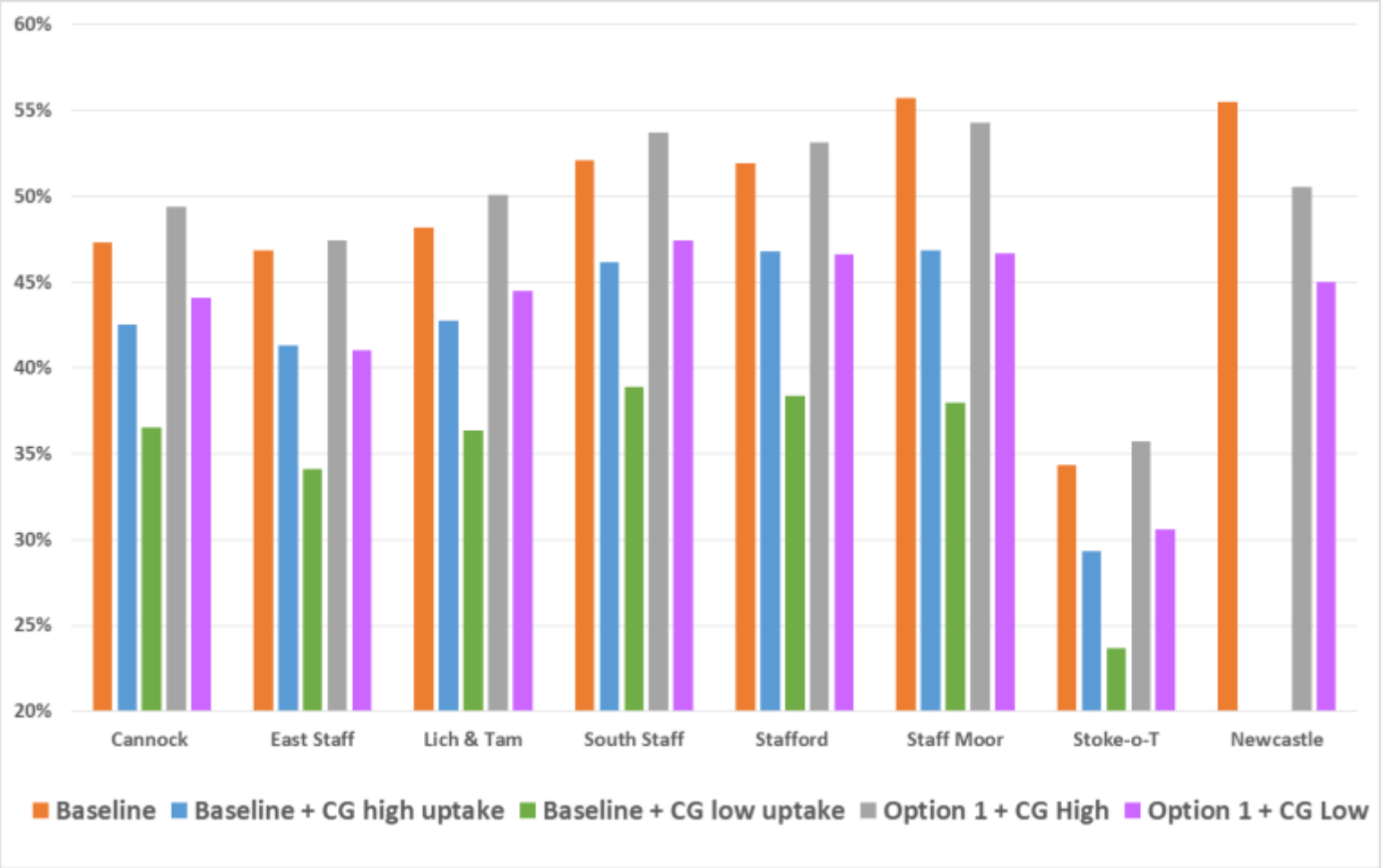
Table 40 Sensitivity 3 chargeable garden option assumptions

Description	Name	Household uptake of chargeable scheme	Charge for garden waste scheme	Garden waste diverted to residual bin	Garden waste diverted to HWRC site
Baseline: Current service	Baseline			0%	0%
Baseline + Chargeable Garden high uptake	Opt 0a	65%	£35	15%	5%
Baseline + Chargeable Garden low uptake	Opt 0b	30%	£35	15%	5%
Option 1 Food waste collection + Chargeable Garden High	Opt 1a	65%	£35	15%	5%
Option 1 Food waste collection + Chargeable Garden Low	Opt 1b	30%	£35	15%	5%

11.6.1 Recycling rate for Sensitivity 3 options

The following chart shows the recycling and composting rates of sensitivity option 3 (15% of current garden waste diverted to kerbside residual waste).

Figure 47 Recycling rate for the chargeable garden sensitivity 3 options



The recycling rate analysis shows that the additional residual waste entering the kerbside recycling container further reduces the recycling rate of each option by a few percentage points compared to the chargeable garden Reference Option rates in Section 11.3.1.

This indicates that recycling rates will be impacted upon by the destination of any garden waste material no longer collected once a chargeable scheme is introduced. Home composting would be the favoured approach followed by HWRC sites. The deposit of garden waste in the residual bin should be discouraged. Any additional material going go to the HWRC sites will aid the WDA recycling performance.

11.6.2 WCA costs for Sensitivity 3 options

Increasing the residual tonnage collected by a further 10% on top of the current garden waste tonnage has a minimal impact on WCA collection costs. For the majority of the authorities there is spare capacity within the service to accommodate the additional tonnage without requiring any additional vehicles. The number of household visited is not changing and the additional tonnage is not sufficient to require an additional tip during the day.

The modelling for South Staffordshire and Lichfield & Tamworth did indicate an additional vehicle would be required for the residual waste collections, but only for Option 0a and 0b, where no separate food waste is collected. The modelling indicates they only just pass the tipping point for an additional vehicle and in reality this is likely to be accommodated through the existing service. However, the estimated costs do include the additional vehicles to represent the worst case scenario.

Table 41 WCA costs for the chargeable garden sensitivity 3 options

Authority	Assessment	Option				
		Baseline	Opt 0a	Opt 0b	Opt 1a	Opt 1b
		Baseline	Baseline + CG 65% uptake	Baseline + CG 30% uptake	Option 1 + CG 65% uptake	Option 1 + CG 30% uptake
Cannock Chase	WCA cost (£'000)	£800	-£300	£200	£200	£600
	Diff. to baseline (£'000)	£0	-£1,100	-£600	-£600	-£200
	Diff. to baseline (%)	0%	-138%	-75%	-75%	-25%
	Rank	5	1	2	2	4
East Staffordshire	WCA cost (£'000)	£1,200	£0	£600	£600	£1,200
	Diff. to baseline (£'000)	£0	-£1,200	-£600	-£600	£0
	Diff. to baseline (%)	0%	-100%	-50%	-50%	0%
	Rank	4	1	2	2	4
Lichfield & Tamworth	WCA cost (£'000)	£3,400	£1,600	£2,100	£2,900	£3,400
	Diff. to baseline (£'000)	£0	-£1,800	-£1,300	-£500	£0
	Diff. to baseline (%)	0%	-53%	-38%	-15%	0%
	Rank	4	1	2	3	4
South Staffordshire	WCA cost (£'000)	£1,800	£800	£1,200	£1,300	£1,800
	Diff. to baseline (£'000)	£0	-£1,000	-£600	-£500	£0
	Diff. to baseline (%)	0%	-56%	-33%	-28%	0%
	Rank	4	1	2	3	4
Stafford	WCA cost (£'000)	£1,800	£500	£1,000	£1,300	£1,800
	Diff. to baseline (£'000)	£0	-£1,300	-£800	-£500	£0
	Diff. to baseline (%)	0%	-72%	-44%	-28%	0%
	Rank	4	1	2	3	4
Staffordshire Moorlands	WCA cost (£'000)	£2,100	£400	£1,000	£1,300	£1,800
	Diff. to baseline (£'000)	£0	-£1,700	-£1,100	-£800	-£300
	Diff. to baseline (%)	0%	-81%	-52%	-38%	-14%
	Rank	5	1	2	3	4
Stoke-on-Trent	WCA cost (£'000)	£2,700	£500	£1,400	£1,600	£2,400
	Diff. to baseline (£'000)	£0	-£2,200	-£1,300	-£1,100	-£300
	Diff. to baseline (%)	0%	-81%	-48%	-41%	-11%
	Rank	5	1	2	3	4
Newcastle-under-Lyme	WCA cost (£'000)	£2,000	£700	£1,200	£700	£1,200
	Diff. to baseline (£'000)	£0	-£1,300	-£800	-£1,300	-£800
	Diff. to baseline (%)	0%	-108%	-67%	-108%	-67%
	Rank	5	1	3	1	3

11.6.3 WDA costs for Sensitivity 3 options

Compared to the Reference Options this sensitivity increases the garden waste being placed in the kerbside residual container. The resulting increase in residual waste pushes up the residual treatment costs (shown in the following table) compared to the Reference Options in Section 11.3.3.

The Baseline options with a chargeable garden scheme (Options 0a and 0b) have higher residual treatment costs than present. The introduction of food waste collections (Options 1a

and 1b) reduces residual waste but this this is offset in part by the additional garden waste assumed to enter the residual container.

Table 42 Residual disposal and additional garden treatment costs for each Sensitivity 3 option (£'000)

Option	Residual treatment costs	Additional garden waste treatment costs at HWRC	Total	Difference to Baseline
Baseline	£10,800	£0	£10,760	£0
Baseline + CG 65% uptake	£11,600	£180	£11,740	£980
Baseline + CG 30% uptake	£11,600	£180	£11,740	£980
Option 1 + CG 65% uptake	£10,200	£180	£10,410	-£360
Option 1 + CG 30% uptake	£10,200	£180	£10,410	-£360

11.6.4 Whole system performance for Sensitivity 3 options

The table below shows the whole system costs, which includes WCA costs and waste disposal costs but excludes recycling credits. This gives an indication of the overall whole system costs for the different options for the Partnership. The recycling performance is also shown alongside the rankings of each option for cost and recycling performance.

Table 43 Cost and recycling performance for Sensitivity 3 options

Option	Name	Total SWP costs (£k)	Total SWP costs (RANK)	Recycling Rate	Recycling Rate (RANK)
Baseline	Baseline	£36,690	5	48%	2
Baseline + CG 65% uptake	Opt 0a	£24,920	1	43%	4
Baseline + CG 30% uptake	Opt 0b	£27,180	2	37%	5
Option 1 + CG 65% uptake	Opt 1a	£30,570	3	49%	1
Option 1 + CG 30% uptake	Opt 1b	£32,780	4	44%	3

The impact of the additional garden waste entering the kerbside residual container increases the whole system costs compared to the Reference options. The increase is as a result of increased residual disposal plus for Options 0a and 0b increased collection costs for a couple of authorities. All the option still result in lower costs than the Baseline.

11.7 Sensitivity 4 – SWP recommendation

This sensitivity is based on SWP recommendations and assumes the worst case values from the previous three sensitivities i.e. greater garden waste is diverted to the kerbside residual, greater waste diverted to the HWRC site and £35 charge,. In addition the modelling assumes only a 20% uptake in the chargeable service, thus reducing the tonnage collected. Full collection models have not been run for this sensitivity and the resources and costs for conducting the collections is taken from sensitivity 3 (15% additional residual waste) and the 30% uptake options. The recycling credits, treatment costs, charges, recycling rates, etc. are all based on the 20% uptake assumption.

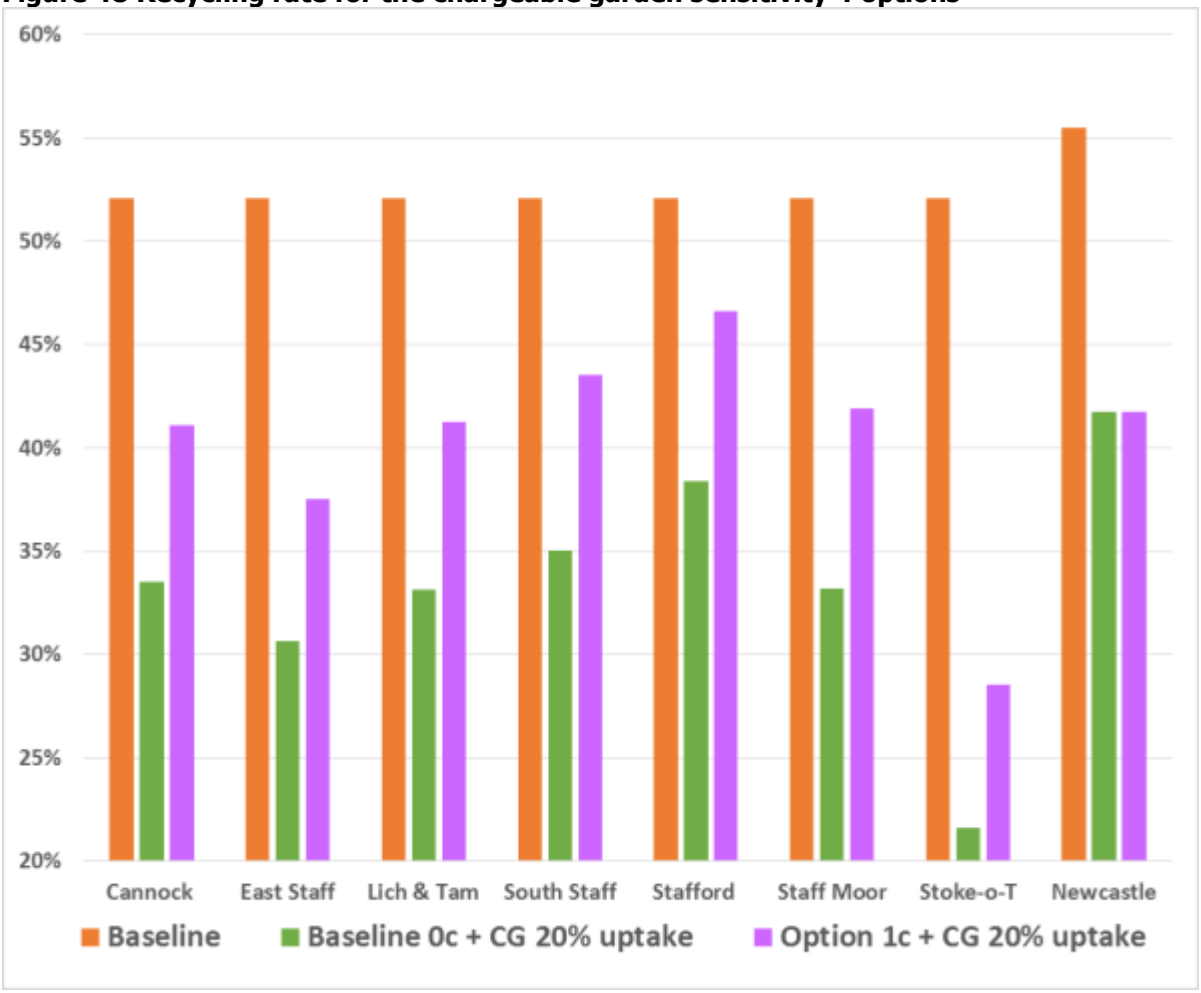
Table 44 Sensitivity 4 Worst case chargeable garden option assumptions

Description	Name	Household uptake of chargeable scheme	Charge for garden waste scheme	Garden waste diverted to residual bin	Garden waste diverted to HWRC site
Baseline: Current service	Baseline			0%	0%
Baseline + Chargeable Garden 20% uptake	Opt 0c	20%	£35	15%	15%
Option 1 Food waste collection + Chargeable Garden 20% uptake	Opt 1c	20%	£35	15%	15%

11.7.1 Recycling rate for Sensitivity 4 options

The following chart shows the recycling and composting rates of the sensitivity 4 options. The recycling rates all drop considerably due to the 20% uptake meaning reduced garden waste collected and the 15% of current garden waste diverted to kerbside residual waste. The addition of a food waste collection in option 1c does offset the recycling rate drop but there is still significant reduction across all the authorities. Any additional material going go to the HWRC sites will aid the WDA recycling performance.

Figure 48 Recycling rate for the chargeable garden sensitivity 4 options



11.7.2 WCA costs for Sensitivity 4 options

Reducing the uptake to 20% reduces the treatment costs but also the income from household charges and recycling credits. The modelling has assumed the collection costs are in line with Sensitivity 3, therefore increasing the residual tonnage collected by a further 10% on top of the current garden waste tonnage has only a minimal impact on WCA collection costs.

The WCA cost results are shown in the following table and indicate that even with the reduced income introducing a chargeable garden service, added to the Baseline, appear to reduce costs. However, it no longer creates sufficient savings to offset the costs of introducing a food waste collection. The results using the parameters for this sensitivity indicated than only 1 authority, other than Newcastle, would have lower costs with both a food waste collection and a chargeable garden service.

Table 45 WCA costs for the chargeable garden sensitivity 3 options

Authority	Assessment	Option		
		Baseline	Opt 0c	Opt 1c
		Baseline	Baseline + CG 20% uptake	Option 1 + CG 20% uptake
Cannock Chase	WCA cost (£'000)	£800	£300	£800
	Diff. to baseline (£'000)	£0	-£500	£0
	Diff. to baseline (%)	0%	-63%	0%
East Staffordshire	WCA cost (£'000)	£1,200	£800	£1,400
	Diff. to baseline (£'000)	£0	-£400	£200
	Diff. to baseline (%)	0%	-33%	17%
Lichfield & Tamworth	WCA cost (£'000)	£3,400	£2,400	£3,800
	Diff. to baseline (£'000)	£0	-£1,000	£400
	Diff. to baseline (%)	0%	-29%	12%
South Staffordshire	WCA cost (£'000)	£1,800	£1,400	£1,900
	Diff. to baseline (£'000)	£0	-£400	£100
	Diff. to baseline (%)	0%	-22%	6%
Stafford	WCA cost (£'000)	£1,800	£1,300	£2,100
	Diff. to baseline (£'000)	£0	-£500	£300
	Diff. to baseline (%)	0%	-28%	17%
Staffordshire Moorlands	WCA cost (£'000)	£2,100	£1,200	£2,000
	Diff. to baseline (£'000)	£0	-£900	-£100
	Diff. to baseline (%)	0%	-43%	-5%
Stoke-on-Trent	WCA cost (£'000)	£2,700	£1,700	£2,700
	Diff. to baseline (£'000)	£0	-£1,000	£0
	Diff. to baseline (%)	0%	-37%	0%
Newcastle-under-Lyme	WCA cost (£'000)	£2,000	£1,400	£1,400
	Diff. to baseline (£'000)	£0	-£600	-£600
	Diff. to baseline (%)	0%	-43%	-43%

11.7.3 WDA costs for Sensitivity 4 options

Compared to the Reference Options this sensitivity increases the garden waste being placed in the kerbside residual container and the additional garden waste entering HWRC sites. The resulting increase in residual waste pushes up the residual treatment costs and HWRC garden waste treatment.

The Baseline option with a chargeable garden scheme (Options 0c) has higher residual treatment cost than present. The introduction of food waste collections (Options 1c) reduces residual waste but this this is offset by the additional garden waste assumed to enter the residual container.

Table 46 Residual disposal and additional garden treatment costs for each Sensitivity 4 option (£'000)

Option	Residual treatment costs	Additional garden waste treatment costs at HWRC	Total	Difference to Baseline
Baseline	£10,800	£0	£10,760	£0
Baseline 0c + CG 20% uptake	£11,600	£540	£12,100	£1,340
Option 1c + CG 20% uptake	£10,200	£540	£10,770	£10

11.7.4 Whole system performance for Sensitivity 3 options

The table below shows the whole system costs, which includes WCA costs and waste disposal costs but excludes recycling credits. This gives an indication of the overall whole system costs for the different options for the Partnership. The recycling performance is also shown alongside the rankings of each option for cost and recycling performance.

Table 47 Cost and recycling performance for Sensitivity 3 options

Option	Name	Total SWP costs (£k)	Total SWP costs (RANK)	Recycling Rate	Recycling Rate (RANK)
Baseline	Baseline	£36,690	3	48%	1
Baseline 0c + CG 20% uptake	Opt 0a	£28,850	1	35%	3
Option 1c + CG 20% uptake	Opt 1b	£34,450	2	42%	2

The reduced uptake, additional garden waste entering the kerbside residual container and the increase in waste going to HWRC sites all impact on the whole system costs and bring the options closer to the Baseline. The results indicate that collecting food waste and operating a chargeable garden waste collection has slightly lower overall costs than the baseline. Introducing a chargeable garden scheme to the baseline still appears to result in lower costs than the Baseline, however the recycling rate drops significantly.

11.8 Comparison of chargeable garden sensitivities

The table below shows the whole system costs for the Baseline and each sensitivity. The shading indicates the most expensive (red) through to the least expensive (green).

All the options result in savings compared to the Baseline, due to the income generation and reduced vehicles and staff requirements. Even with low uptake, the introduction of a food waste scheme and additional material going to the kerbside residual collection, the whole system costs appear lower than the current service.

The greater the uptake the greater the saving, as the charge appears to offset the collection and treatment costs. Although it should be noted the analysis does not include the whole collection service costs, for example items such as central charges and spare vehicle are not covered.

Increasing the charge for garden waste collections reduces overall costs in each option, however, in reality the higher charges could reduce uptake. The modelling indicates a reduction in whole system costs of around £2.8million for the high uptake options (0a and 1a) and £1.3million for the low uptake options (0b and 1b).

For all but two authorities, the additional residual waste collected at the kerbside did not result in significant additional collection costs but did incur additional residual treatment costs and an overall increase of between £0.5 and £1million compared to the Reference Options.

Sensitivity 4 has looked as pulling together the SWP parameters which use the worst case assumptions of those modelled and assumes a 20% uptake of the scheme. The results still indicate that the overall cost are lower than the Baseline, however the introduction of a food waste collection does bring costs significantly closer to the Baseline.

Table 48 Chargeable garden sensitivities whole system costs (£'000)

Option	Reference Options	Sensitivity 1 Charge increased to £45	Sensitivity 2 Increased garden waste to HWRC	Sensitivity 3 Increased garden waste to kerbside residual	Sensitivity 4 Increased garden waste to kerbside residual and HWRC
Baseline	£36,690	£36,690	£36,690	£36,690	£36,690
Baseline + CG 65 uptake	£23,970	£21,090	£24,330	£24,920	
Baseline + CG 30% uptake	£26,230	£24,910	£26,590	£27,180	
Baseline + CG 20% uptake					£28,850
Option 1 + CG 65% uptake	£30,000	£27,120	£30,360	£30,570	
Option 1 + CG 30% uptake	£32,210	£30,890	£32,570	£32,780	
Option 1 + CG 20% uptake					£34,450

The analysis would suggest that once a chargeable garden scheme is chosen to be introduced, the next two most important factors are the level of uptake and level of charge, both of which influence each other and the overall service performance. It is recommended to undertake further analysis, potentially through consultation with the public, to identify the optimum charge to ensure high uptake and sufficient income generation.

12.0 Summary

The report has considered the options for the future shape and delivery of household waste collection services in the Staffordshire Waste Partnership. A range of options and sensitivities have been conducted to investigate the impact on both the collection authorities and the Partnership as a whole.

The key finding from the work are:

- Introducing a food waste collection across the Partnership could drive up recycling rates and reduce residual waste. However, the costs increase, irrespective of how the food is collected, for both collection authorities and from a whole system basis.
- Collecting food waste as part of a multi-stream service results in marginally lower costs than a dedicated service or a pod vehicle but would require significant service changes for all authorities except Newcastle-under-Lyme.
- Moving to a three weekly residual collection reduces costs and can help improve overall recycling rates, however, the costs do not offset the introduction of a food waste scheme.
- Operating a shared food waste collection service could reduce front line collection costs but only in the order of £40k per authority per annum.
- There appears to be significant potential food waste treatment facilities within and surrounding the Partnership.
- Introducing food waste and moving to three weekly residual collections can reduce residual waste, whilst a chargeable garden scheme has the potential to increase residual waste at the kerbside.
- The only options that consistently reduce costs compared to current costs, across each authority, are those that introduce chargeable garden schemes. However, this reduces recycling rates significantly.
- The potential saving and drop in recycling rate from chargeable garden schemes will be dependent on the uptake by householders.
- The introduction of a food waste collection and a chargeable garden waste scheme has the potential to reduce costs but also maintain or increase recycling rates.

The overall trend of the options, as shown by the table below, indicates that to hit high recycling rates additional expenditure is required compared to the Baseline. Equally to reduce costs it will typically cause a change in service that will reduce recycling rate. The option of introducing a separate food waste collection and charging for garden waste may offer a balance between cost savings and maintaining recycling rates, however, the actual performance will depend on the level of uptake of the chargeable service.

Table 49 Cost and recycling performance[6]

Option	Total SWP costs (£k)	Total SWP costs (RANK)	Recycling Rate	Recycling Rate (RANK)
Op0 Baseline	£36,700	4	48%	7
Op1 + FW	£42,300	8	54%	5
Op2 + FW & 3wk RES	£39,500	6	59%	2
Op3 + FW & Pod RCV	£43,500	9	54%	4
Op4 Multi-stream & FW	£40,400	7	54%	3
Op5 Multi-stream & FW & 3wk RES	£36,900	5	60%	1
Op1a + FW + CG (65%)	£29,800	3	50%	6
Op0a + CG (65%)	£23,900	1	43%	8
Op0b + CG (30%)	£25,900	2	36%	9

The additional analysis, examining chargeable garden waste options in more detail, has identified that even when varying some of the assumptions, a chargeable garden scheme would appear to still offer significant costs savings. However, this is to the detriment of the overall recycling and composting rate. The main cost savings are from reduced vehicle and staff requirements and the income from the charges. Further research is recommended to identify an optimum charge to encourage high uptake but also ensure the costs of providing the service are appropriately covered.

[6] *The total out-turns for these options are based on the original modelling and do not incorporate the additional sensitivities conducted in Section 11*

Appendix 1 Key assumptions

This section provides the main assumption used for the modelling. Within each authority there will be individual variation but uniform data used for all the modelling to ensure the analysis is conducted on a like for like basis.

Table 50 Vehicle unit costs

Vehicle Type	Cost
RCV	£ 152,000.00
Food (7.5t)	£ 65,000.00
REL + Pod	£ 172,000.00
Stillage	£ 92,000.00
Twin pack	£ 180,000.00
Romaquip	£ 130,000.00

Table 51 Front-line operatives estimated per vehicle type

Vehicle type	Drivers	Loaders	Total
RCV	1	2	3
REL + front Pod	1	3	4
Twin pack	1	2	3
Food	1	2	3
RRV	1	2	3

Table 52 Average driver and loader costs

Position	Cost
Driver	£ 26,500.00
Loader	£ 23,000.00

Table 53 Container unit cost

Container Type	Unit Cost	Replacement rate	Lifetime
Wheeled bin (all sizes)	£19.00	0.50%	10
Box	£2.25	15.00%	5
Food caddy and bucket	£3.50	10.00%	5
Reusable bag	£0.06	25.00%	5
Food waste liners	£0.01	N/A	N/A

Appendix 2 Authority Cost Data

Data removed due to confidentiality reasons.

Appendix 3 Local Authorities outputs

A3.1 Cannock Chase

Baseline data

The results of the initial baseline for Cannock Chase are shown in Table A 3-1. A comparison with the actual data provided by the Council is also shown.

Some of the average timings provided have been slightly amended to reflect the number of loads and round sizes reported on KAT. The modelling assumes there are 5 vehicles in total used for the refuse and garden waste collections.

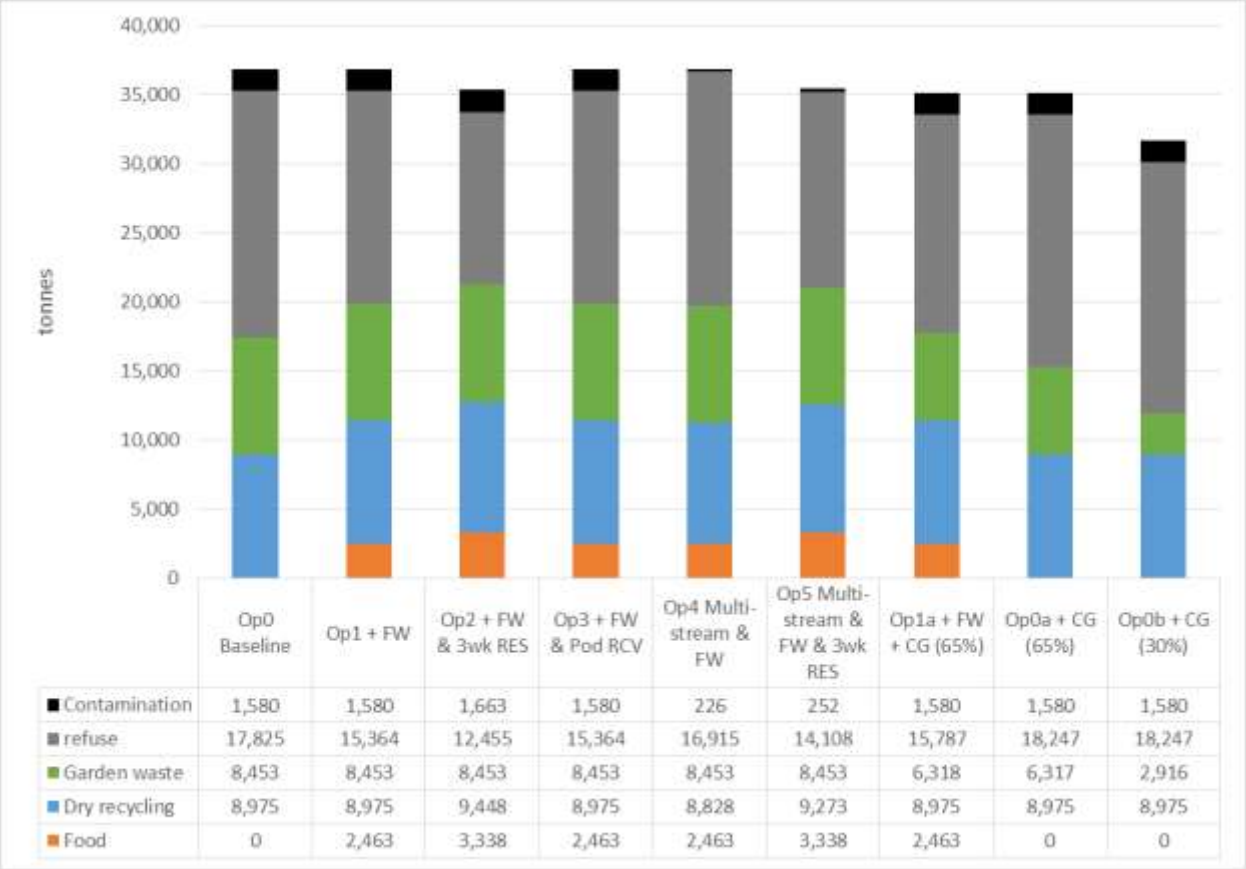
Table A 3-1 Cannock Chase baseline results

	Refuse		Dry recycling		Mixed organics	
Parameter	**KAT**	**Actual**	**KAT**	**Actual**	**KAT**	**Actual**
Collection frequency	Fortnightly		Fortnightly comingled		Fortnightly garden	
Collection vehicle	RCV: 2x 10.5 tonne payload, 1x 13 tonne payload	RCV: 4x 10.5 tonne payload, 1x 13 tonne payload	RCV: 2x 10.5 tonne payload, 1x 13 tonne payload	RCV: 2x 10.5 tonne payload, 1x 13 tonne payload	RCV: 2x 10.5 tonne payload, 1x 13 tonne payload	RCV: 4x 10.5 tonne payload, 1x 13 tonne payload
Number of collection vehicles required	2.5 (5 if include shared with garden)	5	2.7	3	2.5 (5 if include shared with refuse)	5
Collection limited by weight or volume?	Weight	Weight	Volume	Volume	Volume	Volume
Number of loads collected per vehicle per day	2.5	3	2	2	2.4	2
Number of households passed by per vehicle per day	1,679	1,650	1,543	1,650	1,626	1,650

System performance – materials captured

The approximate tonnage for each option is shown in Figure A 3-1. The estimates are based on current data and projected performance for each option, as presented in Section 4.0 of the main report. The values for dry recyclate exclude contamination, which is assumed to be 15% for the current service and 2% for the multi-stream options

Figure A 3-1 Tonnage of each stream collected in each option



	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
Contamination	1,580	1,580	1,663	1,580	226	252	1,580	1,580	1,580
refuse	17,825	15,364	12,455	15,364	16,915	14,108	15,787	18,247	18,247
Garden waste	8,453	8,453	8,453	8,453	8,453	8,453	6,318	6,317	2,916
Dry recycling	8,975	8,975	9,448	8,975	8,828	9,273	8,975	8,975	8,975
Food	0	2,463	3,338	2,463	2,463	3,338	2,463	0	0

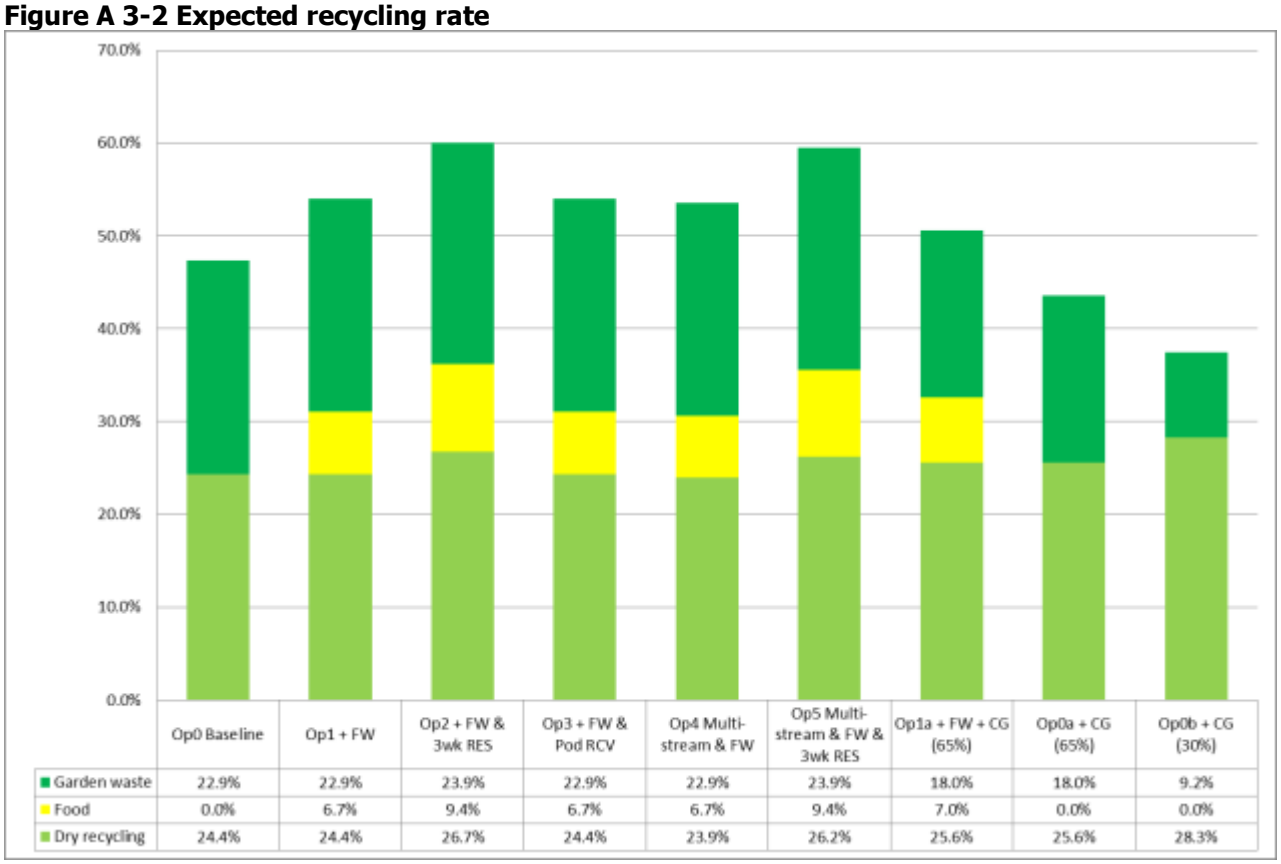
Key observations

- Food waste and recycling tonnages collected are assumed to increase by operating a three weekly collection, along with a reduction in overall waste;
- Multi-stream recycling reduces the level of contamination;
- Operating a chargeable garden waste scheme will reduce the quantity of garden waste collected at the kerbside.

Recycling Rate

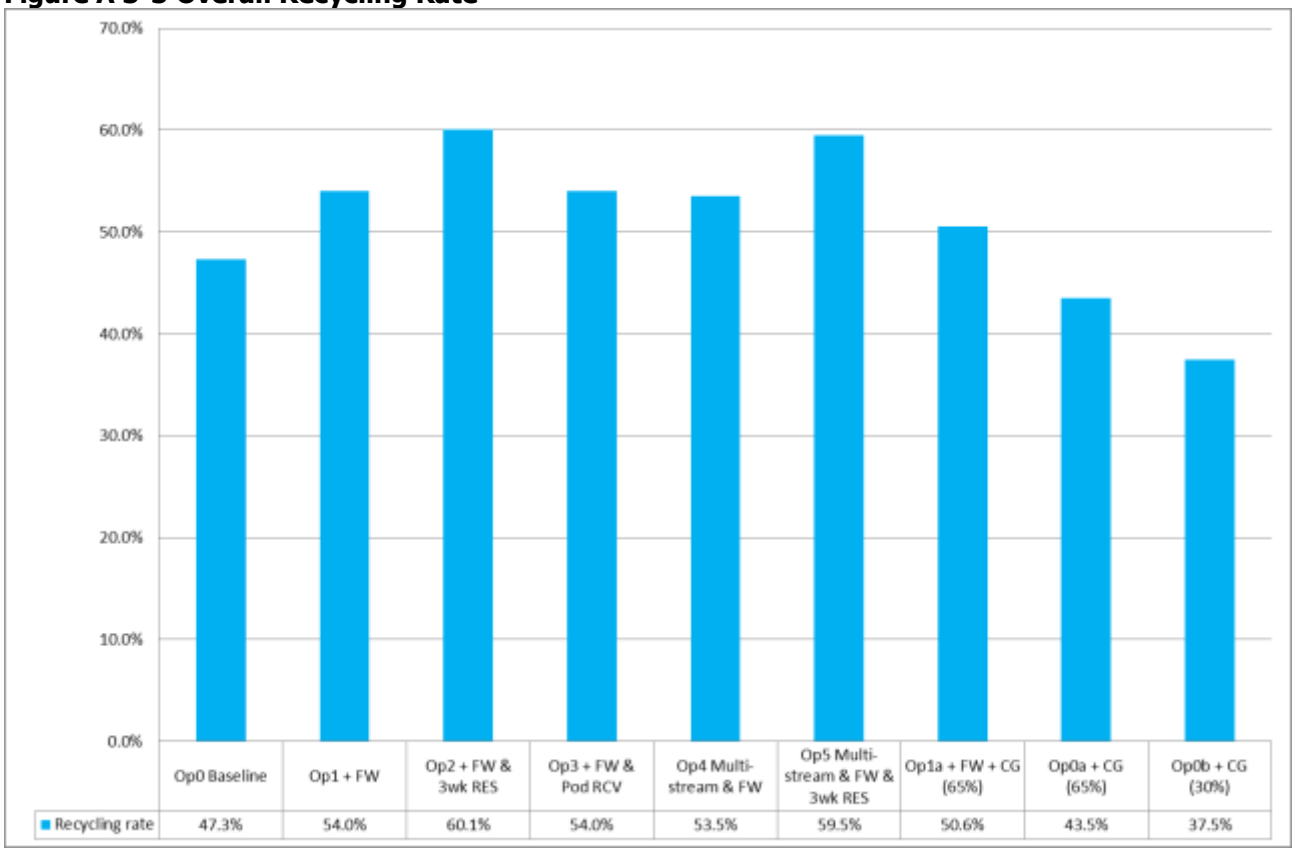
The expected recycling rates for dry recycling, food waste and garden waste for each option are shown individually in Figure A 3-2, whilst the overall recycling rate is presented in Figure A 3-3.

Figure A 3-2 Expected recycling rate



	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
Garden waste	22.9%	22.9%	23.9%	22.9%	22.9%	23.9%	18.0%	18.0%	9.2%
Food	0.0%	6.7%	9.4%	6.7%	6.7%	9.4%	7.0%	0.0%	0.0%
Dry recycling	24.4%	24.4%	26.7%	24.4%	23.9%	26.2%	25.6%	25.6%	28.3%

Figure A 3-3 Overall Recycling Rate



	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
Recycling rate	47.3%	54.0%	60.1%	54.0%	53.5%	59.5%	50.6%	43.5%	37.5%

Key observations

- Recycling rates range between 37% (Option 0b) and 60% (Options 2 & 5).
- The increase in the recycling rate, as a result of increased capture of food waste, is between 7% and 9% depending on the collection system.
- Dry recycling rates range between 24% and 28% depending on the option. This is determined by the type of recycling collection service offered and its frequency. The options with a chargeable garden service cause an increase in the dry recycling percentage (not tonnage) due to less waste collected within the kerbside schemes, but the overall recycling rate is lower for these options, due to reduced quantities of compostable material being collected.
- Options 2 and 5 have the highest recycling rate (~60%), due to separately collected food waste, increased dry recycling and reduced overall waste caused by three-weekly residual collections.
- Option 0b has the lowest recycling rate of the options modelled, this is due to having a weekly residual collection and a fortnightly comingled collection.

Resources required – front line vehicles

The KAT modelling shows that different numbers of front line vehicles are required across the options. Although some of the existing vehicles may be suitable for use initially, we have modelled on the assumption that all options require a new vehicle fleet, and costs are depreciated and included in order to take this into account. We have taken this approach as the existing collection vehicles will ultimately need replacing and it allows for options to be compared on a like for like basis. Table A 3-2 and Table A 3-3 show the key operational parameters and the difference in the numbers and types of vehicles required in each of the modelled collection options.

Table A 3-2 Key operational parameters

Parameter	Scenario	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
Number of vehicles	Dry	2.7	2.7	2.8	2.7	9.4	9.4	2.7	2.7	2.7
	Garden	2.5	2.5	2.5	3.4	2.5	2.5	1.6	1.6	0.8
	Food	-	3.7	4.3	-	-	-	3.7	-	-
	Refuse	2.5	2.5	1.6	3.3	2.5	1.6	2.5	2.5	2.5
	Total	**7.7**	**11.4**	**11.3**	**9.4**	**14.4**	**13.6**	**10.5**	**6.8**	**5.9**
Number of households passed by per vehicle per day	Dry	1,543	1,543	1,466	1,543	881	877	1,543	1,543	1,543
	Garden	1,638	1,638	1,638	1,213	1,638	1,638	1,638	1,638	1,638
	Food		2,205	1,931				2,205		
	Refuse	1,683	1,683	1,683	1,259	1,683	1,675	1,683	1,683	1,683
Number of loads collected per vehicle per day	Dry	2.0	2.0	2.0	2.0	1.3	1.4	2.0	2.0	2.0
	Garden	1.3	1.3	1.3	1.2	1.3	1.3	1.5	1.5	1.5
	Food		0.8	1.0				0.8		
	Refuse	2.5	2.2	2.7	2.0	2.4	3.0	2.2	2.6	2.6

Table A 3-3 Vehicles required for each option

	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
RCV	8	8	7	4	5	5	7	7	6
Romaquip	0	0	0	0	10	10	0	0	0
REL + Pod	0	0	0	6	0	0	0	0	0
SplitRCV	0	0	0	0	0	0	0	0	0
Food	0	4	5	0	0	0	4	0	0
Total	**8**	**12**	**12**	**10**	**15**	**15**	**11**	**7**	**6**

The key observations from the number of front line vehicles modelled are:

- A dedicated food waste service requires 4 or 5 vehicles depending on the amount of material collected.
- Operating a three-weekly residual collection reduces residual RCV vehicles by 1.
- Using a pod based vehicle increases the vehicles required by 2, compared to the baseline.
- Moving to a chargeable garden waste collection reduces the vehicles required by 1 or 2, depending on the number of households taking up the scheme.
- A multi-stream service is likely to require 10 romaquip type vehicles to service the authority.
- All the options require additional vehicles compared to the baseline, except Options 0a and 0b, where 7 and 6 vehicles are required respectively (down from 8 for the baseline).

Annual vehicle costs

We have estimated the capital costs for the purchase of vehicles using the unit costs presented in Appendix 1. We have detailed the total vehicle capital cost in **Table A 3-4**. It is assumed that all vehicles will need to be purchased, with the cost depreciated over 10 years.

Table A 3-4 Vehicle capital cost to purchase

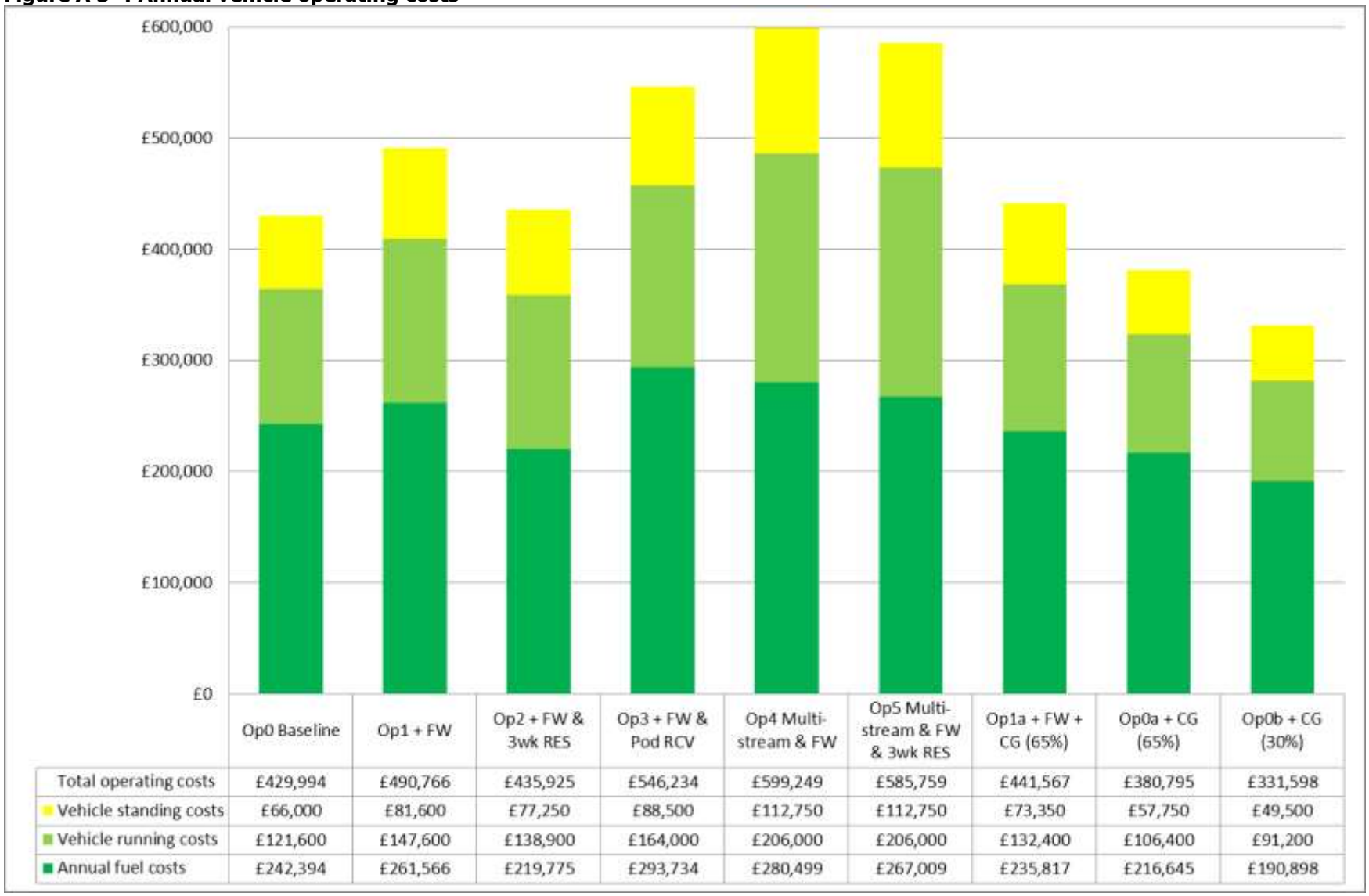
	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
RCV	£1,216,000	£1,216,000	£1,064,000	£608,000	£760,000	£760,000	£1,064,000	£1,064,000	£912,000
Romaquip					£1,300,000	£1,300,000			
REL + Pod				£1,032,000					
SplitRCV									
Food		£260,000	£325,000				£260,000		
Total	**£1,216,000**	**£1,476,000**	**£1,389,000**	**£1,640,000**	**£2,060,000**	**£2,060,000**	**£1,324,000**	**£1,064,000**	**£912,000**

The key observations are:

- Options 4 and 5 is the most expensive option in terms of vehicle costs, primarily due to the high number of multi-stream vehicles required to collect dry recycling and food waste weekly.
- Option 0b has the lowest vehicle costs, this is because it requires the least number of vehicles due to the introduction of a chargeable garden waste service.

The annual vehicle operating costs are shown in Figure A 3-4. These include vehicle fuel, maintenance, operating and running costs.

