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Municipal Waste Arisings Projection

Final Report for Gloucestershire County Council

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Report for:

Gloucestershire County Council

Prepared by:

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Project Manager

Approved by

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Project Director

Contact Details

1 Kings Court
Little King Street
Bristol
BS1 4HW

Office: 0117 945 0100
Fax: 0117 945 0550

Web: www.eunomia.co.uk

Acknowledgements

Our thanks to

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1.0 Introduction

This short project was conducted as a supplement to the work Eunomia Research & Consulting was commissioned to undertake for Gloucestershire County Council on developing a Waste Prevention Strategy. This waste arisings projection is required for the County's Municipal Waste Management Strategy but also has implications for the impact of the waste prevention strategy work and is required to input into the calculations for the waste prevention strategy business case.

2.0 Objective

The purpose of this project is to develop a sensible projection of potential future waste arisings on which planning for waste treatment and disposal facilities can be based. Because of the impact of compounding percentage increases over time, the level of growth that is assumed can have a significant impact on the quantity of material that Gloucestershire must plan to manage, and hence on the number and type of facilities required. As this clearly has significant financial implications in terms of procuring the facilities as well as for potential exposure to LATS liabilities, the quality and accuracy of the projection is critical.

3.0 Scope

This project covers the development of a 25 year waste arisings projection for municipal waste in Gloucestershire as a whole. Individual arisings projections for each district were not developed for this project, although some district specific data was used in deriving the county wide projection.

4.0 Method

The projection was developed in accordance with the following methodology:

4.1 Compilation and Analysis of Waste Data

Data supplied by Gloucestershire County Council was used to develop the projections. Data between 1998/99 and 2005/6 were used to provide 7 years of data on which to base the projection. Before the supplied data was used in the projection, the following manipulations were performed:

- An adjustment was made to account for material arising at the Cheltenham HRC site. (This data was not included in the HRC data as it is not officially an HRC, but for the purposes of analysis, material arising from the site should be classified alongside other HRC data);
- District level arisings data for collected wastes were broken out;
- Monthly arisings figures were compiled into individual spreadsheets to enable time trends to be developed;
- Data was compiled/extracted to produce the following streams:

- Household collected waste. This includes collected residual, dry recycling, bring and bulky waste.
- Kerbside Collected Green waste
- HRC residual waste and dry recyclables (including DIY waste and fridges)
- HRC Green waste
- HRC Inert waste
- Trade waste (incl flytips)

- Estimates of the green waste remaining in the collected residual for each district were made based on the 2005 waste analysis data supplied by Entec. The quantities remaining in the residual reflected the green waste collection schemes in place at the time of the audit.
- Each of these sets of figures was then plotted to identify possible patterns and trends. The historical data produced by the analysis is shown in section 5.1.

4.2 Compilation and Analysis of Population and Household Data

Mid year population data and housing data was used to establish historical data points. Annual data was not available for all years, therefore straight line projections were used to produce data points for the years where no data was available.

For future years, household and population projection data supplied by Gloucestershire County Council was used. As with the historical data, straight line projections were used for years where no data was available.

4.3 Estimates of Green Waste in Residual

The quantity of green waste in the residual for each district was obtained from the 2005 Waste Analysis data supplied by Entec. This however provided only summer and winter figures valid for the systems that were in place in 2005. For the purposes of the analysis the summer figures were applied for the months April to September and the winter figures were applied for the months October to March. In order to develop the projection however it was necessary to make estimates of the likely quantity of greenwaste historically present in the residual.

Where there had been no service changes in respect of green waste collections it was assumed that the quantity of greenwaste in the residual had not changed significantly over time. Where service changes had taken place (ie in Cheltenham, Cotswold, and Forest of Dean), estimates were made of the green waste in residual prior to the introduction of green waste services based on average data from authorities where there were no green waste collections in place. The initial Cheltenham, Cotswold, and Forest of Dean figures were therefore derived from the same data. As the difference in total green waste between these three districts (calculated from the most recent year of data) was found to be marginal and within any likely margin of error, there was no basis on which to justify using different figures for each district, and so the same data was applied across all three districts

for the initial years. Table 1 shows the assumed green waste in residual figures used in the analysis.

Table 1: Monthly Green Waste in Residual Estimates

	Initial Years (Tonnes)		After Any Service Change (Tonnes)	
	Summer	Winter	Summer	Winter
Gloucester	892	153	No change	No change
Stroud	269	228	No change	No change
Tewkesbury	570	251	No change	No change
Forest of Dean	577	211	178	10
Cheltenham	577	211	639	290
Cotswold	577	211	73	115

4.4 Analysis of Waste Streams & Development of Projection

4.4.1 Bin Waste

4.4.1.1 One off changes

The data was analysed to attempt to identify where 'one off' changes in household waste arisings have occurred, so that these can be separated from underlying changes in municipal waste growth due to ongoing influences (such as household and population growth and changes in consumption). In general service changes such as alterations to bin size, collection frequency, material bans, and the separate collection of garden[1] waste result in one off 'step changes' in waste arisings levels. As there have been a number of such service changes among the districts, these changes may well be responsible for much of the recent arisings growth. Collection of dry recyclable material on the other hand is not understood to result in an increase in overall household arisings, as material is essentially transferred from the residual to the recycling stream. In terms of formulating projections, therefore, total 'bin waste' (including both residual and recycling) was be used.

4.4.1.2 Garden Waste

Because garden waste collection results in a one off increase in arisings this was factored out by calculating a 'bin waste minus all green' figure. Green waste (with no background annual inflation of the figures) was added back to the total after the household waste projection was made.

[1] Separate collection of garden wastes has been shown to result in increases in municipal waste arisings as material that was previously home composted, or left 'in situ' is effectively brought into the collection system. Work by WRAP suggests that this can result in an approximate additional 80kg per household of waste arisings for participating households.

4.4.1.3 Other Material Streams

There are other material streams which are directly attributable to households and for which there can be transference between their points of entry to the waste stream. This applies to bring site recycling, 3rd party recycling and bulky (household) waste. For the purposes of this analysis, these are added to the 'bin waste minus all green waste' figures and it is from this that a growth rate is calculated on which the 'household waste' projections were based.

4.4.1.4 Adjustments for Exponential Data

Since a percentage waste growth produces an exponential effect, the natural log of each monthly tonnage per household figure was taken and the resulting (straight) line of best fit was plotted. The gradient of this line was determined and the inverse log taken to give the true percentage growth rate. This technique removes inaccuracies resulting from uncertainty as to where on the slope of an exponential curve the data used for the projection has been sampled from (ie. If the data has been sampled at the start of the curve the growth rate will appear to be low, whereas if is sampled to the right hand end of the curve then it will appear to be very high).

4.4.1.5 Adjustments for Household Growth

Since this calculated 'per household growth rate' includes any effect from historic changes in the population per household it is necessary to look at expected future changes in the population per household. A declining average household size would be expected to result in increase in total waste generation (since smaller households produce more waste per person). Studying the figures shows that in the 5 years leading up to 2006 the population per household was falling at 3.2%. It is projected that over the next two 5 year periods that it will continue to fall at 2.3% and 2.1% respectively. Although this is a small difference and the consequence likely to be only marginal, since the rate of change in population per household is reducing, the effect would be a slight reduction in the projected growth rate. It is however difficult to incorporate the consequences of this trend since it is not known with any certainty how strong the population per household effect is. As such it is prudent to remain with the existing figure since this is less likely to under-forecast the waste growth.

The green waste was then added back into the overall arisings figures so that it is accounted for but so that it does not affect the projection.

The projection was then extrapolated based on an annual per household growth rate. The resulting figure was then multiplied by the projected number of households to arrive at an arisings projection for bin waste.

4.4.2 HRC Waste (and Relationships with Household Waste)

4.4.2.1 Seasonal Factors

Due to the very seasonal nature of HRC use (compounded by, though not entirely attributable to, green waste) it was not possible to project trends from monthly figures, as the slope of the projection is heavily dependent on the final few data points, and it is essentially random that they end in March. Therefore annual tonnages were used.