Figure A 3-4 Annual vehicle operating costs



	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
Total operating costs	£429,994	£490,766	£435,925	£546,234	£599,249	£585,759	£441,567	£380,795	£331,598
Vehicle standing costs	£66,000	£81,600	£77,250	£88,500	£112,750	£112,750	£73,350	£57,750	£49,500
Vehicle running costs	£121,600	£147,600	£138,900	£164,000	£206,000	£206,000	£132,400	£106,400	£91,200
Annual fuel costs	£242,394	£261,566	£219,775	£293,734	£280,499	£267,009	£235,817	£216,645	£190,898

The key observations are:

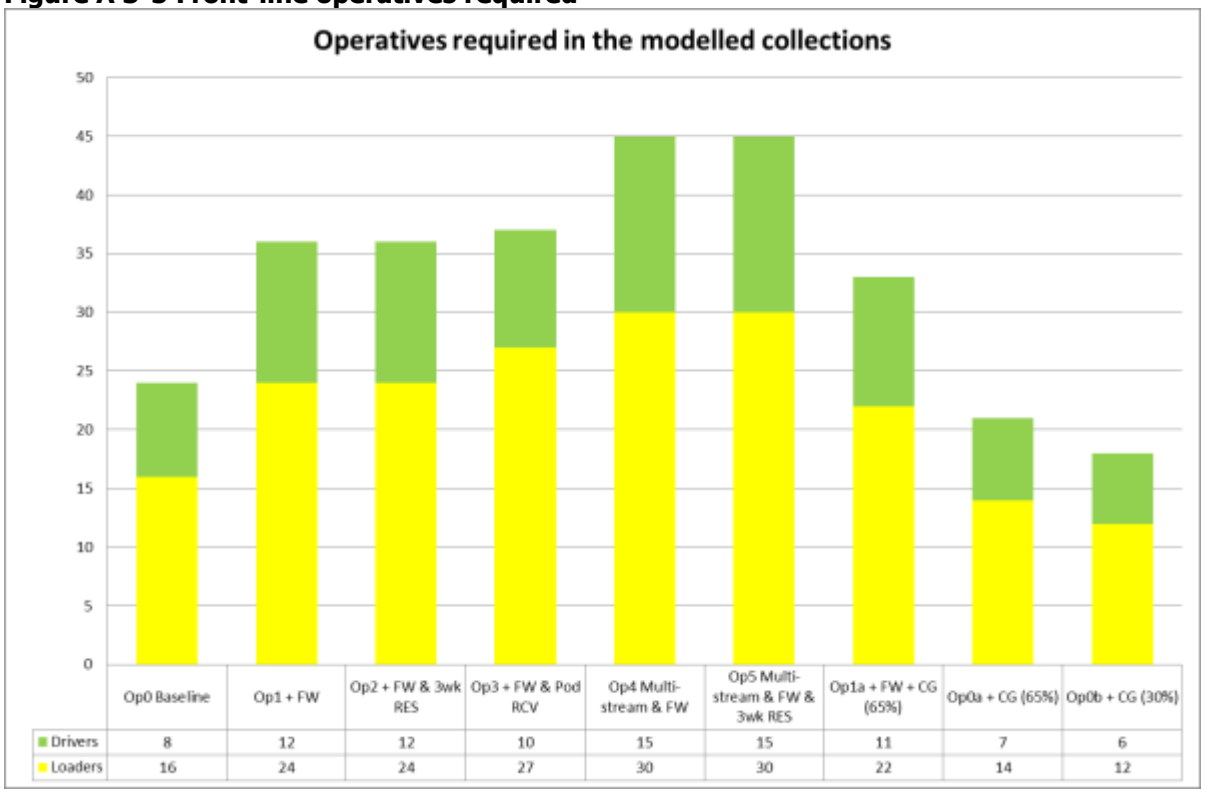
- Options 4 and 5 have the highest vehicle costs, this is due to the high number of multi-stream vehicles.
- Options 0a and 0b have the lowest vehicle and operating costs, this is due the introduction of chargeable garden waste schemes reducing vehicle numbers.
- Operating a dedicated food waste collection increases vehicle costs compared to the Baseline (Option 1), but moving to a three-weekly residual collection (Option 2) helps reduce these costs to a level similar to the baseline.
- The pod-based collection of food waste results in greater costs than a dedicated food waste service.

Resources required – front line operatives

The number of front line operatives required directly relates to the number and type of vehicles required. Appendix 1 lists the number of operatives used in each vehicle and the unit costs.

Figure A 3-5 shows the number of front-line operatives estimated for each scenario. Options 4 and 5 require the highest number of operatives due to the multi-stream vehicles. This is closely followed by Option 3 with the pod vehicles. Options 0a and 0b have the lowest front-line operative requirements, this is due to the lower number of vehicles used when moving to a chargeable garden waste service. Operating a dedicated food waste service increases front line operatives; this is not reduced by moving to a three weekly service as the number of vehicles required is the same (although a different mix of type).

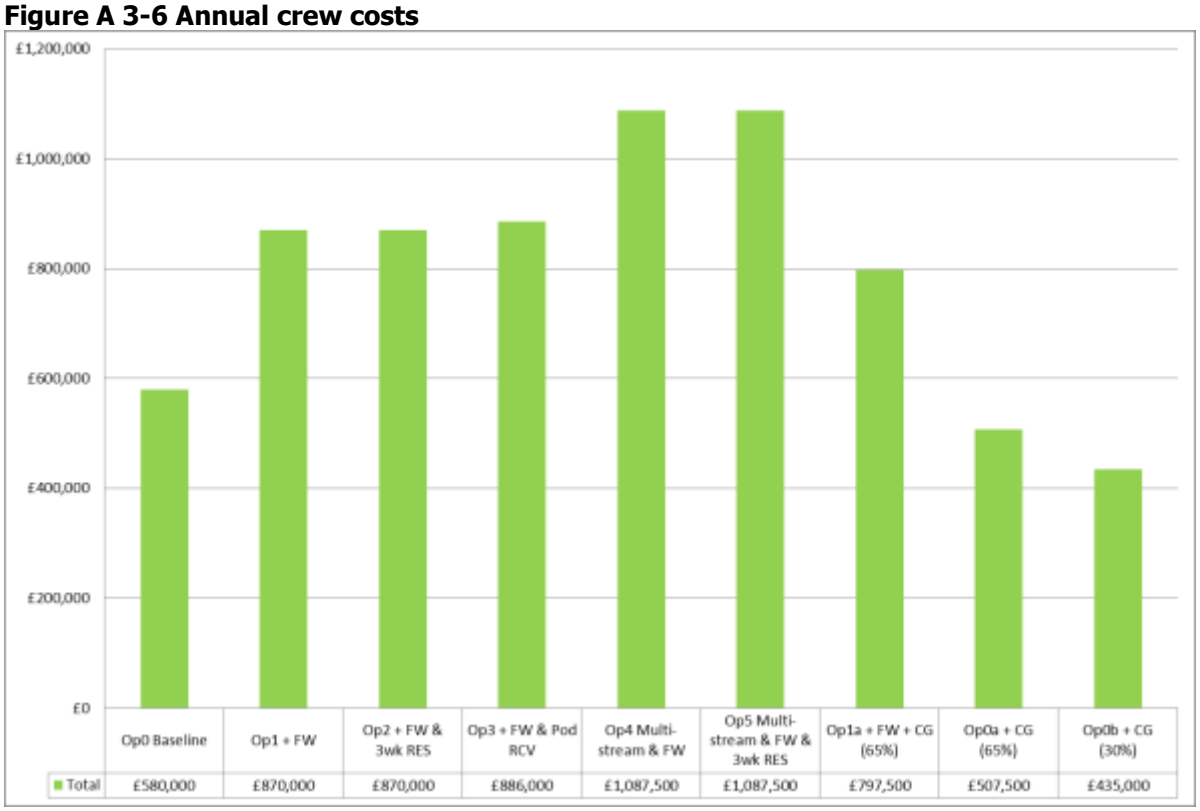
Figure A 3-5 Front-line operatives required



Annual crew costs

The annual crew costs include drivers, loaders and supervisor costs, Figure A 3-6.

Figure A 3-6 Annual crew costs



The key observations on resource requirements are that:

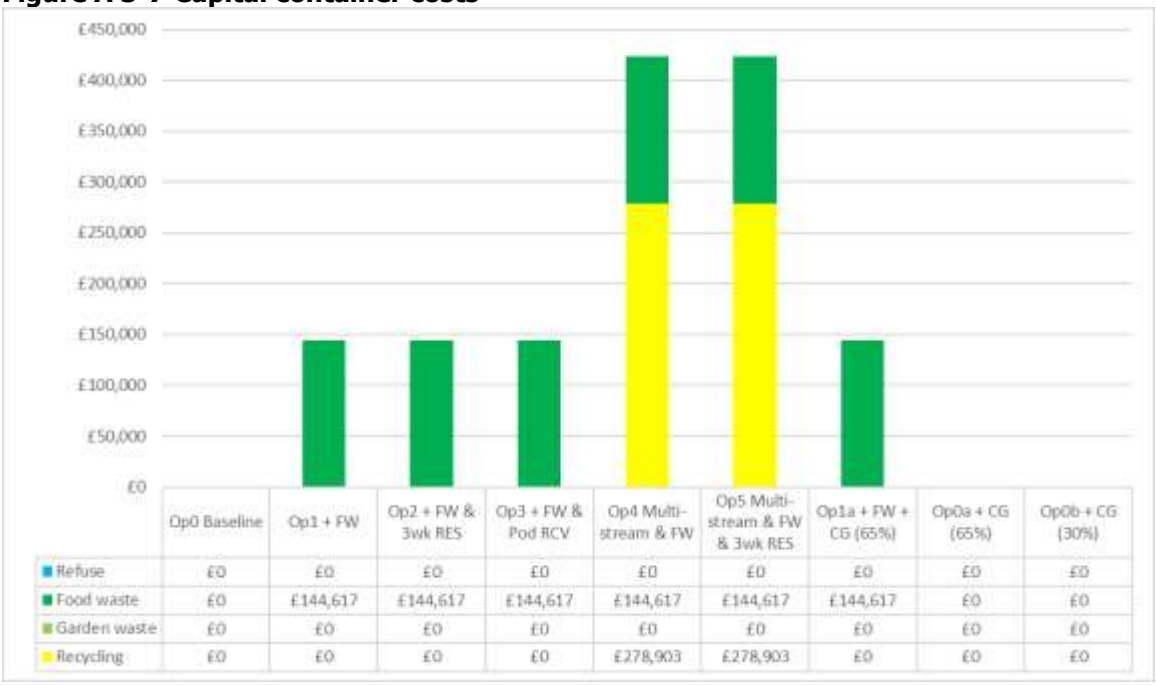
- Option 0b has the lowest crew costs overall (~£420,000), this service has the lowest number of vehicles which translates into the lowest crew numbers and thus costs;
- Options 4 and 5 have the highest crew costs, this is because of the high number of vehicles on the multi-stream service and the high number of operatives per vehicle (a driver and 3 loaders).

Resources required – containers

There are also capital container costs associated with some of the options, where a new collection or set of containers is provided.

For a multi-stream recycling service it has been assumed that each household would receive three boxes that would be purchased as new. Food waste collections require each household to have a food caddy and 23ltr container. These are shown in Figure A 3-7.

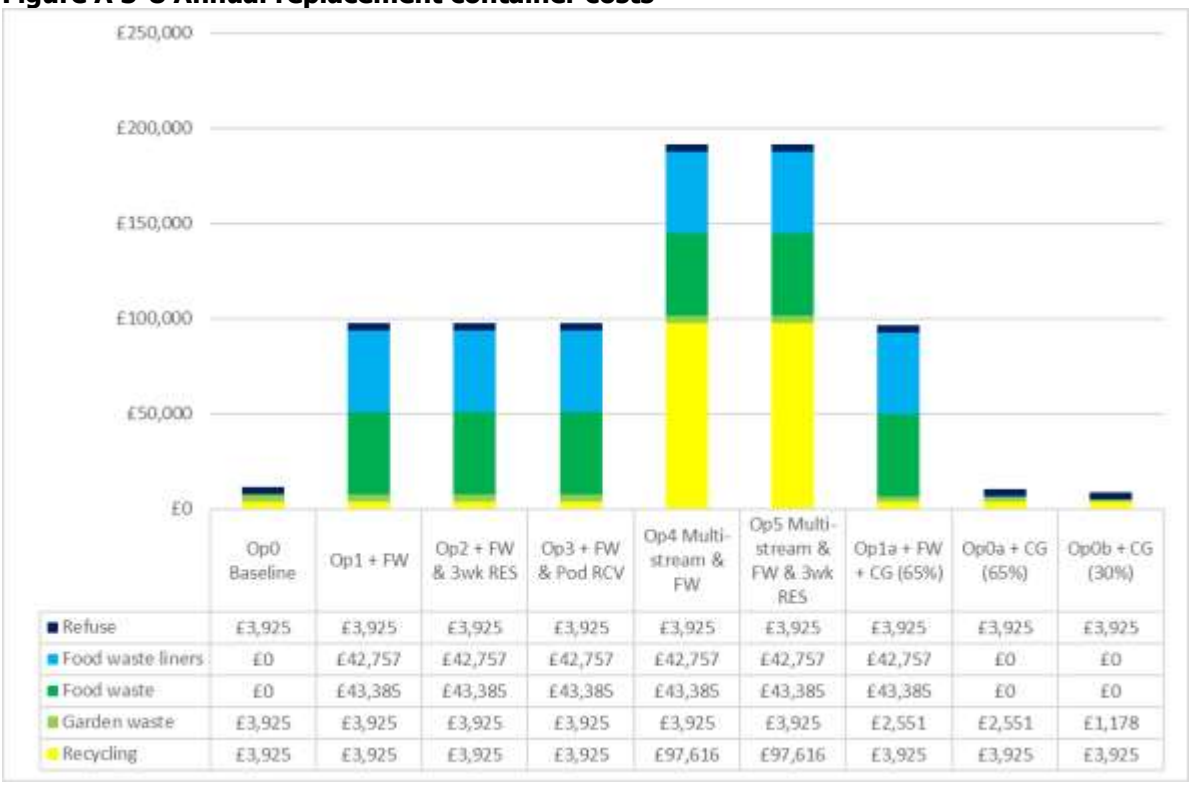
Figure A 3-7 Capital container costs



	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
Refuse	£0	£0	£0	£0	£0	£0	£0	£0	£0
Food waste	£0	£144,617	£144,617	£144,617	£144,617	£144,617	£144,617	£0	£0
Garden waste	£0	£0	£0	£0	£0	£0	£0	£0	£0
Recycling	£0	£0	£0	£0	£278,903	£278,903	£0	£0	£0

In addition to the purchase of new bins, there is also an annual replacement cost for provided containers, e.g. lost or damaged bins. Figure A 3-8 shows the annualised capital costs of purchasing new containers (based on their excepted life time), the annual replacement costs and annual cost of proving food waste liners (2 per household per week). The cost of collecting and disposing of 'old' bins is not included, and would be an additional consideration for the authority. However, this may be a cost neutral activity, as once the 'old' bins are collected, they can be sold and chipped for recycling.

Figure A 3-8 Annual replacement container costs



	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
Refuse	£3,925	£3,925	£3,925	£3,925	£3,925	£3,925	£3,925	£3,925	£3,925
Food waste liners	£0	£42,757	£42,757	£42,757	£42,757	£42,757	£42,757	£0	£0
Food waste	£0	£43,385	£43,385	£43,385	£43,385	£43,385	£43,385	£0	£0
Garden waste	£3,925	£3,925	£3,925	£3,925	£3,925	£3,925	£2,551	£2,551	£1,178
Recycling	£3,925	£3,925	£3,925	£3,925	£97,616	£97,616	£3,925	£3,925	£3,925

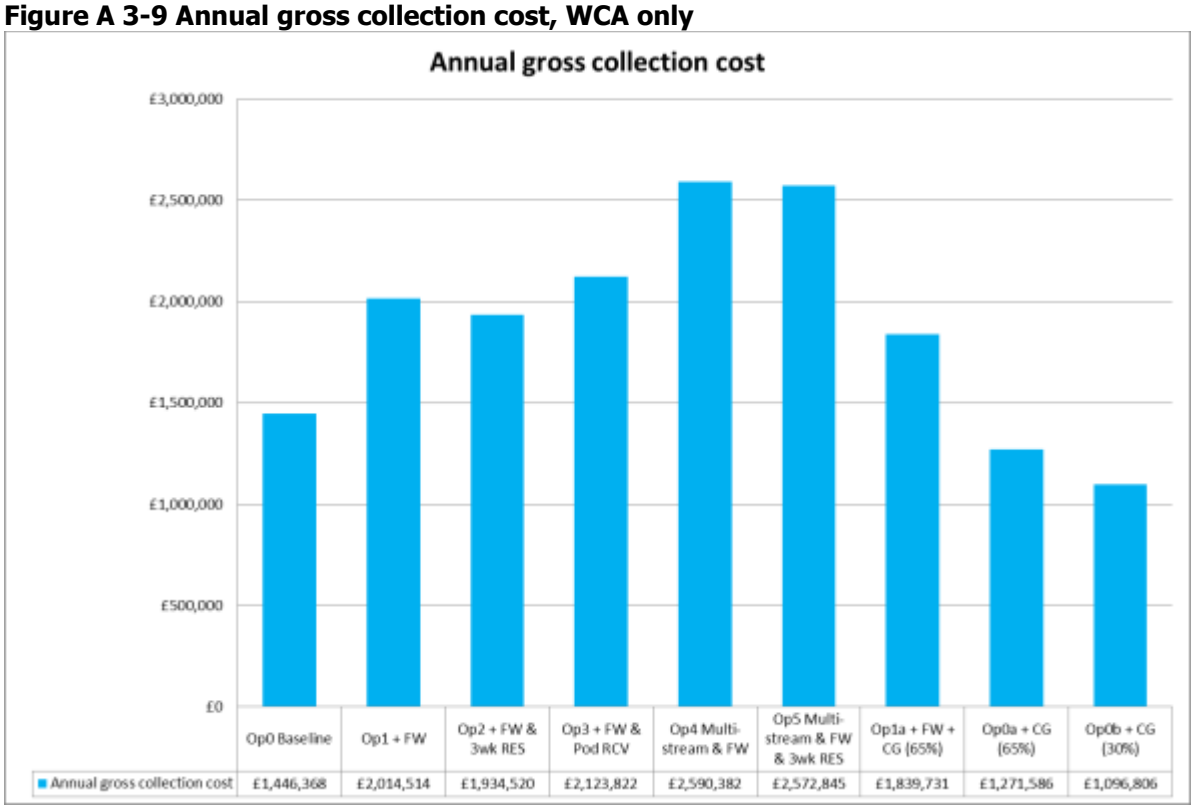
Observations:

- Introducing new schemes such as food waste and multi-stream recycling increased container costs due to the purchase of new containers. Even when annualised the costs can be significant.
- The baseline and options 0a and 0b have has the lowest container replacement costs due to them offering no new services.
- All garden waste collections have the same container costs, but these decrease as the number of households on the chargeable scheme decrease.
- Multi-stream collections have the highest cost for containers due to the cost of new boxes and food waste containers.

Annual gross collections costs

The cost of waste and recycling collections is a significant consideration for local authorities when determining their future collection system configuration. The annual gross collection cost of each option, is shown Figure A 3-9. This includes the cost of front-line operatives, supervision, annualised container costs (including the purchase of new containers where necessary and replacement containers at an assumed percentage replacement rate), vehicle costs (depreciated over 10 years) and vehicle standing and running costs and fuel. N.B. The gross collection costs exclude recycling credits, MRF gates fees and any material income from recycled materials and any disposal costs.

Figure A 3-9 Annual gross collection cost, WCA only



Observations:

- The multi-stream options (4 & 5) have the largest annual gross costs of ~ £2.5m, due to a combination of large vehicle numbers, leading to higher running costs and associated crew costs.
- The Baseline and Options 0a and 0b have the lowest annual gross cost, this is because they have the lowest crew numbers, coupled with the lowest vehicle numbers.
- All the options with some form of food waste collection have increased gross collection costs due to the additional vehicles (either dedicated or pod-based).

WCA net costs

This section provides an estimate of the WCA net costs, which includes:

- The gross collection costs;
- MRF gates fees and any material income from recycled materials;
- Garden and food waste treatment costs;
- Bulking of food waste where not able to direct deliver; and
- Recycling credits.

The current material values for dry recycling are taken from MRF data provided by the authority. Where the materials are collected separately, we have assumed that the authority would receive the full market value. Treatment for food waste and garden waste is based on data provided by the authority or an agreed assumption.

Detailed cost data is provided in Appendix 2.

For separately collected materials, these costs do not include the following, as the uncertainties involved are beyond the scope of the project:

- Any change to delivery points - Where a new collection system is used, the existing transfer station may not be suitable and so an alternative would be required;
- Infrastructure changes – for example, additional bays may be required where there are an increased number of material streams. Where these bays do not exist, there would be capital costs required to put them in place. There may also be a need to purchase additional plant, such as a forklift or loading shovel. Some of these costs may be passed on to the Councils, either directly or indirectly;
- Bulking and haulage – the bulking and haulage of materials are an additional cost. This includes arranging for materials to be taken to reprocessors.
- The cost for this haulage would be highly dependent on the final destination and the fuel costs; and
- Similarly, the recycling income figures are derived from information in the public domain and these may not accurately reflect the income offered by a service provider.

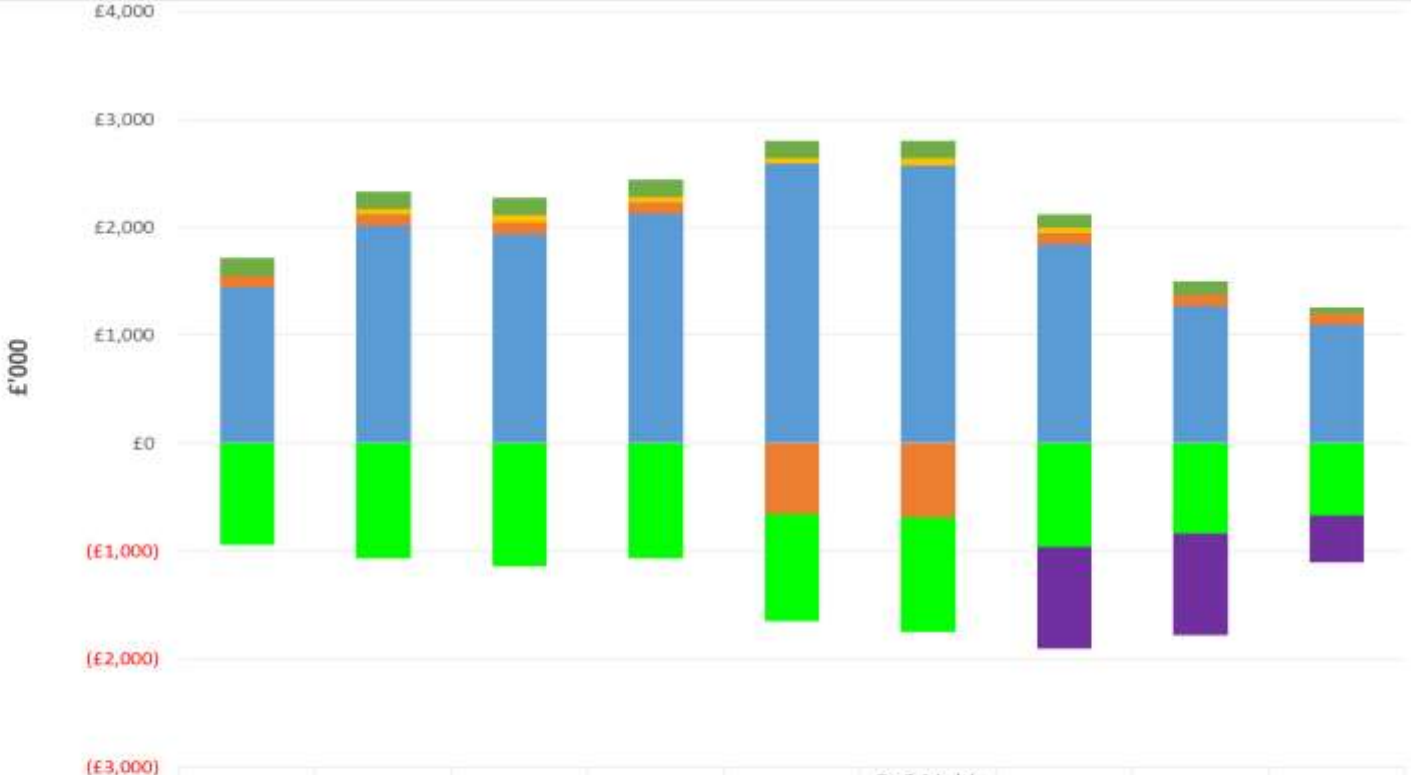
The Council receives recycling credits from the Waste Disposal Authority (WDA) equivalent to £50 for every tonne of dry recycling or food waste that avoids being sent for disposal as residual waste. The WDA pays recycling credits for garden waste collected of £49 per tonne, this is because the WDA does not pay for the disposal of organic waste collected by the authorities.

Figure A 3-10 shows the main cost categories for the authority. There are a number of categories that are income generating, such as recycling credits, garden waste charges and income from materials sales, these are negative and appear below the y axis.

Observations:

- The collection costs are the dominant category, followed by recycling credits.
- Using a MRF to sort material typically results in additional costs, whilst the sale of materials from a multi-stream service typically results in significant income.
- The garden, food and mixed organic processing costs make up only a small part of the costs compared to most of the other categories.

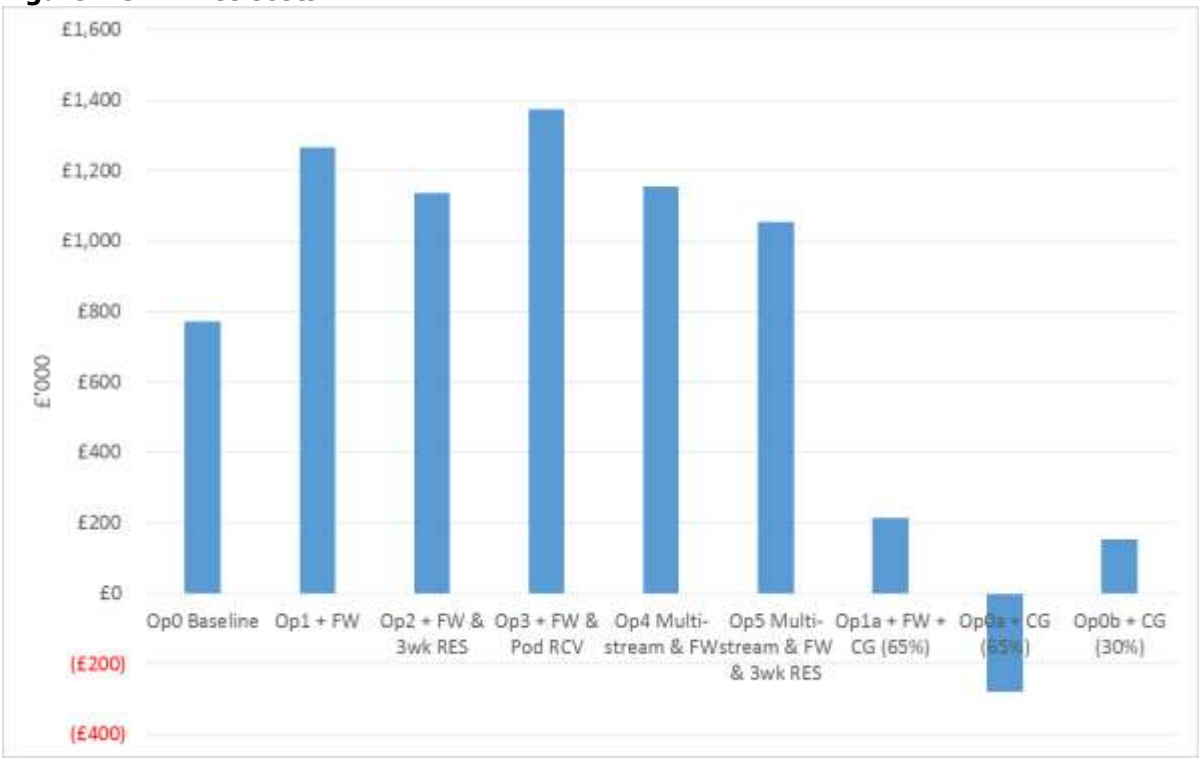
Figure A 3-10 WCA cost categories (£'000)



	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
Garden waste charge	0	0	0	0	0	0	-940	-940	-434
Recycling credits	-944	-1,067	-1,139	-1,067	-992	-1,060	-963	-839	-672
Mixed food & Garden Waste Treatment	0	0	0	0	0	0	0	0	0
Garden Waste Treatment	163	163	163	163	163	163	122	122	56
Food Waste Treatment	0	49	67	49	49	67	49	0	0
Bulking	0	0	0	0	0	0	0	0	0
Dry income/charge	106	106	111	106	-655	-688	106	106	106
Collection costs	1,446	2,015	1,935	2,124	2,590	2,573	1,840	1,272	1,097

The total annual net collection costs are also presented in the chart below, Figure A 3-11.

Figure A 3-11 Net Costs



Key observations:

- The main 5 options all increase the net WCA costs, in part due to the addition of food waste collections.
- Option 3 is the most expensive collection system, this is due to the use of pod vehicles requiring an additional loader, and the increased costs associated with that particular vehicle.
- Moving to a multi-stream service increases the collection costs but these are offset significantly by greater income from materials' sales.
- The net costs of options where a chargeable garden service is introduced are consistently below the Baseline. This is due to a combination of lower vehicle numbers, crew costs and most significantly, the income stream from charging £35 per household.
- Introducing a chargeable garden waste scheme could potentially result in lower overall costs even if a dedicated food waste scheme were also introduced at the same time.
- Moving to a three-weekly residual collection does result in lower net costs but not sufficient to offset the introduction of a food waste collection.

Options summary

The total annual net collection costs and recycling rates for each option are shown in the table below (Table A 3-5). The ranks of both the cost and recycling rates are also provided.

Table A 3-5 Annual net costs, WCA

Option	WCA Total (£k)	Difference to Baseline	Rank	Recycling rate	Rank
Op0 Baseline	771	0	4	47%	7
Op1 + FW	1,265	494	8	54%	4
Op2 + FW & 3wk RES	1,137	365	6	60%	1
Op3 + FW & Pod RCV	1,375	603	9	54%	3
Op4 Multi-stream & FW	1,156	384	7	54%	5
Op5 Multi-stream & FW & 3wk RES	1,055	284	5	59%	2
Op1a + FW + CG (65%)	214	-558	3	51%	6
Op0a + CG (65%)	-280	-1,051	1	44%	8
Op0b + CG (30%)	153	-619	2	37%	9

The main outcomes of the modelling are the following:

- Recycling rates range between 37% and 60%.
- Operating a chargeable garden waste scheme significantly reduces recycling rates but this can be offset to a varying degree by a food waste collection.
- A 7% increase in the recycling rate would be expected for a separate collection of food waste.
- Introducing a food waste collection and a 3 weekly residual service (Option 2) increases recycling rates considerably but also increases costs.
- A multi-stream service with food waste (Options 4 & 5) appears to be a less expensive option than the current service with a dedicated food collection (Option 1 & 2), although this would mean a significant change in how recycling is collected and does not reduce costs below the Baseline.
- The Baseline options with a chargeable garden service (Options 0a and 0b) result in the lowest costs but also the lowest recycling rate.
- Operating a pod vehicle appears to be the most expensive option of collecting food waste.

It is important to note, that whilst the modelled costs show a relative comparison between each option, they do not necessarily represent the actual costs, nor do they show any savings that could be made through service management or through subjecting the service to competition through a procurement exercise.

A3.2 East Staffordshire

Baseline data

The results of the initial baseline for East Staffordshire are shown in Table A 3-6. A comparison with the actual data provided by the Council is also shown.

Some of the average timings provided have been slightly amended to reflect the number of loads and round sizes reported on KAT. The modelling assumes there are 5 vehicles in total used for the refuse and garden waste collections.

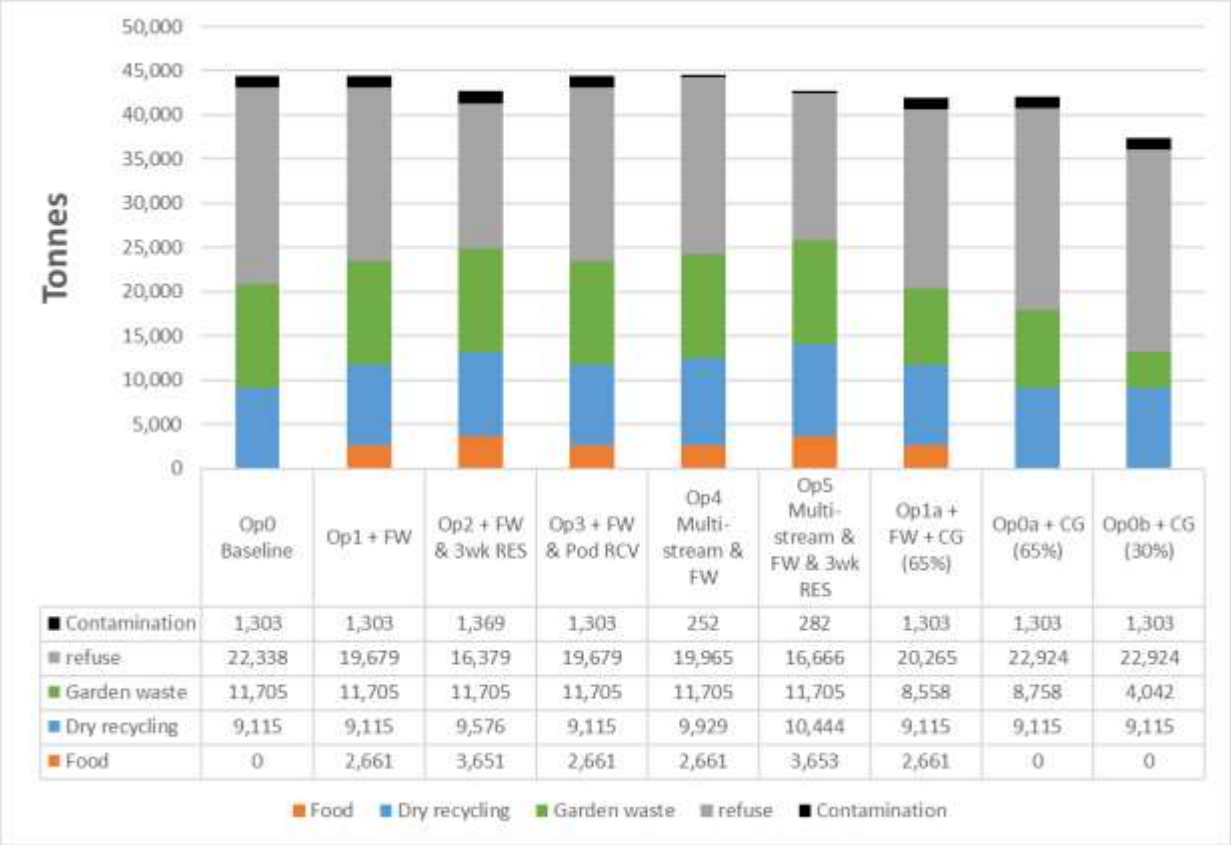
Table A 3-6 East Staffordshire baseline results.

	Refuse		Dry recycling		Mixed organics	
Parameter	**KAT**	**Actual**	**KAT**	**Actual**	**KAT**	**Actual**
Collection frequency	Fortnightly		Fortnightly two-stream		Fortnightly garden	
Collection vehicle	RCV: 10.7 tonne payload	RCV: 10.7 tonne payload	4x 10.7 tonne payload	4x 10.7 tonne payload	RCV: 7x 10.7 tonne payload	RCV: 7x 10.7 tonne payload
Number of collection vehicles required	3.7 (6.9 if include shared organics)	7	3.9	4	3.2 (6.9 if include shared with refuse)	7
Collection limited by weight or volume?	Weight	Weight	Volume	Volume	Volume	Volume
Number of loads collected per vehicle per day	2.2	2-3	2.2	2-3	2.7	1-3
Number of households passed by per vehicle per day	1,320	540 Rural 1540 Urban	947	540 Rural 1540 Urban	1,351	540 Rural 1540 Urban

System performance – materials captured

The approximate tonnage for each option is shown in Figure A 3-12. The estimates are based on current data and projected performance for each option, as presented in Section 4.0 of the main report. The values for dry recyclate exclude contamination, which is assumed to be 12.5% for the current service and 2% for the multi-stream options

Figure A 3-12 Tonnage of each stream collected in each option.



	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
Contamination	1,303	1,303	1,369	1,303	252	282	1,303	1,303	1,303
refuse	22,338	19,679	16,379	19,679	19,965	16,666	20,265	22,924	22,924
Garden waste	11,705	11,705	11,705	11,705	11,705	11,705	8,558	8,758	4,042
Dry recycling	9,115	9,115	9,576	9,115	9,929	10,444	9,115	9,115	9,115
Food	0	2,661	3,651	2,661	2,661	3,653	2,661	0	0

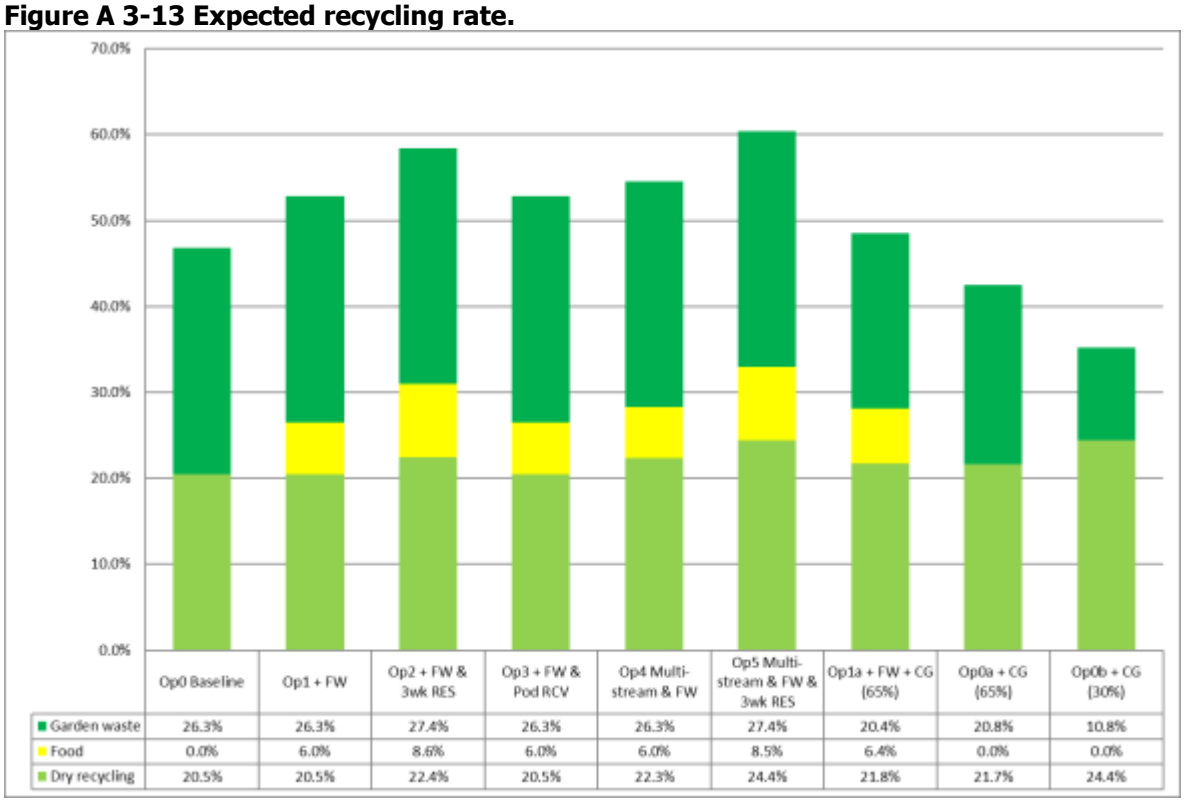
Key observations

- Food waste and recycling tonnages collected are assumed to increase by operating a three weekly collection, along with a reduction in overall waste;
- Multi-stream recycling reduces the level of contamination;
- Operating a chargeable garden waste scheme will reduce the quantity of garden waste collected at the kerbside.

Recycling Rate

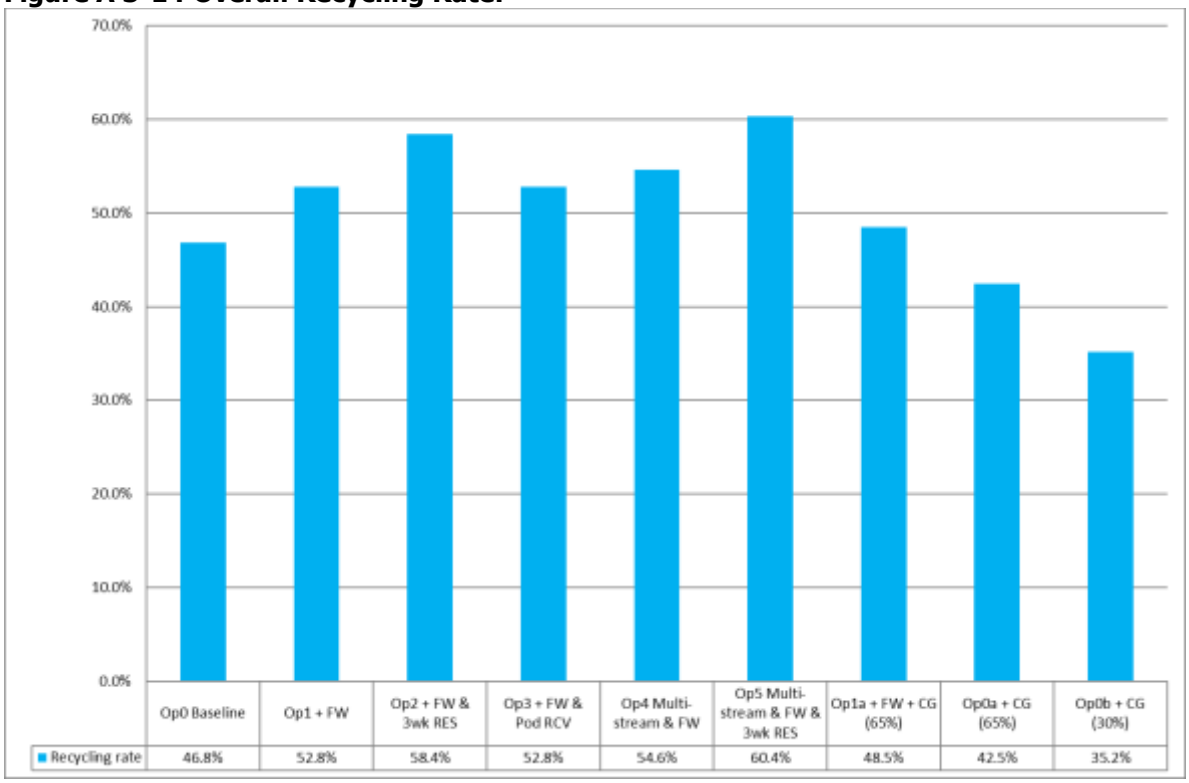
The expected recycling rates for dry recycling, food waste and garden waste for each option can be seen in Figure A 3-13 and overall recycling rate in Figure A 3-14.

Figure A 3-13 Expected recycling rate.



	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
Garden waste	26.3%	26.3%	27.4%	26.3%	26.3%	27.4%	20.4%	20.8%	10.8%
Food	0.0%	6.0%	8.6%	6.0%	6.0%	8.5%	6.4%	0.0%	0.0%
Dry recycling	20.5%	20.5%	22.4%	20.5%	22.3%	24.4%	21.8%	21.7%	24.4%

Figure A 3-14 Overall Recycling Rate.



	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
Recycling rate	46.8%	52.8%	58.4%	52.8%	54.6%	60.4%	48.5%	42.5%	35.2%

Key observations

- Recycling rates range between 35% (Option 0b) and 60% (Option 4).
- The increase in the recycling rate, as a result of increased capture of food waste, is between 6% and 9% depending on the collection system.
- Dry recycling rates range between 21% and 24% depending on the option. This is determined by the type of recycling collection service offered and its frequency. The options with a chargeable garden service cause an increase in the dry recycling

percentage (not tonnage) due to less waste collected within the kerbside schemes, but the overall recycling rate is lower for these options, due to reduced quantities of compostable material being collected.

- Options 2 and 5 have the highest recycling rate (~58-60%), due to separately collected food waste, increased dry recycling and reduced overall waste caused by three-weekly residual collections.
- Option 0b has the lowest recycling rate of the options modelled, this is due to having a weekly residual collection, a fortnightly comingled collection, and less garden waste due to a low uptake with collection being charged for.

Resources required – front line vehicles

The KAT modelling shows that different numbers of front line vehicles are required across the options. Although some of the existing vehicles may be suitable for use initially, we have modelled on the assumption that all options require a new vehicle fleet, and costs are depreciated and included in order to take this into account. We have taken this approach as the existing collection vehicles will ultimately need replacing and it allows for options to be compared on a like for like basis. Table A 3-7 and Table A 3-8 show the key operational parameters and the difference in the numbers and types of vehicles required in each of the modelled collection options.

Table A 3-7 Key operational parameters.

Parameter	Scenario	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
Number of vehicles	Dry	3.87	3.87	3.87	3.87	11.85	11.93	3.87	3.87	3.87
	Garden	3.22	3.22	3.22	5.18	3.22	3.22	2.10	2.10	0.97
	Food	-	4.74	4.90	-	-	-	4.74	-	-
	Refuse	3.73	3.54	2.49	4.20	3.59	2.49	3.64	3.73	3.73
	Total	10.8	15.4	14.5	13.3	18.7	17.6	14.4	9.7	8.6
Number of households passed by per vehicle per day	Dry	1,234	1,234	1,234	1,234	806	801	1,234	1,234	1,234
	Garden	1,482	1,482	1,482	923	1,482	1,482	1,482	1,482	1,482
	Food		2,016	1,951				2,016		
	Refuse	1,281	1,351	1,281	1,137	1,332	1,281	1,312	1,281	1,281
Number of loads collected per vehicle per day	Dry	2.4	2.4	2.6	2.4	1.4	1.5	2.4	2.4	2.4
	Garden	1.5	1.5	1.5	1.1	1.5	1.5	1.7	1.7	1.7
	Food		0.7	1.0				0.7		
	Refuse	2.2	2.0	2.4	2.0	2.0	2.4	2.0	2.2	2.2

Table A 3-8 Vehicles required for each option.

	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
RCV	7.0	7.0	6.0	0.0	7.0	6.0	6.0	6.0	5.0
Romaquip	0.0	0.0	0.0	0.0	12.0	12.0	0.0	0.0	0.0
REL + Pod	0.0	0.0	0.0	10.0	0.0	0.0	0.0	0.0	0.0
SplitRCV	4.0	4.0	4.0	4.0	0.0	0.0	4.0	4.0	4.0
Food	0.0	5.0	5.0	0.0	0.0	0.0	5.0	0.0	0.0
Total	**11.0**	**16.0**	**15.0**	**14.0**	**19.0**	**18.0**	**15.0**	**10.0**	**9.0**

The key observations from the number of front line vehicles modelled are:

- A dedicated food waste service requires 5 vehicles;
- Operating a three-weekly residual collection reduces residual RCV vehicles required from 7 to 6;
- Using a pod based vehicle increases the vehicles required by 3, compared to the baseline. Seven or eight more vehicles are required for a multi-stream service;
- Moving to a chargeable garden waste collection reduces the vehicles required by 1 or 2 (compared to the baseline), depending on the number of households taking up the scheme;
- A multi-stream service is likely to require 12 romaquip type vehicles to service the authority;
- All the options require additional vehicles compared to the baseline, except Options 0a and 0b, where 10 and 9 vehicles are required respectively (down from 11 for the Baseline).

Annual vehicle costs

We have estimated the capital costs for the purchase of vehicles using the unit costs presented in Appendix 1. We have detailed the total vehicle capital cost in the following table. It is assumed that all vehicles will need to be purchased, with the cost depreciated over 10 years.

Table A 3-9 Vehicle capital cost to purchase.

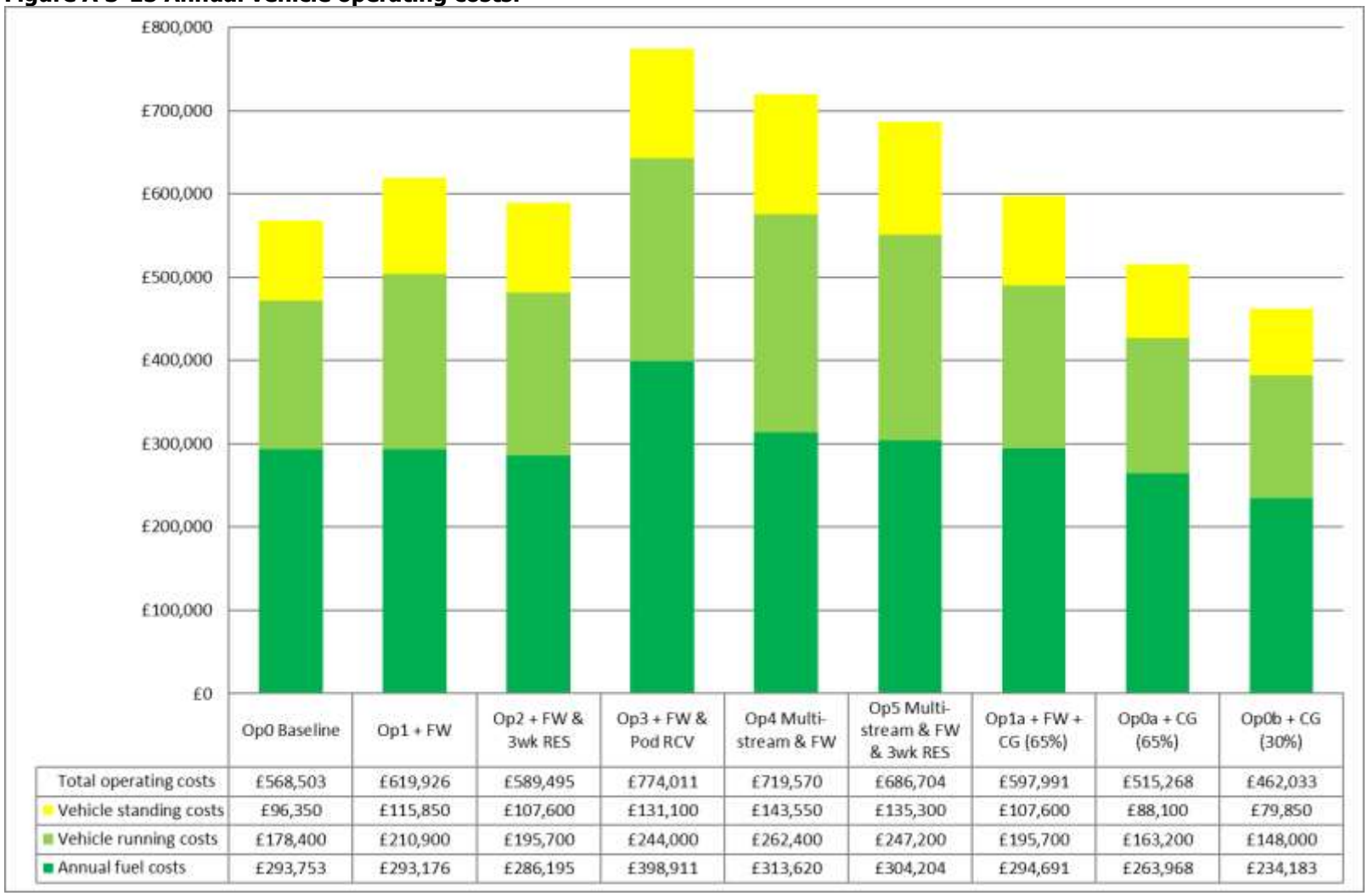
	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
RCV	£1,064,000	£1,064,000	£912,000		£1,064,000	£912,000	£912,000	£912,000	£760,000
Romaquip					£1,560,000	£1,560,000			
REL + Pod				£1,720,000					
SplitRCV	£720,000	£720,000	£720,000	£720,000			£720,000	£720,000	£720,000
Food		£325,000	£325,000				£325,000		
Total	**£1,784,000**	**£2,109,000**	**£1,957,000**	**£2,440,000**	**£2,624,000**	**£2,472,000**	**£1,957,000**	**£1,632,000**	**£1,480,000**

The key observations are:

- Option 4 is the most expensive option in terms of vehicle costs, closely followed by Options 3 and 5, primarily due to the high number of multi-stream vehicles / pods required to collect dry recycling and food waste weekly.
- Option 0b has the lowest vehicle costs, this is because it requires the least number of vehicles due to the introduction of a chargeable garden waste service (with only 30% uptake).