4.4.2.2 Trends

HRC waste was analysed by material to identify any trends in waste production and determine the influences that may have been at work.

Analysis of the data shows significant and unprecedented increase in arisings since 2002/3. Following discussion with Gloucester County Council this was attributed to the start of a new HRC management contact, subsequent improved site management and separation of materials, and an increase in the overall use of the sites. Analysis showed that HRC waste increased in correlation with separation of inert material in particular.

4.4.2.3 Additional Material

The majority of the additional material (such as wood waste, DIY, and green waste) was identified as being material that would not normally be found in collected bin waste. This additional HRC material must therefore be material that was not previously a part of the MSW stream but may have been managed in other ways such as through private hire skips. For the purposes of the projection therefore, it was assumed that the majority (90%) of this constituted a one off arisings increase[2]. Consequently the slope of the HRC projection was calculated on the total HRC arisings figures from 1998/99 to 2002/03 but projected forward from the 2005/06 tonnage levels. The increase attributable to the change in site management was therefore factored out in the calculation of an HRC arisings projection since this would be a one off effect and would not be expected to be a continuing trend. Without accounting for this the projection would have been significantly overstated.

4.4.2.4 Adjustments for Household Growth

As was done with the bin waste, the tonnages were converted to 'per household' figures so that the effect of household growth can be included. The historical arisings were then assessed after taking logarithms of the figures to ensure that effects from exponential growth were accurately accounted for in the projection. The projection produced an annual per household growth rate. The resulting figure was applied to the final year of real data (2005/06) and multiplied by the projected number of households to arrive at an arisings projection for HRC waste.

4.4.3 Trade Waste

Trade waste quantities in Gloucestershire have remained largely stable in recent years. Projections for trade waste (which makes up less than 3% of total arisings) cannot be developed in the same way as other waste streams as future municipal trade waste arisings are more dependent on municipal collection policies and practices than on quantities generated by businesses.

There are a number of factors which could influence the quantity of trade waste – in particular the impact of LATS on disposal costs and the prices charged to trade waste customers could see trade business move increasingly to the private sector.

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[2] It should be noted that the source of this material is not clear and that this remains a source of uncertainty in the development of the projection. To account for this increase which may or may not be seen to continue, best and worst case projections are also provided.

Balanced against this is an incentive for Councils to collect biodegradable trade material (eg paper, card, and food waste) for recycling and composting which could offset LATS obligations.

In view of this, and the level of uncertainty surrounding councils responses to LATS in respect of trade waste, trade waste arisings were simply projected forward at current levels (an average figure across the last 3 years was used).

4.5 Known Future Service Change Impacts

4.5.1 Service Changes Accounted For

Once the initial projection had been developed, the impact of known future service changes was accounted for. The following were specifically factored into the projection:

- **Green Waste Collections**
  - Gloucester City kerbside green: extra 13,000 (50%) coverage from 2007/8
  - Tewkesbury £26 charged kerbside green scheme district wide from April 06
  - Cheltenham kerbside green: extra 9,200 (26%) coverage in 2007/8
- **Residual Waste -fortnightly collection & not side waste**
  - Tewkesbury fortnightly and no side waste from 2006/7
  - Cotswold fortnightly and no side waste from 2007/8
  - All fortnightly by 2009/10

These services changes were accounted for by calculating the level of one-off change to the bin waste arisings and allocating it to the figures for the appropriate year. This had the effect of changes the absolute tonnages involved but did not alter the slope of the projection. The assumptions used in making these one off adjustments are outlined in the sections below.

4.5.2 Green Waste Adjustment Assumptions

Green waste was assumed not to be subject to any per-household annual arisings inflation since it has no direct relation to economic growth or consumer habits.

For Cheltenham the calculation to project future green waste capture was straightforward. The 2005/6 tonnage was multiplied by the proportional increase in coverage.

For Gloucester, the 2005/6 tonnages indicate a very low capture per household covered, 25kg/hhld/yr. This suggests the system has not been widely taken up by residents. For 2007/8 and beyond the figures are projected to match Cheltenham's 2005/6 capture of 67kg/hhld/yr, which was deemed to be a more realistic figure for this scheme.