The annual vehicle operating costs are shown in Figure A 3-15. These include vehicle fuel, maintenance, operating and running costs.

Figure A 3-15 Annual vehicle operating costs.



	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
Total operating costs	£568,503	£619,926	£589,495	£774,011	£719,570	£686,704	£597,991	£515,268	£462,033
Vehicle standing costs	£96,350	£115,850	£107,600	£131,100	£143,550	£135,300	£107,600	£88,100	£79,850
Vehicle running costs	£178,400	£210,900	£195,700	£244,000	£262,400	£247,200	£195,700	£163,200	£148,000
Annual fuel costs	£293,753	£293,176	£286,195	£398,911	£313,620	£304,204	£294,691	£263,968	£234,183

The key observations are:

- Option 3 has the highest vehicle costs, this is due to high pod vehicles costs and also the higher fuel costs for the podded vehicles, due to additional vehicles. Options 4 and 5 are the next most expensive to run, due to the high number of multi-stream vehicles;
- Options 0a and 0b have the lowest vehicle and operating costs, this is due the introduction of chargeable garden waste schemes reducing vehicle numbers;
- Operating a dedicated food waste collection (Option 1) increases vehicle costs compared to the Baseline, but moving to a three-weekly residual collection (Option 2) helps reduce these costs to a level similar to the baseline;
- The pod-based collection of food waste results in greater costs than a dedicated food waste service.

Resources required – front line operatives

The number of front line operatives required directly relates to the number and type of vehicles required. Appendix 1 lists the number of operatives used in each vehicle and the unit costs.

Figure A 3-16 shows the number of front-line operatives estimated for each scenario. Options 4 and 5 require the highest number of operatives due to the multi-stream vehicles. This is closely followed by Option 3 with the pod vehicles. Options 0a and 0b have the lowest front-line operative requirements, this is due to the lower number of vehicles used when moving to a chargeable garden waste service. Operating a dedicated food waste service increases front line operatives; this is not reduced by moving to a three weekly service as the number of vehicles required is the same (although a different mix of type).

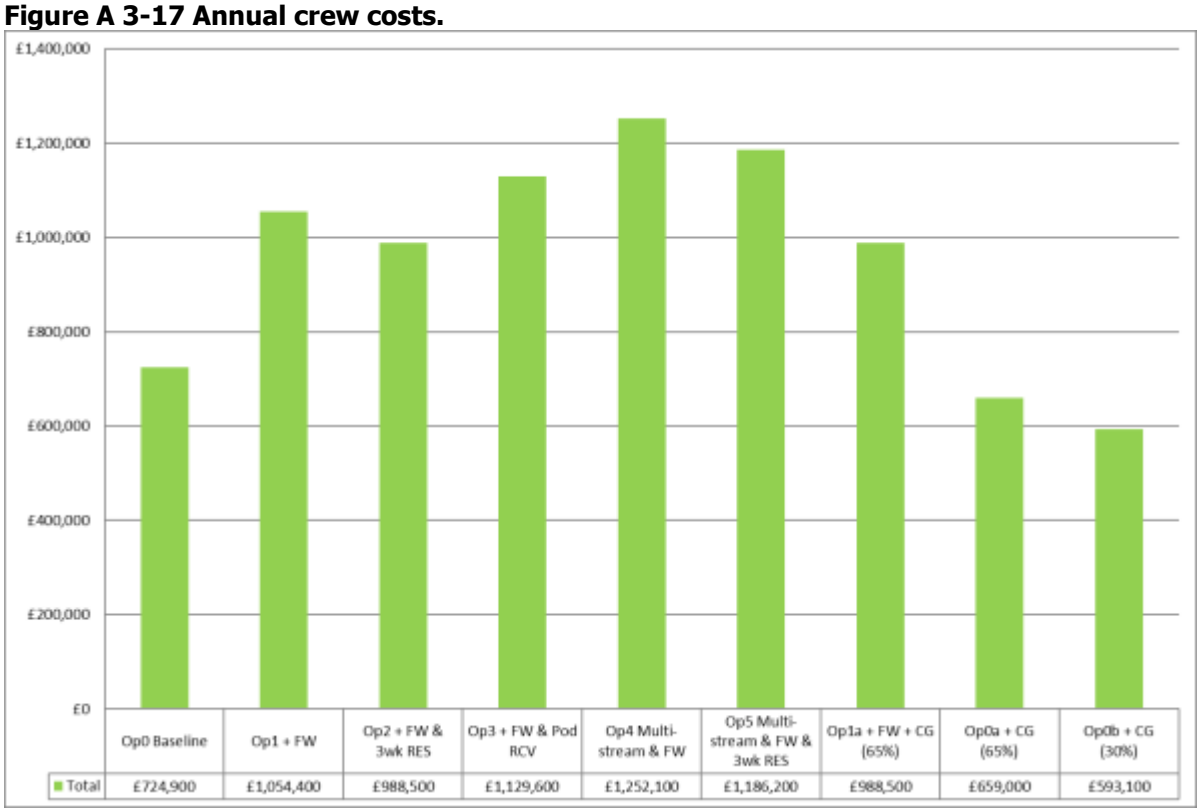
Figure A 3-16 Front-line operatives required.

	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
Drivers	11	16	15	14	19	18	15	10	9
Loaders	22	32	30	38	38	36	30	20	18

Annual crew costs

The annual crew costs include drivers, loaders and supervisor costs, Figure A 3-17.

Figure A 3-17 Annual crew costs.



The key observations on resource requirements are that:

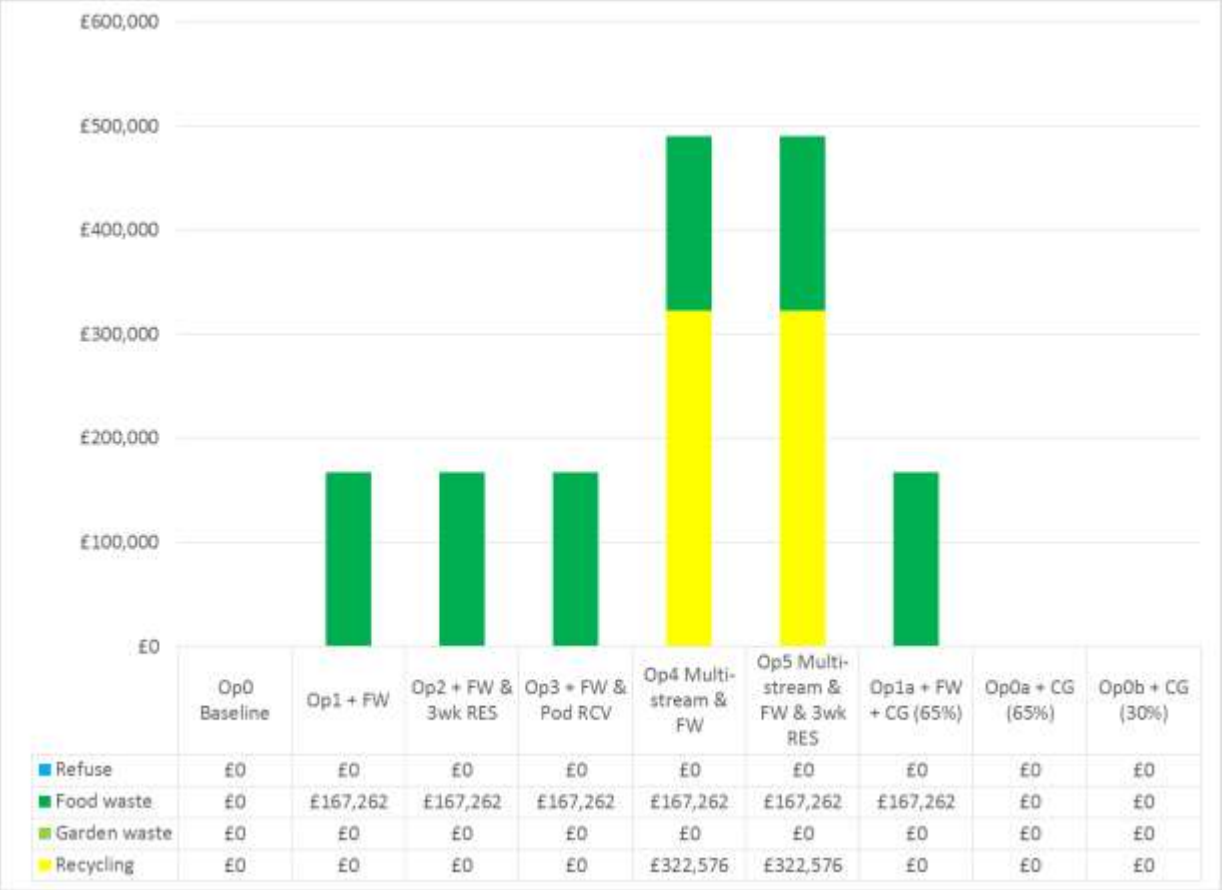
- Option 0b has the lowest crew costs overall (~£600,000). This service has the lowest number of vehicles which translates into the lowest crew numbers and thus costs;
- The Baseline and Option 0a have similar staff costs, based on similar numbers of drivers and operatives;
- Options 4 and 5 have the highest crew costs, this is because of the high number of vehicles on the multi-stream service and the high number of operatives per vehicle (a driver and 3 loaders).

Resources required – containers

There are also capital container costs associated with some of the options, where a new collection or set of containers is provided.

For a multi-stream recycling service it has been assumed that each household would receive three boxes that would be purchased as new. Food waste collections require each household to have a food caddy and 23ltr container. The cost of these are shown in the following chart.

Figure A 3-18 Capital container costs.



	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
Refuse	£0	£0	£0	£0	£0	£0	£0	£0	£0
Food waste	£0	£167,262	£167,262	£167,262	£167,262	£167,262	£167,262	£0	£0
Garden waste	£0	£0	£0	£0	£0	£0	£0	£0	£0
Recycling	£0	£0	£0	£0	£322,576	£322,576	£0	£0	£0

In addition to the purchase of new bins, there is also an annual replacement cost for provided containers, e.g. lost or damaged bins. Figure A 3-19 shows the annualised capital costs of purchasing new containers (based on their excepted life time), the annual replacement costs and annual cost of proving food waste liners (2 per household per week). The cost of collecting and disposing of 'old' bins is not included, and would be an additional consideration for the authority. However, this may be a cost neutral activity, as once the 'old' bins are collected, they can be sold and chipped for recycling.

Figure A 3-19 Annual container replacement costs.

	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
Refuse	£4,540	£4,540	£4,540	£4,540	£4,540	£4,540	£4,540	£4,540	£4,540
Food waste liners	£0	£42,757	£42,757	£42,757	£42,757	£42,757	£42,757	£0	£0
Food waste	£0	£50,178	£50,178	£50,178	£50,178	£50,178	£50,178	£0	£0
Garden waste	£4,540	£4,540	£4,540	£4,540	£4,540	£4,540	£2,951	£2,951	£1,362
Recycling	£5,257	£5,257	£5,257	£5,257	£112,902	£112,902	£5,257	£5,257	£5,257

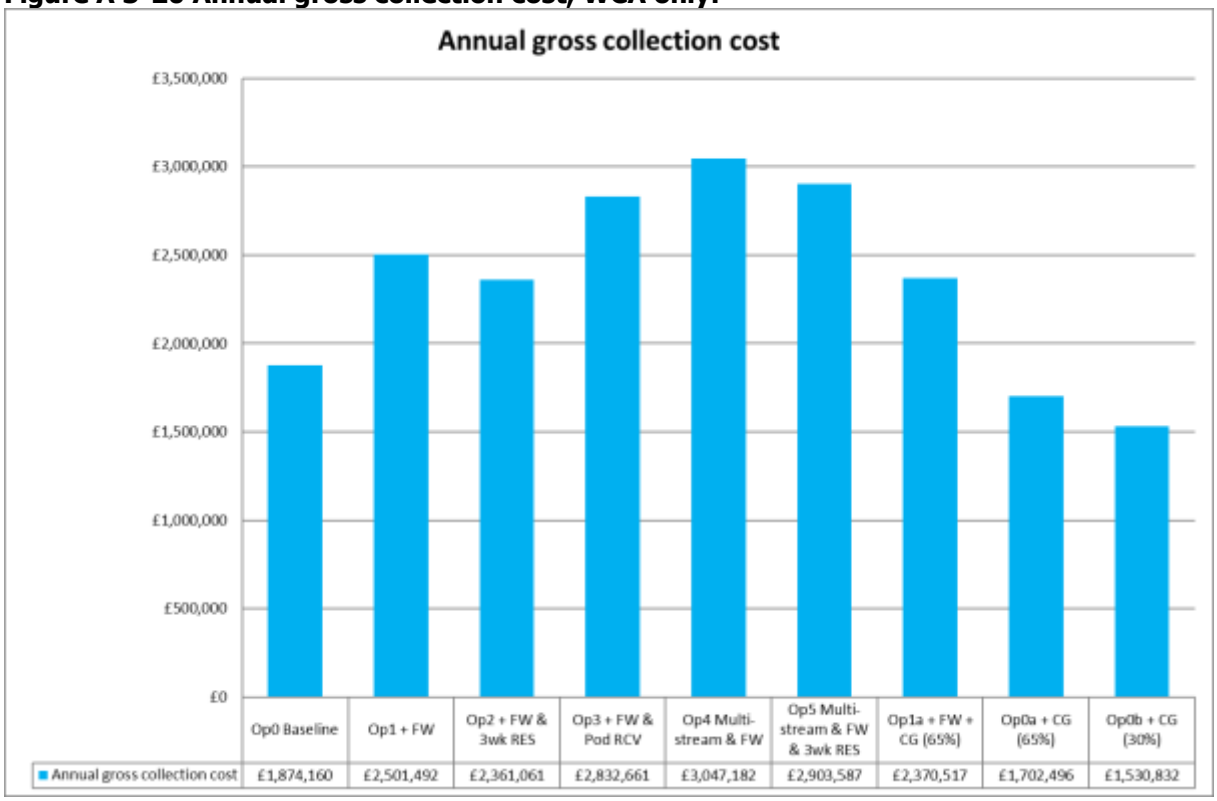
Observations:

- Introducing new schemes such as food waste and multi-stream recycling increased container costs due to the purchase of new containers. Even when annualised the costs can be significant.
- The Baseline and options 0a and 0b have has the lowest container replacement costs due to them offering no new services.
- All garden waste collections have the same container costs, but these decrease as the number of households on the chargeable scheme decrease.
- Multi-stream collections have the highest cost for containers due to the cost of new boxes and food waste containers.

Annual gross collections costs

The cost of waste and recycling collections is a significant consideration for local authorities when determining their future collection system configuration. The annual gross collection cost of each option is shown Figure A 3-20. This includes the cost of front-line operatives, supervision, annualised container costs (including the purchase of new containers where necessary and replacement containers at an assumed percentage replacement rate), vehicle costs (depreciated over 10 years) and vehicle standing and running costs and fuel.
N.B. The gross collection costs exclude recycling credits, MRF gates fees and any material income from recycled materials and any disposal costs.

Figure A 3-20 Annual gross collection cost, WCA only.



Observations:

- The multi-stream options (4 and 5) have the largest annual gross costs of ~ £3m, due to a combination of large vehicle numbers, leading to higher running costs and associated crew costs.
- The Baseline and Options 0a and 0b have the lowest annual gross cost, this is because they have the lowest crew numbers, coupled with the lowest vehicle numbers.

- All the options with some form of food waste collection have increased gross collection costs due to the additional vehicles (either dedicated or pod-based).

WCA net costs

This section provides an estimate of the WCA net costs, which includes:

- The gross collection costs;
- MRF gates fees and any material income from recycled materials;
- Garden and food waste treatment costs;
- Bulking of food waste where not able to direct deliver; and
- Recycling credits.

The current material values for dry recycling are taken from MRF data provided by the authority. Where the materials are collected separately, we have assumed that the authority would receive the full market value. Treatment for food waste and garden waste is based on data provided by the authority or an agreed assumption.

Detailed cost data is provided within Appendix 2.

For separately collected materials, these costs do not include the following, as the uncertainties involved are beyond the scope of the project:

- Any change to delivery points - Where a new collection system is used, the existing transfer station may not be suitable and so an alternative would be required;
- Infrastructure changes – for example, additional bays may be required where there are an increased number of material streams. Where these bays do not exist, there would be capital costs required to put them in place. There may also be a need to purchase additional plant, such as a forklift or loading shovel. Some of these costs may be passed on to the Councils, either directly or indirectly;
- Bulking and haulage – the bulking and haulage of materials are an additional cost. This includes arranging for materials to be taken to reprocessors.
- The cost for this haulage would be highly dependent on the final destination and the fuel costs; and
- Similarly, the recycling income figures are derived from information in the public domain and these may not accurately reflect the income offered by a service provider.

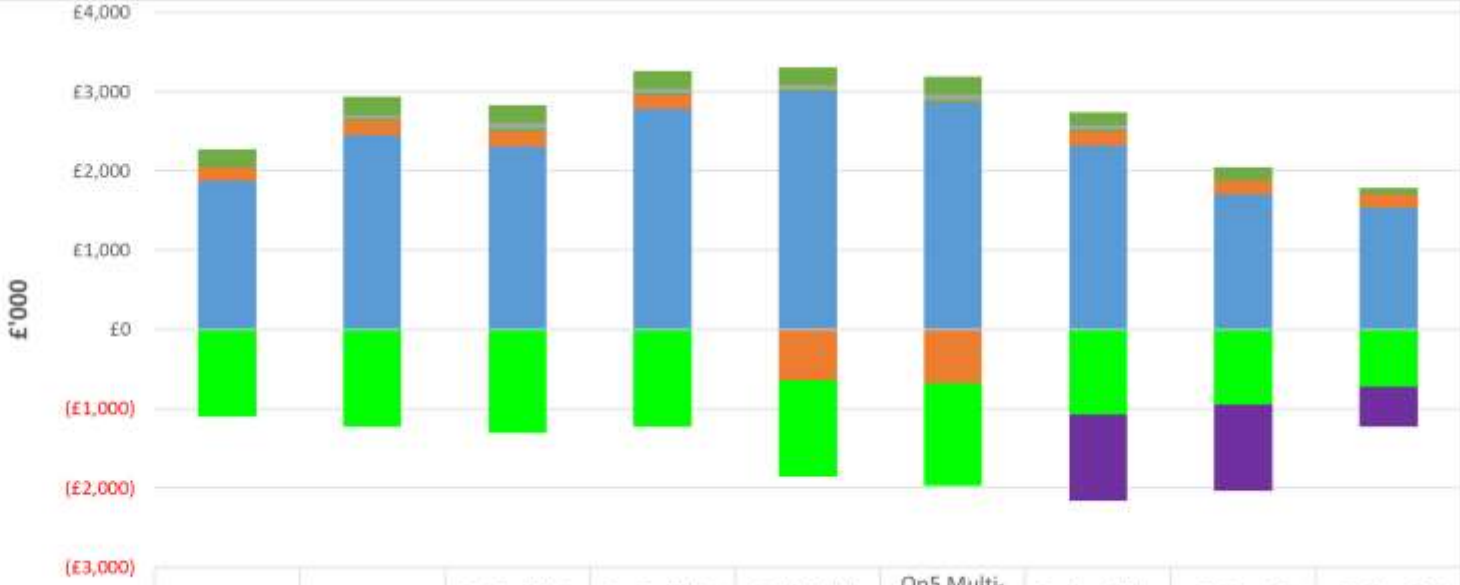
The Council receives recycling credits from the Waste Disposal Authority (WDA) equivalent to £50 for every tonne of dry recycling or food waste that avoids being sent for disposal as residual waste. The WDA pays recycling credits for garden waste collected of £49 per tonne, this is because the WDA does not pay for the disposal of organic waste collected by the authorities.

Figure A 3-21 shows the main cost categories for the authority. There are a number of categories that are income generating, such as recycling credits, garden waste charges and income from materials sales, these are negative and appear below the y axis.

Observations:

- The collection costs are the dominant category, followed by recycling credits;
- Using a MRF to sort material typically results in additional costs, whilst the sale of materials from a multi-stream service typically results in significant income;
- The garden, food and mixed organic processing costs make up only a small part of the costs compared to most of the other categories.

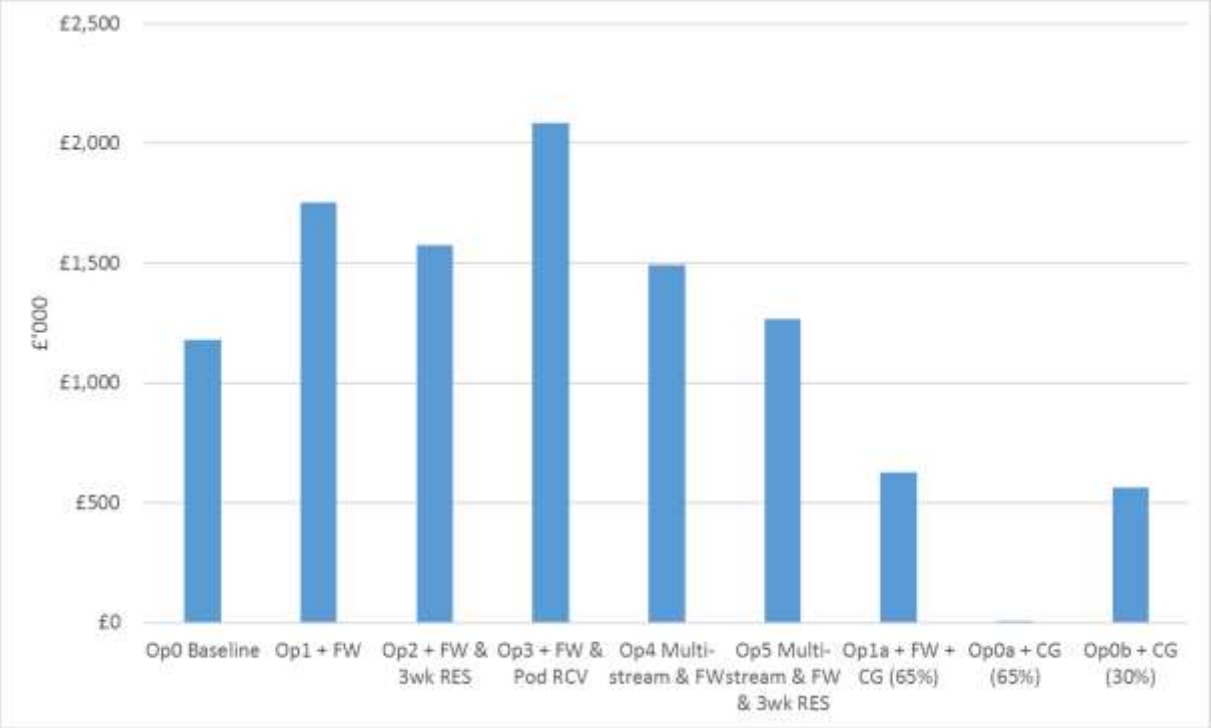
Figure A 3-21 WCA cost categories (£'000).



	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
Garden waste charge	0	0	0	0	0	0	-1,087	-1,087	-502
Recycling credits	-1,096	-1,230	-1,306	-1,230	-1,218	-1,295	-1,076	-952	-721
Mixed food & Garden Waste Treatment	0	0	0	0	0	0	0	0	0
Garden Waste Treatment	226	226	226	226	226	226	165	169	78
Food Waste Treatment	0	53	73	53	53	73	53	0	0
Bulking	0	27	37	27	27	37	27	0	0
Dry income/charge	176	176	185	176	-642	-675	176	176	176
Collection costs	1,874	2,452	2,312	2,783	2,998	2,854	2,321	1,702	1,531

The total annual net collection costs are also presented in the chart below, Figure A 3-22.

Figure A 3-22 Net Costs



Key observations:

- The main 5 options all increase the net WCA costs, in part due to the addition of food waste collections;
- Option 3 is the most expensive collection system, this is due to the use of pod vehicles requiring an additional loader, and the increased costs associated with that particular vehicle;
- Moving to a multi-stream service increases the collection costs but these are offset significantly by greater income from materials' sales;
- The options where a chargeable garden service is introduced are consistently below the Baseline. This is due to a combination of lower vehicle numbers, crew costs and most significantly, the income stream from charging £35 per household;
- Introducing a chargeable garden waste scheme could potentially result in lower overall costs even if a dedicated food waste scheme were also introduced at the same time (Option 1a);
- Moving to a three-weekly residual collection does result in lower net costs but not sufficient to offset the introduction of a food waste collection.

Options summary

The total annual net collection costs and recycling rates for each option are shown in the table below (Table A 3-10. The ranks of both the cost and recycling rates are also provided.

Table A 3-10 Annual net costs, WCA.

Option	WCA Total (£k)	Difference to Baseline	Rank	Recycling rate	Rank
Op0 Baseline	1,180	0	4	47%	7
Op1 + FW	1,753	574	8	53%	5
Op2 + FW & 3wk RES	1,575	396	7	58%	2
Op3 + FW & Pod RCV	2,084	905	9	53%	4
Op4 Multi-stream & FW	1,493	313	6	55%	3
Op5 Multi-stream & FW & 3wk RES	1,269	89	5	60%	1
Op1a + FW + CG (65%)	629	-551	3	49%	6
Op0a + CG (65%)	8	-1,171	1	42%	8
Op0b + CG (30%)	562	-617	2	35%	9

The main outcomes of the modelling are the following:

- Recycling rates range between 35% and 60%.
- Operating a chargeable garden waste scheme significantly reduces recycling rates but this can be offset to a varying degree by a food waste collection.
- A 6% increase in the recycling rate would be expected for a separate collection of food waste.
- Introducing a food waste collection and a 3 weekly residual service (Option 2) increases recycling rates considerably but also increases costs.
- A multi-stream service with food waste (Options 4 & 5) appears to be a less expensive option than the current service with a dedicated food collection (Option 1 & 2), although this would mean a significant change in how recycling is collected and does not reduce costs below the Baseline.
- The Baseline options with a chargeable garden service (Options 0a and 0b) result in the lowest costs but also the lowest recycling rate.
- Operating a pod vehicle appears to be the most expensive option of collecting food waste.

It is important to note, that whilst the modelled costs show a relative comparison between each option, they do not necessarily represent the actual costs, nor do they show any savings that could be made through service management or through subjecting the service to competition through a procurement exercise.

A3.3 Lichfield and Tamworth

Baseline data

The results of the initial baseline for Lichfield and Tamworth are shown in Table A 3-11. A comparison with the actual data provided by the Council is also shown.

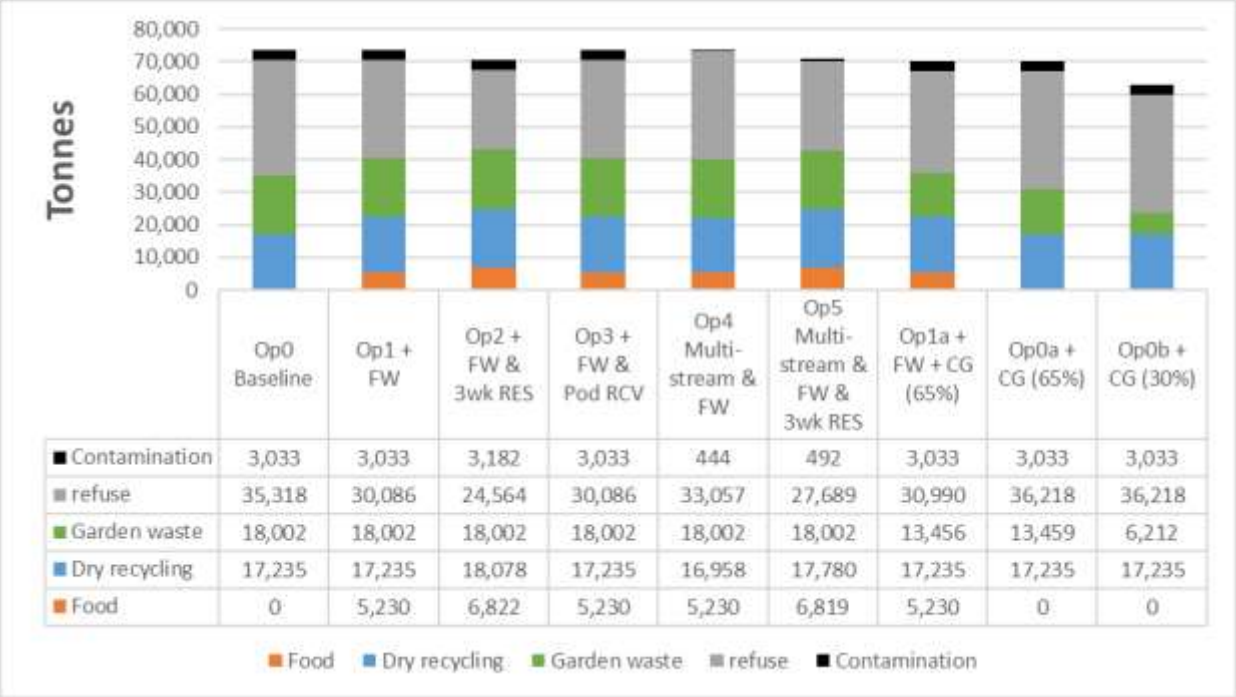
Table A 3-11 Lichfield and Tamworth baseline results.

	Refuse		Dry recycling		Mixed organics	
Parameter	**KAT**	**Actual**	**KAT**	**Actual**	**KAT**	**Actual**
Collection frequency	Fortnightly		Fortnightly comingled		Fortnightly	
Collection vehicle	RCV: 6x 10.5 tonne payload, 1x 5.5 tonne payload	RCV: 6x 10.5 tonne payload, 1x 5.5 tonne payload	RCV: 6x 10.5 tonne payload, 1x 5.5 tonne payload	RCV: 6x 10.5 tonne payload, 1x 5.5 tonne payload	RCV: 6x 10.5 tonne payload, 1x 5.5 tonne payload	RCV: 6x 10.5 tonne payload, 1x 5.5 tonne payload
Number of collection vehicles required	6.9	7	6.9	7	6.8	7
Collection limited by weight or volume?	Weight	Weight	Volume	Volume	Volume	Volume
Number of loads collected per vehicle per day	2.0	2	1.8	1.5	1	2
Number of households passed by per vehicle per day	1108	1200	1107	1200	1125	1200

System performance – materials captured

The approximate tonnage for each option is shown in Figure A 3-23. The estimates are based on current data and projected performance for each option, as presented in Section 4.0 of the main report. The values for dry recyclate exclude contamination, which is assumed to be 15% for the current service and 2% for the multi-stream options.

Figure A 3-23 Tonnage of each stream collected in each option.



	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
Contamination	3,033	3,033	3,182	3,033	444	492	3,033	3,033	3,033
refuse	35,318	30,086	24,564	30,086	33,057	27,689	30,990	36,218	36,218
Garden waste	18,002	18,002	18,002	18,002	18,002	18,002	13,456	13,459	6,212
Dry recycling	17,235	17,235	18,078	17,235	16,958	17,780	17,235	17,235	17,235
Food	0	5,230	6,822	5,230	5,230	6,819	5,230	0	0

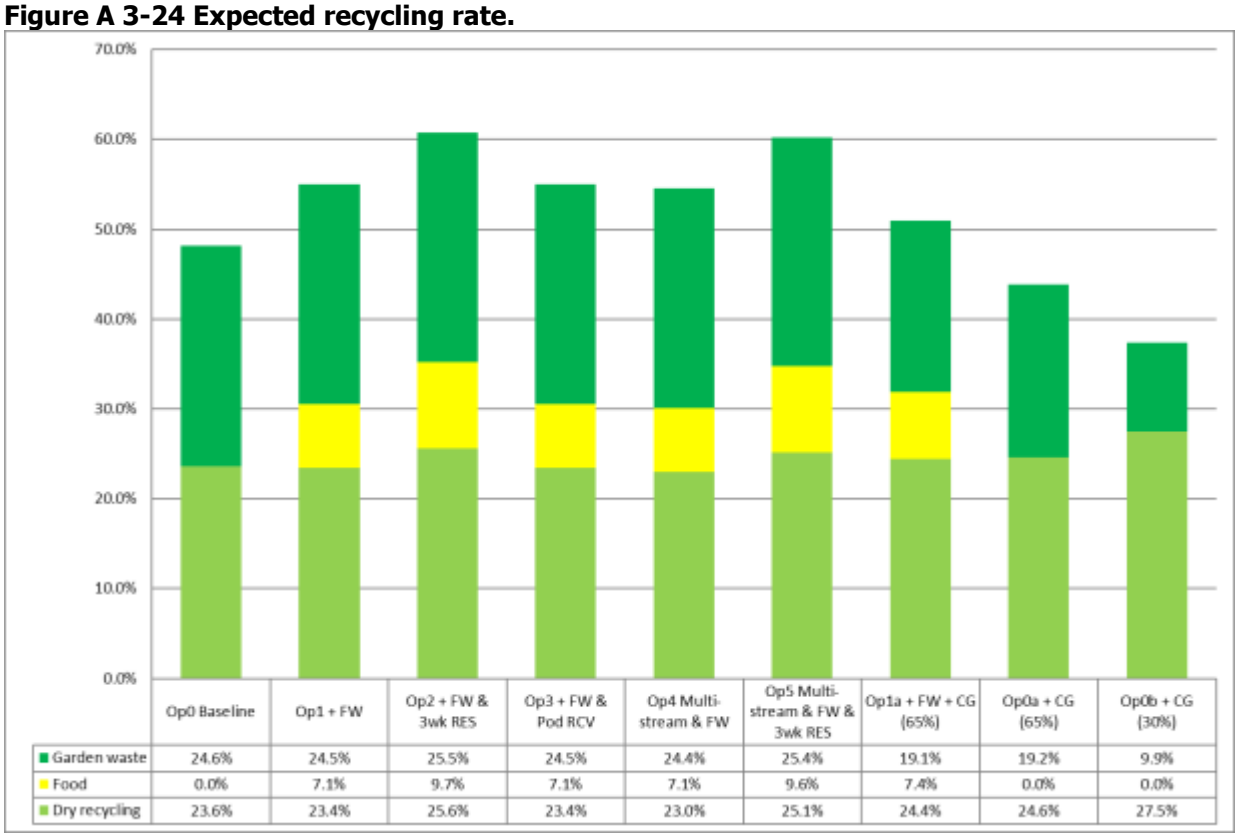
Key observations

- Food waste and recycling tonnages collected are assumed to increase by operating a three weekly collection, along with a reduction in overall waste;
- Multi-stream recycling reduces the level of contamination;
- Operating a chargeable garden waste scheme will reduce the quantity of garden waste collected at the kerbside.

Recycling Rate

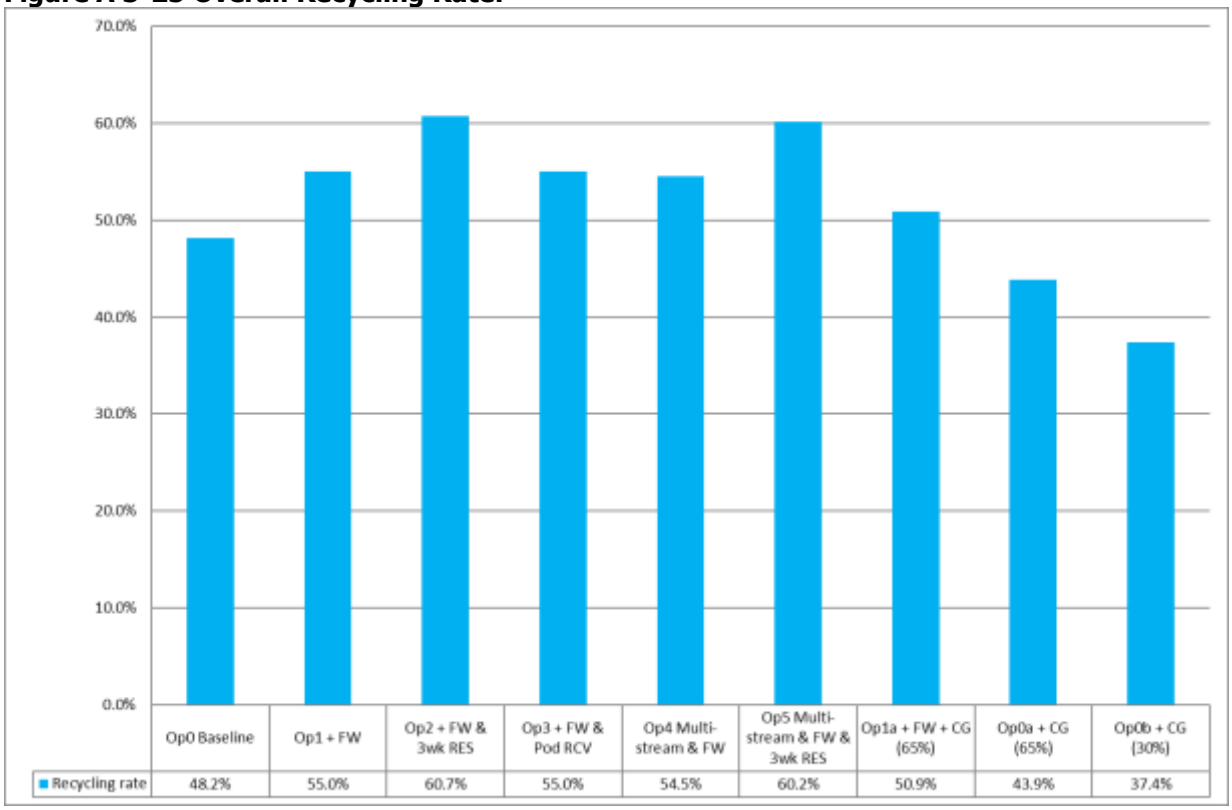
The expected recycling rates for dry recycling, food waste and garden waste for each option can be seen in Figure A 3-24and overall recycling rate in Figure A 3-25

Figure A 3-24 Expected recycling rate.



	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
Garden waste	24.6%	24.5%	25.5%	24.5%	24.4%	25.4%	19.1%	19.2%	9.9%
Food	0.0%	7.1%	9.7%	7.1%	7.1%	9.6%	7.4%	0.0%	0.0%
Dry recycling	23.6%	23.4%	25.6%	23.4%	23.0%	25.1%	24.4%	24.6%	27.5%

Figure A 3-25 Overall Recycling Rate.



	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
Recycling rate	48.2%	55.0%	60.7%	55.0%	54.5%	60.2%	50.9%	43.9%	37.4%

Key observations

- Recycling rates range between 37% (Option 0b) and 61% (Option 2).
- The increase in the recycling rate, as a result of increased capture of food waste, is between 7% and 10% depending on the collection system.

- Dry recycling rates range between 23% and 28% depending on the option. This is determined by the type of recycling collection service offered and its frequency. The options with a chargeable garden service cause an increase in the dry recycling percentage (not tonnage) due to less waste collected within the kerbside schemes, but the overall recycling rate is lower for these options, due to reduced quantities of compostable material being collected.
- Options 2 and 5 have the highest recycling rate (~60%), due to separately collected food waste, increased dry recycling and reduced overall waste caused by three-weekly residual collections.
- Option 0b has the lowest recycling rate of the options modelled, this is due to having a weekly residual collection and a fortnightly comingled collection.

Resources required – front line vehicles

The KAT modelling shows that different numbers of front line vehicles are required across the options. Although some of the existing vehicles may be suitable for use initially, we have modelled on the assumption that all options require a new vehicle fleet, and costs are depreciated and included in order to take this into account. We have taken this approach as the existing collection vehicles will ultimately need replacing and it allows for options to be compared on a like for like basis. Table A 3-12 and Table A 3-13 show the key operational parameters and the difference in the numbers and types of vehicles required in each of the modelled collection options.

Table A 3-12 Key operational parameters.

Parameter	Scenario	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
Number of vehicles	Dry	6.89	6.89	6.89	6.89	19.93	19.99	6.89	6.89	6.89
	Garden	6.78	6.78	6.78	8.63	6.78	6.78	4.41	4.41	2.03
	Food	-	10.47	10.57	-	-	-	10.47	-	-
	Refuse	6.88	6.88	4.72	8.21	6.88	5.19	6.88	6.96	6.96
	Total	**20.5**	**31.0**	**29.0**	**23.7**	**33.6**	**32.0**	**28.6**	**18.3**	**15.9**
Number of households passed by per vehicle per day	Dry	1,107	1,107	1,107	1,107	765	763	1,107	1,107	1,107
	Garden	1,125	1,125	1,125	883	1,125	1,125	1,125	1,125	1,125
	Food		1,457	1,443				1,457		
	Refuse	1,108	1,108	1,076	928	1,108	980	1,108	1,094	1,094
Number of loads collected per vehicle per day	Dry	1.8	1.8	1.9	1.8	1.2	1.3	1.8	1.8	1.8
	Garden	1.0	1.0	1.0	1.0	1.0	1.0	1.2	1.2	1.2
	Food		0.6	0.8				0.6		
	Refuse	2.0	1.7	2.0	1.6	1.8	2.1	1.8	2.0	2.0

Table A 3-13 Vehicles required for each option.

	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
RCV	21	21	19	7	14	13	19	19	16
Romaquip	0	0	0	0	20	20	0	0	0
REL + Pod	0	0	0	18	0	0	0	0	0
SplitRCV	0	0	0	0	0	0	0	0	0
Food	0	11	11	0	0	0	11	0	0
Total	**21**	**32**	**30**	**25**	**34**	**33**	**30**	**19**	**16**

The key observations from the number of front line vehicles modelled are:

- A dedicated food waste service requires 11 vehicles.
- Operating a three-weekly residual collection reduces residual RCV vehicles required from 21 to 19, offering a small reduction in the number of collection vehicles.
- Using a pod based vehicle increases the vehicles required by 4, compared to the baseline.
- Moving to a chargeable garden waste collection reduces the vehicles required by 2 or 5, depending on the number of households taking up the scheme.
- A multi-stream service is likely to require 20 romaquip type vehicles to service the authority (a total of 33 or 34 vehicles).
- All the options require additional vehicles compared to the baseline, except Options 0a and 0b, where 19 and 16 vehicles are required respectively (down from 21 for the Baseline).

Annual vehicle costs

We have estimated the capital costs for the purchase of vehicles using the unit costs presented in Appendix 1. We have detailed the total vehicle capital cost in **Table A 3-14**. It is assumed that all vehicles will need to be purchased, with the cost depreciated over 10 years.

Table A 3-14 Vehicle capital cost to purchase.

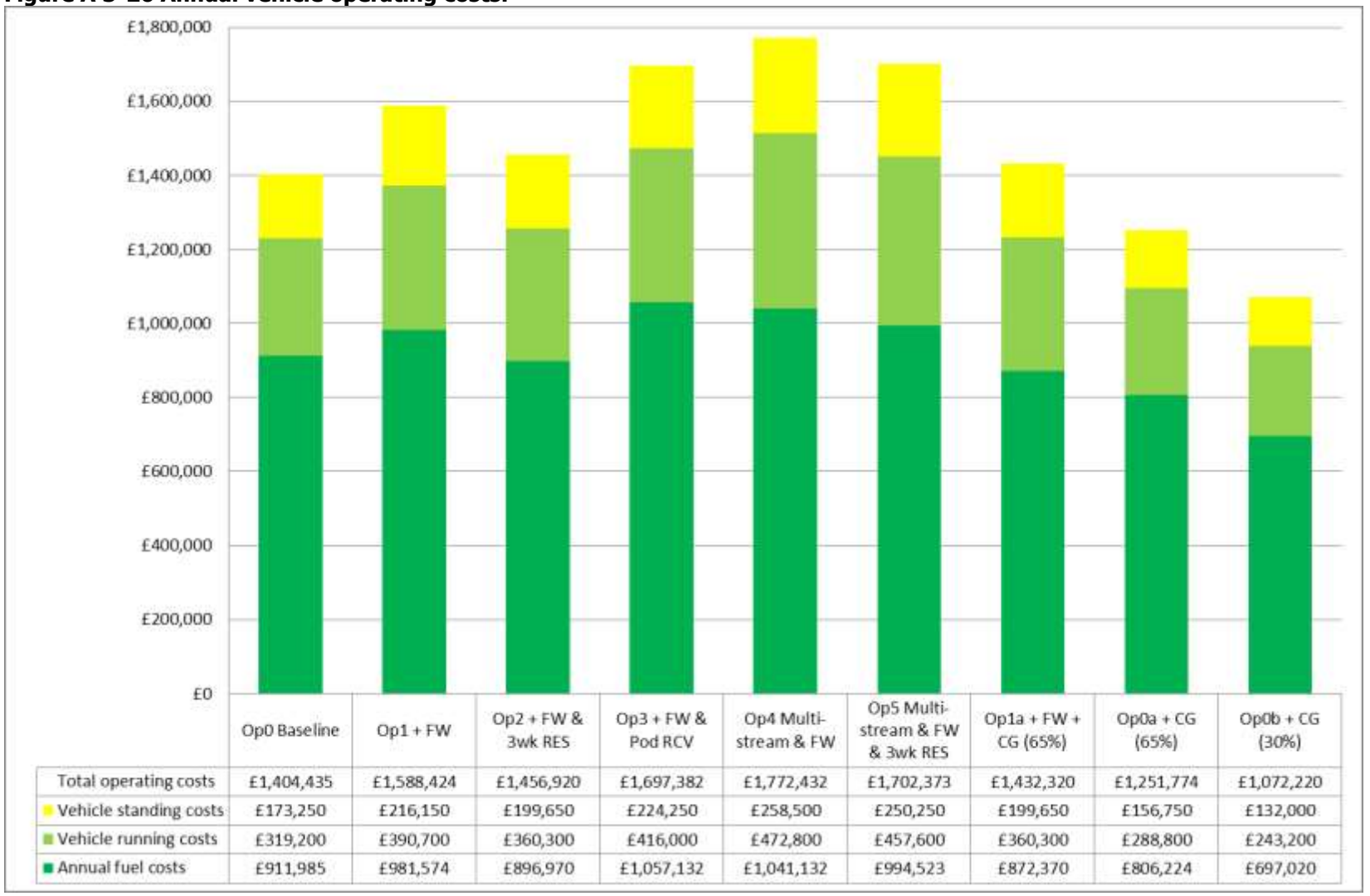
	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
RCV	£3,192,000	£3,192,000	£2,888,000	£1,064,000	£2,128,000	£1,976,000	£2,888,000	£2,888,000	£2,432,000
Romaquip					£2,600,000	£2,600,000			
REL + Pod				£3,096,000					
SplitRCV									
Food		£715,000	£715,000				£715,000		
Total	**£3,192,000**	**£3,907,000**	**£3,603,000**	**£4,160,000**	**£4,728,000**	**£4,576,000**	**£3,603,000**	**£2,888,000**	**£2,432,000**

The key observations are:

- Options 4 and 5 are the most expensive option in terms of vehicle costs, primarily due to the high number of multi-stream vehicles required to collect dry recycling and food waste weekly.
- Option 0b has the lowest vehicle costs, this is because it requires the least number of vehicles due to the introduction of a chargeable garden waste service.

The annual vehicle operating costs are shown in Figure A 3-26. These include vehicle fuel, maintenance, operating and running costs.

Figure A 3-26 Annual vehicle operating costs.



	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
Total operating costs	£1,404,435	£1,588,424	£1,456,920	£1,697,382	£1,772,432	£1,702,373	£1,432,320	£1,251,774	£1,072,220
Vehicle standing costs	£173,250	£216,150	£199,650	£224,250	£258,500	£250,250	£199,650	£156,750	£132,000
Vehicle running costs	£319,200	£390,700	£360,300	£416,000	£472,800	£457,600	£360,300	£288,800	£243,200
Annual fuel costs	£911,985	£981,574	£896,970	£1,057,132	£1,041,132	£994,523	£872,370	£806,224	£697,020

The key observations are:

- Options 3, 4 and 5 have the highest vehicle costs, this is due to the high number of multi-stream vehicles (4 and 5) and the cost of the podded vehicles (Option 3).
- Options 0a and 0b have the lowest vehicle and operating costs, this is due the introduction of a chargeable garden waste scheme reducing vehicle numbers.
- Operating a dedicated food waste collection (Option 1) increases vehicle costs compared to the Baseline, but moving to a three-weekly residual collection (Option 2) helps reduce these costs to a level similar to the baseline.
- The pod-based collection of food waste results in greater costs than a dedicated food waste service.

Resources required – front line operatives

The number of front line operatives required directly relates to the number and type of vehicles required. Appendix 1 lists the number of operatives used in each vehicle and the unit costs.

Figure A 3-27 shows the number of front-line operatives estimated for each scenario. Options 4 and 5 require the highest number of operatives due to the multi-stream vehicles. This is closely followed by Option 1, the current co-mingled scheme with the addition of food waste. Options 0a and 0b have the lowest front-line operative requirements, this is due to the lower number of vehicles used when moving to a chargeable garden waste service. Operating a dedicated food waste service increases front line operatives; this is not reduced by moving to a three weekly service as the number of vehicles required is the same (although a different mix of type).

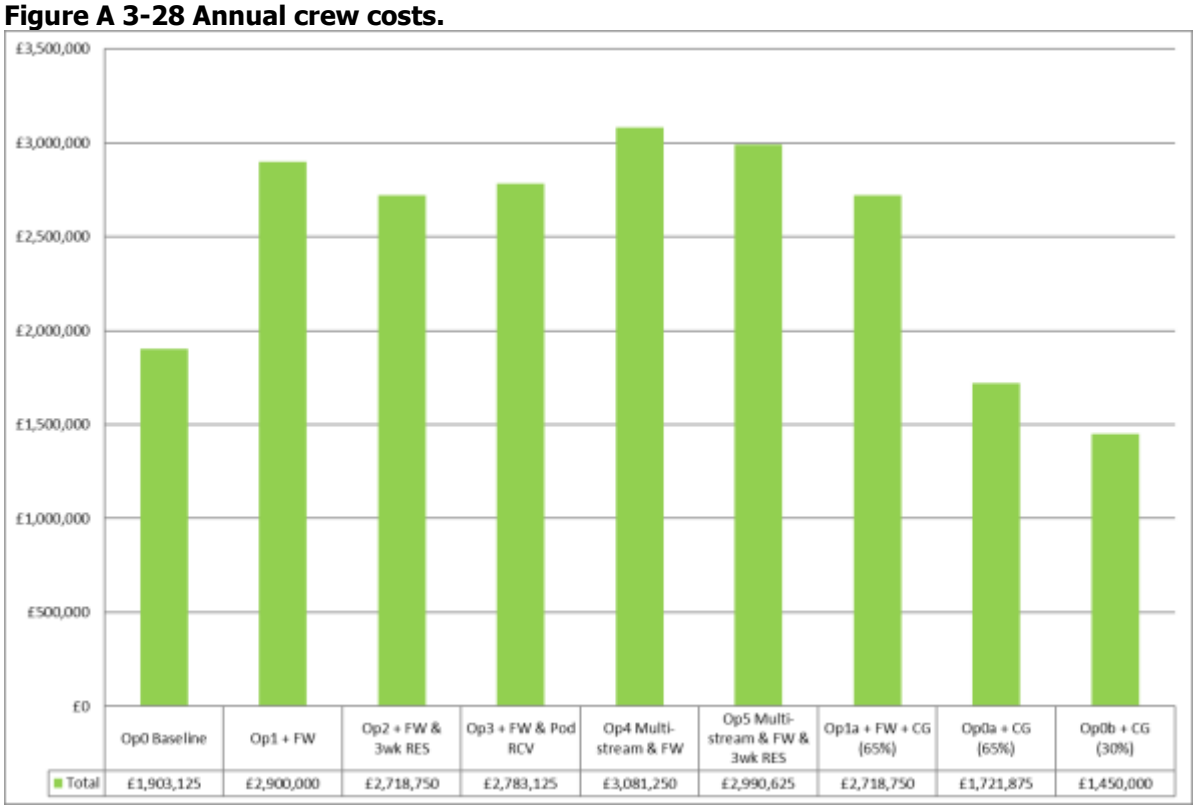
Figure A 3-27 Front-line operatives required

	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
Drivers	26	40	38	31	43	41	38	24	20
Loaders	53	80	75	85	85	83	75	48	40

Annual crew costs

The annual crew costs include drivers, loaders and supervisor costs, Figure A 3-28.

Figure A 3-28 Annual crew costs.



The key observations on resource requirements are that:

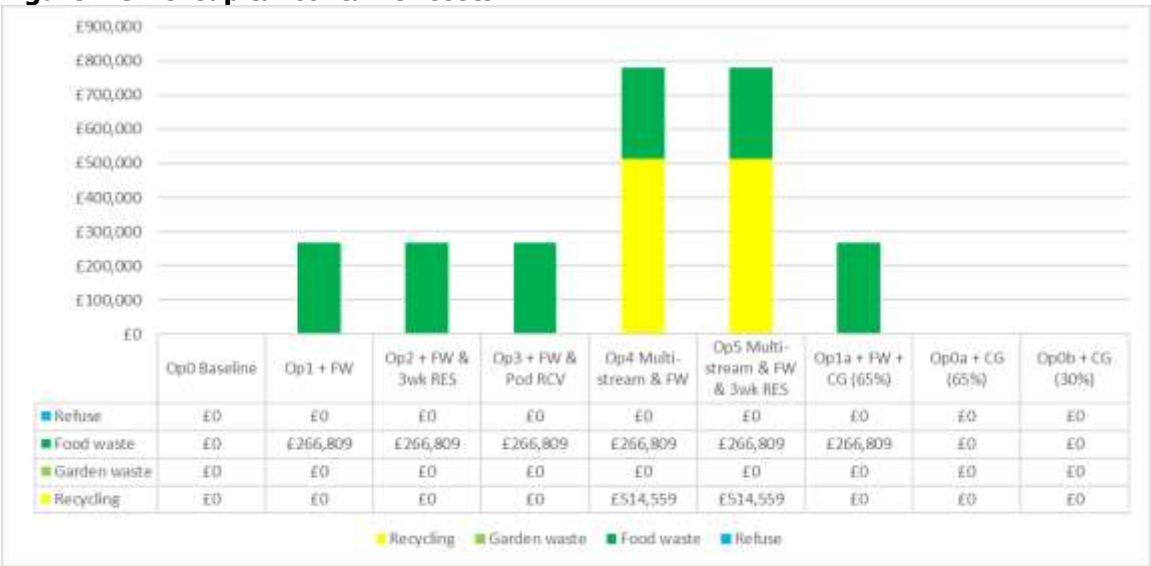
- Option 0b has the lowest crew costs overall (~£1.5M), this service has the lowest number of vehicles which translates into the lowest crew numbers and thus costs;
- The Baseline and Option 5 have similar staff costs, based on similar numbers of drivers and operatives.
- Options 4 and 5 have the highest crew costs, this is because of the high number of vehicles on the multi-stream service and the high number of operatives per vehicle (a driver and 3 loaders).

Resources required – containers

There are also capital container costs associated with some of the options, where a new collection or set of containers is provided.

For a multi-stream recycling service it has been assumed that each household would receive three boxes that would be purchased as new. Food waste collections require each household to have a food caddy and 23ltr container. These are shown in Figure A 3-29.

Figure A 3-29 Capital container costs.



In addition to the purchase of new bins, there is also an annual replacement cost for provided containers, e.g. lost or damaged bins.Figure A 3-30 shows the annualised capital costs of purchasing new containers (based on their excepted life time), the annual replacement costs and annual cost of proving food waste liners (2 per household per week). The cost of collecting and disposing of 'old' bins is not included, and would be an additional consideration for the authority. However, this may be a cost neutral activity, as once the 'old' bins are collected, they can be sold and chipped for recycling.

Figure A 3-30 Annual container replacement costs.

Observations:

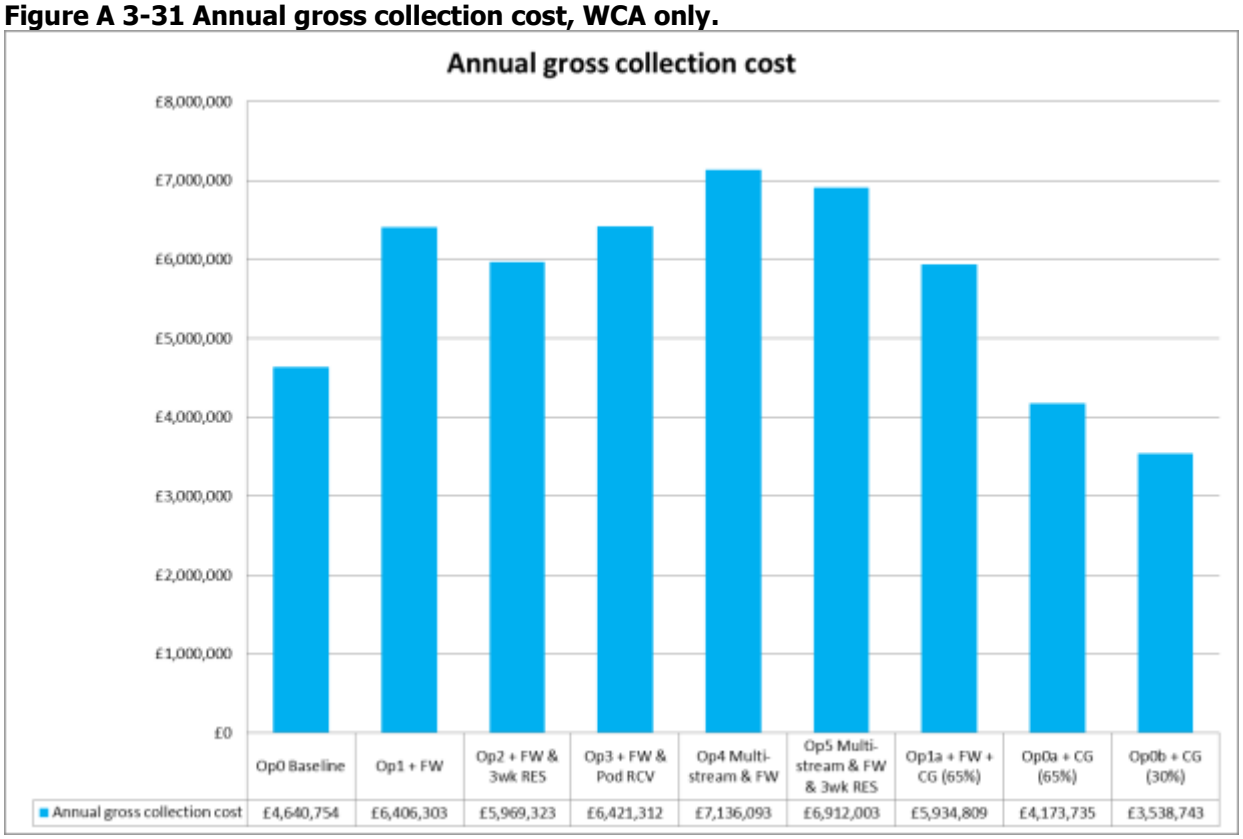
- Introducing new schemes such as food waste and multi-stream recycling increased container costs due to the purchase of new containers. Even when annualised the costs can be significant.

- The Baseline and Options 0a and 0b have the lowest container costs due to them offering no new services.
- All garden waste collections have the same container costs, except those with chargeable scheme where the number of households on the service decrease.
- Multi-stream collections have the highest cost for containers due to the cost of new boxes and food waste containers.

Annual gross collections costs

The cost of waste and recycling collections is a significant consideration for local authorities when determining their future collection system configuration. The annual gross collection cost of each option, is shown Figure A 3-31. This includes the cost of front-line operatives, supervision, annualised container costs (including the purchase of new containers where necessary and replacement containers at an assumed percentage replacement rate), vehicle costs (depreciated over 10 years) and vehicle standing and running costs and fuel.
N.B. The gross collection costs exclude recycling credits, MRF gates fees and any material income from recycled materials and any disposal costs.

Figure A 3-31 Annual gross collection cost, WCA only.



Observations:

- The multi-stream options (4 & 5) have the largest annual gross costs of ~ £7m, due to a combination of large vehicle numbers, leading to higher running costs and associated crew costs.
- Options 0a and 0b have the lowest annual gross cost, this is because they have the lowest crew numbers, coupled with the lowest vehicle numbers.
- All the options with some form of food waste collection have increased gross collection costs due to the additional vehicles (either dedicated or pod-based).

WCA net costs

This section provides an estimate of the WCA costs, which includes:

- The gross collection costs;

- MRF gates fees and any material income from recycled materials;
- Garden and food waste treatment costs;
- Bulking of food waste where not able to direct deliver; and
- Recycling credits.

The current material values for dry recycling are taken from MRF data provided by the authority. Where the materials are collected separately, we have assumed that the authority would receive the full market value. Treatment for food waste and garden waste is based on data provided by the authority or an agreed assumption.

Detailed cost data is provided within Appendix 2.

For separately collected materials, these costs do not include the following, as the uncertainties involved are beyond the scope of the project:

- Any change to delivery points - Where a new collection system is used, the existing transfer station may not be suitable and so an alternative would be required;
- Infrastructure changes – for example, additional bays may be required where there are an increased number of material streams. Where these bays do not exist, there would be capital costs required to put them in place. There may also be a need to purchase additional plant, such as a forklift or loading shovel. Some of these costs may be passed on to the Councils, either directly or indirectly;
- Bulking and haulage – the bulking and haulage of materials are an additional cost. This includes arranging for materials to be taken to reprocessors.
- The cost for this haulage would be highly dependent on the final destination and the fuel costs; and
- Similarly, the recycling income figures are derived from information in the public domain and these may not accurately reflect the income offered by a service provider.

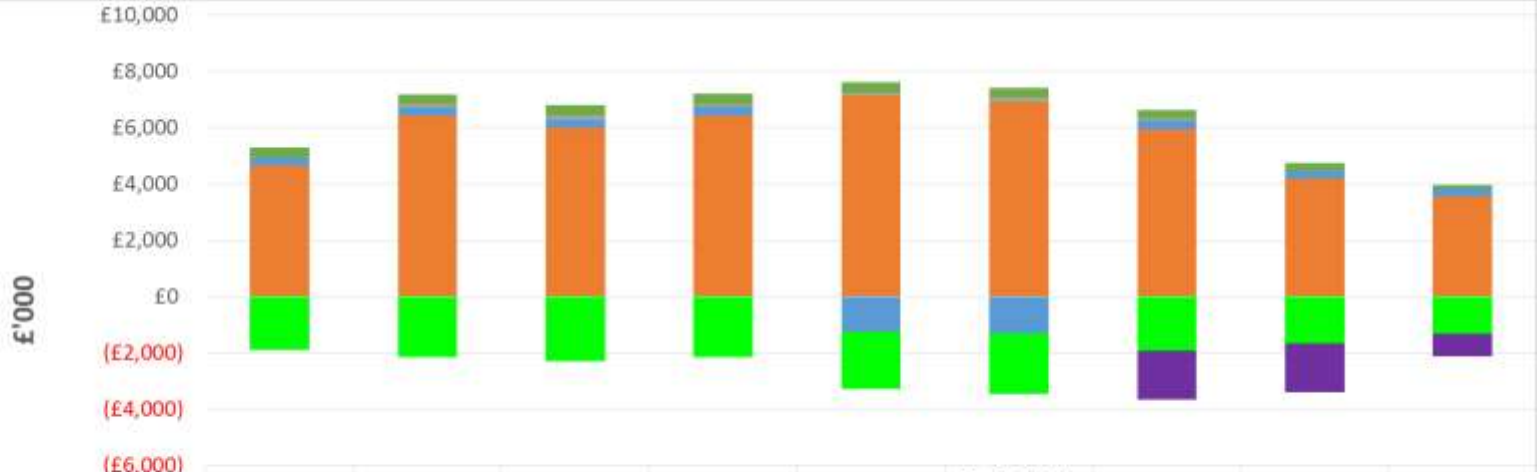
The Council receives recycling credits from the Waste Disposal Authority (WDA) equivalent to £50 for every tonne of dry recycling or food waste that avoids being sent for disposal as residual waste. The WDA pays recycling credits for garden waste collected of £49 per tonne, this is because the WDA does not pay for the disposal of organic waste collected by the authorities.

Figure A 3-32 shows the main cost categories for the authority. There are a number of categories that are income generating, such as recycling credits, garden waste charges and income from materials sales, these are negative and appear below the y axis.

Observations:

- The collection costs are the dominant category, followed by recycling credits.
- Using a MRF to sort material typically results in additional costs, whilst the sale of materials from a multi-stream service typically results in significant income.
- The garden, food and mixed organic processing costs make up only a small part of the costs compared to most of the other categories.

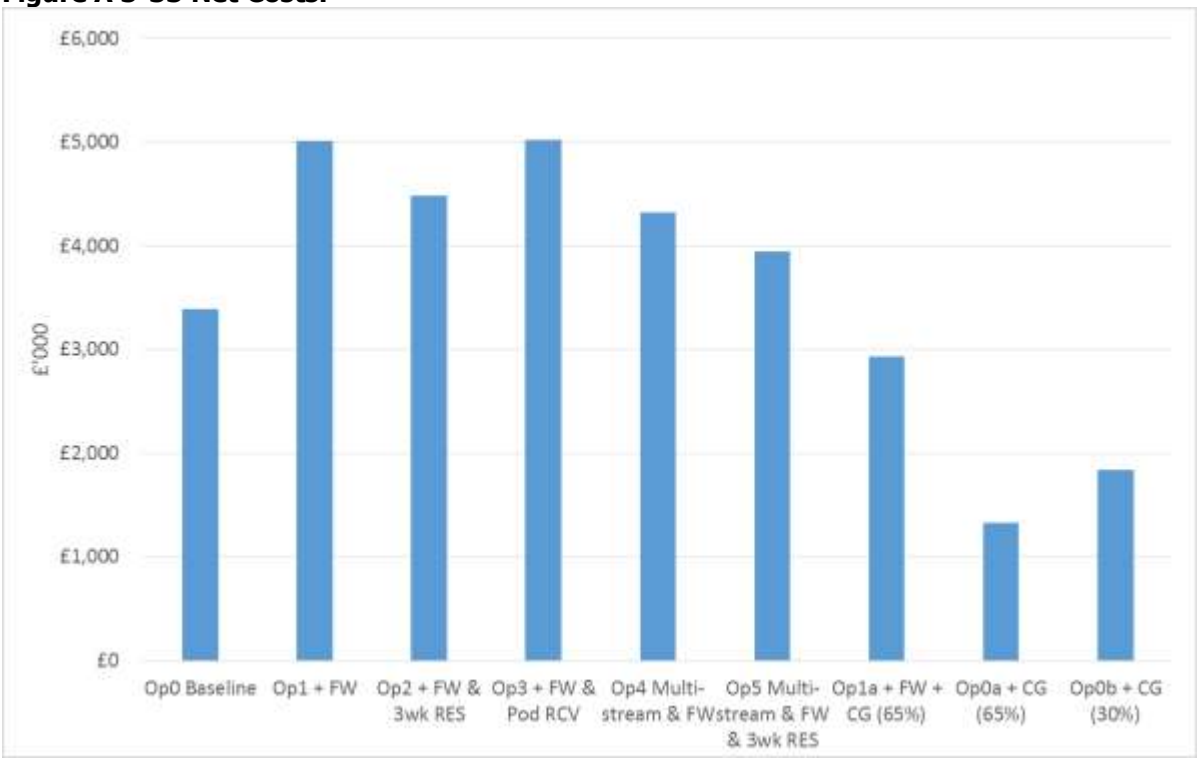
Figure A 3-32 WCA cost categories (£'000).



	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
Garden waste charge	0	0	0	0	0	0	-1,734	-1,734	-800
Recycling credits	-1,899	-2,162	-2,291	-2,162	-2,018	-2,141	-1,939	-1,677	-1,321
Mixed food & Garden Waste Treatment	0	0	0	0	0	0	0	0	0
Garden Waste Treatment	360	360	360	360	360	360	269	269	124
Food Waste Treatment	0	105	136	105	105	136	105	0	0
Bulking	0	0	0	0	0	0	0	0	0
Dry income/charge	293	300	315	300	-1,257	-1,318	300	300	300
Collection costs	4,641	6,406	5,969	6,421	7,136	6,912	5,935	4,174	3,539

The total annual net collection costs are also presented in the chart below, Figure A 3-33.

Figure A 3-33 Net Costs.



Key observations:

- The main 5 options all increase the net WCA costs, in part due to the addition of food waste collections;
- Options 1 and 3 are the most expensive collection options, due to the additional vehicles and for Option 3 the increased costs associated with that particular vehicle.
- Moving to a multi-stream service increases the collection costs but these are offset significantly by greater income from materials' sales.
- The options where a chargeable garden service is introduced are consistently below the Baseline. This is due to a combination of lower vehicle numbers, crew costs and most significantly, the income stream from charging £35 per household.
- Introducing a chargeable garden waste scheme could potentially result in lower overall costs, even if a dedicated food waste scheme were also introduced at the same time.
- Moving to a three-weekly residual collection does result in lower net costs but not sufficient to offset the introduction of a food waste collection (against the Baseline).

Options summary

The total annual net collection costs and recycling rates for each option are shown in the following table (Table A 3-15). The ranks of both the cost and recycling rates are also provided.

Table A 3-15 Annual net costs, WCA.

Option	WCA Total (£k)	Difference to Baseline	Rank	Recycling rate	Rank
Op0 Baseline	3,395	0	4	48%	7
Op1 + FW	5,009	1,614	8	55%	4
Op2 + FW & 3wk RES	4,489	1,094	7	61%	1
Op3 + FW & Pod RCV	5,024	1,629	9	55%	3
Op4 Multi-stream & FW	4,325	930	6	55%	5
Op5 Multi-stream & FW & 3wk RES	3,949	554	5	60%	2
Op1a + FW + CG (65%)	2,935	-460	3	51%	6
Op0a + CG (65%)	1,332	-2,063	1	44%	8
Op0b + CG (30%)	1,841	-1,554	2	37%	9

The main outcomes of the modelling are the following:

- Recycling rates range between 37% and 61%.
- Operating a chargeable garden waste scheme significantly reduces recycling rates but this can be offset to a varying degree by a food waste collection.
- Introducing a food waste collection and a 3 weekly residual service (Option 2) increases recycling rates considerably but also increases costs.
- A multi-stream service with food waste (Options 4 & 5) appears to be a less expensive option than the current service with a dedicated food collection (Options 1 & 2), although this would mean a significant change in how recycling is collected and does not reduce costs below the Baseline.
- The Baseline options with a chargeable garden service (Options 0a and 0b) result in the lowest costs but also the lowest recycling rate.
- Operating a pod vehicle appears to be the most expensive option of collecting food waste.

It is important to note, that whilst the modelled costs show a relative comparison between each option, they do not necessarily represent the actual costs, nor do they show any savings that could be made through service management or through subjecting the service to competition through a procurement exercise.

A3.4 Newcastle-under-Lyme

Baseline data

The results of the initial baseline for Newcastle-under-Lyme are shown in Table A 3-16. A comparison with the actual data provided by the Council is also shown.

Some of the average timings provided have been slightly amended to reflect the number of loads and round sizes reported on KAT. The modelling assumes there are 10 vehicles in total used for the refuse and garden waste collections.

Table A 3-16 Newcastle-under-Lyme baseline results.

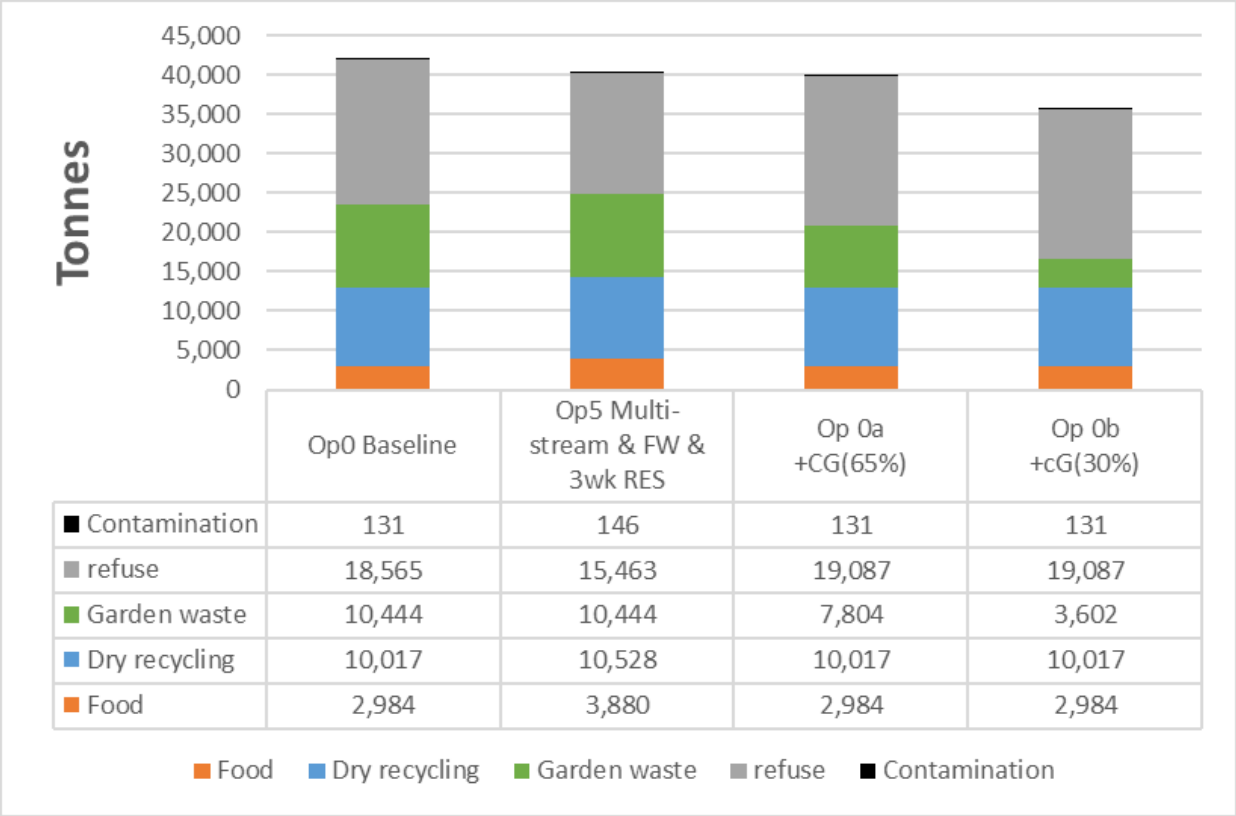
	Refuse		Dry recycling		Mixed organics	
Parameter	**KAT**	**Actual**	**KAT**	**Actual**	**KAT**	**Actual**
Collection frequency	Fortnightly		Weekly multi-stream, separate food		Fortnightly, garden only	
Collection vehicle	RCV: 4x 10 tonne payload, 1x 4 tonne payload	RCV: 4x 10 tonne payload, 1x 4 tonne payload	Romaquip: 13x 3.75 tonne payload	Romaquip: 13x 3.75 tonne payload	RCV: 4x 10 tonne payload, 1x 4 tonne payload	RCV: 4x 10 tonne payload, 1x 4 tonne payload
Number of collection vehicles required	4.8 (10 in total as shared with garden)	5	12.9	13	4.6 (10 in total as shared with refuse)	5
Collection limited by weight or volume?	Weight	Weight	Volume	Volume	Volume	Volume
Number of loads collected per vehicle per day	1.4	2	1.3	1	1.8	2
Number of households passed by per vehicle per day	1,020	1,000	754	750	1,068	1,000

System performance – materials captured

Because Newcastle already has a weekly multi-stream dry recycling collection and a separate weekly food waste collection, it was only modelled for its Baseline and three other scenarios (Options 5, 0a and 0b).

The approximate tonnage for each option is shown in Figure A 3-34. The estimates are based on current data and projected performance for each option, as presented in Section 4.0 of the main report. The values for dry recyclate exclude contamination, which is assumed to be 1% for the current service and 1% for the multi-stream options.

Figure A 3-34 Tonnage of each stream collected in each option.



	Op0 Baseline	Op5 Multi-stream & FW & 3wk RES	Op 0a +CG(65%)	Op 0b +cG(30%)
Contamination	131	146	131	131
refuse	18,565	15,463	19,087	19,087
Garden waste	10,444	10,444	7,804	3,602
Dry recycling	10,017	10,528	10,017	10,017
Food	2,984	3,880	2,984	2,984

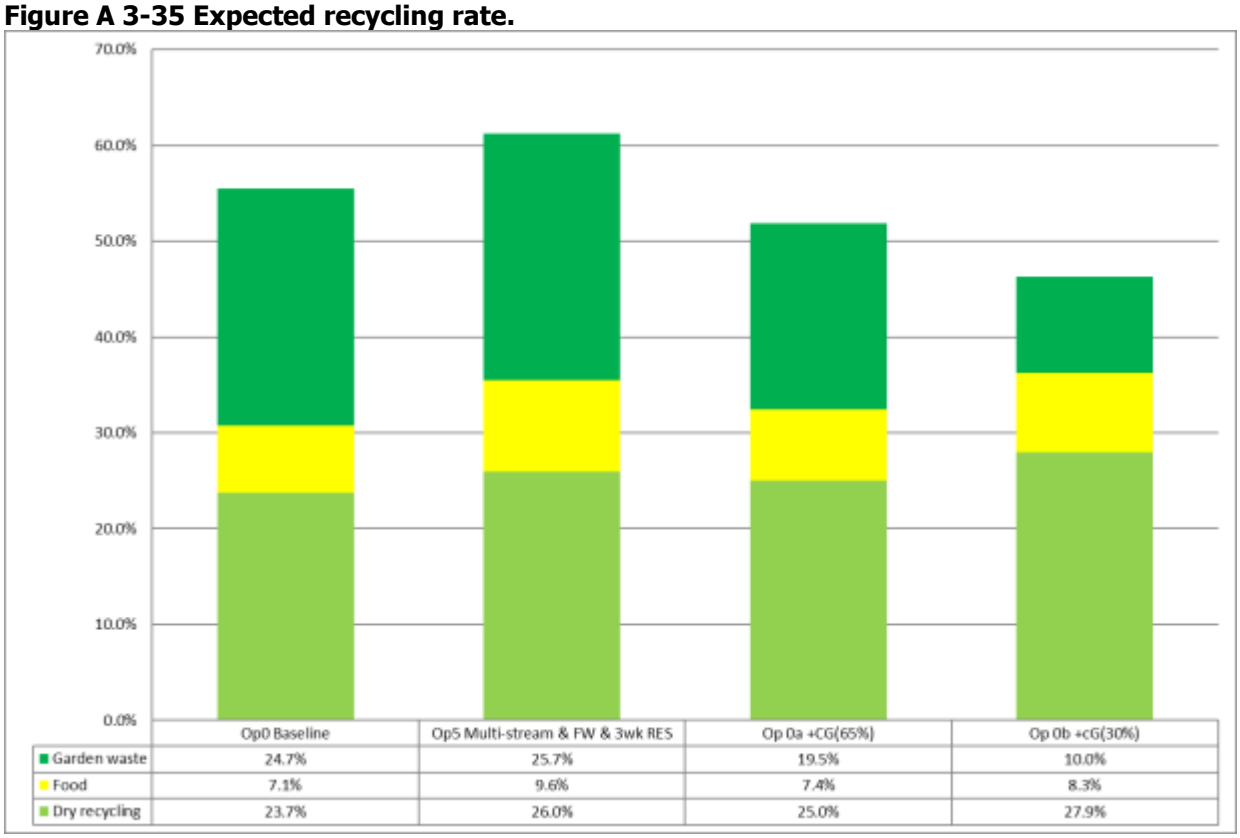
Key observations

- Food waste and recycling tonnages collected are assumed to increase by operating a three weekly collection, along with a reduction in overall waste;
- Operating a chargeable garden waste scheme will reduce the quantity of garden waste collected at the kerbside.

Recycling Rate

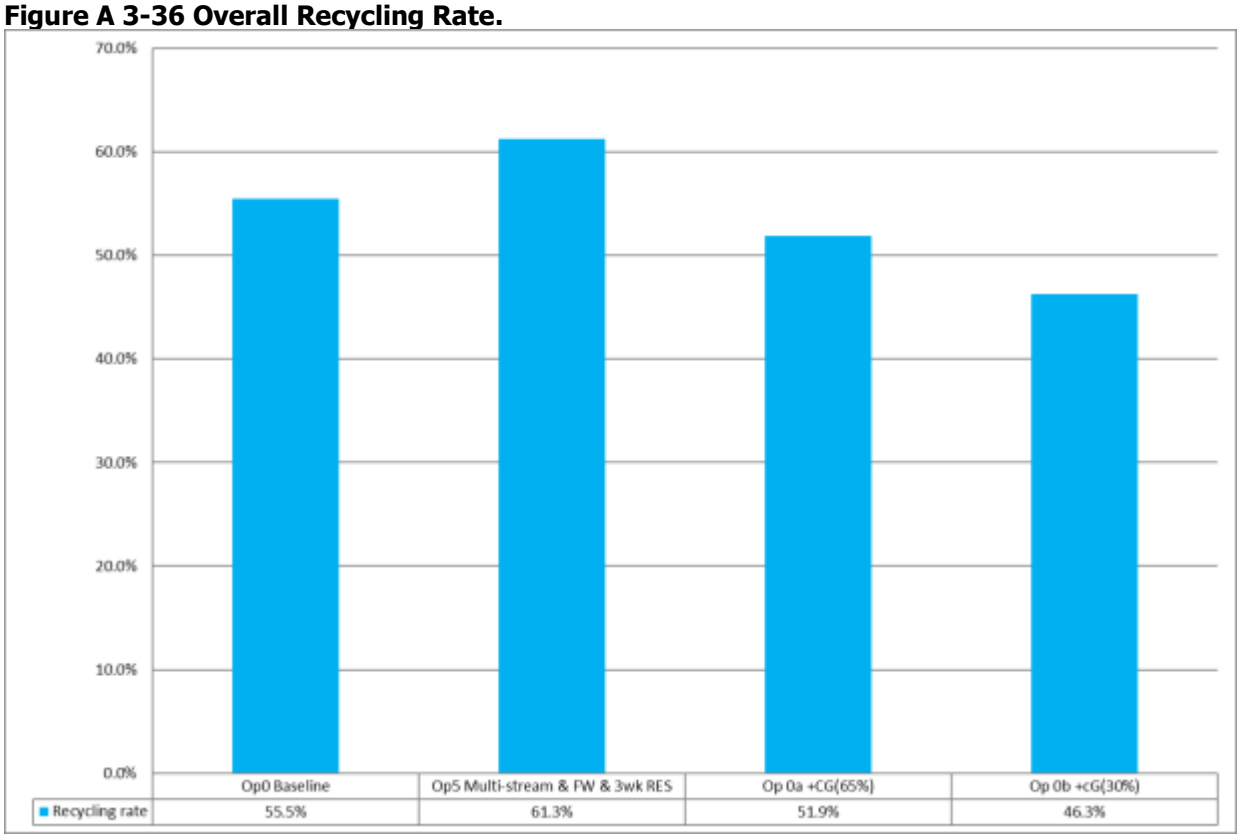
The expected recycling rates for dry recycling, food waste and garden waste for each option can be seen in Figure A 3-35 and overall recycling rate in Figure A 3-36.

Figure A 3-35 Expected recycling rate.



	Op0 Baseline	Op5 Multi-stream & FW & 3wk RES	Op 0a +CG(65%)	Op 0b +cG(30%)
Garden waste	24.7%	25.7%	19.5%	10.0%
Food	7.1%	9.6%	7.4%	8.3%
Dry recycling	23.7%	26.0%	25.0%	27.9%

Figure A 3-36 Overall Recycling Rate.



	Op0 Baseline	Op5 Multi-stream & FW & 3wk RES	Op 0a +CG(65%)	Op 0b +cG(30%)
Recycling rate	55.5%	61.3%	51.9%	46.3%

Key observations

- Recycling rates range between 46% (Option 0b) and 61% (Option 5).
- Option 5 has the highest recycling rate (61%), rhe recycling rate goes up 5% in Option 5, due to the reduced frequency of the residual waste collection improving recycling and food waste performance at the household and reducing overall waste;

- When a charge is introduced for garden waste collections, the recycling rate goes down between 4% and 10%, depending on the level of uptake of the scheme.
- Dry recycling rates range between 24% and 28% depending on the option. This is determined by the frequency of the residual waste collection and the level up uptake of the chargeable garden waste collection. The dry recycling percentage (not tonnage) increases for the options with a chargeable garden waste service due to less waste collected within the kerbside schemes, but the overall recycling rate is lower for these options, due to reduced quantities of compostable material being collected.
- Option 0b has the lowest recycling rate of the options modelled, this is due to only 30% of residents taking up the chargeable garden waste collection service, resulting in significantly less garden waste being collected.

Resources required – front line vehicles

The KAT modelling shows that different numbers of front line vehicles are required across the options. Although some of the existing vehicles may be suitable for use initially, we have modelled on the assumption that all options require a new vehicle fleet, and costs are depreciated and included in order to take this into account. We have taken this approach as the existing collection vehicles will ultimately need replacing and it allows for options to be compared on a like for like basis. Table A 3-17 and Table A 3-18 show the key operational parameters and the difference in the numbers and types of vehicles required in each of the modelled collection options.

Table A 3-17 Key operational parameters.

Parameter	Scenario	Op0 Baseline	Op5 Multi-stream & FW & 3wk RES	Op0a + CG (65%)	Op0b + CG (30%)
Number of vehicles	Dry	12.93	12.93	12.93	12.93
	Garden	4.56	4.56	2.99	1.38
	Food	-	-	-	-
	Refuse	4.78	3.18	4.78	4.78
	Total	**22.3**	**20.7**	**20.7**	**19.1**
Number of households passed by per vehicle per day	Dry	754	754	754	754
	Garden	1,068	1,068	1,060	1,060
	Food				
	Refuse	1,020	1,020	1,020	1,020
Number of loads collected per vehicle per day	Dry	1.2	1.3	1.2	1.2
	Garden	1.8	1.8	2.0	2.0
	Food				
	Refuse	1.4	1.7	1.4	1.4

Table A 3-18 Vehicles required for each option.

	Op0 Baseline	Op5 Multi-stream & FW & 3wk RES	Op0a + CG (65%)	Op0b + CG (30%)
RCV	10	9	8	7
Romaquip	13	13	13	13
REL + Pod	0	0	0	0
SplitRCV	0	0	0	0
Food	0	0	0	0
Total	**23**	**22**	**21**	**20**

The key observations from the number of front line vehicles modelled are:

- Operating a three-weekly residual collection reduces residual RCV vehicles required from 10 to 9, therefore this will give some reduction in collection vehicles.
- Moving to a chargeable garden waste collection reduces the vehicles required by 2 or 3, depending on the number of households taking up the scheme.
- All the modelled options require fewer vehicles compared to the Baseline.

Annual vehicle costs

We have estimated the capital costs for the purchase of vehicles using the unit costs presented in Appendix 1. We have detailed the total vehicle capital cost in **Table A 3-19**. It is assumed that all vehicles will need to be purchased, with the cost depreciated over 10 years.

Table A 3-19 Vehicle capital cost to purchase.

	Op0 Baseline	Op5 Multi-stream & FW & 3wk RES	Op0a + CG (65%)	Op0b + CG (30%)
RCV	£1,520,000	£1,368,000	£1,216,000	£1,064,000
Romaquip	£1,690,000	£1,690,000	£1,690,000	£1,690,000
REL + Pod				
SplitRCV				
Food				
Total	£3,210,000	£3,058,000	£2,906,000	£2,754,000

The key observations are:

- The Baseline is the most expensive option in terms of vehicle costs, because each of the modelled options require fewer vehicles.
- Option 0b has the lowest vehicle costs, this is because it requires the least number of vehicles due to the introduction of a chargeable garden waste service, with only 30% uptake.

The annual vehicle operating costs are shown in Figure A 3-37. These include vehicle fuel, maintenance, operating and running costs.

Figure A 3-37 Annual vehicle operating costs.

	Op0 Baseline	Op5 Multi-stream & FW & 3wk RES	Op 0a +CG(65%)	Op 0b +cG(30%)
Total operating costs	£801,394	£740,585	£740,861	£645,721
Vehicle standing costs	£175,450	£167,200	£158,950	£150,700
Vehicle running costs	£321,000	£305,800	£290,600	£275,400
Annual fuel costs	£304,944	£267,585	£291,311	£219,621

The key observations are:

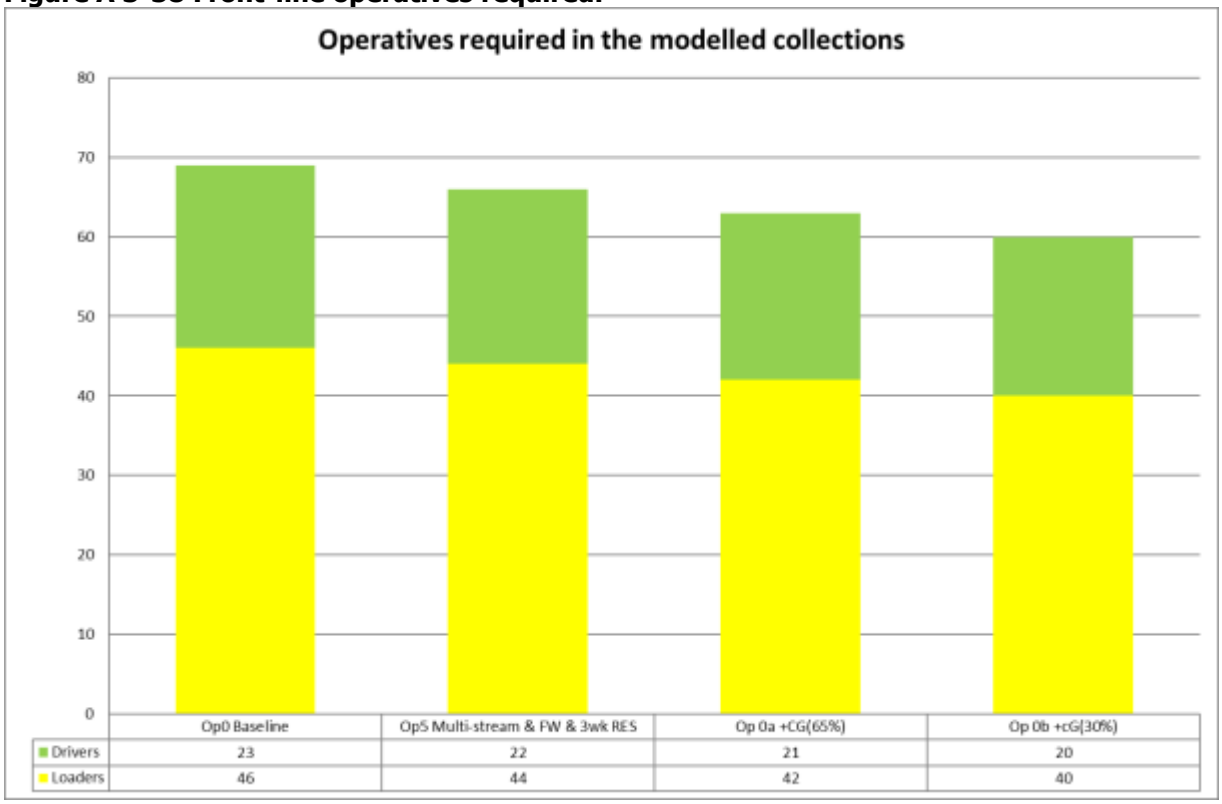
- The Baseline has the highest vehicle costs. This is because all the modelled options require fewer vehicles.
- Option 0b has the lowest vehicle operating costs. This is due to the introduction of chargeable garden waste schemes and only 30% of households requesting the scheme, significantly reducing garden waste vehicle numbers.
- Moving to a three-weekly residual collection (Option 5) helps reduce Baseline costs whilst keeping the rest of the service as it is.

Resources required – front line operatives

The number of front line operatives required directly relates to the number and type of vehicles required. Appendix 1 lists the number of operatives used in each vehicle and the unit costs.

Figure A 3-38 shows the number of front-line operatives estimated for each scenario. The Baseline requires the highest number of operatives due to the multi-stream vehicles already used and the reduction in numbers of vehicles needed for the modelled options. Options 0a and 0b have the lowest front-line operative requirements, this is because of the lower number of vehicles used when moving to a chargeable garden waste service.

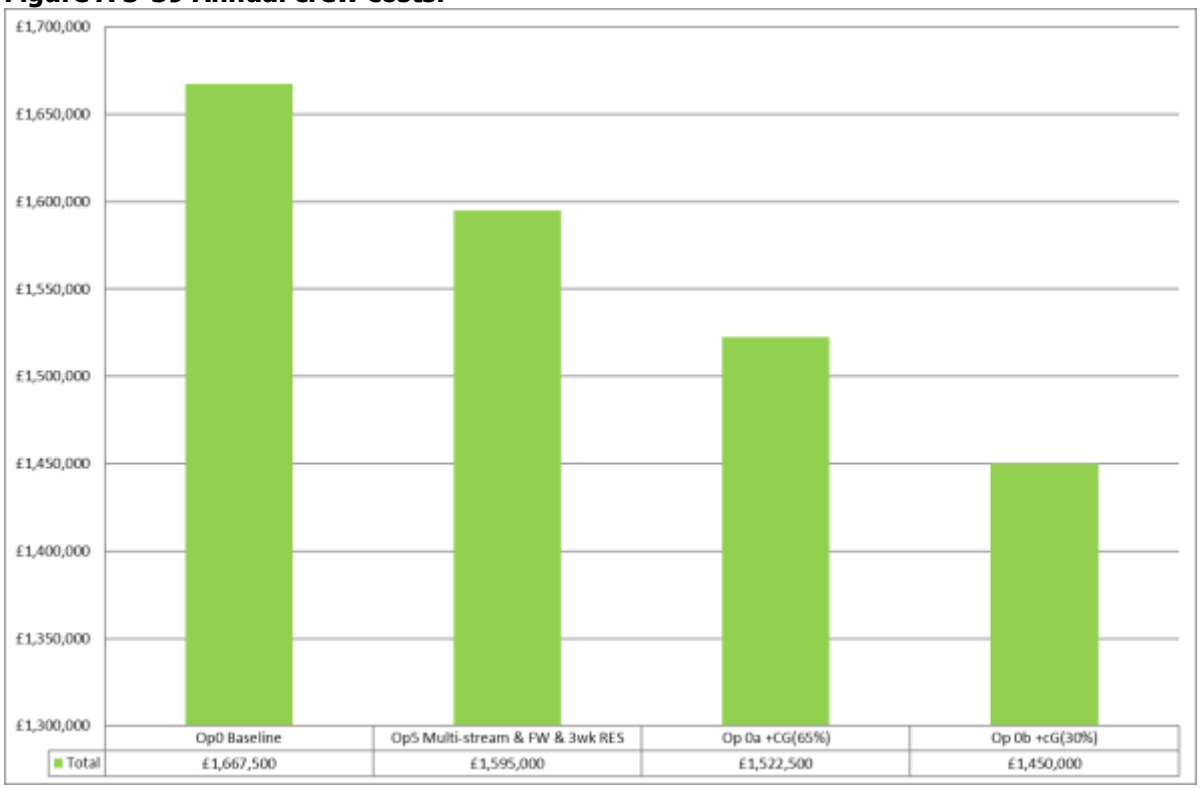
Figure A 3-38 Front-line operatives required.



Annual crew costs

The annual crew costs include drivers, loaders and supervisor costs, Figure A 3-39.

Figure A 3-39 Annual crew costs.



The key observations on resource requirements are that:

- Option 0b has the lowest crew costs overall (£1.45m), this service has the lowest number of vehicles which translates into the lowest crew numbers and thus costs;
- The Baseline has the highest crew costs. This is because of the high number of vehicles on the weekly multi-stream service and the high number of operatives per vehicle (a driver and 3 loaders).

Resources required – containers

There are no capital container costs associated with any of the options for Newcastle-under-Lyme because they already operate the scheme that has been modelled, so households already have all the containers that they will need. The only change that could occur is (as with all the other authorities) that households not choosing to sign up to the garden waste collections might ask for their bins to be removed.

There is, however, an annual replacement cost for provided containers, e.g. lost or damaged bins, that would be incure. Figure A 3-40 shows the annualised capital costs of purchasing new containers (based on their excepted life time), the annual replacement costs and annual cost of proving food waste liners (2 per household per week). The cost of collecting and disposing of 'old' bins is not included, and would be an additional consideration for the authority. However, this may be a cost neutral activity, as once the 'old' bins are collected, they can be sold and chipped for recycling.

Figure A 3-40 Annual container costs.

	Op0 Baseline	Op5 Multi-stream & FW & 3wk RES	Op 0a +CG(65%)	Op 0b +cG(30%)
Refuse	£13,882	£13,882	£13,882	£13,882
Food waste liners	£50,405	£50,405	£50,405	£50,405
Food waste	£8,144	£8,144	£8,144	£8,144
Garden waste	£13,882	£13,882	£9,024	£4,165
Recycling	£17,828	£17,828	£17,828	£17,828

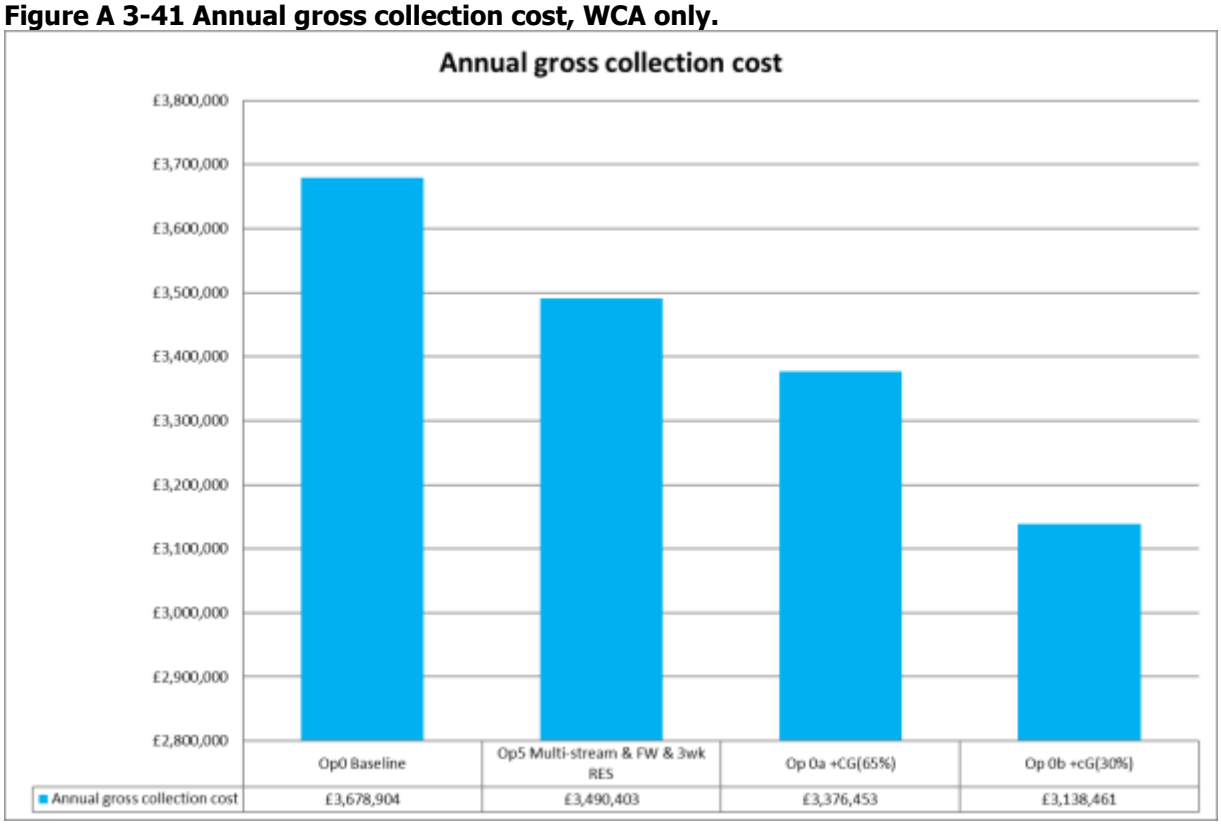
Observations:

- Garden waste container costs for Options 0a and 0b correspond to the level of uptake of the chargeable scheme, with costs reducing as participation does.

Annual gross collections costs

The cost of waste and recycling collections is a significant consideration for local authorities when determining their future collection system configuration. The annual gross collection cost of each option, is shown Figure A 3-41. This includes the cost of front-line operatives, supervision, annualised container costs (including the purchase of new containers where necessary and replacement containers at an assumed percentage replacement rate), vehicle costs (depreciated over 10 years) and vehicle standing and running costs and fuel. N.B. The gross collection costs exclude recycling credits, MRF gates fees and any material income from recycled materials and any disposal costs.

Figure A 3-41 Annual gross collection cost, WCA only.



Observations:

- The Baseline has the largest annual gross costs, of ~£3.7m, due to the large number of vehicles required, leading to higher running costs and associated crew costs.
- Option 5 is a little cheaper, due to the slight reduction in vehicle numbers and associated running and crew costs, with the move to three-weekly refuse collections.
- Option 0b has the lowest annual gross cost, this is because it requires the lowest crew numbers, coupled with the lowest vehicle numbers.

WCA costs

This section provides an estimate of the WCA costs, which includes:

- The gross collection costs;
- Material income from recycled materials;
- Garden and food waste treatment costs;
- Bulking of food waste where not able to direct deliver; and
- Recycling credits.

As the materials are collected separately in Newcastle, we have assumed that the authority receives the full market value for material collected in all options. Treatment for food waste and garden waste is based on data provided by the authority or an agreed assumption.

Detailed cost data is provided within Appendix 2.

The recycling income figures are derived from information in the public domain and provided by the Council and these may not accurately reflect the income offered by a service provider.

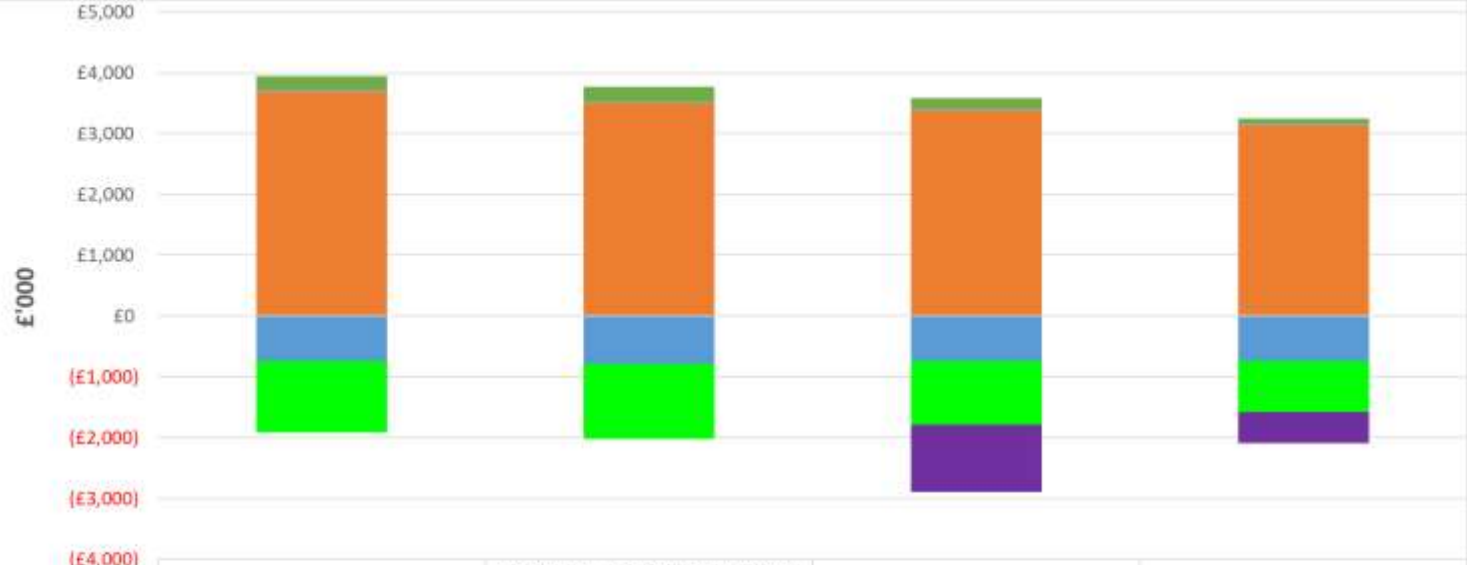
The Council receives recycling credits from the Waste Disposal Authority (WDA) equivalent to £50 for every tonne of dry recycling or food waste that avoids being sent for disposal as residual waste. The WDA pays recycling credits for garden waste collected of £49 per tonne, this is because the WDA does not pay for the disposal of organic waste collected by the authorities.

Figure A 3-42 shows the main cost categories for the authority. There are a number of categories that are income generating, such as recycling credits, garden waste charges and income from materials sales, these are negative and appear below the y axis.

Observations:

- The collection costs are the dominant category, followed by recycling credits.
- The garden, food and mixed organic processing costs make up only a small part of the costs compared to most of the other categories.

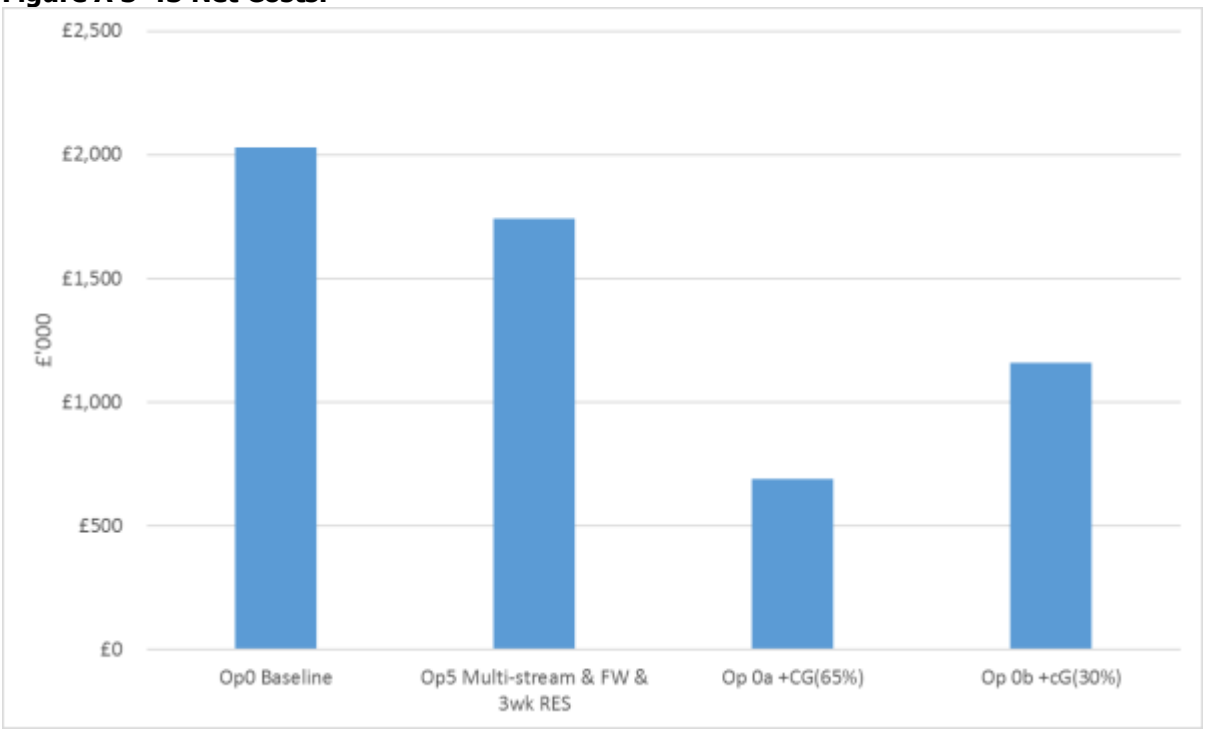
Figure A 3-42 WCA cost categories (£'000).



	Op0 Baseline	Op5 Multi-stream & FW & 3wk RES	Op 0a +CG(65%)	Op 0b +cG(30%)
Garden waste charge	0	0	-1,108	-511
Recycling credits	-1,171	-1,242	-1,041	-835
Mixed food & Garden Waste Treatment	0	0	0	0
Garden Waste Treatment	235	235	176	81
Food Waste Treatment	33	43	33	33
Bulking	0	0	0	0
Dry income/charge	-745	-783	-745	-745
Collection costs	3,679	3,490	3,376	3,138

The total annual net collection costs are also presented in the chart below, Figure A 3-43.

Figure A 3-43 Net Costs.



Key observations:

- The three modelled options all reduce the net WCA costs compared to the Baseline.
- The options where a chargeable garden service is introduced cost significantly less than the Baseline. This is due to a combination of lower vehicle numbers, crew costs and most significantly, the income stream from charging £35 per household.
- Moving to a three-weekly residual collection leads to lower net costs due to the reduction in vehicle and staff numbers.

Options summary

The total annual net collection costs and recycling rates for each option are shown in the table below (Table A 3-20). The ranks of both the cost and recycling rates are also provided.

Table A 3-20 Annual net costs, WCA.

Option	WCA Total (£k)	Difference to Baseline	Rank	Recycling rate	Rank
Op0 Baseline	2,031	0	4	55%	2
Op5 Multi-stream & FW & 3wk RES	1,743	-288	3	61%	1
Op 0a +CG(65%)	690	-1,341	1	52%	3
Op 0b +cG(30%)	1,160	-871	2	46%	4

The main outcomes of the modelling are the following:

- Recycling rates range between 46% and 61%.
- Introducing a 3 weekly residual service (Option 5) increases recycling rates by 6 percentage points and also reduces net costs.
- The Baseline options with a chargeable garden service (Options 0a and 0b) offer significant reductions in net costs but also the lowest recycling rates.

It is important to note, that whilst the modelled costs show a relative comparison between each option, they do not necessarily represent the actual costs, nor do they show any savings that could be made through service management or through subjecting the service to competition through a procurement exercise.

A3.5 South Staffordshire

Baseline data

The results of the initial baseline for South Staffordshire are shown in Table A 3-21. A comparison with the actual data provided by the Council is also shown.

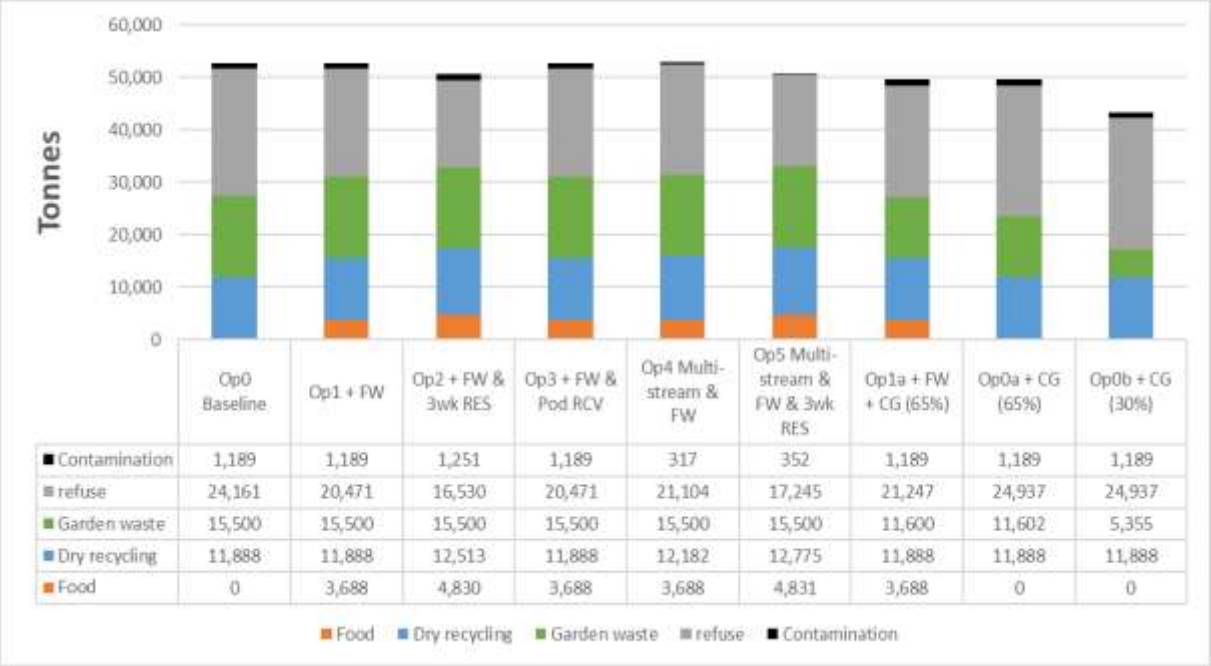
Table A 3-21 South Staffordshire baseline results.

	Refuse		Dry recycling		Mixed organics	
Parameter	**KAT**	**Actual**	**KAT**	**Actual**	**KAT**	**Actual**
Collection frequency	Fortnightly		Fortnightly comingled		Fortnightly garden only	
Collection vehicle	RCV: 2x 13 tonne payload, 2x 10.5 tonne payload	RCV: 2x 13 tonne payload, 2x 10.5 tonne payload	RCV: 4x 10.5 tonne payload	RCV: 4x 10.5 tonne payload	RCV: 2x 13 tonne payload, 2x 10.5 tonne payload	RCV: 2x 13 tonne payload, 2x 10.5 tonne payload
Number of collection vehicles required	3.9	4	3.8	4	3.7	4
Collection limited by weight or volume?	Weight	Weight	Volume	Volume	Volume	Volume
Number of loads collected per vehicle per day	1.9	2	1.5	1.3	1.2	1.8
Number of households passed by per vehicle per day	1,176	1,190	1,220	1158	1,180	1,096

System performance – materials captured

The approximate tonnage for each option is shown in Figure A 3-44. The estimates are based on current data and projected performance for each option, as presented in Section 4.0 of the main report. The values for dry recyclate exclude contamination, which is assumed to be 8% for the current service and 2% for the multi-stream options

Figure A 3-44 Tonnage of each stream collected in each option.



	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
Contamination	1,189	1,189	1,251	1,189	317	352	1,189	1,189	1,189
refuse	24,161	20,471	16,530	20,471	21,104	17,245	21,247	24,937	24,937
Garden waste	15,500	15,500	15,500	15,500	15,500	15,500	11,600	11,602	5,355
Dry recycling	11,888	11,888	12,513	11,888	12,182	12,775	11,888	11,888	11,888
Food	0	3,688	4,830	3,688	3,688	4,831	3,688	0	0

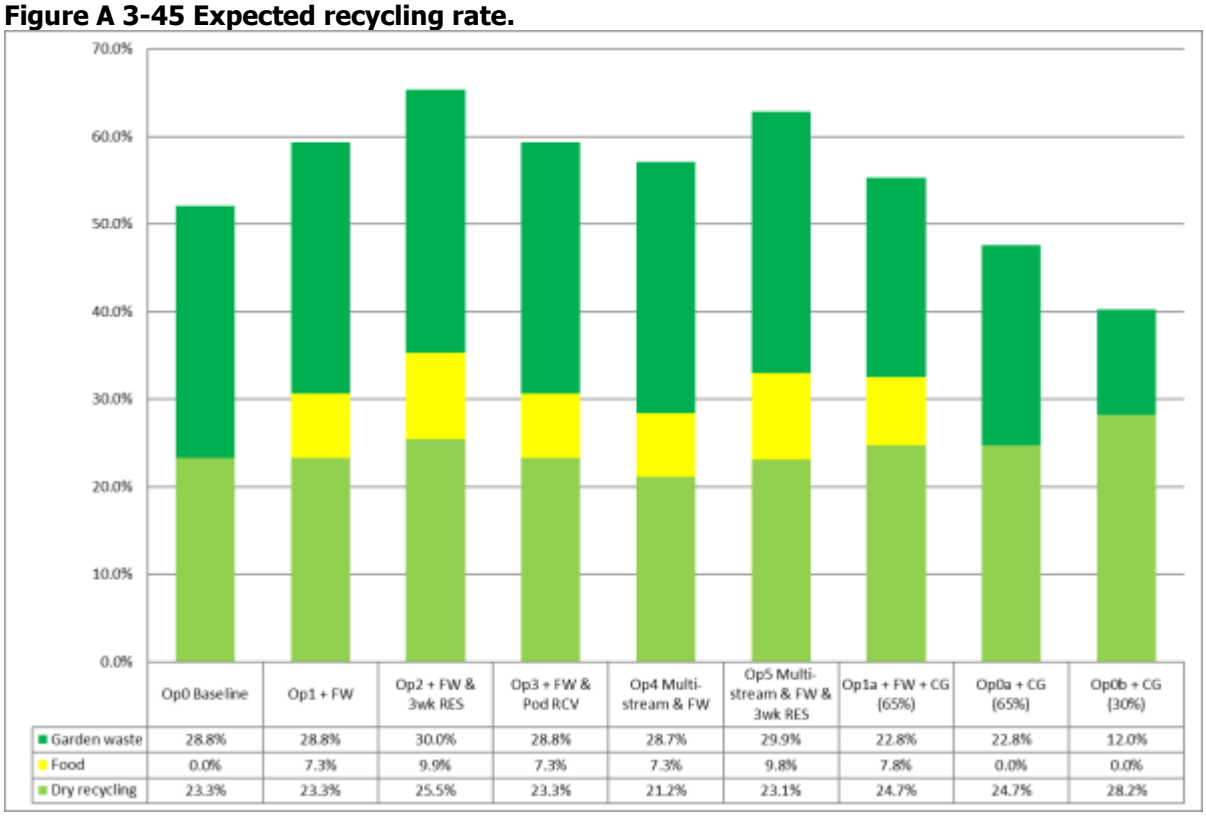
Key observations

- Food waste and recycling tonnages collected are assumed to increase by operating a three weekly collection, along with a reduction in overall waste;
- Multi-stream recycling reduces the level of contamination by up to 70%;
- Operating a chargeable garden waste scheme will reduce the quantity of garden waste collected at the kerbside; estimated reduction rates vary between 3000 tpa for Option 1a and 5000 tpa for Option 0b.

Recycling Rate

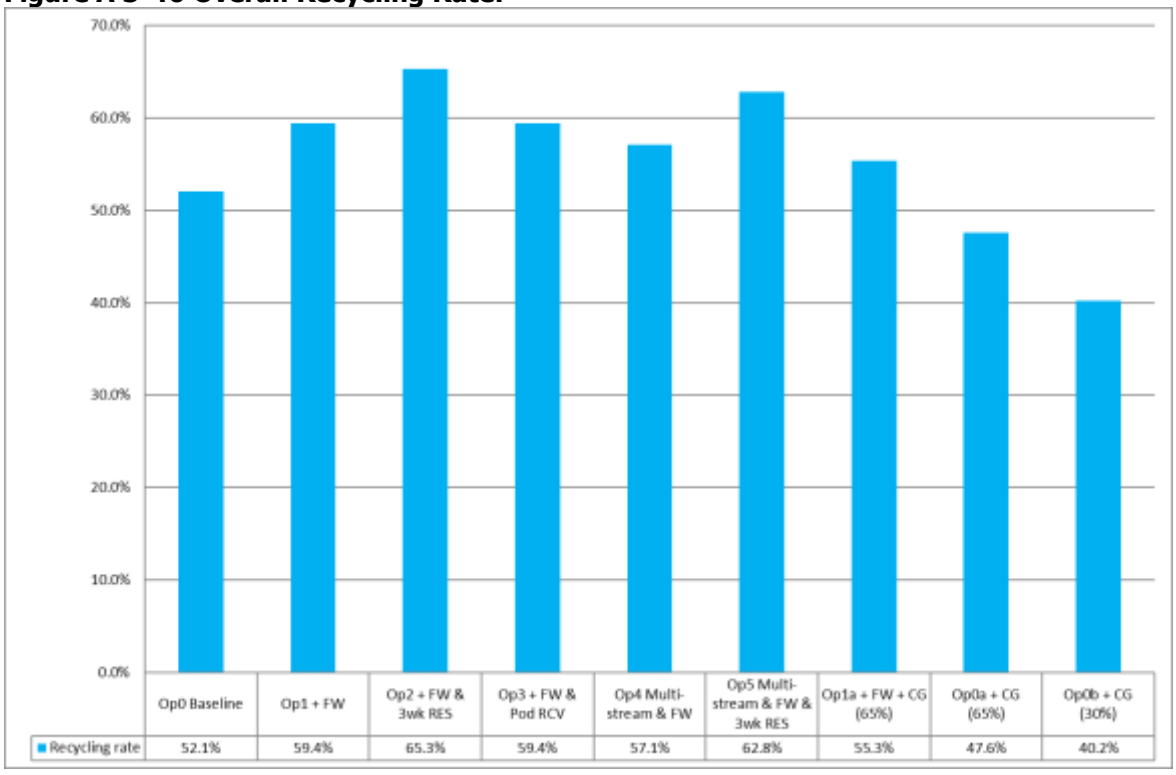
The expected recycling rates for dry recycling, food waste and garden waste for each option can be seen in Figure A 3-45and overall recycling rate in Figure A 3-46.

Figure A 3-45 Expected recycling rate.



	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
Garden waste	28.8%	28.8%	30.0%	28.8%	28.7%	29.9%	22.8%	22.8%	12.0%
Food	0.0%	7.3%	9.9%	7.3%	7.3%	9.8%	7.8%	0.0%	0.0%
Dry recycling	23.3%	23.3%	25.5%	23.3%	21.2%	23.1%	24.7%	24.7%	28.2%

Figure A 3-46 Overall Recycling Rate.



	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
Recycling rate	52.1%	59.4%	65.3%	59.4%	57.1%	62.8%	55.3%	47.6%	40.2%

Key observations

- Recycling rates range between 40% (Option 0b) and 65% (Option 2).
- The increase in the recycling rate, as a result of increased capture of food waste, is between 7% and 10% depending on the collection system.
- Dry recycling rates range between 21% and 28% depending on the option. This is determined by the type of recycling collection service offered and its frequency. The options with a chargeable garden service cause an increase in the dry recycling

percentage (not tonnage) due to less waste collected within the kerbside schemes, but the overall recycling rate is lower for these options, due to reduced quantities of compostable material being collected.

- The introduction of a rechargeable garden waste scheme reduces garden waste recycling rates significantly; estimated reduction values ranges are 6% for Option 1 and up to 16.8% for Option 0.
- Options 2 and 5 have the highest recycling rate (~63-65%), due to separately collected food waste, increased dry recycling and reduced overall waste caused by three-weekly residual collections.
- Option 0b has the lowest overall recycling rate of the options modelled (40%), this is in spite of having a fortnightly residual and comingled collection. This could be also explained due to the substantial reduction in green waste collected.

Resources required – front line vehicles

The KAT modelling shows that different numbers of front line vehicles are required across the options. Although some of the existing vehicles may be suitable for use initially, we have modelled on the assumption that all options require a new vehicle fleet, and costs are depreciated and included in order to take this into account. We have taken this approach as the existing collection vehicles will ultimately need replacing and it allows for options to be compared on a like for like basis. Table A 3-22 and Table A 3-23 show the key operational parameters and the difference in the numbers and types of vehicles required in each of the modelled collection options.

Table A 3-22 Key operational parameters.

Parameter	Scenario	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
Number of vehicles	Dry	3.80	3.80	3.80	4.82	11.66	11.71	3.80	3.80	3.80
	Garden	3.71	3.71	3.71	3.71	3.71	3.71	2.81	2.41	1.11
	Food	-	4.17	5.00	-	-	-	4.17	-	-
	Refuse	3.94	3.94	2.62	5.19	3.94	2.87	3.94	3.94	3.94
	Total	**11.4**	**15.6**	**15.3**	**13.7**	**19.3**	**18.3**	**14.7**	**10.1**	**8.8**
Number of households passed by per vehicle per day	Dry	1,220	1,220	1,220	962	794	791	1,220	1,220	1,220
	Garden	1,180	1,180	1,180	1,180	1,180	1,180	1,014	1,180	1,180
	Food		2,223	1,808				2,223		
	Refuse	1,176	1,176	1,176	893	1,176	1,076	1,176	1,176	1,176
Number of loads collected per vehicle per day	Dry	1.5	1.5	1.6	1.5	1.1	1.3	1.5	1.5	1.5
	Garden	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.4	1.4
	Food		1.0	1.1				1.0		
	Refuse	1.9	1.6	1.9	1.4	1.8	2.0	1.7	2.0	2.0

Table A 3-23 Vehicles required for each option.

	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
RCV	12.0	12.0	11.0	5.0	8.0	7.0	11.0	11.0	10.0
Romaquip	0.0	0.0	0.0	0.0	12.0	12.0	0.0	0.0	0.0
REL + Pod	0.0	0.0	0.0	9.0	0.0	0.0	0.0	0.0	0.0
SplitRCV	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Food	0.0	5.0	5.0	0.0	0.0	0.0	5.0	0.0	0.0
Total	**12.0**	**17.0**	**16.0**	**14.0**	**20.0**	**19.0**	**16.0**	**11.0**	**10.0**

The key observations from the number of front line vehicles modelled are:

- A separate food waste service requires an additional 5 vehicles.
- Operating a three-weekly residual collection reduces residual RCV vehicles required by one compared to the same scheme on a fortnightly collection.
- Using a pod based vehicle increases the vehicles required by 2, compared to the baseline.
- Moving to a chargeable garden waste collection reduces the vehicles required by up to 2 vehicles based on the number of households taking up the scheme.
- A multi-stream service is likely to require 12 romaquip type vehicles to service the authority.
- All the options require additional vehicles compared to the baseline, except Options 0a and 0b, where 11 and 10 vehicles are required respectively (down from 12 for the baseline).

Annual vehicle costs

We have estimated the capital costs for the purchase of vehicles using the unit costs presented in Appendix 1. We have detailed the total vehicle capital cost in **Table A 3-24**. It is assumed that all vehicles will need to be purchased, with the cost depreciated over 10 years.

Table A 3-24 Vehicle capital cost to purchase.

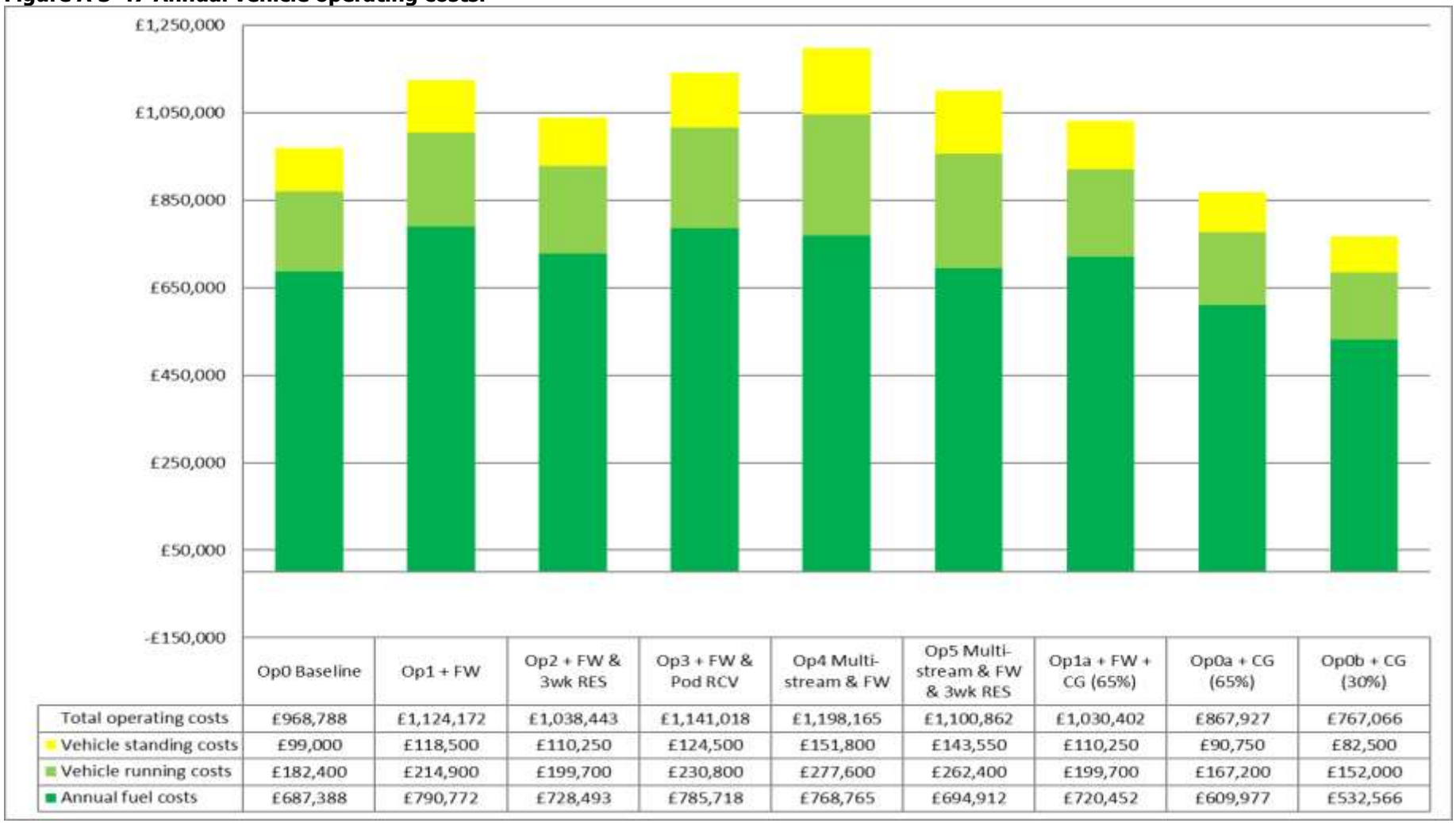
	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
RCV	£1,824,000	£1,824,000	£1,672,000	£760,000	£1,216,000	£1,064,000	£1,672,000	£1,672,000	£1,520,000
Romaquip					£1,560,000	£1,560,000			
REL + Pod				£1,548,000					
SplitRCV									
Food		£325,000	£325,000				£325,000		
Total	£1,824,000	£2,149,000	£1,997,000	£2,308,000	£2,776,000	£2,624,000	£1,997,000	£1,672,000	£1,520,000

The key observations are:

- Options 4 and 5 are the most expensive option in terms of vehicle costs, primarily due to the high number of multi-stream vehicles required to collect dry recycling and food waste weekly, as shown in Table A 3-24 above.
- Option 0b has the lowest vehicle costs, this is because it requires the least number of vehicles due to the introduction of a chargeable garden waste service.

The annual vehicle operating costs are shown in Figure A 3-47. These include vehicle fuel, maintenance, operating and running costs.

Figure A 3-47 Annual vehicle operating costs.



	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
Total operating costs	£968,788	£1,124,172	£1,038,443	£1,141,018	£1,198,165	£1,100,862	£1,030,402	£867,927	£767,066
Vehicle standing costs	£99,000	£118,500	£110,250	£124,500	£151,800	£143,550	£110,250	£90,750	£82,500
Vehicle running costs	£182,400	£214,900	£199,700	£230,800	£277,600	£262,400	£199,700	£167,200	£152,000
Annual fuel costs	£687,388	£790,772	£728,493	£785,718	£768,765	£694,912	£720,452	£609,977	£532,566

The key observations are:

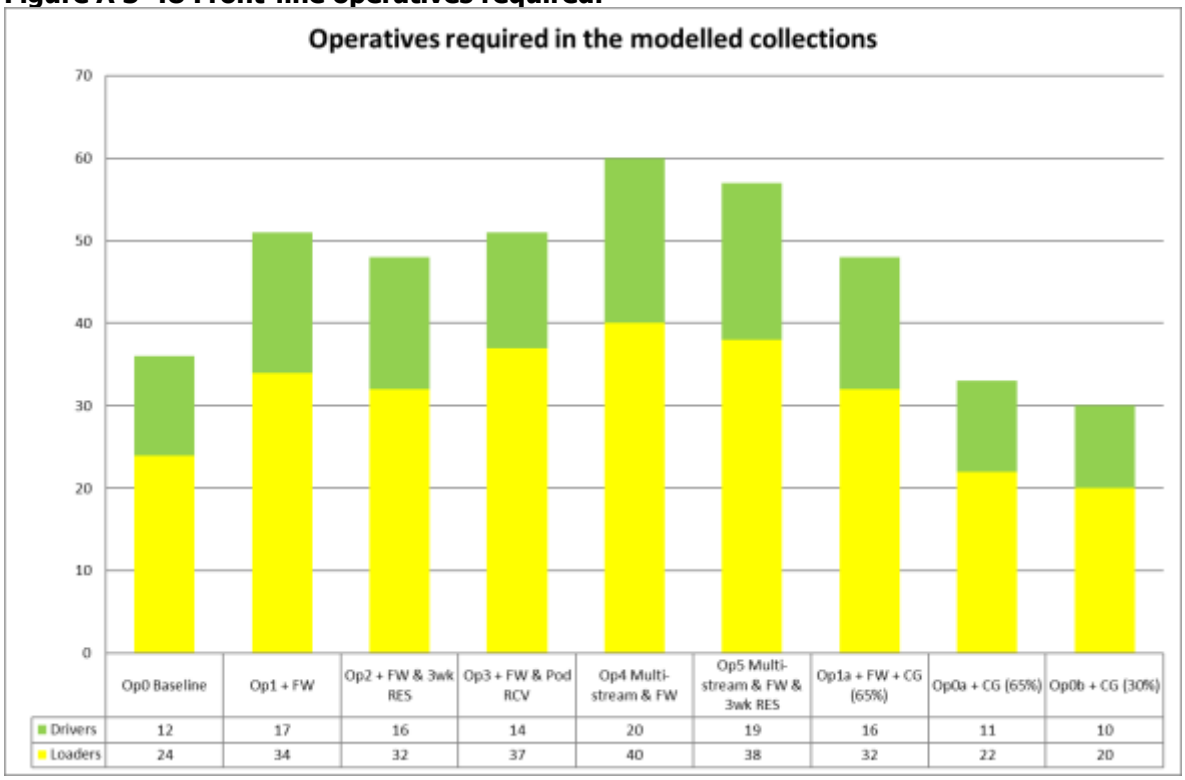
- Options 4, 3, 1 and 5 have the highest vehicle costs, this is due to the high number of multi-stream vehicles or additional vehicles used for a dedicated food waste collection model.
- Options 0a and 0b have the lowest vehicle and operating costs, this is due the introduction of chargeable garden waste schemes and consequently a reduction in vehicle numbers as quantities of garden waste collected are expected to be reduced significantly.
- Operating a dedicated food waste collection increases vehicle costs compared to the Baseline (Option 1). In spite of the introduction of a three-weekly residual collection (Option 2) helps reduce these costs by 7%, the total operating cost remains higher than total cost associated with Option 0.
- The pod-based collection of food waste results in greater costs than a dedicated food waste service.

Resources required – front line operatives

The number of front line operatives required directly relates to the number and type of vehicles required. Appendix 1 lists the number of operatives used in each vehicle and the unit costs.

Figure A 3-48 shows the number of front-line operatives estimated for each scenario. Options 4 and 5 require the highest number of operatives due to the multi-stream vehicles. This is followed by Option 3 with the pod vehicles. Options 0a and 0b have the lowest front-line operative requirements, this is due to the lower number of vehicles used when moving to a chargeable garden waste service. Operating a dedicated food waste service increases front line operatives; this is not reduced significantly by moving to a three weekly service as the number of vehicles required is the same.

Figure A 3-48 Front-line operatives required.

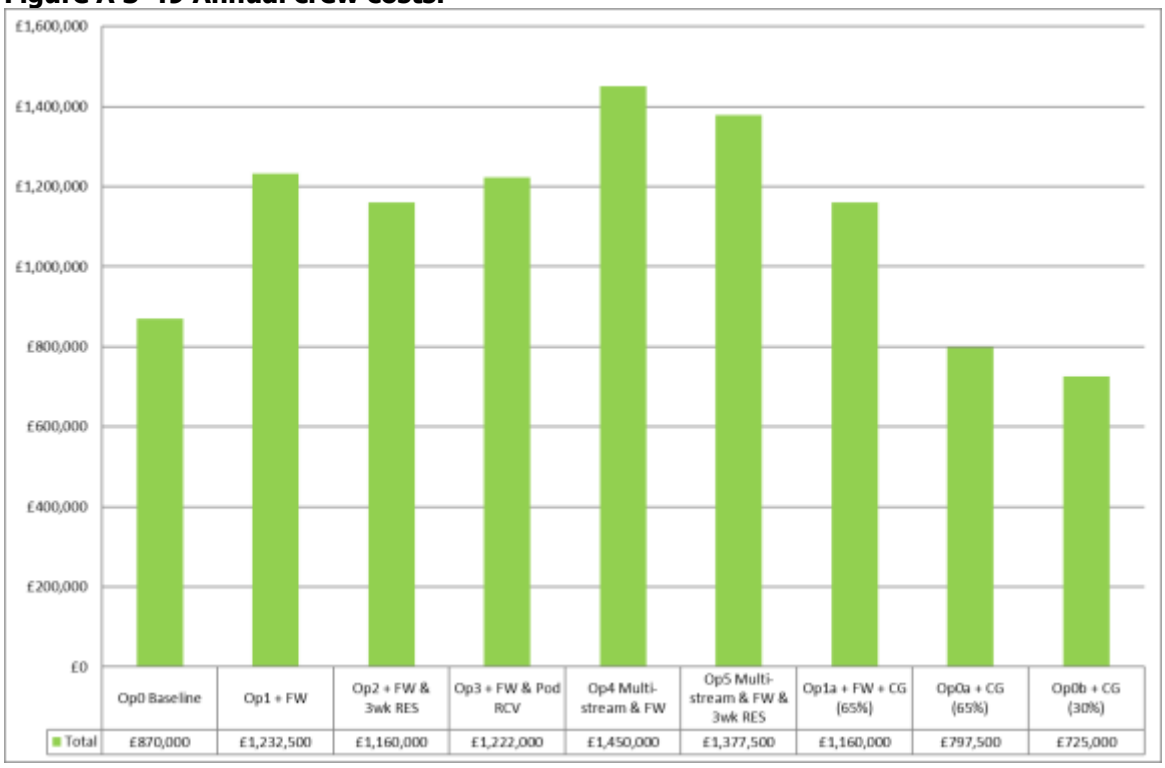


	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
Drivers	12	17	16	14	20	19	16	11	10
Loaders	24	34	32	37	40	38	32	22	20

Annual crew costs

The annual crew costs include drivers, loaders and supervisor costs, Figure A 3-49.

Figure A 3-49 Annual crew costs.



The key observations on resource requirements are that:

- Option 0b has the lowest crew costs overall (~£725,000). This is attributed to the reduction in the number of vehicles required and, accordingly, the number of personnel needed.
- Options 4 and 5 have the highest crew costs, this is because of the high number of vehicles on the multi-stream service and the high number of operatives per vehicle (a driver and 3 loaders).

Resources required – containers

There are also capital container costs associated with some of the options, where a new collection or set of containers is provided.

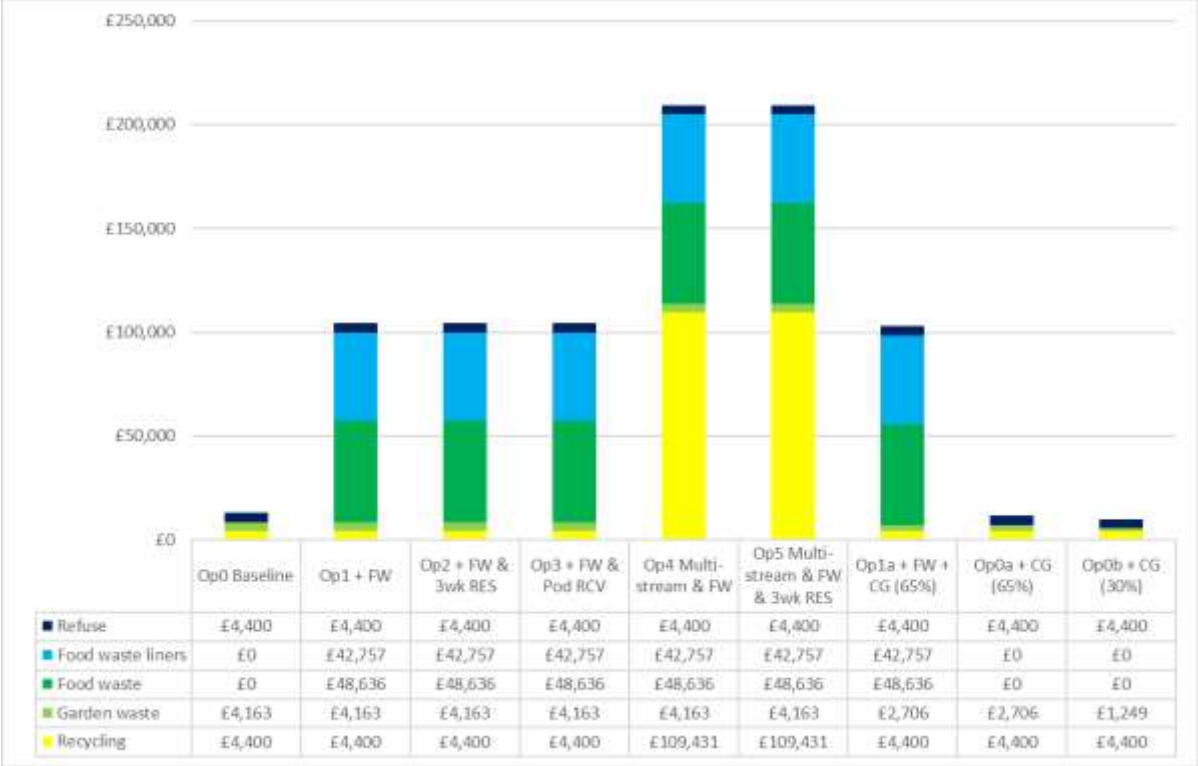
For a multi-stream recycling service it has been assumed that each household would receive three boxes that would be purchased as new. Food waste collections require each household to have a food caddy and 23ltr container. These are shown in Figure A 3-50.

Figure A 3-50 Capital container costs.

	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
Refuse	£0	£0	£0	£0	£0	£0	£0	£0	£0
Food waste	£0	£162,120	£162,120	£162,120	£162,120	£162,120	£162,120	£0	£0
Garden waste	£0	£0	£0	£0	£0	£0	£0	£0	£0
Recycling	£0	£0	£0	£0	£312,660	£312,660	£0	£0	£0

In addition to the purchase of new bins, there is also an annual replacement cost for provided containers, e.g. lost or damaged bins. Figure A 3-51 shows the annualised capital costs of purchasing new containers (based on their excepted life time), the annual replacement costs and annual cost of proving food waste liners (2 per household per week). The cost of collecting and disposing of 'old' bins is not included, and would be an additional consideration for the authority. However, this may be a cost neutral activity, as once the 'old' bins are collected, they can be sold and chipped for recycling.

Figure A 3-51 Annual container costs.



	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
Refuse	£4,400	£4,400	£4,400	£4,400	£4,400	£4,400	£4,400	£4,400	£4,400
Food waste liners	£0	£42,757	£42,757	£42,757	£42,757	£42,757	£42,757	£0	£0
Food waste	£0	£48,636	£48,636	£48,636	£48,636	£48,636	£48,636	£0	£0
Garden waste	£4,163	£4,163	£4,163	£4,163	£4,163	£4,163	£2,706	£2,706	£1,249
Recycling	£4,400	£4,400	£4,400	£4,400	£109,431	£109,431	£4,400	£4,400	£4,400

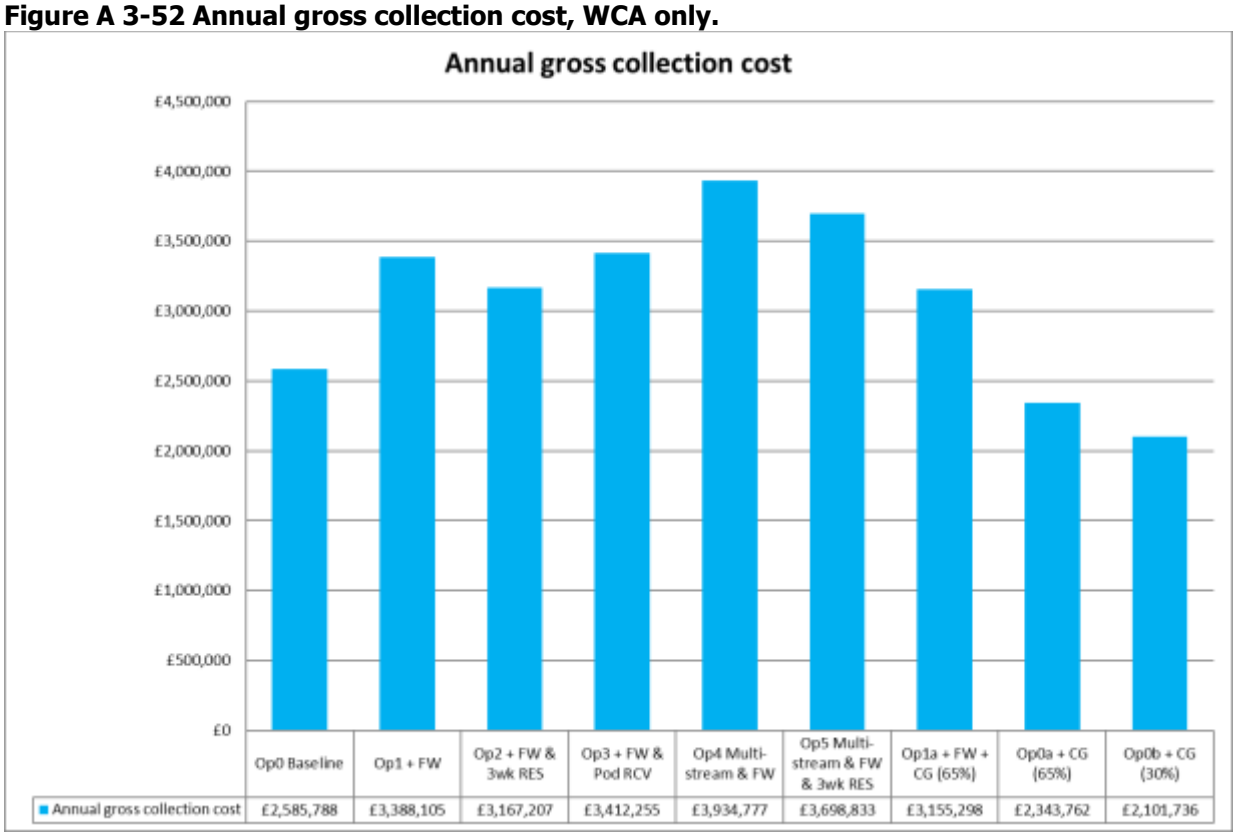
Observations:

- Introducing new schemes such as food waste and multi-stream recycling increased annual container costs due to the purchase of new containers. Even when annualised the costs can be significant.
- The baseline, Options 0a and Option 0b have has the lowest container costs as they do not offer new services and therefore less cost is reported.
- All garden waste collections have the same container costs, but these costs decrease as the number of households participating at the chargeable scheme decreases.
- Multi-stream collections have the highest cost for containers due to the cost of new boxes and food waste containers.

Annual gross collections costs

The cost of waste and recycling collections is a significant consideration for local authorities when determining their future collection system configuration. The annual gross collection cost of each option, is shown Figure A 3-52. This includes the cost of front-line operatives, supervision, annualised container costs (including the purchase of new containers where necessary and replacement containers at an assumed percentage replacement rate), vehicle costs (depreciated over 10 years) and vehicle standing and running costs and fuel. N.B. The gross collection costs exclude recycling credits, MRF gates fees and any material income from recycled materials and any disposal costs.

Figure A 3-52 Annual gross collection cost, WCA only.



Observations:

- The multi-stream options (4 & 5) have the largest annual gross costs, due to a combination of large vehicle numbers, leading to higher running costs and associated crew costs.
- Options 0b, 0a and 0 have the lowest annual gross cost, this is because they have the lowest crew numbers, coupled with the lowest vehicle numbers.
- All the options with some form of food waste collection have increased gross collection costs due to the additional vehicles (either dedicated or pod-based).

WCA costs

This section provides an estimate of the WCA costs, which includes:

- The gross collection costs;
- MRF gates fees and any material income from recycled materials;
- Garden and food waste treatment costs;
- Bulking of food waste where not able to direct deliver; and
- Recycling credits.

The current material values for dry recycling are taken from MRF data provided by the authority. Where the materials are collected separately, we have assumed that the authority would receive the full market value. Treatment for food waste and garden waste is based on data provided by the authority or an agreed assumption.

Detailed cost data is provided within Appendix 2.

For separately collected materials, these costs do not include the following, as the uncertainties involved are beyond the scope of the project:

- Any change to delivery points - Where a new collection system is used, the existing transfer station may not be suitable and so an alternative would be required;
- Infrastructure changes – for example, additional bays may be required where there are an increased number of material streams. Where these bays do not exist, there would be capital costs required to put them in place. There may also be a need to purchase additional plant, such as a forklift or loading shovel. Some of these costs may be passed on to the Councils, either directly or indirectly;
- Bulking and haulage – the bulking and haulage of materials are an additional cost. This includes arranging for materials to be taken to reprocessors.
- The cost for this haulage would be highly dependent on the final destination and the fuel costs; and
- Similarly, the recycling income figures are derived from information in the public domain and these may not accurately reflect the income offered by a service provider.

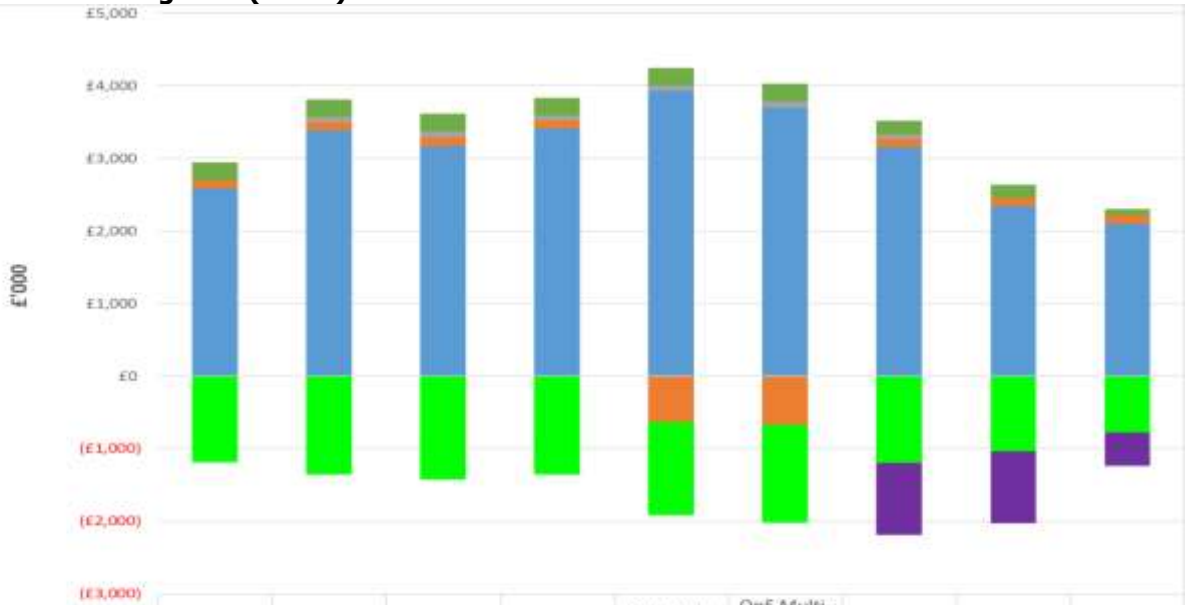
The Council receives recycling credits from the Waste Disposal Authority (WDA) equivalent to £50 for every tonne of dry recycling or food waste that avoids being sent for disposal as residual waste. The WDA pays recycling credits for garden waste collected of £49 per tonne, this is because the WDA does not pay for the disposal of organic waste collected by the authorities.

Figure A 3-53 shows the main cost categories for the authority. There are a number of categories that are income generating, such as recycling credits, garden waste charges and income from materials sales, these are negative and appear below the y axis.

Observations:

- The collection costs are the dominant category, followed by recycling credits.
- Using a MRF to sort material typically results in additional costs, whilst the sale of materials from a multi-stream service typically results in significant income.
- The garden, food and mixed organic processing costs make up only a small part of the costs compared to most of the other categories.

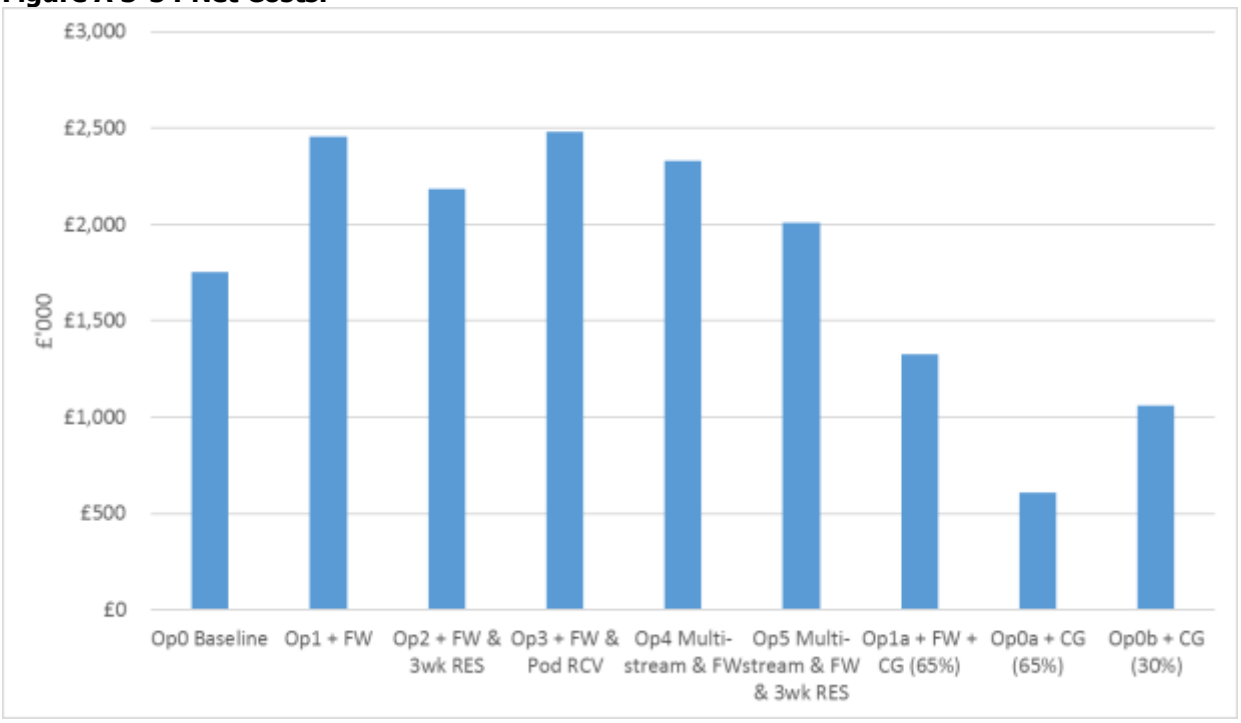
Figure A 3-53 WCA cost categories (£'000).



	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
Garden waste charge	0	0	0	0	0	0	-997	-997	-460
Recycling credits	-1,192	-1,355	-1,432	-1,355	-1,277	-1,351	-1,197	-1,034	-781
Mixed food & Garden Waste Treatment	0	0	0	0	0	0	0	0	0
Garden Waste Treatment	247	247	247	247	247	247	185	185	85
Food Waste Treatment	0	65	84	65	65	85	65	0	0
Bulking	0	0	0	0	0	0	0	0	0
Dry income/charge	113	113	119	113	-640	-672	113	113	113
Collection costs	2,586	3,388	3,167	3,412	3,935	3,699	3,155	2,344	2,102

The total annual net costs are also presented in the chart below, Figure A 3-54.

Figure A 3-54 Net Costs.



Key observations:

- The main 5 options all increase the net WCA costs, in part due to the addition of food waste collections.
- Option 3 is the most expensive collection system, this is due to the use of pod vehicles requiring an additional loader, and the increased costs associated with that particular vehicle.
- Moving to a multi-stream service increases the collection costs but these are offset by income from materials' sales; estimated dry income ranges between £640k for Option 4 and £670 for Option 5.
- The net cost of options where a chargeable garden service is introduced are consistently below the baseline. This is due to a combination of lower vehicle numbers, crew costs and most significantly, the income stream from charging £35 per household.
- Introducing a chargeable garden waste scheme could potentially result in lower overall costs even if a dedicated food waste scheme were also introduced at the same time (as shown in Option 1a).
- Moving to a three-weekly residual collection does result in lower net costs but not sufficient to offset the introduction of a food waste collection.

Options summary

The total annual net collection costs and recycling rates for each option are shown in the table below (Table A 3-25). The ranks of both the cost and recycling rates are also provided.

Table A 3-25 Annual net costs, WCA.

Option	WCA Total (£k)	Difference to Baseline	Rank	Recycling rate	Rank
Op0 Baseline	1,754	0	4	52%	7
Op1 + FW	2,458	704	8	59%	4
Op2 + FW & 3wk RES	2,185	432	6	65%	1
Op3 + FW & Pod RCV	2,482	728	9	59%	3
Op4 Multi-stream & FW	2,330	576	7	57%	5
Op5 Multi-stream & FW & 3wk RES	2,007	254	5	63%	2
Op1a + FW + CG (65%)	1,324	-429	3	55%	6
Op0a + CG (65%)	611	-1,143	1	48%	8
Op0b + CG (30%)	1,059	-695	2	40%	9

The main outcomes of the modelling are the following:

- Recycling rates range between 40% and 65%.
- Operating a chargeable garden waste scheme significantly reduces recycling rates but this can be offset to a varying degree by a food waste collection.
- Introducing a food waste collection and a 3 weekly residual service (Option 2) increases recycling rates considerably. However, leads to significant increase in the overall cost.
- A multi-stream service with food waste (Options 4 & 5) appears to be a less expensive option than the current service with a dedicated food collection (Option 1 & 2), although this would mean a significant change in how recycling is collected and does not reduce costs below the Baseline.
- The Baseline options with a chargeable garden service (Options 0a and 0b) result in the lowest costs but also the lowest recycling rate.
- Operating a pod vehicle appears to be the most expensive option of collecting food waste (as highlighted above).

It is important to note, that whilst the modelled costs show a relative comparison between each option, they do not necessarily represent the actual costs, nor do they show any savings that could be made through service management or through subjecting the service to competition through a procurement exercise.

A3.6 Stafford

Baseline data

The results of the initial baseline for Stafford are shown in Table A 3-26. A comparison with the actual data provided by the Council is also shown.

Some of the average timings provided have been slightly amended to reflect the number of loads and round sizes reported on KAT. The modelling assumes there are 5 vehicles in total used for the refuse and garden waste collections.

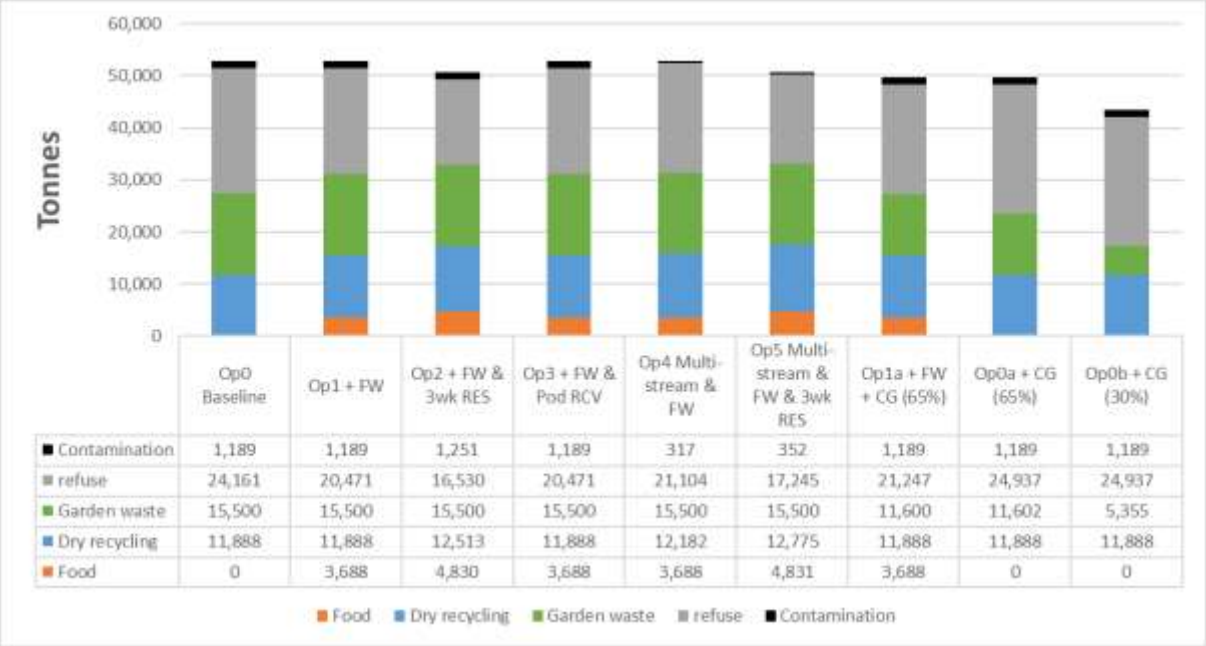
Table A 3-26 Stafford baseline results.

	Refuse		Dry recycling		Mixed organics	
Parameter	**KAT**	**Actual**	**KAT**	**Actual**	**KAT**	**Actual**
Collection frequency	Fortnightly		Fortnightly two-stream		Fortnightly garden only	
Collection vehicle	RCV: 6x 13 tonne payload	RCV: 6x 13 tonne payload	Splitback 65%/35% RCV: 6x 13 tonne payload	Splitback RCV: 6x 13 tonne payload	RCV: 5x 13 tonne payload	RCV: 5x 13 tonne payload
Number of collection vehicles required	5.8	6	5.8	6	5.0	5
Collection limited by weight or volume?	Weight	Weight	Volume	Volume	Volume	Volume
Number of loads collected per vehicle per day	1.4	2	2.0	2	1.9	2
Number of households passed by per vehicle per day	937	Unknown	945	560 – 1,300	1,110	Unknown

System performance – materials captured

The approximate tonnage for each option is shown in Figure A 3-55. The estimates are based on current data and projected performance for each option, as presented in Section 4.0 of the main report. The values for dry recyclate exclude contamination, which is assumed to be 9% for the current service and 2% for the multi-stream options

Figure A 3-55 Tonnage of each stream collected in each option .



	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
Contamination	1,189	1,189	1,251	1,189	317	352	1,189	1,189	1,189
refuse	24,161	20,471	16,530	20,471	21,104	17,245	21,247	24,937	24,937
Garden waste	15,500	15,500	15,500	15,500	15,500	15,500	11,600	11,602	5,355
Dry recycling	11,888	11,888	12,513	11,888	12,182	12,775	11,888	11,888	11,888
Food	0	3,688	4,830	3,688	3,688	4,831	3,688	0	0

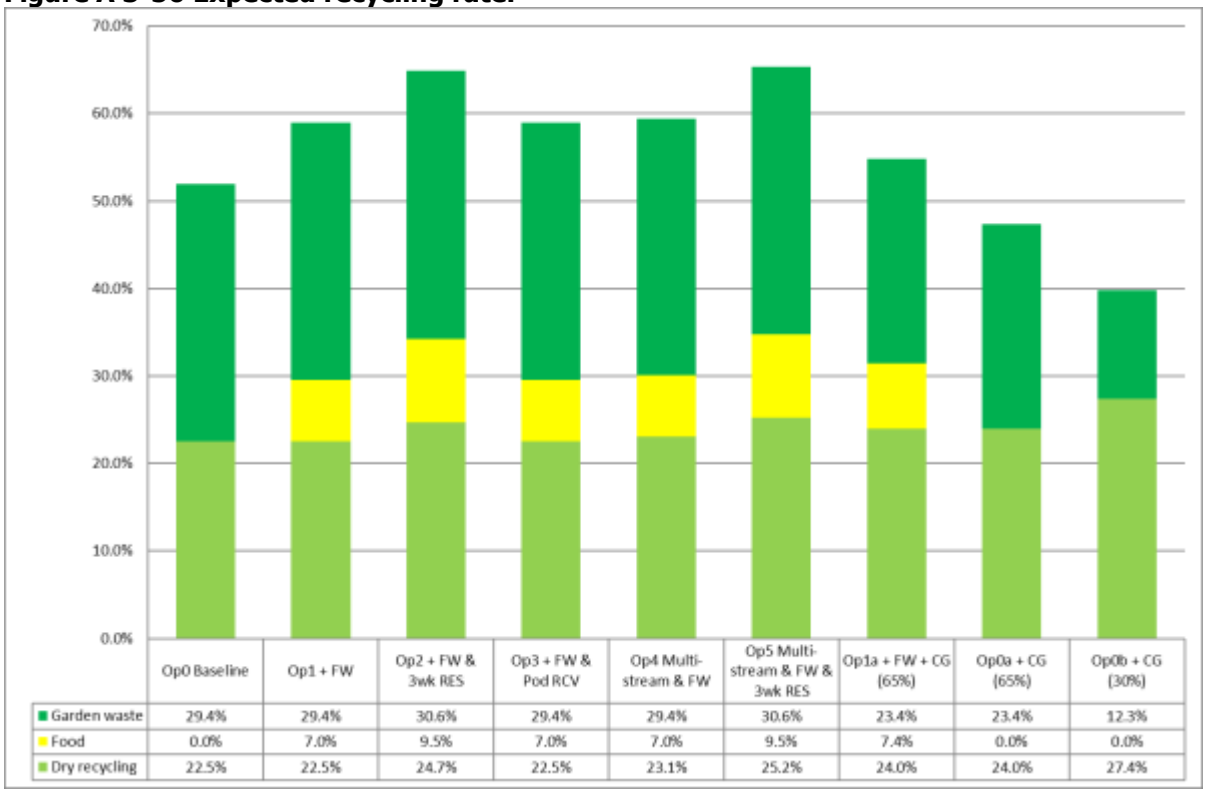
Key observations

- Food waste and recycling tonnages collected are assumed to increase by operating a three weekly collection, along with a reduction in overall waste;
- Multi-stream recycling reduces the level of contamination;
- Operating a chargeable garden waste scheme will reduce the quantity of garden waste collected at the kerbside; estimated reduction rates vary between 4,000 tpa for Option 0a and 10,000 tpa for Option 0b.

Recycling Rate

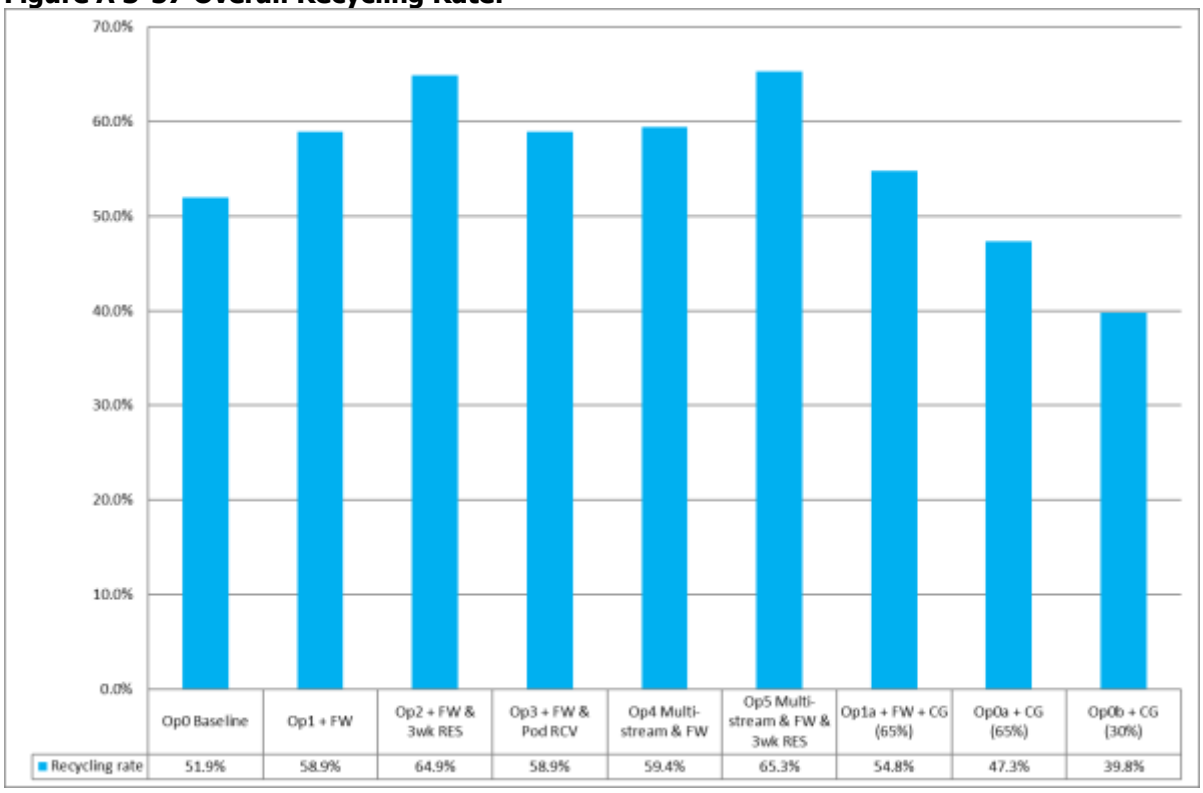
The expected recycling rates for dry recycling, food waste and garden waste for each option can be seen in Figure A 3-56and overall recycling rate in Figure A 3-57.

Figure A 3-56 Expected recycling rate.



	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
Garden waste	29.4%	29.4%	30.6%	29.4%	29.4%	30.6%	23.4%	23.4%	12.3%
Food	0.0%	7.0%	9.5%	7.0%	7.0%	9.5%	7.4%	0.0%	0.0%
Dry recycling	22.5%	22.5%	24.7%	22.5%	23.1%	25.2%	24.0%	24.0%	27.4%

Figure A 3-57 Overall Recycling Rate.



Key observations

- Recycling rates range between 40% (Option 0b) and 65% (Options 2 & 5).
- The increase in the recycling rate, as a result of increased capture of food waste, is between 7% and 10% depending on the option.
- Dry recycling rates range between 22.5% and 27.5% depending on the option. This is determined by the type of recycling collection service offered and its frequency. The options with a chargeable garden service cause an increase in the dry recycling percentage (not tonnage) due to less waste collected within the kerbside schemes.
- Options 2 and 5 have the highest recycling rate (~65%), due to separately collected food waste, increased dry recycling and reduced overall waste caused by three-weekly residual collections.
- Option 1b has the lowest recycling rate of the options modelled, this is due to having a weekly residual collection and a fortnightly comingled collection.

Resources required – front line vehicles

The KAT modelling shows that different numbers of front line vehicles are required across the options. Although some of the existing vehicles may be suitable for use initially, we have modelled on the assumption that all options require a new vehicle fleet, and costs are depreciated and included in order to take this into account. We have taken this approach as the existing collection vehicles will ultimately need replacing and it allows for options to be compared on a like for like basis. Table A 3-27 and Table A 3-28 show the key operational parameters and the difference in the numbers and types of vehicles required in each of the modelled collection options.

Table A 3-27 Key operational parameters.

Parameter	Scenario	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
Number of vehicles	Dry	5.82	5.82	6.00	5.82	18.11	18.18	5.82	5.82	5.82
	Garden	4.96	4.96	4.96	7.45	4.96	4.96	3.43	3.43	1.58
	Food	-	6.74	6.83	-	-	-	6.74	-	-
	Refuse	5.87	5.87	3.91	8.37	5.87	3.91	5.87	5.87	5.87
	Total	16.6	23.4	21.7	21.6	28.9	27.1	21.9	15.1	13.3
Number of households passed by per vehicle per day	Dry	945	945	916	945	608	605	945	945	945
	Garden	1,110	1,110	1,110	738	1,110	1,110	1,042	1,041	1,041
	Food		1,631	1,610				1,631		
	Refuse	937	937	937	657	937	937	937	937	937
Number of loads collected per vehicle per day	Dry	2.0	2.0	2.0	2.0	1.1	1.2	2.0	2.0	2.0
	Garden	1.9	1.9	1.9	2.0	1.9	1.9	2.0	2.0	2.0
	Food		0.7	0.9				0.7		
	Refuse	1.4	1.2	1.5	1.0	1.3	1.5	1.3	1.5	1.5

Table A 3-28 Vehicles required for each option.

	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
RCV	11	11	9	0	11	9	10	10	8
Romaquip	0	0	0	0	19	19	0	0	0
REL + Pod	0	0	0	17	0	0	0	0	0
SplitRCV	6	6	6	6	0	0	6	6	6
Food	0	7	7	0	0	0	7	0	0
Total	17	24	22	23	30	28	23	16	14

The key observations from the number of front line vehicles modelled are:

- A dedicated food waste service in Options 1, 2 and 1a requires an additional 7 vehicles.
- Operating a three-weekly residual collection reduces residual RCV vehicles required from 11 to 9.
- Using a pod based vehicle increases the vehicles required by 5, compared to the baseline.
- Moving to a chargeable garden waste collection reduces the vehicles required by 1 to 3, depending on the number of households taking up the scheme.
- A multi-stream service is likely to require 19 romaquip type vehicles to service the authority.
- All the options require additional vehicles compared to the baseline, except Options 0a and 0b, where 16 and 14 vehicles are required respectively (down from 17 for the baseline).

Annual vehicle costs

We have estimated the capital costs for the purchase of vehicles using the unit costs presented in Appendix 1. We have detailed the total vehicle capital cost in **Table A 3-29**. It is assumed that all vehicles will need to be purchased, with the cost depreciated over 10 years.

Table A 3-29 Vehicle capital cost to purchase.

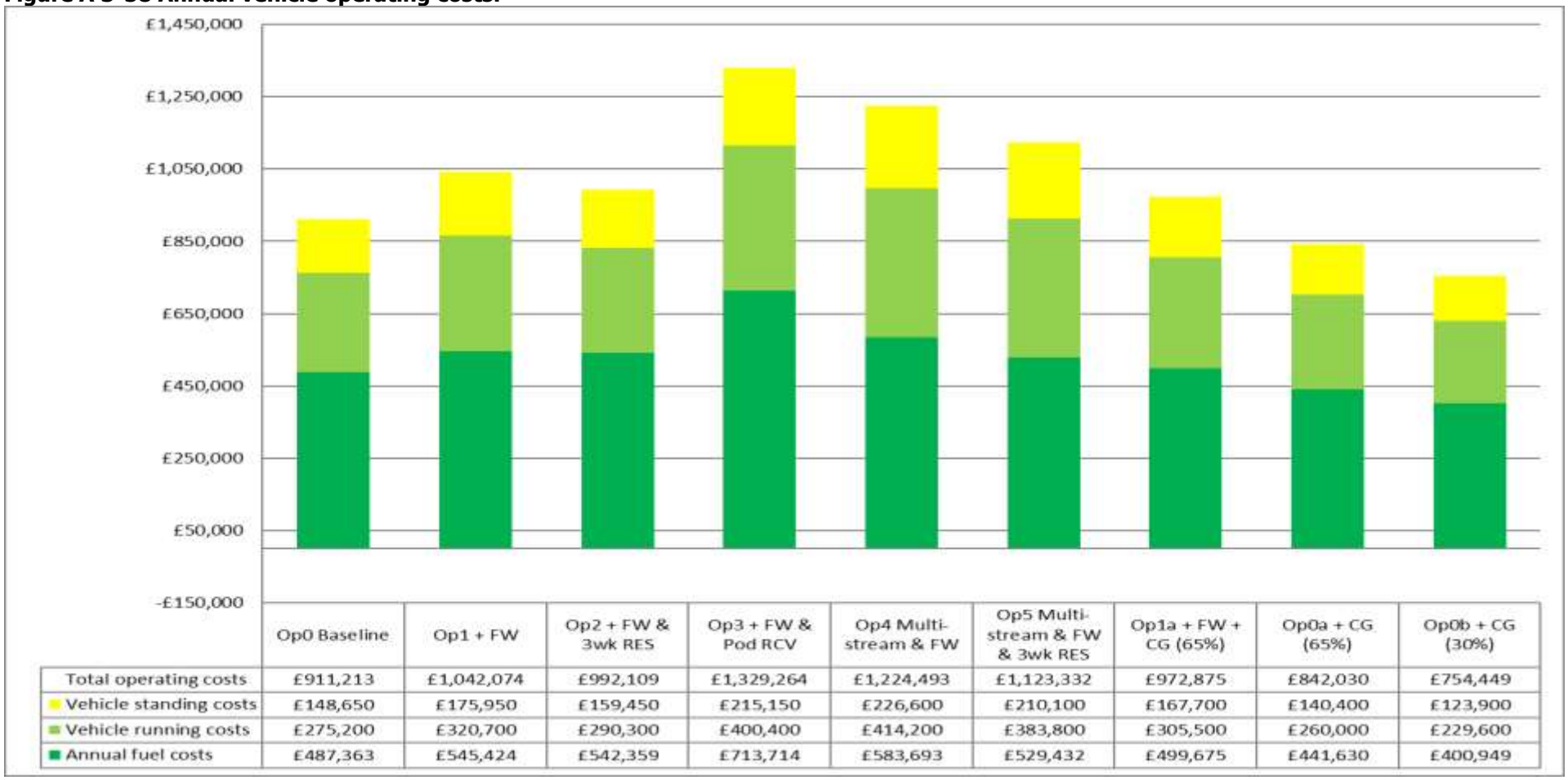
	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
RCV	£1,672,000	£1,672,000	£1,368,000		£1,672,000	£1,368,000	£1,520,000	£1,520,000	£1,216,000
Romaquip					£2,470,000	£2,470,000			
REL + Pod				£2,924,000					
SplitRCV	£1,080,000	£1,080,000	£1,080,000	£1,080,000			£1,080,000	£1,080,000	£1,080,000
Food		£455,000	£455,000				£455,000		
Total	£2,752,000	£3,207,000	£2,903,000	£4,004,000	£4,142,000	£3,838,000	£3,055,000	£2,600,000	£2,296,000

The key observations are:

- Options 3 and 4 is the most expensive options in terms of vehicle costs, primarily due to the number of vehicles required and in the pod option, the higher vehicle purchase cost.
- Option 0b has the lowest vehicle costs, this is because it requires the least number of vehicles due to the introduction of a chargeable garden waste service that lowers the required vehicles.

The annual vehicle operating costs are shown in Figure A 3-58. These include vehicle fuel, maintenance, operating and running costs.

Figure A 3-58 Annual vehicle operating costs.



	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
Total operating costs	£911,213	£1,042,074	£992,109	£1,329,264	£1,224,493	£1,123,332	£972,875	£842,030	£754,449
Vehicle standing costs	£148,650	£175,950	£159,450	£215,150	£226,600	£210,100	£167,700	£140,400	£123,900
Vehicle running costs	£275,200	£320,700	£290,300	£400,400	£414,200	£383,800	£305,500	£260,000	£229,600
Annual fuel costs	£487,363	£545,424	£542,359	£713,714	£583,693	£529,432	£499,675	£441,630	£400,949

The key observations are:

- Options 3 and 4 have the highest vehicle costs, this is due to the high number of vehicles required to introduce new collection systems (either multi-stream or food pod based).
- Options 0a and 0b have the lowest vehicle and operating costs, this is due the introduction of chargeable garden waste schemes reducing vehicle numbers.
- Operating a dedicated food waste collection increases vehicle costs compared to the Baseline (Option 1), but moving to a three-weekly residual collection (Option 2) helps reduce these costs partially.
- The pod-based collection of food waste results in greater costs than a dedicated food waste service.

Resources required – front line operatives

The number of front line operatives required directly relates to the number and type of vehicles required. Appendix 1 lists the number of operatives used in each vehicle and the unit costs.

Figure A 3-59 shows the number of front-line operatives estimated for each scenario. Options 3 and 4 require the highest number of operatives due to number of vehicles and th4e additional loaders. Options 0a and 0b have the lowest front-line operative requirements, this is due to the lower number of vehicles used when moving to a chargeable garden waste service. Operating a dedicated food waste service increases front line operatives; this is reduced in part by moving to a three weekly service as the number of vehicles required is reduced from 24 to 22.

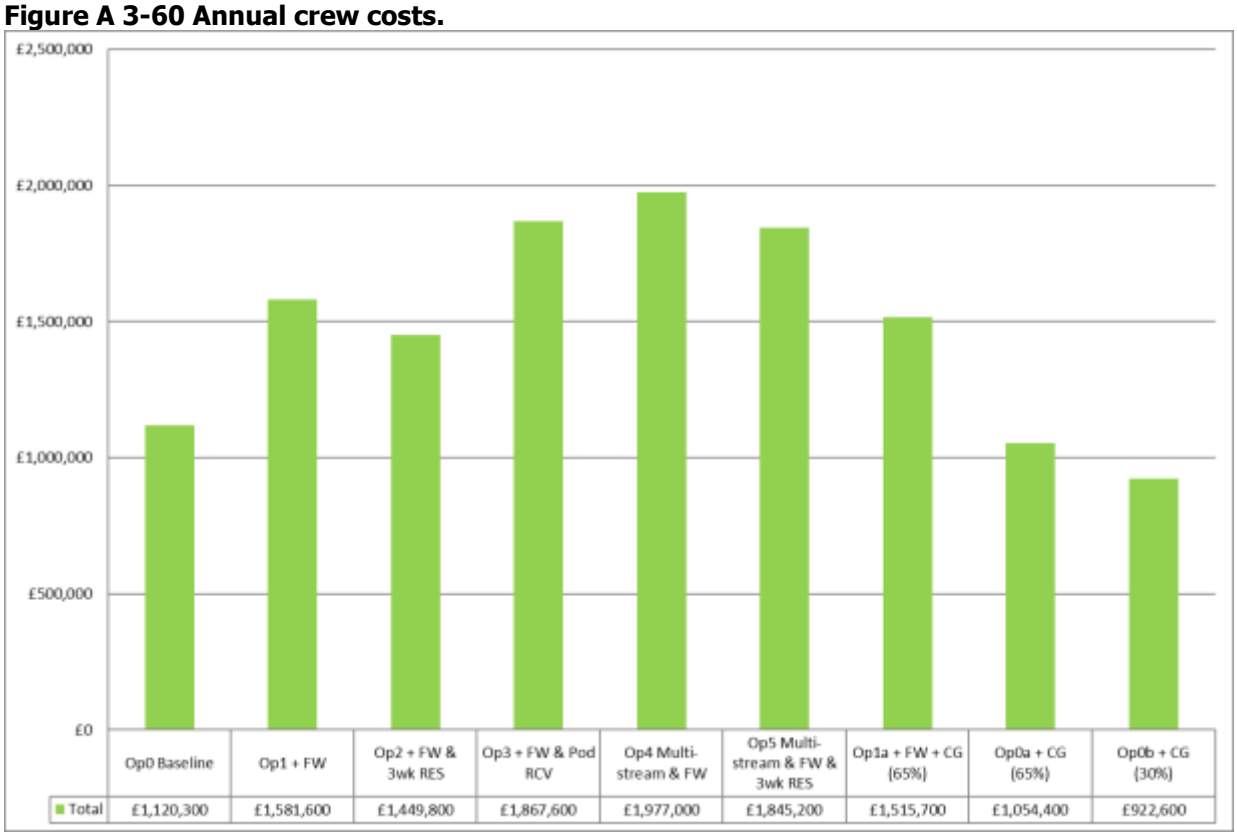
Figure A 3-59 Front-line operatives required.

	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
Drivers	17	24	22	23	30	28	23	16	14
Loaders	34	48	44	63	60	56	46	32	28

Annual crew costs

The annual crew costs include drivers, loaders and supervisor costs, Figure A 3-60.

Figure A 3-60 Annual crew costs.



The key observations on resource requirements are that:

- Option 0b has the lowest crew costs overall (~£923k), this service has the lowest number of vehicles which translates into the lowest crew numbers and thus costs;
- Options 4, 3 and5 have the highest crew costs, this is because of the high number of vehicles on the multi-stream service (or pod food waste collection service in case of Option 3) and the high number of operatives per vehicle.

Resources required – containers

There are also capital container costs associated with some of the options, where a new collection or set of containers is provided.

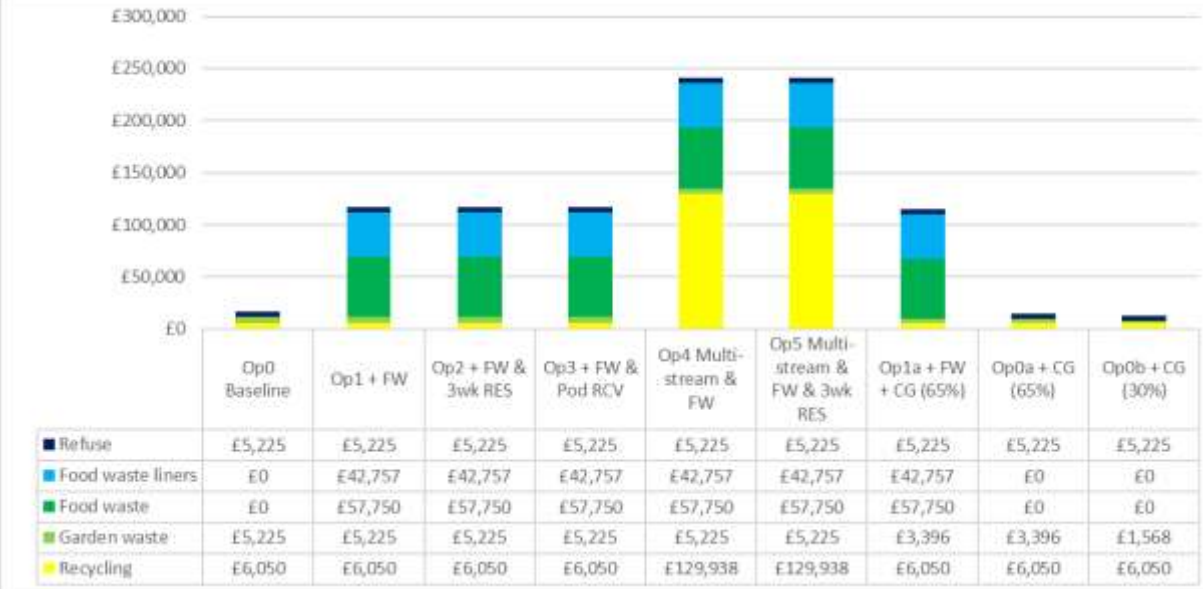
For a multi-stream recycling service, it has been assumed that each household would receive three new boxes that would be purchased. A separate food waste collections would require each household to have a food caddy and 23ltr container. The capital cost of these appear under the dry recycling category in the following charts, as food waste will be collected on these vehicles. These are shown in Figure A 3-61.

Figure A 3-61 Capital container costs.

	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
Series5	0								
Refuse	£0	£0	£0	£0	£0	£0	£0	£0	£0
Food waste	£0	£192,500	£192,500	£192,500	£192,500	£192,500	£192,500	£0	£0
Garden waste	£0	£0	£0	£0	£0	£0	£0	£0	£0
Recycling	£0	£0	£0	£0	£371,250	£371,250	£0	£0	£0

In addition to the purchase of new bins, there is also an annual replacement cost for provided containers, e.g. lost or damaged bins. Figure A 3-62 shows the annualised capital costs of purchasing new containers (based on their excepted life time), the annual replacement costs and annual cost of proving food waste liners (2 per household per week). The cost of collecting and disposing of 'old' bins is not included, and would be an additional consideration for the authority. However, this may be a cost neutral activity, as once the 'old' bins are collected, they can be sold and chipped for recycling.

Figure A 3-62 Annual container costs.



	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
Refuse	£5,225	£5,225	£5,225	£5,225	£5,225	£5,225	£5,225	£5,225	£5,225
Food waste liners	£0	£42,757	£42,757	£42,757	£42,757	£42,757	£42,757	£0	£0
Food waste	£0	£57,750	£57,750	£57,750	£57,750	£57,750	£57,750	£0	£0
Garden waste	£5,225	£5,225	£5,225	£5,225	£5,225	£5,225	£3,396	£3,396	£1,568
Recycling	£6,050	£6,050	£6,050	£6,050	£129,938	£129,938	£6,050	£6,050	£6,050

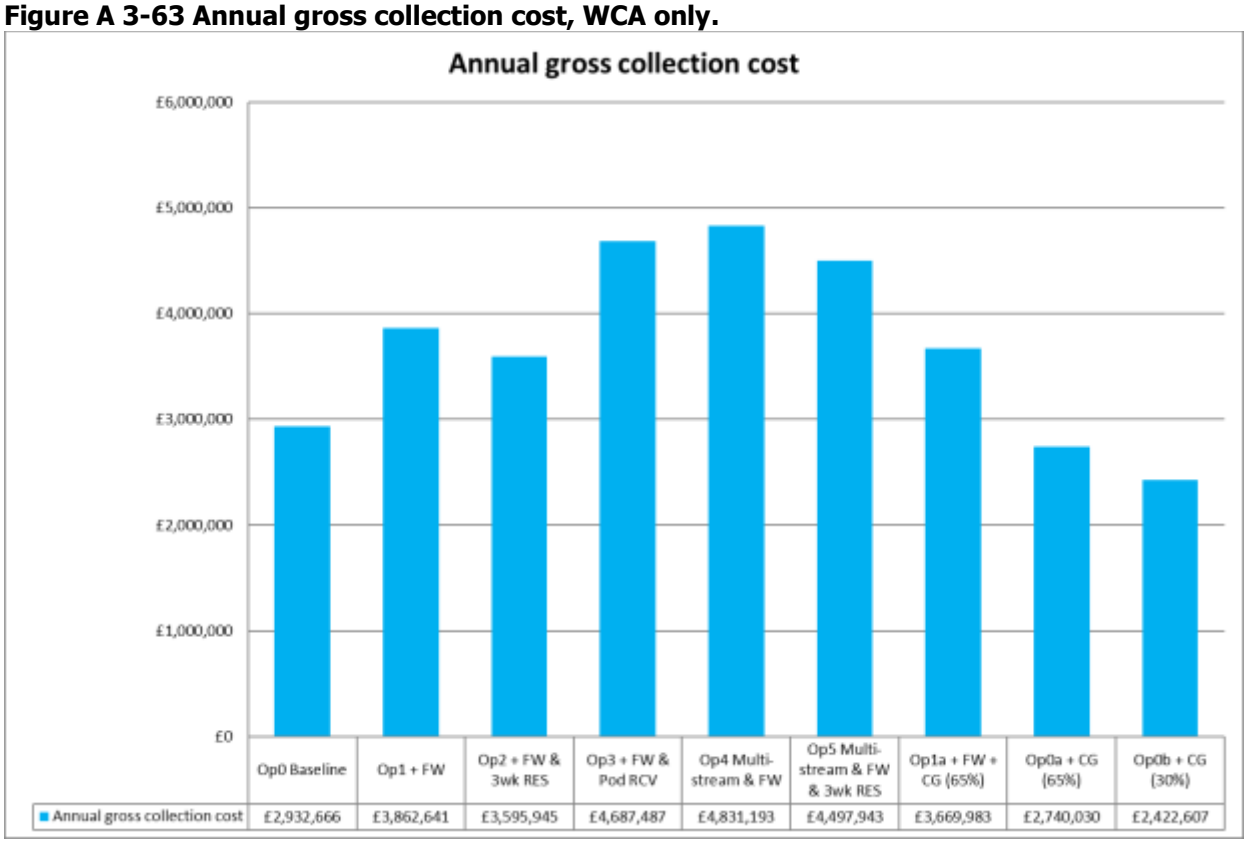
Observations:

- Introducing new schemes such as food waste and multi-stream recycling increased container costs due to the purchase of new containers. Even when annualised the costs can be significant.
- The baseline and options 0a and 0b have the lowest container costs due to them offering no new services.
- All garden waste collections have the same container costs, except where a chargeable service is introduced and the number of households on the scheme decrease.
- Multi-stream collections have the highest cost for containers due to the cost of new boxes and food waste containers.

Annual gross collections costs

The cost of waste and recycling collections is a significant consideration for local authorities when determining their future collection system configuration. The annual gross collection cost of each option, is shown Figure A 3-63. This includes the cost of front-line operatives, supervision, annualised container costs (including the purchase of new containers where necessary and replacement containers at an assumed percentage replacement rate), vehicle costs (depreciated over 10 years) and vehicle standing and running costs and fuel. N.B. The gross collection costs exclude recycling credits, MRF gates fees and any material income from recycled materials and any disposal costs.

Figure A 3-63 Annual gross collection cost, WCA only.



Observations:

- Multi-stream options (4 & 5) and pod based food waste collection option (Option 3) have the largest annual gross, due to a combination of large vehicle numbers and higher pod vehicle purchase costs, leading to higher running costs and associated crew costs.
- The Baseline (Option 0),Options 0a and 0b have the lowest annual gross cost, this is because they have the lowest crew numbers, coupled with the lowest vehicle numbers.

- All the options with some form of food waste collection have increased gross collection costs due to the additional vehicles (either dedicated or pod-based or RRV).

WCA costs

This section provides an estimate of the WCA costs, which includes:

- The gross collection costs;
- MRF gates fees and any material income from recycled materials;
- Garden and food waste treatment costs;
- Bulking of food waste where not able to direct deliver; and
- Recycling credits.

The current material values for dry recycling are taken from MRF data provided by the authority. Where the materials are collected separately, we have assumed that the authority would receive the full market value. Treatment for food waste and garden waste is based on data provided by the authority or an agreed assumption.

Detailed cost data is provided within Appendix 2.

For separately collected materials, these costs do not include the following, as the uncertainties involved are beyond the scope of the project:

- Any change to delivery points - Where a new collection system is used, the existing transfer station may not be suitable and so an alternative would be required;
- Infrastructure changes – for example, additional bays may be required where there are an increased number of material streams. Where these bays do not exist, there would be capital costs required to put them in place. There may also be a need to purchase additional plant, such as a forklift or loading shovel. Some of these costs may be passed on to the Councils, either directly or indirectly;
- Bulking and haulage – the bulking and haulage of materials are an additional cost. This includes arranging for materials to be taken to reprocessors.
- The cost for this haulage would be highly dependent on the final destination and the fuel costs; and
- Similarly, the recycling income figures are derived from information in the public domain and these may not accurately reflect the income offered by a service provider.

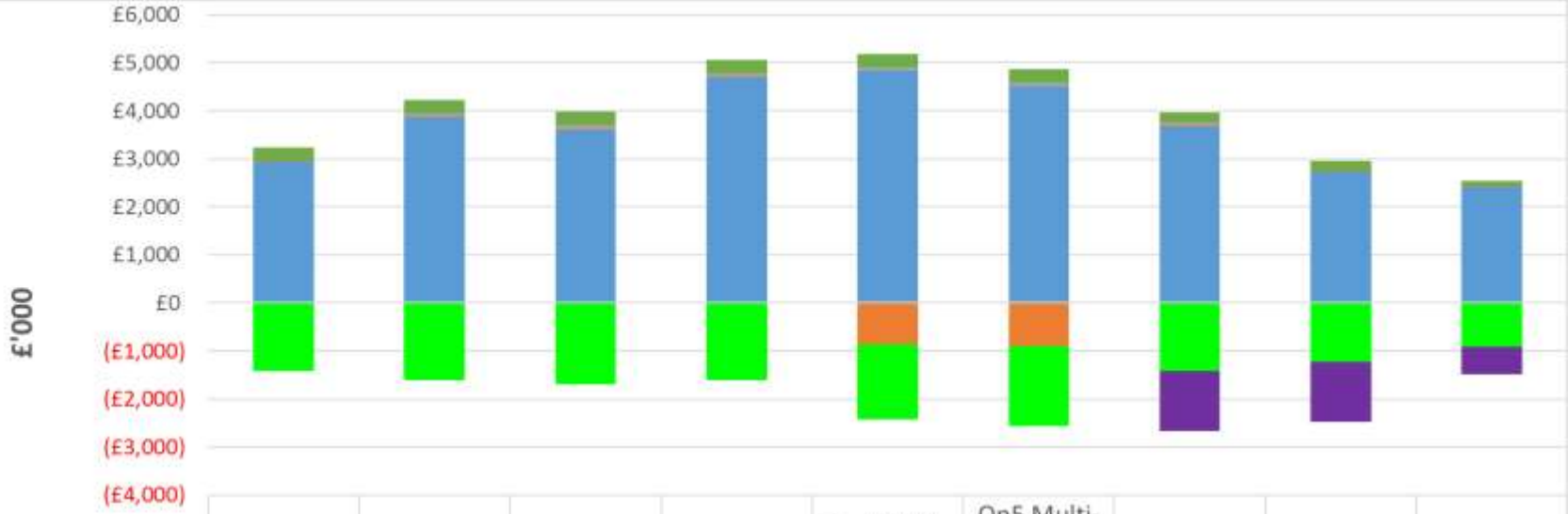
The Council receives recycling credits from the Waste Disposal Authority (WDA) equivalent to £50 for every tonne of dry recycling or food waste that avoids being sent for disposal as residual waste. The WDA pays recycling credits for garden waste collected of £49 per tonne, this is because the WDA does not pay for the disposal of organic waste collected by the authorities.

Figure A 3-64 shows the main cost categories for the authority. There are a number of categories that are income generating, such as recycling credits, garden waste charges and income from materials sales, these are negative and appear below the y axis.

Observations:

- The collection costs are the dominant category, followed by recycling credits.
- Using a MRF to sort material typically results in additional costs, whilst the sale of materials from a multi-stream service typically results in significant income.
- The garden, food and mixed organic processing costs make up only a small part of the costs compared to most of the other categories.

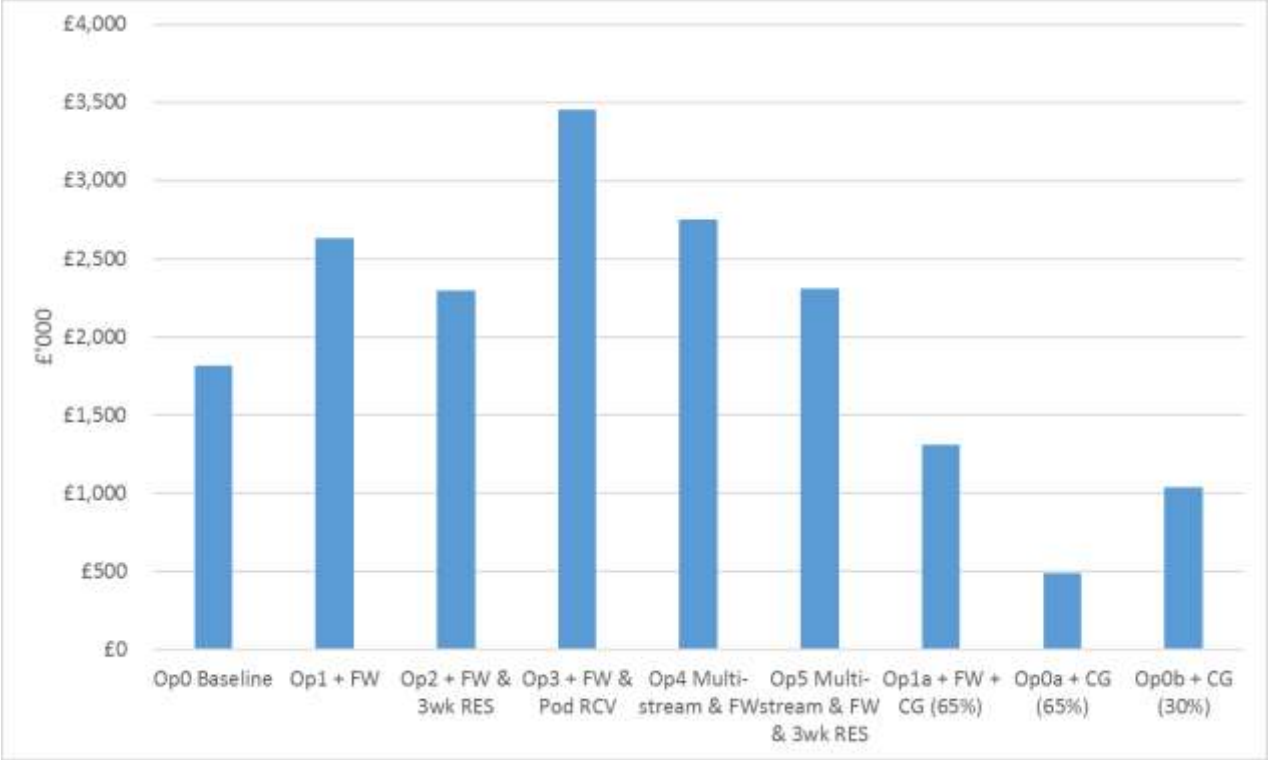
Figure A 3-64 WCA cost categories (£'000).



	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
Garden waste charge	0	0	0	0	0	0	-1,251	-1,251	-578
Recycling credits	-1,416	-1,601	-1,693	-1,601	-1,572	-1,661	-1,410	-1,225	-919
Mixed food & Garden Waste Treatment	0	0	0	0	0	0	0	0	0
Garden Waste Treatment	279	279	279	279	279	279	209	209	96
Food Waste Treatment	0	74	97	74	74	97	74	0	0
Bulking	0	0	0	0	0	0	0	0	0
Dry income/charge	17	17	18	17	-859	-901	17	17	17
Collection costs	2,933	3,863	3,596	4,687	4,831	4,498	3,670	2,740	2,423

The total annual net collection costs are also presented in the chart below, Figure A 3-65.

Figure A 3-65 Net Costs.



Key observations:

- The main 5 options all increase the net WCA costs, in part due to the addition of food waste collections.
- Option 3 is the most expensive collection system, this is due to the use of pod vehicles requiring an additional loader, and the increased costs associated with that particular vehicle.
- Moving to a multi-stream service increases collection costs (Option 4) but these are offset significantly by greater income from materials' sales.
- The net cost of options where a chargeable garden service is introduced is consistently below the baseline. This is due to a combination of lower vehicle numbers, crew costs and most significantly, the income stream from charging £35 per household.
- Introducing a chargeable garden waste scheme could potentially result in lower overall costs even if a dedicated food waste scheme were also introduced at the same time, as shown in Option 1a.
- Moving to a three-weekly residual collection does result in lower net costs but not sufficient to offset the introduction of a food waste collection.

Options summary

The total annual net collection costs and recycling rates for each option are shown in the table below (Table A 3-30). The ranks of both the cost and recycling rates are also provided.

Table A 3-30 Annual net costs, WCA.

Option	WCA Total (£k)	Difference to Baseline	Rank	Recycling rate	Rank
Op0 Baseline	1,813	0	4	52%	7
Op1 + FW	2,632	819	7	59%	5
Op2 + FW & 3wk RES	2,297	484	5	65%	2
Op3 + FW & Pod RCV	3,456	1,644	9	59%	4
Op4 Multi-stream & FW	2,753	940	8	59%	3
Op5 Multi-stream & FW & 3wk RES	2,312	499	6	65%	1
Op1a + FW + CG (65%)	1,309	-504	3	55%	6
Op0a + CG (65%)	490	-1,323	1	47%	8
Op0b + CG (30%)	1,040	-773	2	40%	9

The main outcomes of the modelling are the following:

- Recycling rates range between 47% and 65%.
- Operating a chargeable garden waste scheme significantly reduces recycling rates but this can be offset to a varying degree by a food waste collection.
- Introducing a food waste collection and a 3 weekly residual service (Option 2) increases recycling rates by 13% but also increases costs;
- A multi-stream service with food waste (Options 4 & 5) appears to be a more expensive option than the current service with a dedicated food collection (Option 1 & 2).
- The Baseline options with a chargeable garden service (Options 0a and 0b) result in the lowest costs but also the lowest recycling rate.
- Operating a pod vehicle appears to be the most expensive option of collecting food waste.

It is important to note, that whilst the modelled costs show a relative comparison between each option, they do not necessarily represent the actual costs, nor do they show any savings that could be made through service management or through subjecting the service to competition through a procurement exercise.

A3.7 Staffordshire Moorlands

Baseline data

The results of the initial baseline for Staffordshire Moorlands are shown in Table A 3-31. A comparison with the actual data provided by the Council is also shown.

Some of the average timings provided have been slightly amended to reflect the number of loads and round sizes reported on KAT. The modelling assumes there are 5 vehicles in total used for the refuse and garden waste collections.

Table A 3-31 Staffordshire Moorlands baseline results.

	Refuse		Dry recycling		Mixed organics	
Parameter	**KAT**	**Actual**	**KAT**	**Actual**	**KAT**	**Actual**
Collection frequency	Fortnightly		Fortnightly two-stream		Fortnightly	
Collection vehicle	RCV: 1x 13 tonne payload, 2x 10.8 tonne payload	RCV: 5x 13 tonne payload	Splitbody 70%/30%: 5x 7.5 tonne payload	Splitbody 70%/30%: 5x 7.5 tonne payload	RCV: 5x 13 tonne payload	RCV: 5x 13 tonne payload
Number of collection vehicles required	4.9	5	4.9	5	4.5	5
Collection limited by weight or volume?	Weight	Weight	Volume	Volume	Volume	Volume
Number of loads collected per vehicle per day	1.1	2	1.2	2	1.0	2
Number of households passed by per vehicle per day	896	1000	893	1000	968	1000

System performance – materials captured

The approximate tonnage for each option is shown in Figure A 3-66. The estimates are based on current data and projected performance for each option, as presented in Section 4.0 of the main report. The values for dry recyclate exclude contamination, which is assumed to be 5% for the current service and 2% for the multi-stream options

Figure A 3-66 Tonnage of each stream collected in each option.

	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
Contamination	407	407	427	407	210	236	407	407	407
refuse	17,644	14,846	11,965	14,846	15,057	12,186	15,519	18,315	18,315
Garden waste	13,461	13,461	13,461	13,461	13,461	13,461	10,061	10,065	4,645
Dry recycling	7,678	7,678	8,062	7,678	7,714	8,099	7,678	7,678	7,678
Food	0	2,798	3,705	2,798	2,798	3,705	2,798	0	0

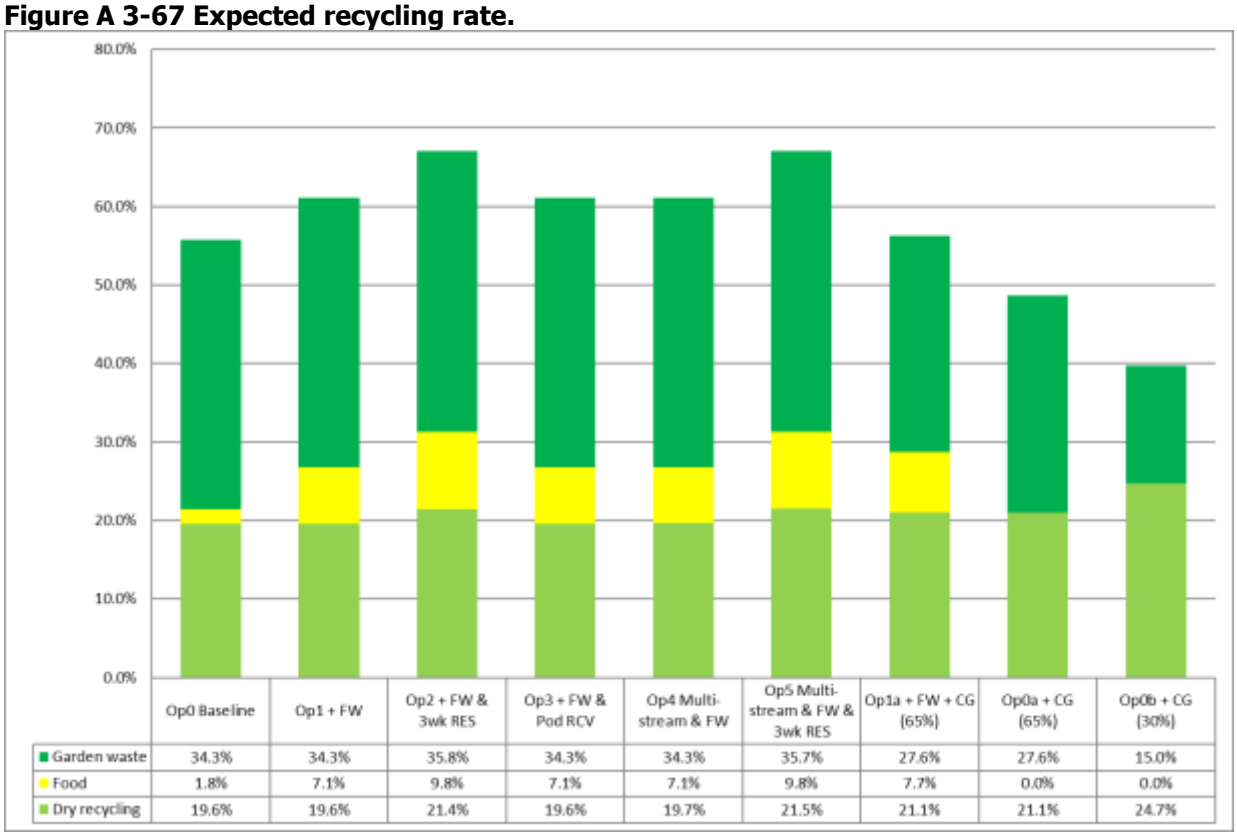
Key observations:

- Food waste and recycling tonnages collected are assumed to increase by operating a three weekly collection, along with a reduction in overall waste
- Multi-stream recycling reduces the level of contamination
- Operating a chargeable garden waste scheme will reduce the quantity of garden waste collected at the kerbside.

Recycling Rate

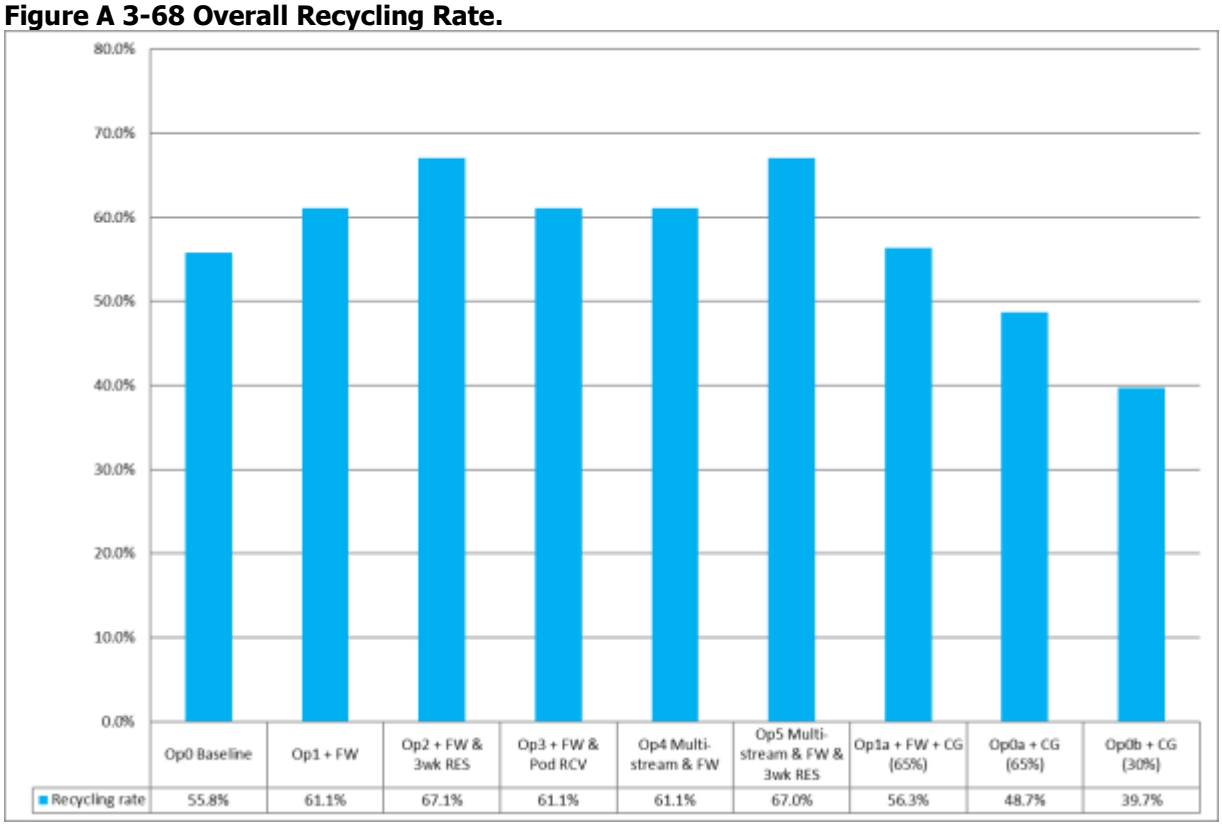
The expected recycling rates for dry recycling, food waste and garden waste for each option can be seen in Figure A 3-67 and overall recycling rate in Figure A 3-68.

Figure A 3-67 Expected recycling rate.



	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
Garden waste	34.3%	34.3%	35.8%	34.3%	34.3%	35.7%	27.6%	27.6%	15.0%
Food	1.8%	7.1%	9.8%	7.1%	7.1%	9.8%	7.7%	0.0%	0.0%
Dry recycling	19.6%	19.6%	21.4%	19.6%	19.7%	21.5%	21.1%	21.1%	24.7%

Figure A 3-68 Overall Recycling Rate.



	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
Recycling rate	55.8%	61.1%	67.1%	61.1%	61.1%	67.0%	56.3%	48.7%	39.7%

Key observations

- Recycling rates range between 40% (Option 0b) and 67% (Options 2 & 5).
- The increase in the recycling rate, as a result of increased capture of food waste, is between 5% and 8% depending on the collection system.
- Dry recycling rates range between 20% and 25% depending on the option. This is determined by the type of recycling collection service offered and its frequency. The

options with a chargeable garden service cause an increase in the dry recycling percentage (not tonnage) due to less waste collected within the kerbside schemes, but the overall recycling rate is lower for these options, due to reduced quantities of compostable material being collected.

- Options 2 and 5 have the highest recycling rate (67%), due to separately collected food waste, increased dry recycling and reduced overall waste caused by three-weekly residual collections.

Resources required – front line vehicles

The KAT modelling shows that different numbers of front line vehicles are required across the options. Although some of the existing vehicles may be suitable for use initially, we have modelled on the assumption that all options require a new vehicle fleet, and costs are depreciated and included in order to take this into account. We have taken this approach as the existing collection vehicles will ultimately need replacing and it allows for options to be compared on a like for like basis. Table A 3-32 and Table A 3-33 show the key operational parameters and the difference in the numbers and types of vehicles required in each of the modelled collection options.

Table A 3-32 Key operational parameters.

Parameter	Scenario	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
Number of vehicles	Dry	4.90	4.90	4.90	4.90	11.36	11.36	4.90	4.90	4.90
	Garden	4.52	4.31	4.31	5.22	4.31	4.31	2.94	2.94	1.36
	Food	-	6.42	6.49	-	-	-	6.42	-	-
	Refuse	4.88	4.76	3.25	5.78	4.83	3.25	4.88	4.88	4.88
	Total	**14.3**	**20.4**	**19.0**	**15.9**	**20.5**	**18.9**	**19.1**	**12.7**	**11.1**
Number of households passed by per vehicle per day	Dry	893	893	893	893	770	770	893	893	893
	Garden	968	1,013	1,013	837	1,014	1,013	968	968	968
	Food		1,362	1,347				1,362		
	Refuse	896	919	896	756	906	896	896	896	896
Number of loads collected per vehicle per day	Dry	1.2	1.2	1.3	1.2	1.1	1.2	1.2	1.2	1.2
	Garden	1.0	1.0	1.0	1.2	1.0	1.0	1.1	1.1	1.1
	Food		0.6	0.7				0.6		
	Refuse	1.1	1.0	1.2	1.1	1.0	1.2	1.0	1.2	1.2

Table A 3-33 Vehicles required for each option.

	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
RCV	10	10	9	0	10	9	8	8	7
Romaquip	0	0	0	0	12	12	0	0	0
REL + Pod	0	0	0	12	0	0	0	0	0
SplitRCV	5	5	5	5	0	0	5	5	5
Food	0	7	7	0	0	0	7	0	0
Total	**15**	**22**	**21**	**17**	**22**	**21**	**20**	**13**	**12**

The key observations from the number of front line vehicles modelled are:

- A dedicated food waste service requires 7 vehicles.
- Operating a three-weekly residual collection reduces RCV vehicles required very slightly, from 10 to 9.
- Using a pod based vehicle increases the vehicles required by 2, compared to the baseline.
- Moving to a chargeable garden waste collection reduces the vehicles required by 2 or 3 (compared to the baseline), depending on the number of households taking up the scheme.
- A multi-stream service is likely to require 12 romaquip type vehicles to service the authority.
- All the options require additional vehicles compared to the baseline, except Options 0a and 0b, where 13 and 12 vehicles are required respectively (down from 15 for the baseline).

Annual vehicle costs

We have estimated the capital costs for the purchase of vehicles using the unit costs presented in Appendix 1. We have detailed the total vehicle capital cost in **Table A 3-34**. It is assumed that all vehicles will need to be purchased, with the cost depreciated over 10 years.

Table A 3-34 Vehicle capital cost to purchase.

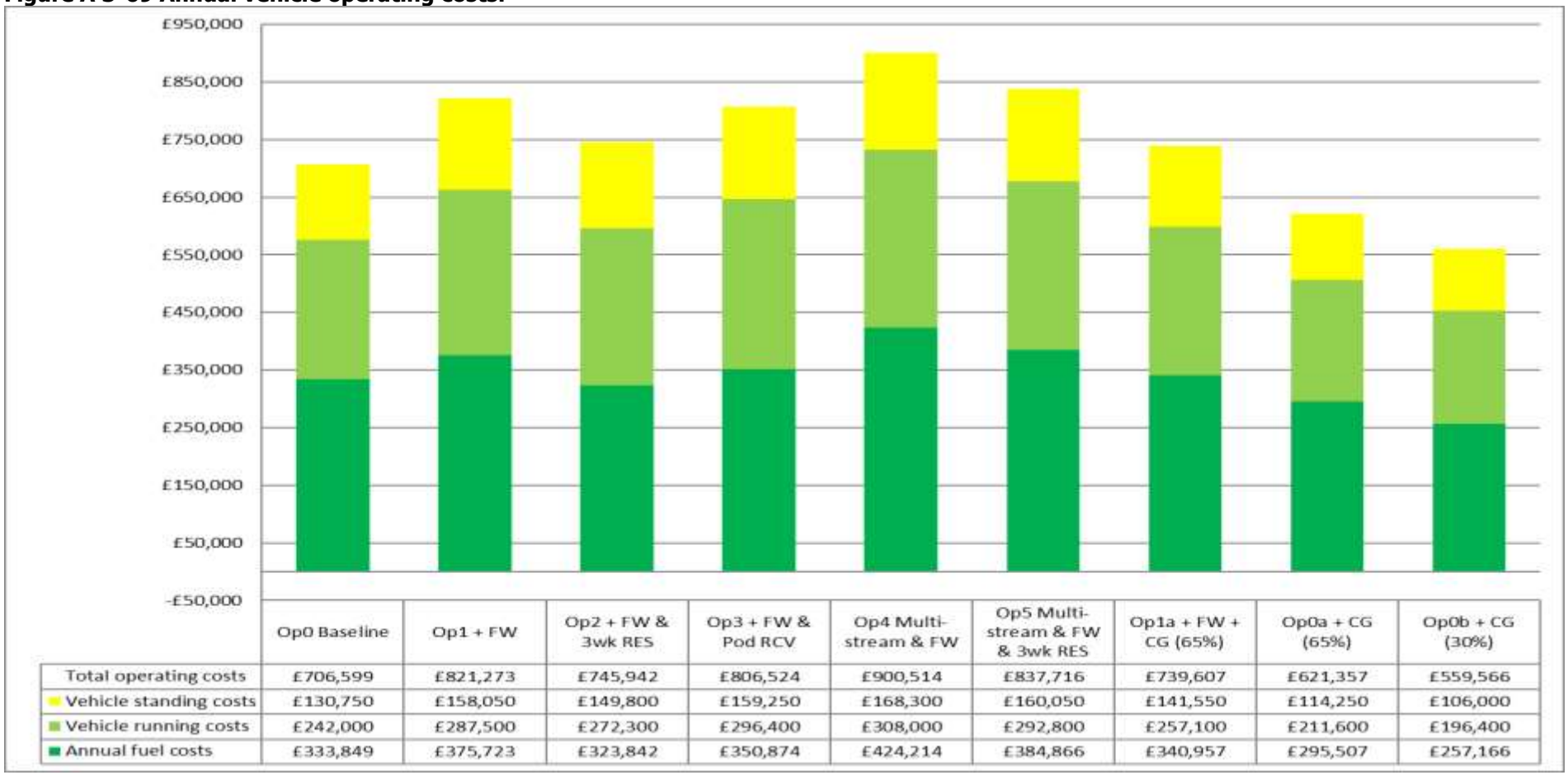
	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
RCV	£1,520,000	£1,520,000	£1,368,000		£1,520,000	£1,368,000	£1,216,000	£1,216,000	£1,064,000
Romaquip					£1,560,000	£1,560,000			
REL + Pod				£2,064,000					
SplitRCV	£900,000	£900,000	£900,000	£900,000			£900,000	£900,000	£900,000
Food		£455,000	£455,000				£455,000		
Total	**£2,420,000**	**£2,875,000**	**£2,723,000**	**£2,964,000**	**£3,080,000**	**£2,928,000**	**£2,571,000**	**£2,116,000**	**£1,964,000**

The key observations are:

- Options 3, 4 and 5 are the most expensive options in terms of vehicle costs, primarily due to the high number of multi-stream vehicles required to collect dry recycling and food waste weekly and the higher costs of the pod vehicles on Option 3;
- Option 0b has the lowest vehicle costs, this is because it requires the least number of vehicles due to the introduction of a chargeable garden waste service.

The annual vehicle operating costs are shown in Figure A 3-69. These include vehicle fuel, maintenance, operating and running costs.

Figure A 3-69 Annual vehicle operating costs.



	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
Total operating costs	£706,599	£821,273	£745,942	£806,524	£900,514	£837,716	£739,607	£621,357	£559,566
Vehicle standing costs	£130,750	£158,050	£149,800	£159,250	£168,300	£160,050	£141,550	£114,250	£106,000
Vehicle running costs	£242,000	£287,500	£272,300	£296,400	£308,000	£292,800	£257,100	£211,600	£196,400
Annual fuel costs	£333,849	£375,723	£323,842	£350,874	£424,214	£384,866	£340,957	£295,507	£257,166

The key observations are:

- Option 4 has the highest vehicle costs and Option 5 is the next most expensive; this is due to the high number of multi-stream vehicles.
- Options 0a and 0b have the lowest vehicle and operating costs, this is due the introduction of chargeable garden waste schemes reducing vehicle numbers.
- Operating a dedicated food waste collection (Option 1) increases vehicle costs compared to the Baseline, but moving to a three-weekly residual collection (Option 2) helps reduce these costs to a level only a little higher than the baseline.
- The pod-based collection of food waste has similar costs compared to a dedicated food waste service.

Resources required – front line operatives

The number of front line operatives required directly relates to the number and type of vehicles required. Appendix 1 lists the number of operatives used in each vehicle and the unit costs.

Figure A 3-70 shows the number of front-line operatives estimated for each scenario. Options 1 and 4 require the highest number of operatives due to higher number of vehicles. Options 0a and 0b have the lowest front-line operative requirements, this is due to the lower number of vehicles used when moving to a chargeable garden waste service. Operating a dedicated food waste service increases front line operatives; this is slightly reduced by moving to a three weekly service.

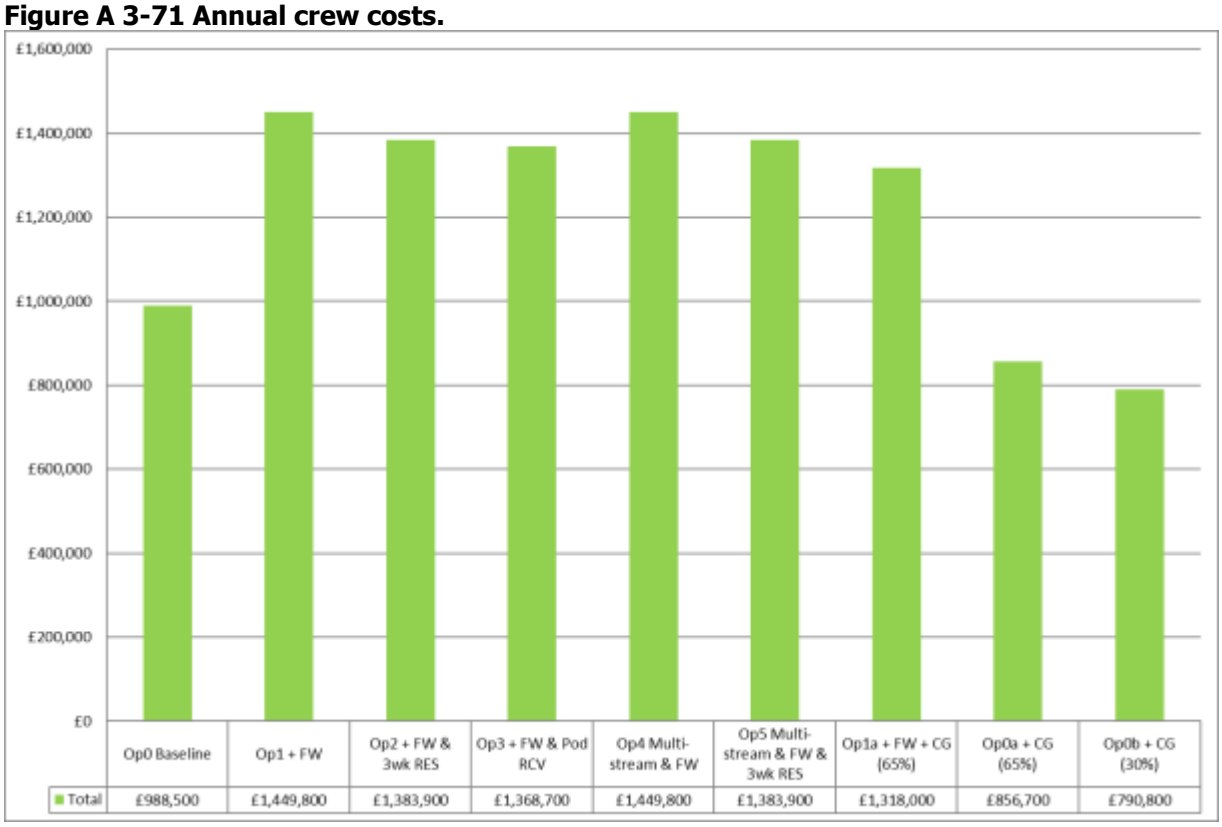
Figure A 3-70 Front-line operatives required.

	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
Drivers	15	22	21	17	22	21	20	13	12
Loaders	30	44	42	46	44	42	40	26	24

Annual crew costs

The annual crew costs include drivers, loaders and supervisor costs, Figure A 3-71.

Figure A 3-71 Annual crew costs.



The key observations on resource requirements are that:

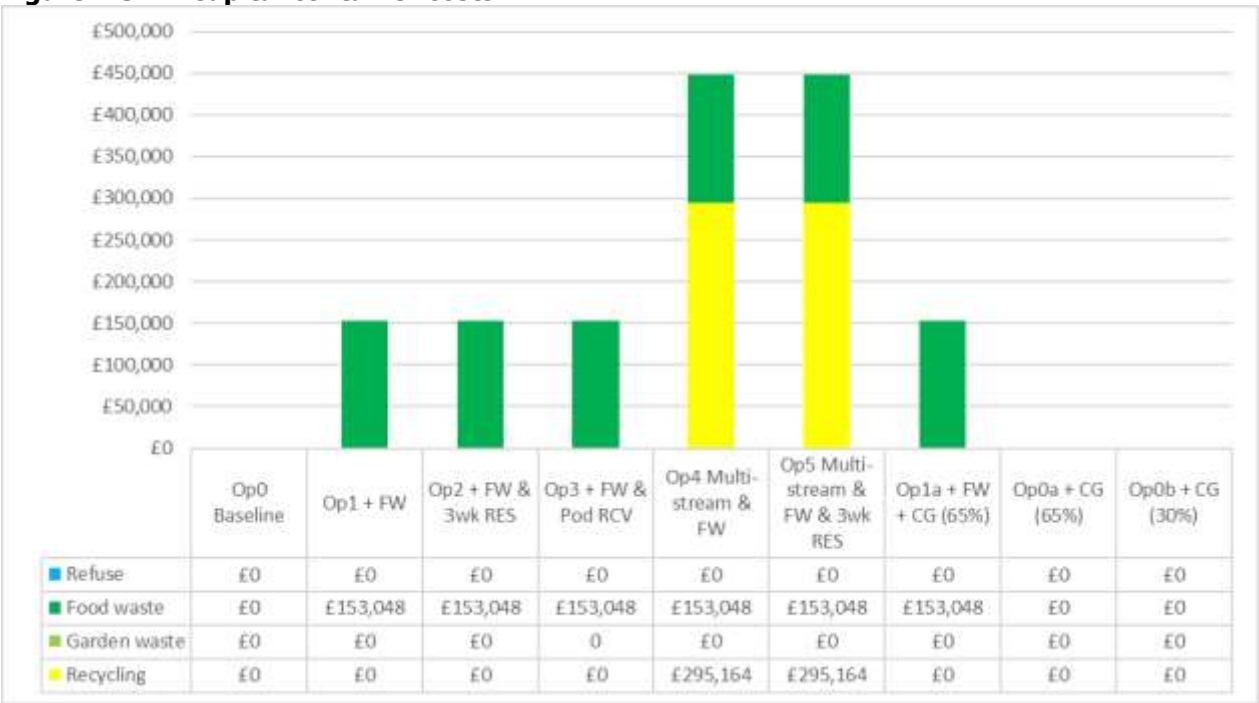
- Option 0b has the lowest crew costs overall (~£790,000). This service has the lowest number of vehicles which translates into the lowest crew numbers and thus costs;
- Options 1 and 4 have the highest crew costs, this is because of the high number of vehicles on the multi-stream service and dedicated food service.

Resources required – containers

There are also capital container costs associated with some of the options, where a new collection or set of containers is provided.

For a multi-stream recycling service it has been assumed that each household would receive three boxes that would be purchased as new. Food waste collections require each household to have a food caddy and 23ltr container. These are shown in Figure A 3-72.

Figure A 3-72 Capital container costs.



	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
Refuse	£0	£0	£0	£0	£0	£0	£0	£0	£0
Food waste	£0	£153,048	£153,048	£153,048	£153,048	£153,048	£153,048	£0	£0
Garden waste	£0	£0	£0	0	£0	£0	£0	£0	£0
Recycling	£0	£0	£0	£0	£295,164	£295,164	£0	£0	£0

In addition to the purchase of new bins, there is also an annual replacement cost for provided containers, e.g. lost or damaged bins. Figure A 3-73 shows the annualised capital costs of purchasing new containers (based on their excepted life time), the annual replacement costs and annual cost of proving food waste liners (2 per household per week). The cost of collecting and disposing of 'old' bins is not included, and would be an additional consideration for the authority. However, this may be a cost neutral activity, as once the 'old' bins are collected, they can be sold and chipped for recycling.

Figure A 3-73 Annual container replacement costs.

	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
Refuse	£4,154	£4,154	£4,154	£4,154	£4,154	£4,154	£4,154	£4,154	£4,154
Food waste liners	£0	£42,757	£42,757	£42,757	£42,757	£42,757	£42,757	£0	£0
Food waste	£0	£45,914	£45,914	£45,914	£45,914	£45,914	£45,914	£0	£0
Garden waste	£4,154	£4,154	£4,154	£4,154	£4,154	£4,154	£2,700	£2,700	£1,246
Recycling	£4,810	£4,810	£4,810	£4,810	£103,307	£103,307	£4,810	£4,810	£4,810

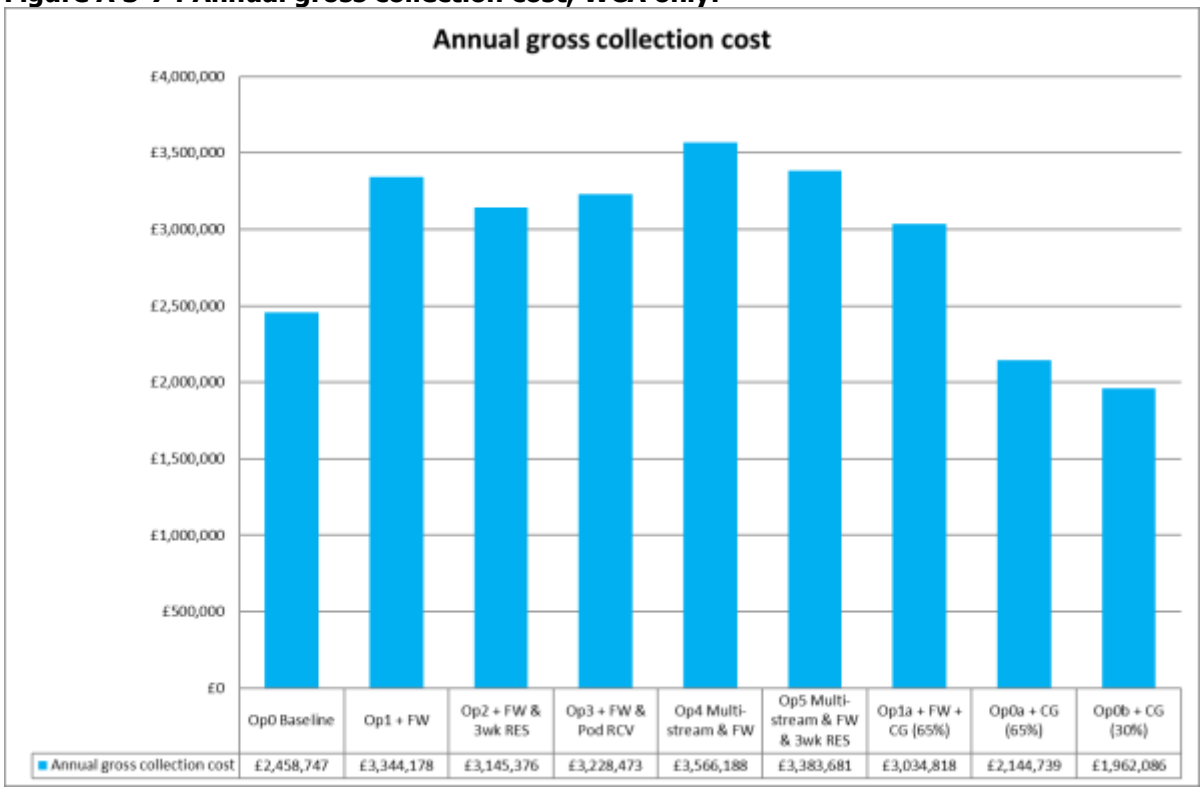
Observations:

- Introducing new schemes such as food waste and multi-stream recycling increased container costs due to the purchase of new containers. Even when annualised the costs can be significant.
- The baseline and options 0a and 0b have has the lowest container replacement costs due to them offering no new services.
- All garden waste collections have the same container costs, but these decrease as the number of households on the chargeable scheme decrease.
- Multi-stream collections have the highest cost for containers due to the cost of new boxes and food waste containers.

Annual gross collections costs

The cost of waste and recycling collections is a significant consideration for local authorities when determining their future collection system configuration. The annual gross collection cost of each option, is shown Figure A 3-74. This includes the cost of front-line operatives, supervision, annualised container costs (including the purchase of new containers where necessary and replacement containers at an assumed percentage replacement rate), vehicle costs (depreciated over 10 years) and vehicle standing and running costs and fuel. N.B. The gross collection costs exclude recycling credits, MRF gates fees and any material income from recycled materials and any disposal costs.

Figure A 3-74 Annual gross collection cost, WCA only.



Observations:

- Option 4 has the largest annual gross costs, of ~£3.5m, due to the need for a larger number of vehicle, leading to higher running costs and associated crew costs.
- Options 0a and 0b have the lowest annual gross cost, this is because they have the lowest crew numbers, coupled with the lowest vehicle numbers.
- All the options with some form of food waste collection have increased gross collection costs due to the additional vehicles (either dedicated or pod-based).

WCA net costs

This section provides an estimate of the WCA net costs, which includes:

- The gross collection costs;
- MRF gates fees and any material income from recycled materials;
- Garden and food waste treatment costs;
- Bulking of food waste where not able to direct deliver; and
- Recycling credits.

The current material values for dry recycling are taken from MRF data provided by the authority. Where the materials are collected separately, we have assumed that the authority would receive the full market value. Treatment for food waste and garden waste is based on data provided by the authority or an agreed assumption.

Detailed cost data is provided within Appendix 2.

For separately collected materials, these costs do not include the following, as the uncertainties involved are beyond the scope of the project:

- Any change to delivery points - Where a new collection system is used, the existing transfer station may not be suitable and so an alternative would be required;
- Infrastructure changes – for example, additional bays may be required where there are an increased number of material streams. Where these bays do not exist, there would be capital costs required to put them in place. There may also be a need to purchase additional plant, such as a forklift or loading shovel. Some of these costs may be passed on to the Councils, either directly or indirectly;
- Bulking and haulage – the bulking and haulage of materials are an additional cost. This includes arranging for materials to be taken to reprocessors.
- The cost for this haulage would be highly dependent on the final destination and the fuel costs; and
- Similarly, the recycling income figures are derived from information in the public domain and these may not accurately reflect the income offered by a service provider.

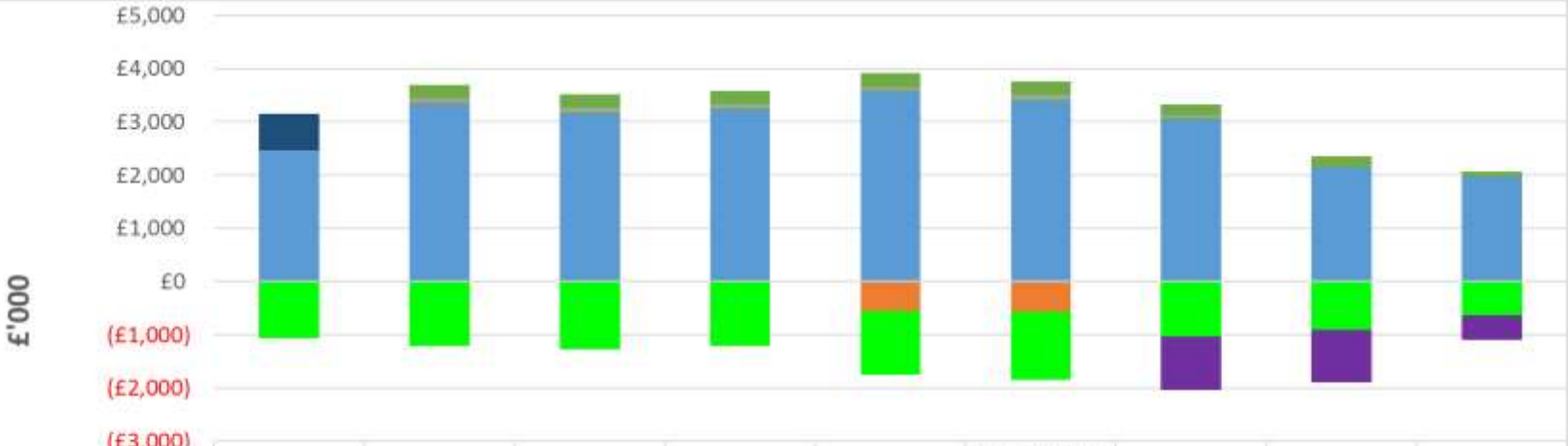
The Council receives recycling credits from the Waste Disposal Authority (WDA) equivalent to £50 for every tonne of dry recycling or food waste that avoids being sent for disposal as residual waste. The WDA pays recycling credits for garden waste collected of £49 per tonne, this is because the WDA does not pay for the disposal of organic waste collected by the authorities.

Figure A 3-75 shows the main cost categories for the authority. There are a number of categories that are income generating, such as recycling credits, garden waste charges and income from materials sales, these are negative and appear below the y axis.

Observations:

- The collection costs are the dominant category, followed by recycling credits.
- Using a MRF to sort material typically results in additional costs, whilst the sale of materials from a multi-stream service typically results in significant income.
- The garden, food and mixed organic processing costs make up only a small part of the costs compared to most of the other categories.

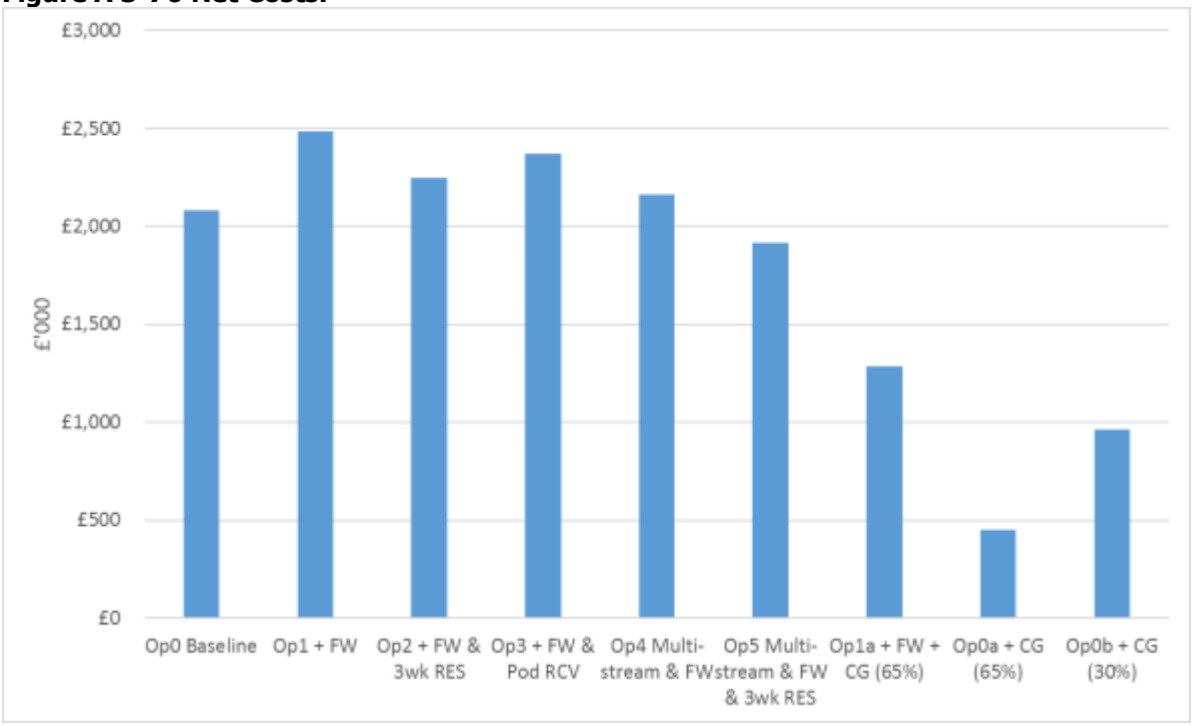
Figure A 3-75 WCA cost categories (£'000).



	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
Garden waste charge	0	0	0	0	0	0	-995	-995	-459
Recycling credits	-1,065	-1,206	-1,271	-1,206	-1,198	-1,264	-1,039	-899	-633
Mixed food & Garden Waste Treatment	683	0	0	0	0	0	0	0	0
Garden Waste Treatment	0	260	260	260	260	260	194	194	90
Food Waste Treatment	0	56	74	56	56	74	56	0	0
Bulking	0	28	37	28	28	37	28	0	0
Dry income/charge	4	4	5	4	-549	-576	4	4	4
Collection costs	2,459	3,344	3,145	3,228	3,566	3,384	3,035	2,145	1,962

The total annual net collection costs are also presented in the chart below, Figure A 3-76.

Figure A 3-76 Net Costs.



Key observations:

- All of the main 5 options apart from Option 5 (which is off-set by recycling being collected three-weekly) increase the net WCA costs, in part due to the addition of food waste collections.
- Option 1 is the most expensive collection system closely followed by the pod vehicle (Option 3).
- Moving to a multi-stream service increases the collection costs but the multi-stream service costs are offset significantly by greater income from materials' sales.
- The options where a chargeable garden service is introduced are consistently below the Baseline option. This is due to a combination of lower vehicle numbers, crew costs and most significantly, the income stream from charging £35 per household.
- Introducing a chargeable garden waste scheme could potentially result in lower overall costs even if a dedicated food waste scheme were also introduced at the same time.
- Moving to a three-weekly residual collection does result in lower net costs but only with the multi-stream collection is it sufficient to offset the introduction of a food waste collection.

Options summary

The total annual net collection costs and recycling rates for each option are shown in the table below (Table A 3-35). The ranks of both the cost and recycling rates are also provided.

Table A 3-35 Annual net costs, WCA.

Option	WCA Total (£k)	Difference to Baseline	Rank	Recycling rate	Rank
Op0 Baseline	2,081	0	5	56%	7
Op1 + FW	2,486	405	9	61%	4
Op2 + FW & 3wk RES	2,249	168	7	67%	1
Op3 + FW & Pod RCV	2,371	289	8	61%	5
Op4 Multi-stream & FW	2,164	82	6	61%	3
Op5 Multi-stream & FW & 3wk RES	1,915	-166	4	67%	2
Op1a + FW + CG (65%)	1,283	-798	3	56%	6
Op0a + CG (65%)	449	-1,632	1	49%	8
Op0b + CG (30%)	964	-1,118	2	40%	9

The main outcomes of the modelling are the following:

- Recycling rates range between 40% and 67%.
- Operating a chargeable garden waste scheme significantly reduces recycling rates but this can be offset to a varying degree by a food waste collection.
- Introducing a food waste collection and a 3 weekly residual service (Option 2) increases recycling rates considerably but also increases costs.
- A multi-stream service with food waste (Options 4 & 5) appears to be a less expensive option than the current service with a dedicated food collection (Options 1 & 2), although this would mean a significant change in how recycling is collected and does not reduce costs below the Baseline.
- The Baseline options with a chargeable garden service (Options 0a and 0b) result in the lowest costs but also the lowest recycling rate.

It is important to note, that whilst the modelled costs show a relative comparison between each option, they do not necessarily represent the actual costs, nor do they show any savings that could be made through service management or through subjecting the service to competition through a procurement exercise.

A3.8 Stoke-on-Trent

Baseline data

The results of the initial baseline for Stoke-on-Trent are shown in Table A 3-36. A comparison with the actual data provided by the Council is also shown.

Some of the average timings provided have been slightly amended to reflect the number of loads and round sizes reported on KAT.

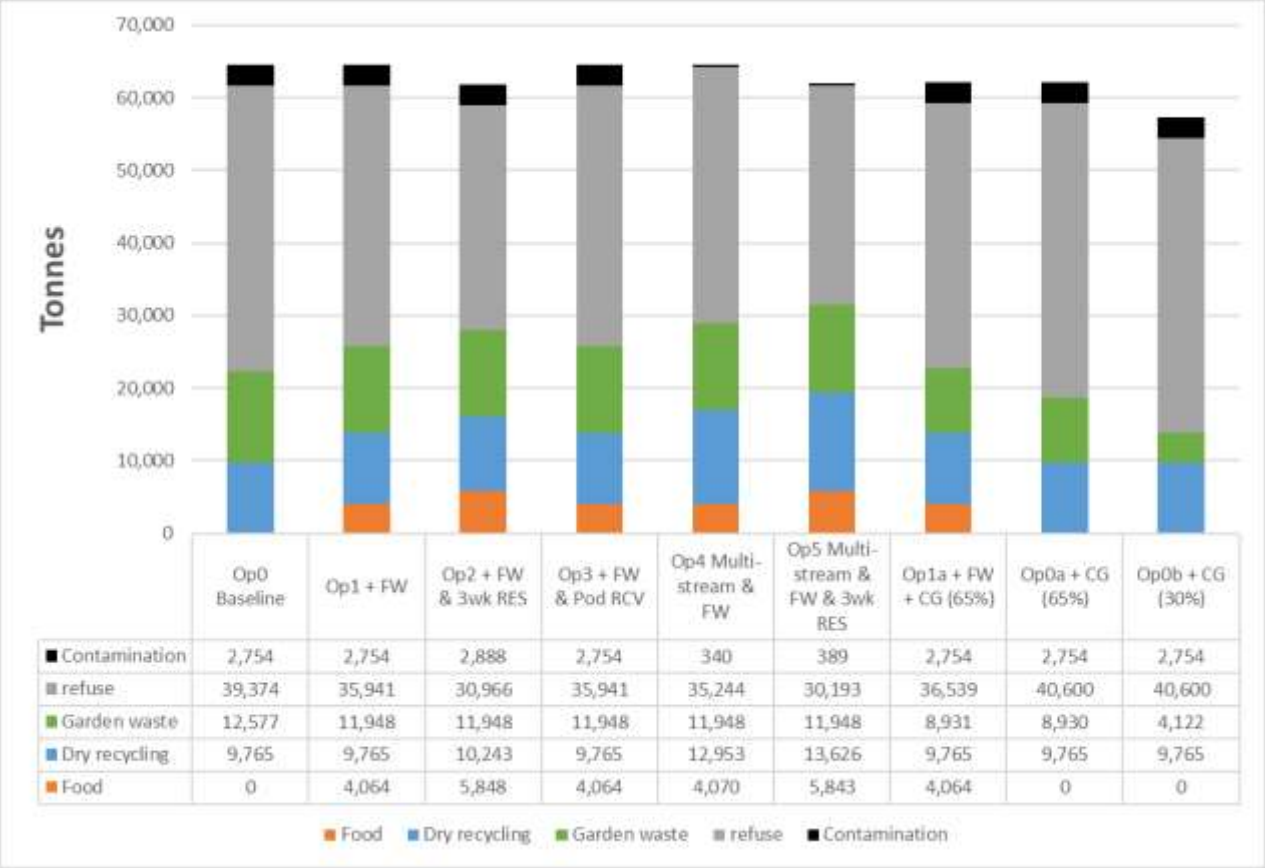
Table A 3-36 Stoke-on-Trent baseline results.

	Refuse		Dry recycling		Mixed organics	
Parameter	**KAT**	**Actual**	**KAT**	**Actual**	**KAT**	**Actual**
Collection frequency	Fortnightly		Fortnightly two-stream		Fortnightly	
Collection vehicle	RCV: 10x 10.8 tonne payload	RCV: 10x 10.8 tonne payload	RCV: 5x 6 tonne payload	RCV: 7x 6 tonne payload	RCV: 5x 11 tonne payload	RCV: 5x 11 tonne payload
Number of collection vehicles required	7.9	11 but scaled to 8 as removed 29,00hh	5.9	8 but scaled to 6 as removed 29,00hh	5.9	6
Collection limited by weight or volume?	Weight	Weight	Volume	Volume	Volume	Volume
Number of loads collected per vehicle per day	1.7	2	2.6	2	1.5	2
Number of households passed by per vehicle per day	1,084	1,600	1,445	1,400	1,463	2,000

System performance – materials captured

The approximate tonnage for each option is shown in Figure A 3-77. The estimates are based on current data and projected performance for each option, as presented in Section 4.0 of the main report. The values for dry recyclate exclude contamination, which is assumed to be 22% for the current service and 2% for the multi-stream options

Figure A 3-77 Tonnage of each stream collected in each option.



	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
Contamination	2,754	2,754	2,888	2,754	340	389	2,754	2,754	2,754
refuse	39,374	35,941	30,966	35,941	35,244	30,193	36,539	40,600	40,600
Garden waste	12,577	11,948	11,948	11,948	11,948	11,948	8,931	8,930	4,122
Dry recycling	9,765	9,765	10,243	9,765	12,953	13,626	9,765	9,765	9,765
Food	0	4,064	5,848	4,064	4,070	5,843	4,064	0	0

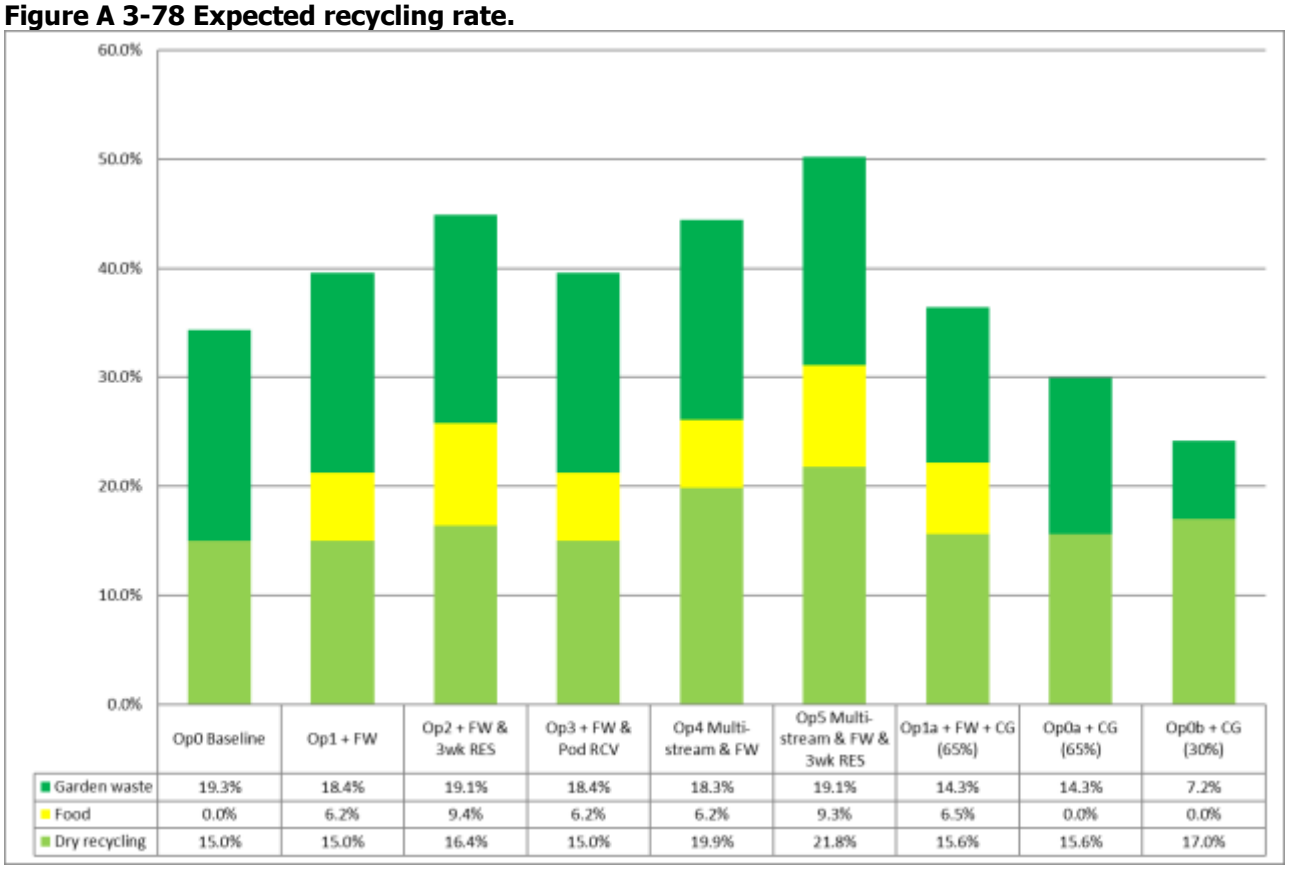
Key observations

- Food waste and recycling tonnages collected are assumed to increase by operating a three weekly collection, along with a reduction in overall waste.
- Multi-stream recycling reduces the level of contamination.
- Operating a chargeable garden waste scheme will reduce the quantity of garden waste collected at the kerbside.

Recycling Rate

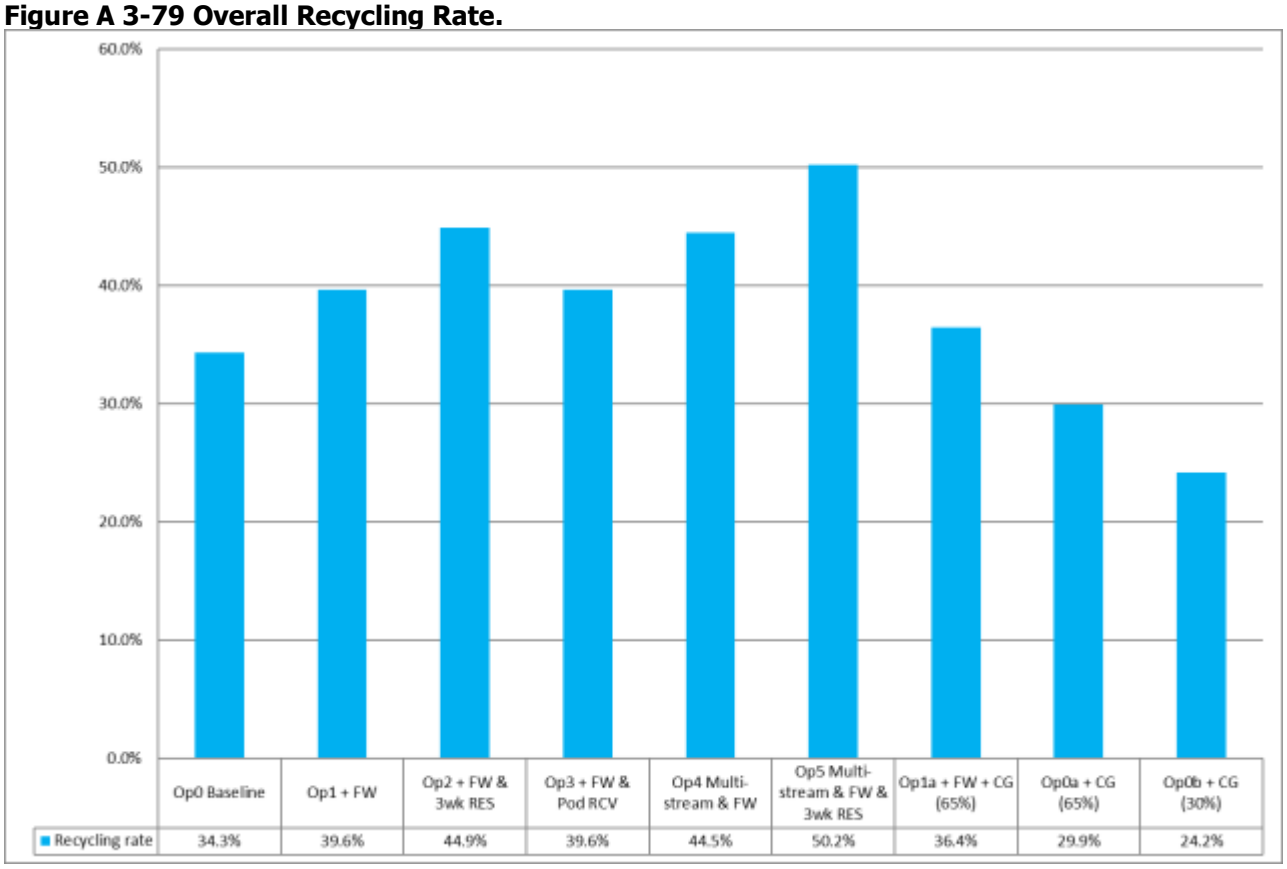
The expected recycling rates for dry recycling, food waste and garden waste for each option can be seen in Figure A 3-78 and overall recycling rate in Figure A 3-79.

Figure A 3-78 Expected recycling rate.



	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
Garden waste	19.3%	18.4%	19.1%	18.4%	18.3%	19.1%	14.3%	14.3%	7.2%
Food	0.0%	6.2%	9.4%	6.2%	6.2%	9.3%	6.5%	0.0%	0.0%
Dry recycling	15.0%	15.0%	16.4%	15.0%	19.9%	21.8%	15.6%	15.6%	17.0%

Figure A 3-79 Overall Recycling Rate.



	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
Recycling rate	34.3%	39.6%	44.9%	39.6%	44.5%	50.2%	36.4%	29.9%	24.2%

Key observations

- Recycling rates range between 24% (Option 0b) and 50% (Option 5).

- The increase in the recycling rate, as a result of increased capture of food waste, is between 6% and 9% depending on the collection system.
- Dry recycling rates range between 15% and 22% depending on the option. This is determined by the type of recycling collection service offered and its frequency. The options with a chargeable garden service cause an increase in the dry recycling percentage (not tonnage) due to less waste collected within the kerbside schemes, but the overall recycling rate is lower for these options, due to reduced quantities of compostable material being collected.
- Option 5 has the highest recycling rate (50%), due to separately collected food waste, increased dry recycling and reduced overall waste caused by three-weekly residual collections.

Resources required – front line vehicles

The KAT modelling shows that different numbers of front line vehicles are required across the options. Although some of the existing vehicles may be suitable for use initially, we have modelled on the assumption that all options require a new vehicle fleet, and costs are depreciated and included in order to take this into account. We have taken this approach as the existing collection vehicles will ultimately need replacing and it allows for options to be compared on a like for like basis. Table A 3-37and Table A 3-38 show the key operational parameters and the difference in the numbers and types of vehicles required in each of the modelled collection options.

Table A 3-37 Key operational parameters.

Parameter	Scenario	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
Number of vehicles	Dry	5.9	5.9	5.9	5.9	20.5	20.6	5.9	5.9	5.9
	Garden	5.9	5.9	5.9	6.2	5.9	5.9	3.8	3.8	1.8
	Food	-	8.8	8.8	-	-	-	8.8	-	-
	Refuse	7.9	7.9	5.4	10.0	7.9	5.3	7.9	7.9	7.9
	Total	**19.7**	**28.6**	**26.1**	**22.1**	**34.3**	**31.8**	**26.5**	**17.7**	**15.6**
Number of households passed by per vehicle per day	Dry	1,445	1,445	1,445	1,445	835	833	1,445	1,445	1,445
	Garden	1,463	1,463	1,463	1,385	1,463	1,463	1,463	1,463	1,463
	Food		1,944	1,944				1,944		
	Refuse	1,084	1,084	1,057	858	1,084	1,084	1,084	1,084	1,084
Number of loads collected per vehicle per day	Dry	2.6	2.6	2.8	2.6	0.9	1.0	2.6	2.6	2.6
	Garden	1.5	1.5	1.5	1.9	1.5	1.5	1.7	1.7	1.7
	Food		0.6	0.8				0.6		
	Refuse	1.7	1.6	2.0	1.5	1.6	2.0	1.6	1.8	1.8

Table A 3-38 Vehicles required for each option.

	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
RCV	14.0	14.0	12.0	0.0	14.0	12.0	12.0	12.0	10.0
Romaquip	0.0	0.0	0.0	0.0	21.0	21.0	0.0	0.0	0.0
REL + Pod	0.0	0.0	0.0	17.0	0.0	0.0	0.0	0.0	0.0
SplitRCV	6.0	6.0	6.0	6.0	0.0	0.0	6.0	6.0	6.0
Food	0.0	9.0	9.0	0.0	0.0	0.0	9.0	0.0	0.0
Total	**20.0**	**29.0**	**27.0**	**23.0**	**35.0**	**33.0**	**27.0**	**18.0**	**16.0**

The key observations from the number of front line vehicles modelled are:

- A dedicated food waste service requires 9 vehicles.
- Operating a three-weekly residual collection reduces residual vehicles by 2.
- Using a pod based vehicle increases the vehicles required by 3, compared to the Baseline.
- Moving to a chargeable garden waste collection reduces the vehicles required by 2 or 4, depending on the number of households taking up the scheme.
- A multi-stream service is likely to require 21 romaquip type vehicles to service the authority.
- All the options require additional vehicles compared to the baseline, except Options 0a and 0b, where 18 and 16 vehicles are required respectively (down from 20 for the baseline).

Annual vehicle costs

We have estimated the capital costs for the purchase of vehicles using the unit costs presented in Appendix 1. We have detailed the total vehicle capital cost in Table A 3-39. It is assumed that all vehicles will need to be purchased, with the cost depreciated over 10 years.

Table A 3-39 Vehicle capital cost to purchase.

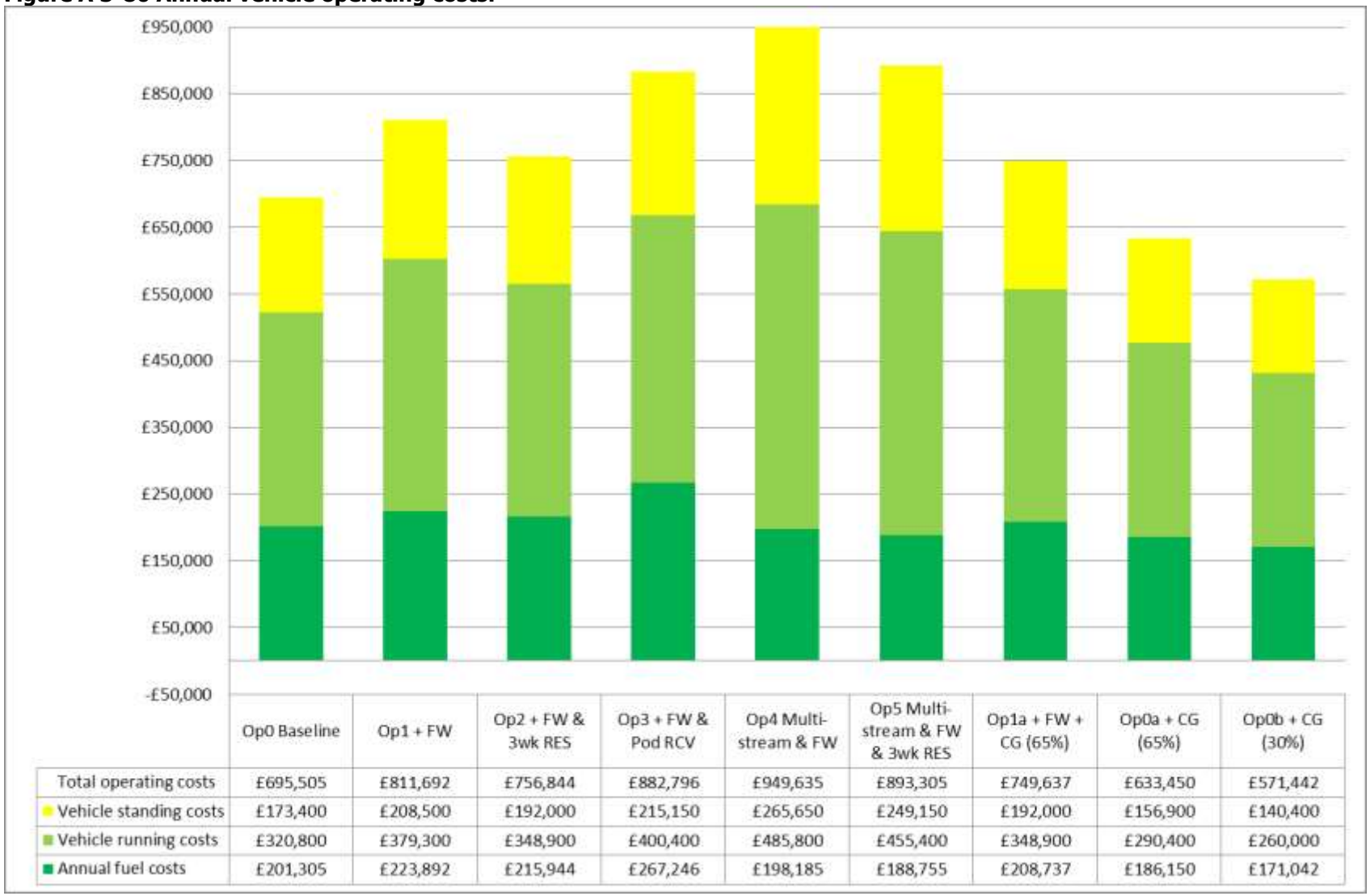
	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
RCV	£2,128,000	£2,128,000	£1,824,000		£2,128,000	£1,824,000	£1,824,000	£1,824,000	£1,520,000
Romaquip					£2,730,000	£2,730,000			
REL + Pod				£2,924,000					
SplitRCV	£1,080,000	£1,080,000	£1,080,000	£1,080,000			£1,080,000	£1,080,000	£1,080,000
Food		£585,000	£585,000				£585,000		
Total	**£3,208,000**	**£3,793,000**	**£3,489,000**	**£4,004,000**	**£4,858,000**	**£4,554,000**	**£3,489,000**	**£2,904,000**	**£2,600,000**

The key observations are:

- Options 4 and 5 are the most expensive option in terms of vehicle costs, primarily due to the high number of multi-stream vehicles required to collect dry recycling and food waste weekly.
- Option 0b has the lowest vehicle costs, this is because it requires the least number of vehicles due to the introduction of a chargeable garden waste service.

The annual vehicle operating costs are shown in Figure A 3-80. These include vehicle fuel, maintenance, operating and running costs.

Figure A 3-80 Annual vehicle operating costs.



	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
Total operating costs	£695,505	£811,692	£756,844	£882,796	£949,635	£893,305	£749,637	£633,450	£571,442
Vehicle standing costs	£173,400	£208,500	£192,000	£215,150	£265,650	£249,150	£192,000	£156,900	£140,400
Vehicle running costs	£320,800	£379,300	£348,900	£400,400	£485,800	£455,400	£348,900	£290,400	£260,000
Annual fuel costs	£201,305	£223,892	£215,944	£267,246	£198,185	£188,755	£208,737	£186,150	£171,042

The key observations are:

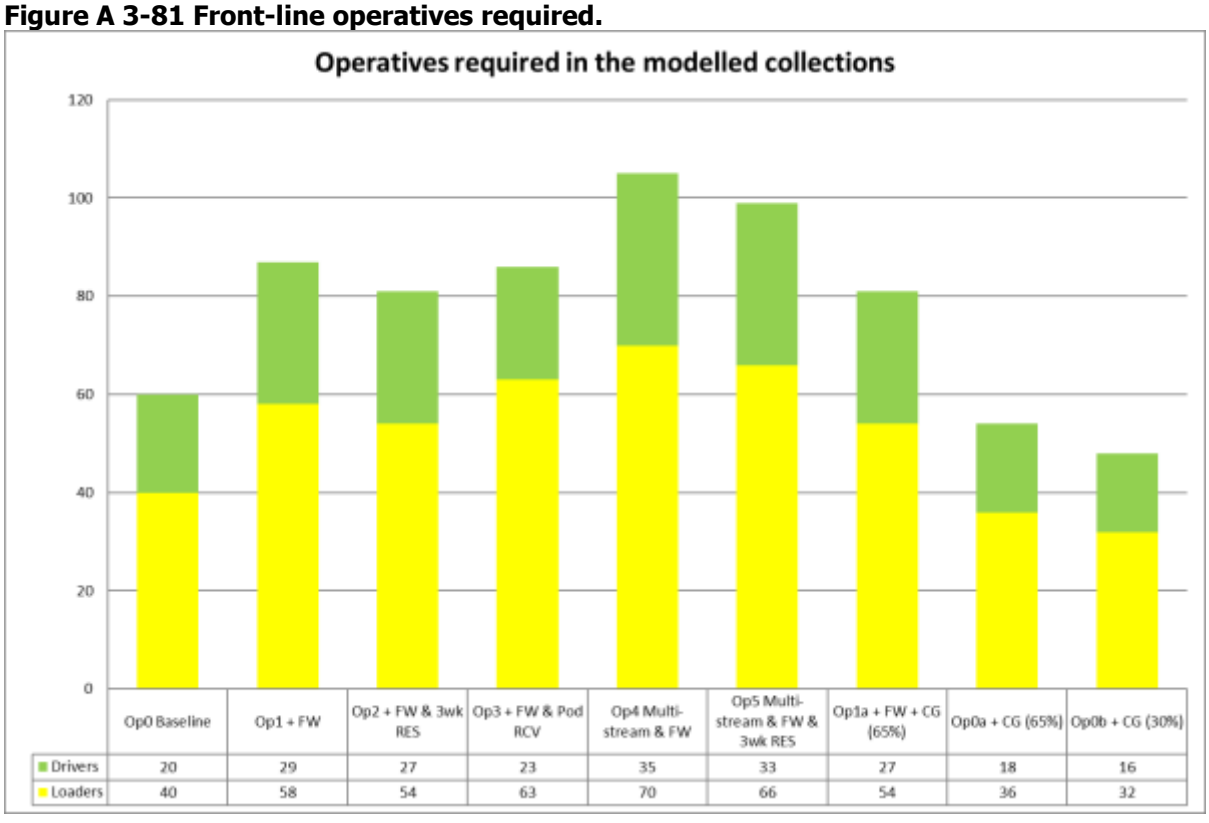
- Options 3, 4 and 5 have the highest vehicle costs. For Option 3 this is due to higher fuel costs and for Options 4 and 5 it is as a result of the high number of multi-stream vehicles.
- Options 0a and 0b have the lowest vehicle and operating costs, this is due the introduction of a chargeable garden waste scheme reducing vehicle numbers.
- Operating a dedicated food waste collection (Option 1), increases vehicle costs compared to the Baseline but moving to a three-weekly residual collection (Option 2) helps reduce these costs to marginally.
- The pod-based collection of food waste results in greater costs than a dedicated food waste service.

Resources required – front line operatives

The number of front line operatives required directly relates to the number and type of vehicles required. Appendix 1 lists the number of operatives used in each vehicle and the unit costs.

Figure A 3-81 shows the number of front-line operatives estimated for each scenario. Options 4 and 5 require the highest number of operatives due to the multi-stream vehicles. This is closely followed by Option 1 and 3 with the pod vehicles. Options 0a and 0b have the lowest front-line operative requirements, this is due to the lower number of vehicles used when moving to a chargeable garden waste service. Operating a dedicated food waste service increases front line operatives; this is reduced to some extent by moving to a three weekly residual waste service as the number of vehicles required is slightly less.

Figure A 3-81 Front-line operatives required.

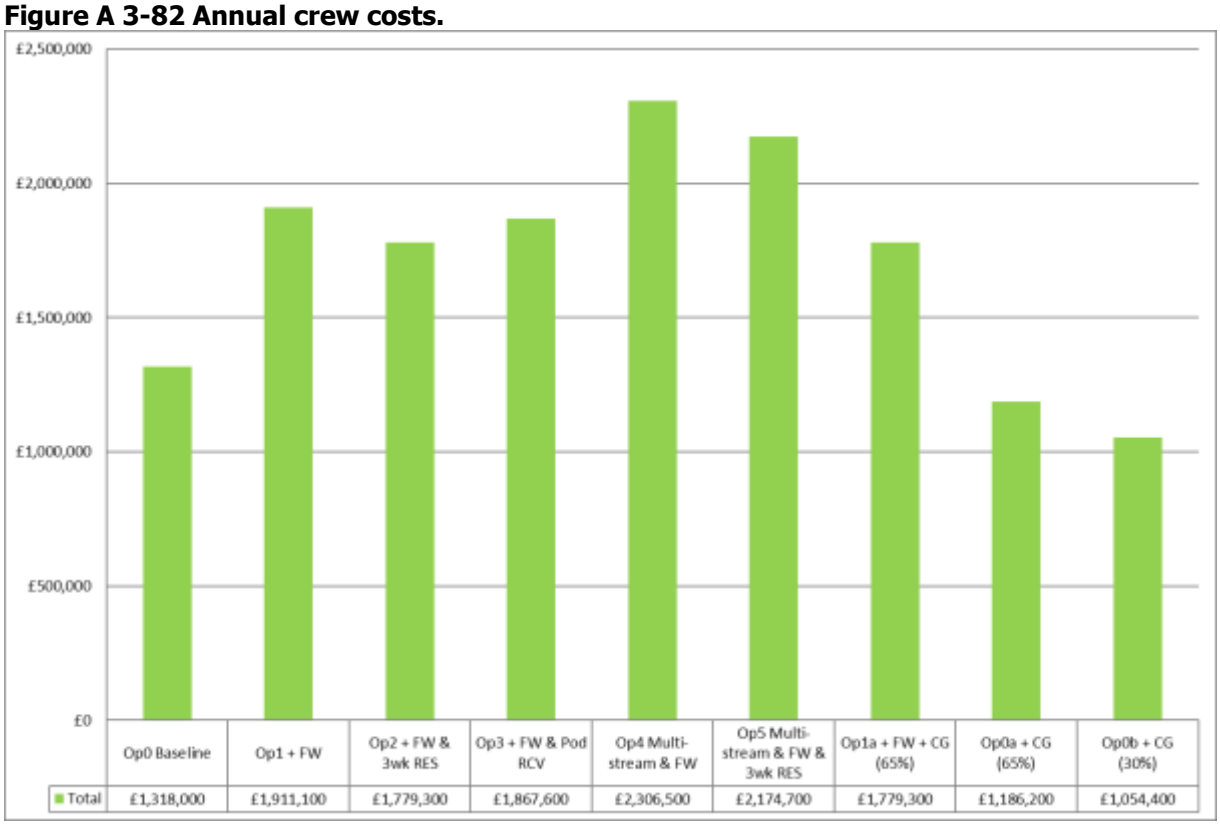


	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
Drivers	20	29	27	23	35	33	27	18	16
Loaders	40	58	54	63	70	66	54	36	32

Annual crew costs

The annual crew costs include drivers, loaders and supervisor costs, Figure A 3-82.

Figure A 3-82 Annual crew costs.



	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
Total	£1,318,000	£1,911,100	£1,779,300	£1,867,600	£2,306,500	£2,174,700	£1,779,300	£1,186,200	£1,054,400

The key observations on resource requirements are that:

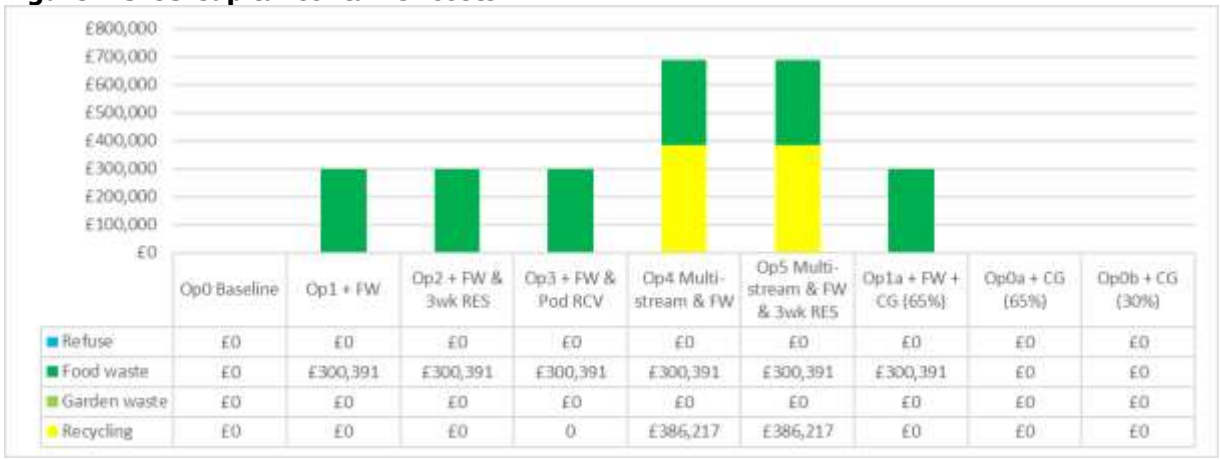
- Option 0b has the lowest crew costs overall (~£1m), this service has the lowest number of vehicles which translates into the lowest crew numbers and thus costs;
- The Baseline and Option 0a have similar staff costs, based on similar numbers of drivers and operatives.
- Options 4 and 5 have the highest crew costs, this is because of the high number of vehicles on the multi-stream service and the high number of operatives per vehicle (a driver and 2 loaders).

Resources required – containers

There are also capital container costs associated with some of the options, where a new collection or set of containers is provided.

For a multi-stream recycling service it has been assumed that each household would receive three boxes that would be purchased as new. Food waste collections require each household to have a food caddy and 23ltr container. These are shown in Figure A 3-83.

Figure A 3-83 Capital container costs.



	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
Refuse	£0	£0	£0	£0	£0	£0	£0	£0	£0
Food waste	£0	£300,391	£300,391	£300,391	£300,391	£300,391	£300,391	£0	£0
Garden waste	£0	£0	£0	£0	£0	£0	£0	£0	£0
Recycling	£0	£0	£0	0	£386,217	£386,217	£0	£0	£0

In addition to the purchase of new bins, there is also an annual replacement cost for provided containers, e.g. lost or damaged bins. Figure A 3-84 shows the annualised capital costs of purchasing new containers (based on their excepted life time), the annual replacement costs and annual cost of proving food waste liners (2 per household per week). The cost of collecting and disposing of 'old' bins is not included, and would be an additional consideration for the authority. However, this may be a cost neutral activity, as once the 'old' bins are collected, they can be sold and chipped for recycling.

Figure A 3-84 Annual container costs.

	Op0 Baseline	Op1 + FW	Op2 + FW & 3wk RES	Op3 + FW & Pod RCV	Op4 Multi-stream & FW	Op5 Multi-stream & FW & 3wk RES	Op1a + FW + CG (65%)	Op0a + CG (65%)	Op0b + CG (30%)
Refuse	£8,153	£8,153	£8,153	£8,153	£8,153	£8,153	£8,153	£8,153	£8,153
Food waste liners	£0	£42,757	£42,757	£42,757	£42,757	£42,757	£42,757	£0	£0
Food waste	£0	£90,117	£90,117	£90,117	£90,117	£90,117	£90,117	£0	£0
Garden waste	£8,153	£8,153	£8,153	£8,153	£8,153	£8,153	£5,294	£5,294	£2,443
Recycling	£37,120	£37,120	£37,120	£37,120	£164,142	£164,142	£37,120	£37,120	£37,120

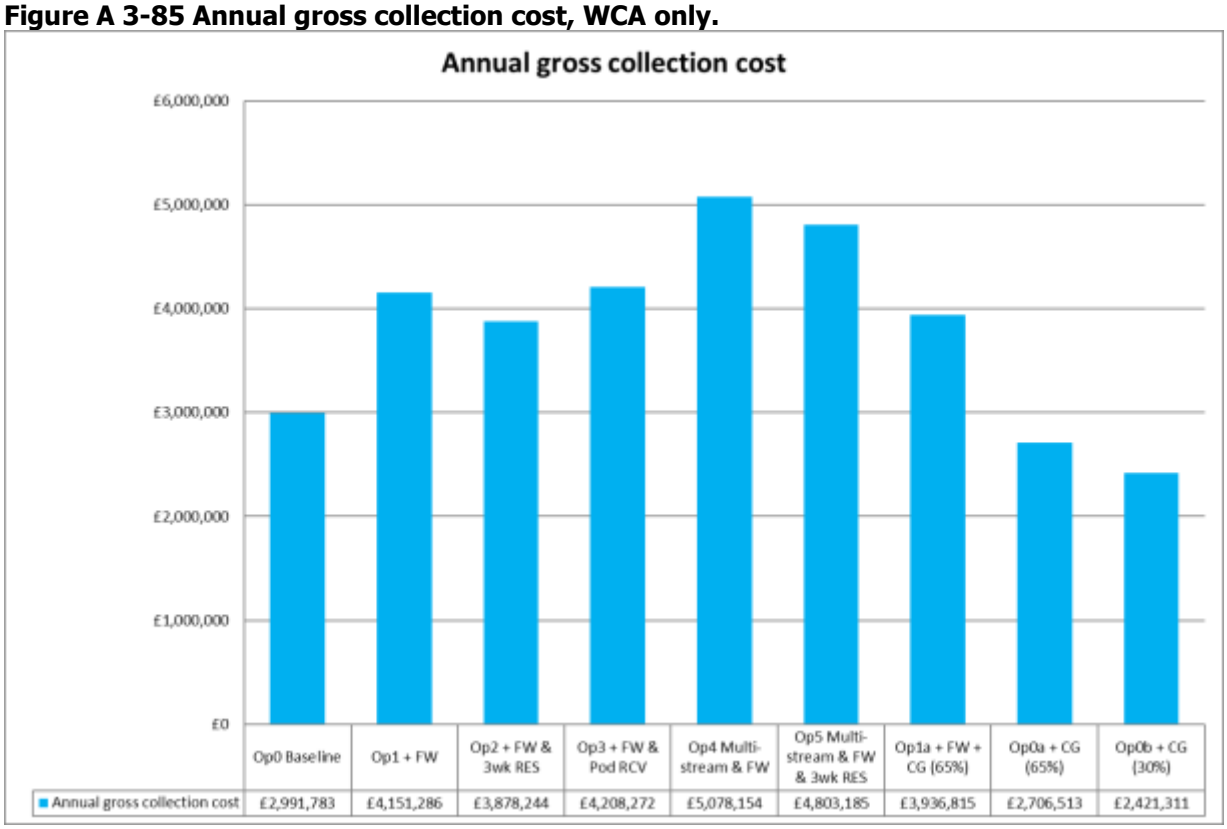
Observations:

- Introducing new schemes such as food waste and multi-stream recycling increased container costs due to the purchase of new containers. Even when annualised the costs can be significant.
- The baseline and options 0a and 0b have has the lowest container costs due to them offering no new services.
- All garden waste collections have the same container costs, but these decrease as the number of households on the chargeable scheme decrease.
- Multi-stream collections have the highest cost for containers due to the cost of new boxes and food waste containers.

Annual gross collections costs

The cost of waste and recycling collections is a significant consideration for local authorities when determining their future collection system configuration. The annual gross collection cost of each option, is shown Figure A 3-85. This includes the cost of front-line operatives, supervision, annualised container costs (including the purchase of new containers where necessary and replacement containers at an assumed percentage replacement rate), vehicle costs (depreciated over 10 years) and vehicle standing and running costs and fuel. N.B. The gross collection costs exclude recycling credits, MRF gates fees and any material income from recycled materials and any disposal costs.

Figure A 3-85 Annual gross collection cost, WCA only.



Observations:

- The multi-stream options (4 and 5) have the largest annual gross costs of ~ £5m, due to a combination of large vehicle numbers, leading to higher running costs and associated crew costs.
- Options 0a and 0b have the lowest annual gross cost, this is because they have the lowest crew numbers, coupled with the lowest vehicle numbers.
- All the options with some form of food waste collection have increased gross collection costs due to the additional vehicles (either dedicated or pod-based) unless a charged for garden waste is also in operation.

WCA costs

This section provides an estimate of the WCA costs, which includes:

- The gross collection costs;
- MRF gates fees and any material income from recycled materials;
- Garden and food waste treatment costs;
- Bulking of food waste where not able to direct deliver;
- Recycling credits; and
-

The current material values for dry recycling are taken from MRF data provided by the authority. Where the materials are collected separately, we have assumed that the authority would receive the full market value. Treatment for food waste and garden waste is based on data provided by the authority or an agreed assumption.

Detailed cost data is provided within Appendix 2.

For separately collected materials, these costs do not include the following, as the uncertainties involved are beyond the scope of the project:

- Any change to delivery points - Where a new collection system is used, the existing transfer station may not be suitable and so an alternative would be required;

- Infrastructure changes – for example, additional bays may be required where there are an increased number of material streams. Where these bays do not exist, there would be capital costs required to put them in place. There may also be a need to purchase additional plant, such as a forklift or loading shovel. Some of these costs may be passed on to the Councils, either directly or indirectly;
- Bulking and haulage – the bulking and haulage of materials are an additional cost. This includes arranging for materials to be taken to reprocessors.
- The cost for this haulage would be highly dependent on the final destination and the fuel costs; and
- Similarly, the recycling income figures are derived from information in the public domain and these may not accurately reflect the income offered by a service provider.

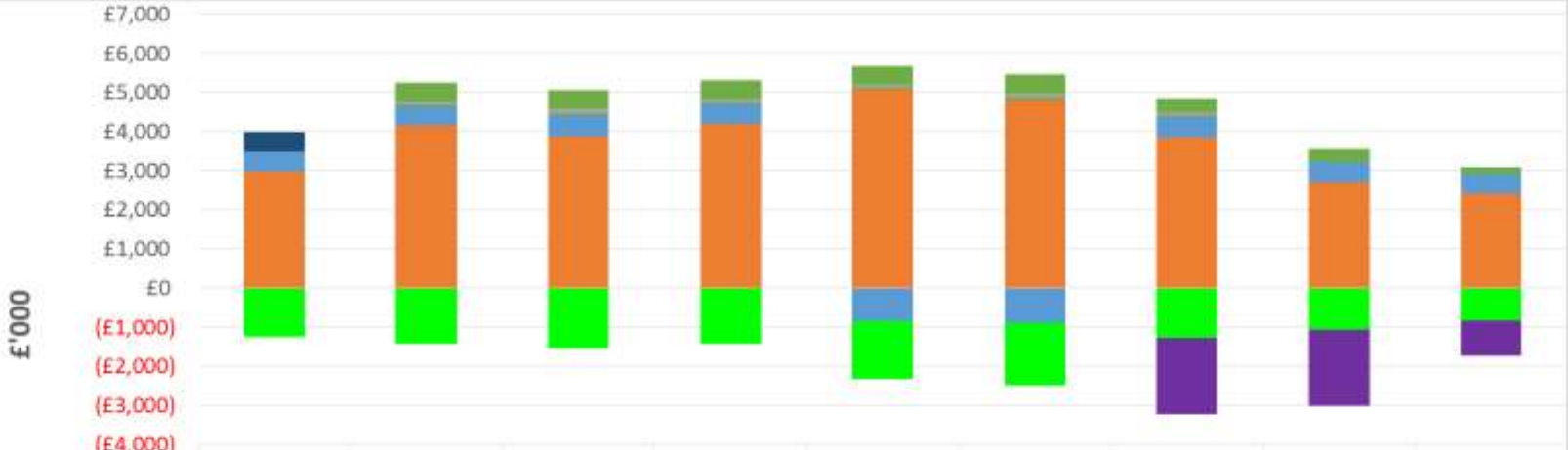
The Council receives recycling credits from the Waste Disposal Authority (WDA) equivalent to £50 for every tonne of dry recycling or food waste that avoids being sent for disposal as residual waste. The WDA pays recycling credits for garden waste collected of £49 per tonne, this is because the WDA does not pay for the disposal of organic waste collected by the authorities.

Figure A 3-86 shows the main cost categories for the authority. There are a number of categories that are income generating, such as recycling credits, garden waste charges and income from materials sales, these are negative and appear below the y axis.

Observations:

- The collection costs are the dominant category, followed by recycling credits.
- Using a MRF to sort material typically results in additional costs, whilst the sale of materials from a multi-stream service typically results in significant income.
- The garden, food and mixed organic processing costs make up only a small part of the costs compared to most of the other categories.

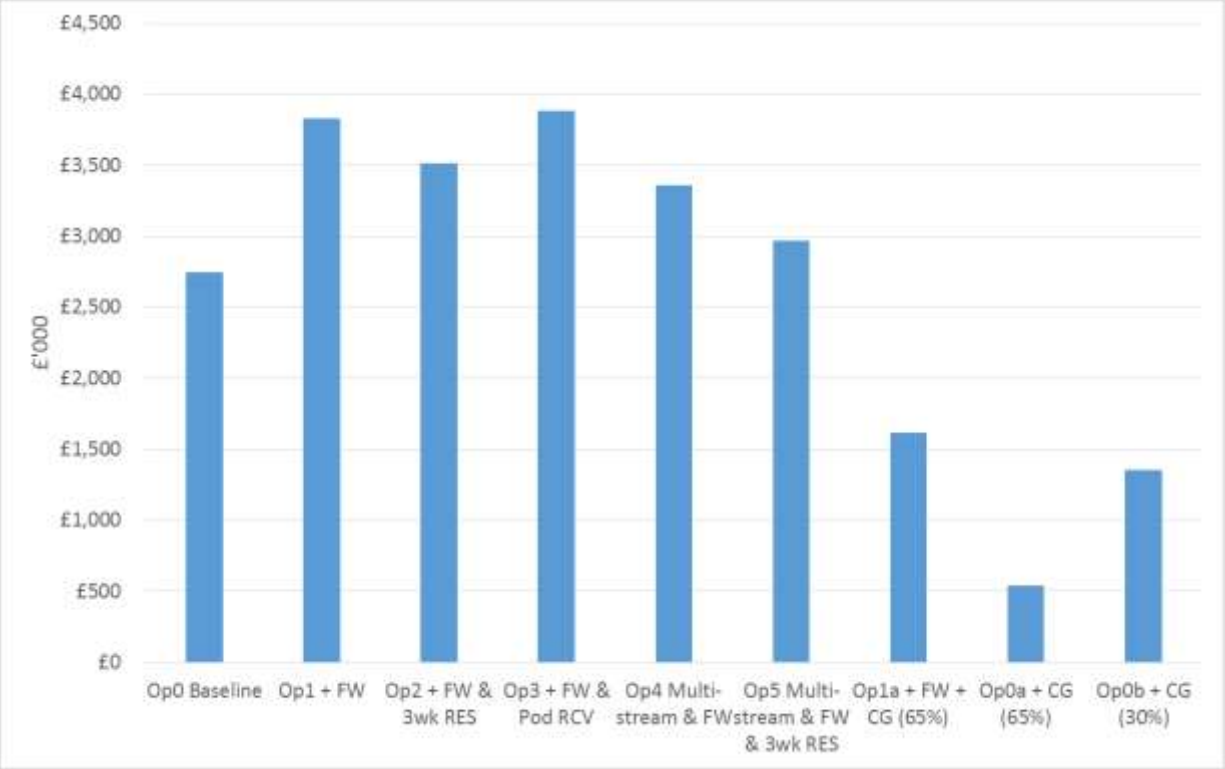
Figure A 3-86 WCA cost categories (£'000).



	Baseline: Current service	Option 1c: Plus FW	Option 1d: Plus FW & 3wk res	Option 2: FW & Pod	Option 3a: Multi stream	Option 3b: Multi stream & 3wk res	Option 1c + CG: Plus FW & CG	Baseline + CG high uptake: Current service +CG 65% uptake	Baseline + CG low uptake: Current service +CG 30% uptake
Garden waste charge	0	0	0	0	0	0	-1,950	-1,950	-900
Recycling credits	-1,244	-1,418	-1,538	-1,418	-1,457	-1,582	-1,270	-1,066	-830
Mixed food & Garden Waste Treatment	499	0	0	0	0	0	0	0	0
Garden Waste Treatment	0	474	474	474	474	474	354	354	163
Food Waste Treatment	0	81	117	81	81	117	81	0	0
Bulking	0	41	58	41	41	58	41	0	0
Dry income/charge	497	497	521	497	-861	-905	497	497	497
Collection costs	2,992	4,151	3,878	4,208	5,078	4,803	3,866	2,707	2,421

The total annual net collection costs are also presented in the chart below, Figure A 3-87.

Figure A 3-87 Net Costs.



Key observations:

- The main 5 options all increase the net WCA costs, in part due to the addition of food waste collections.
- Option 1 is the most expensive collection system, closely followed by Option 3. Option 1 is costly as a result of the addition of food waste collections and Option 3 is due to the use of pod vehicles requiring an additional loader, and the increased costs associated with that particular vehicle.
- Moving to a multi-stream service increases the collection costs but these are offset significantly by greater income from materials' sales.
- The options where a chargeable garden service is introduced are consistently below the Baseline costs. This is due to a combination of lower vehicle numbers, crew costs and most significantly, the income stream from charging £35 per household.
- Introducing a chargeable garden waste scheme could potentially result in lower overall costs even if a dedicated food waste scheme were also introduced at the same time (Option 1a).
- Moving to a three-weekly residual collection (Option 2) does result in lower net costs but not sufficient to offset the introduction of a food waste collection.

Options summary

The total annual net collection costs and recycling rates for each option are shown in the table below (Table A 3-40). The ranks of both the cost and recycling rates are also provided.

Table A 3-40 Annual net costs, WCA.

Option	WCA Total (£k)	Difference to Baseline	Rank	Recycling rate	Rank
Op0 Baseline	2,743	0	4	34%	7
Op1 + FW	3,826	1,083	9	40%	5
Op2 + FW & 3wk RES	3,511	768	7	45%	2
Op3 + FW & Pod RCV	3,793	1,050	8	40%	4
Op4 Multi-stream & FW	3,356	614	6	44%	3
Op5 Multi-stream & FW & 3wk RES	2,965	222	5	50%	1
Op1a + FW + CG (65%)	1,619	-1,124	3	36%	6
Op0a + CG (65%)	541	-2,202	1	30%	8
Op0b + CG (30%)	1,351	-1,392	2	24%	9

The main outcomes of the modelling are the following:

- Recycling rates range between 24% and 50%.
- Operating a chargeable garden waste scheme significantly reduces recycling rates but this can be offset to a varying degree by a food waste collection.
- An increase in the recycling rate of 6 percentage points would be expected for a separate collection of food waste.
- Introducing a food waste collection and a 3 weekly residual service (Option 2) increases recycling rates considerably but also increases costs.
- A multi-stream service with food waste (Options 4 & 5) appears to be the least expensive of all options where food waste is collected (other than those that charge for garden waste collections), although this would mean a significant change in how recycling is collected and does not reduce costs below the Baseline.
- The Baseline options with a chargeable garden service (Options 1a, 0a and 0b) result in the lowest costs but also the lowest recycling rates.

It is important to note, that whilst the modelled costs show a relative comparison between each option, they do not necessarily represent the actual costs, nor do they show any savings that could be made through service management or through subjecting the service to competition through a procurement exercise.

Appendix 4 Modelling limitations

It order to provide an upfront appraisal of the modelling limitations, we have detailed the costs not included within the modelling. It should be noted that although a number of limitations are discussed, KAT is an industry recognised tool that is widely used in the planning and review of kerbside waste and recycling collection systems throughout UK local authorities.

A4.1 Costs not included within the modelling

KAT model options are based on whole service specific collection rounds (i.e. waste collection, paper collection, glass collection, co-mingled collection, etc.) and will produce forecasts of resources (vehicles and labour), performance and costs. However, whilst KAT is a useful tool that has allowed us to model kerbside waste and recycling collection Options for the Councils, the forecast outputs do not address all of the cost associated with potential service changes.

The following is a list of factors that need to be considered as part of the overall picture of service change:

- Infrastructure;
- Interface with other waste collection services;
- Bring Site services;
- Land take requirements at the operational depot;
- Spare vehicles;
- Labour resource issues;
- Disposal activities; and
- Change to collection rounds.

Infrastructure

Any change to a collection methodology may also require amendments to the infrastructure that supports this. For example, where a multi-stream collection system is used, a transfer station with multiple tipping bays would have to be sourced, or the existing transfer stations would require modification.

Interface with other waste collection services

The KAT models do not consider the other waste collection services provided by the Councils, for example: bulky waste, clinical waste, etc. Where any resource for these services has an interface with the current kerbside collection services, for example the shared use of vehicles or labour, then these will not be identified in the KAT models.

Bring Site services

Similarly, the KAT model will not consider any interface with bring site collections. Where any vehicle involved in the kerbside collection services also carries out a service to empty bring site containers this has not been factored-into costs.

Land-take requirements at the operational depot

Any service change that results in an increase in vehicle fleet size (including spare vehicles) will result in a requirement for additional parking at the operational depot. There may be a cost associated with this if suitable space is not available and needs to be acquired.

Spare vehicles

KAT does not model spare vehicles and this will need to be factored in. This will be particularly important for any KAT model option that would introduce a new type of collection vehicle and the need to have spare capacity across a range of different types of refuse collection vehicles (RCV) or RRVs. Estimates of time lost by vehicles through planned and unplanned maintenance would be necessary and spares provided to cover for that.

Labour resource issues
The costs modelled do not include cover for annual leave, sickness and absenteeism. Therefore, this would need to be added to the overall cost.

There may also be some additional training or maintenance related costs associated with the introduction of new types of vehicle: for example, one-off training costs for using the vehicle, including health and safety requirements, training of maintenance staff or the purchase of maintenance software.

Change to collection rounds
The KAT results do not include the costs of changes to collection rounds. Additional costs would be incurred through the reorganisation of collection days for a number of households, including new collection calendars and general communications.

Other costs not included
The list below provides examples of costs that may be included within the whole service cost but that have not been included within the KAT models:

- Administration costs of the subscription-based garden waste service;
- Clinical waste vehicle;
- Bulky waste vehicle;
- Supervisor van(s);
- Operations Manager's van;
- Adverts in press and all public communications for service alteration / behaviour change;
- PPE;
- Training;
- Expenses;
- IT and printing;
- Insurance (non-vehicle);
- Additional mechanics for the maintenance of any specialist vehicles, for example, RRVs;
- Waste and recycling collections from carried out by other rounds (e.g. a van round);
- Bring site servicing and cleaning.

Due to the absence of these costs, the results should not be used for budgetary purposes, but instead used to assess the relative and proportionate differences in costs of future collection options against the current baseline. Some of the additional items to be included in a full cost analysis may well also be relative in scale to the results of the options modelled.

A4.2 Assumptions
All data and assumptions used are based on the best available information at the time of the modelling.

A number of input assumptions are based on the performance of similar collection systems in other authorities of a similar nature. Whilst every attempt has been made to use robust comparative inputs, future trends in waste management are varied, and cannot be predicted by the KAT model.

No planning is made in regards to future legislation changes and changes in household perception of waste and recycling management; that is to say that, we cannot model the unknown.

Local authority specific modelling is best using an accurate local waste composition. However, although the waste composition in the modelling was based on local data and carried out by a reputable company, this is just a snapshot of the waste composition at the time of the study, and no guarantees can be made as to its accuracy. Any waste composition needs to be regularly updated to take account of future changes in materials available for recycling, such as those brought about by factors such as technology, e.g. light-weighting of certain materials or through different buying habits.

Set-out and participation rates have a big influence on the results of KAT modelling. The set-out and participation rates used are based on information provided by the Staffordshire Waste Partnership Councils.

There are also likely to be differences between what KAT has reported as the Baseline costs, and the actual cost. This can be due to varying amounts of overhead costs, contract costs and budgetary assignments. It is, therefore, again suggested that comparisons between the costs of different Options, be taken on their relative value, rather than absolute totals.

Where households are subject to a change in service, e.g. alternative collection days, a reduction in residual waste containment volume, or introduction of new containers, communications materials will need to be produced and sent to relevant households. The costs for these are not included in the modelling.

Finally, although indications are given to the potential kerbside recycling rates associated with each Option, again these should be regarded on their relative values, as modelled, rather than an absolute value.

Appendix 5 AD/IVC sites

Operator	Plant Name	Location	WDA/UA/MDA	Detailed Technology Summary	AD capacity (ktpa)	IVC capacity (ktpa)	Current
SITA	Packington	Packington lamdfill	Coventry	AD, Windrow	50		Planning Granted
Ynergy	Great Ynys Farm	Orcop	Herefordshire	AD	2		Operational
Biogen	South Shropshire Biowaste Digester	Ludlow	Shropshire	AD	5		Operational
Vital Earth Ltd	Sutton Farm	Market Drayton	Shropshire	IVC		10	Operational
Harper Adams Energy	Harper Adams University	Newport	Shropshire	AD	25		Operational
UK Coal, Peel Environmental	Meriden Quarry	Meriden	Solihull	AD	70		In Planning
Lower Reule Bioenergy	Lower Reule Farm	Gnosall	Staffordshire	AD	30		Operational
Biffa	Poplars	Cannock	Staffordshire	AD	120		Operational
John Pointon & Sons	Cheddleton	Staffordshire	Staffordshire	AD	60		Planning Granted
Jack Moody Limited	Hollybush Farm	Shareshill	Staffordshire	IVC		30	Operational
Veolia	Woodhouse Farm	Telford	Telford and Wrekin	IVC, Windrow		64	In Planning
Biogen	Merevale & Blyth estate	Baxterley	Warwickshire	AD	45		In Construction
Biogen	Baxterley	Atherstone	Warwickshire	AD	45		In Construction
Biffa	Ufton Hill Landfill site	Leamington Spa	Warwickshire	IVC		40	Operational
Severn Trent Water	Coleshill AD	Coleshill	Warwickshire	AD	48.5		In Construction
MT-Energie	John Davies Farms Ltd	Swancote	Wolverhampton	AD	20.4		Operational
Unkown	Spring Hill Farm	Pershore	Worcestershire	AD	Unknown		Operational
CZERO	Blackmore Park	Hanley Swan	Worcestershire	AD	Unknown		Commissioning