The figures for Tewkesbury are based on the Cotswold and Forest of Dean wheeled bin based services which in 2005/6 were capturing 220 and 299kg/hh/yr

respectively. The future projections assume that 25% of the district buy into the service and generate 250kg/hh/yr.

4.5.3 Fortnightly Residual Adjustment Assumptions

Following discussions with officers in Gloucestershire, the technique employed to account for a change to fortnightly residual was to reduce the projected household bin waste (excluding green waste) figures by 3%[3]. This was applied for the Tewkesbury households in 2006/7, Cotswold in 2007/8 and all Gloucestershire households in 2009/10. It was assumed that this was a direct waste reduction effect and no material was diverted to HRC.

4.6 Amalgamation Individual Waste Stream Projections

The projections for each stream were then collated to produce an overall county projection. This is presented in section 5.2.

[3] This reduction of 3% in total arisings (as opposed to bin waste or residual waste) is based on an analysis of aggregated 2003/4 data from all local authorities in England which showed that those authorities with AWC collections had 3% lower arisings on average than authorities with weekly collections. Because the analysis did not control for impacts of different collection systems, types of container or types of authority (eg. Rural vs urban), it is likely that the difference found is a conservative estimate.

5.0 Results

5.1 Historical Data

The figures below show the key historical data that was analysed to produce the projections.

5.1.1 Bin Waste

Figure 1. Gloucestershire Bin Waste Arisings By Month

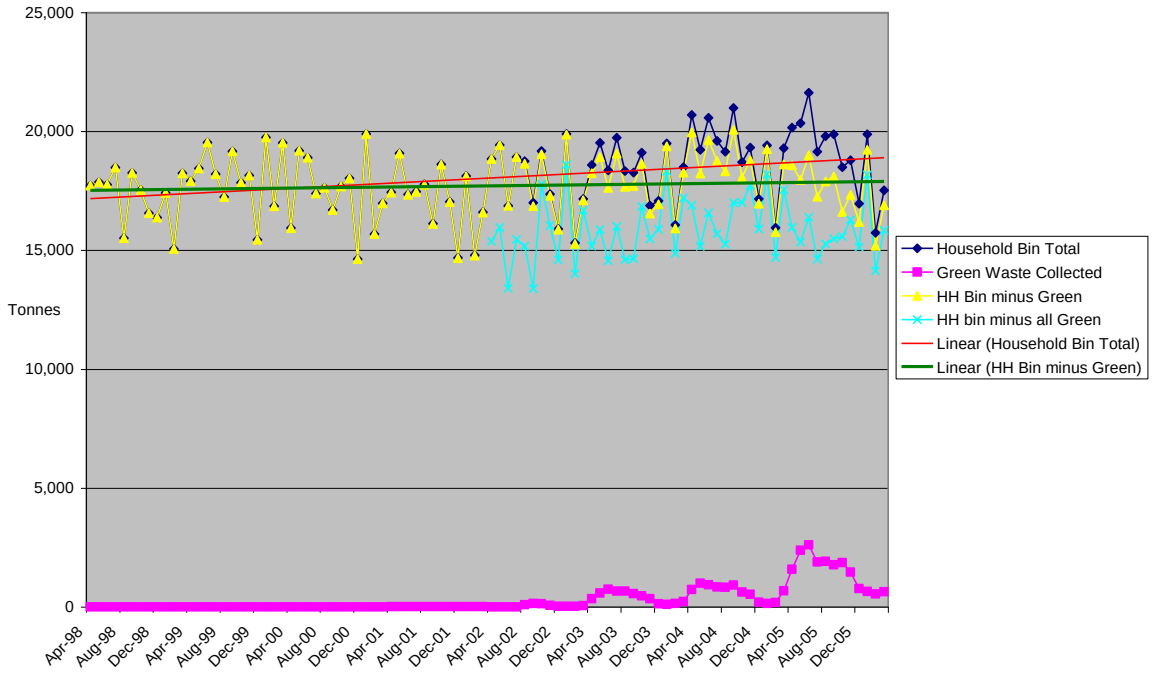
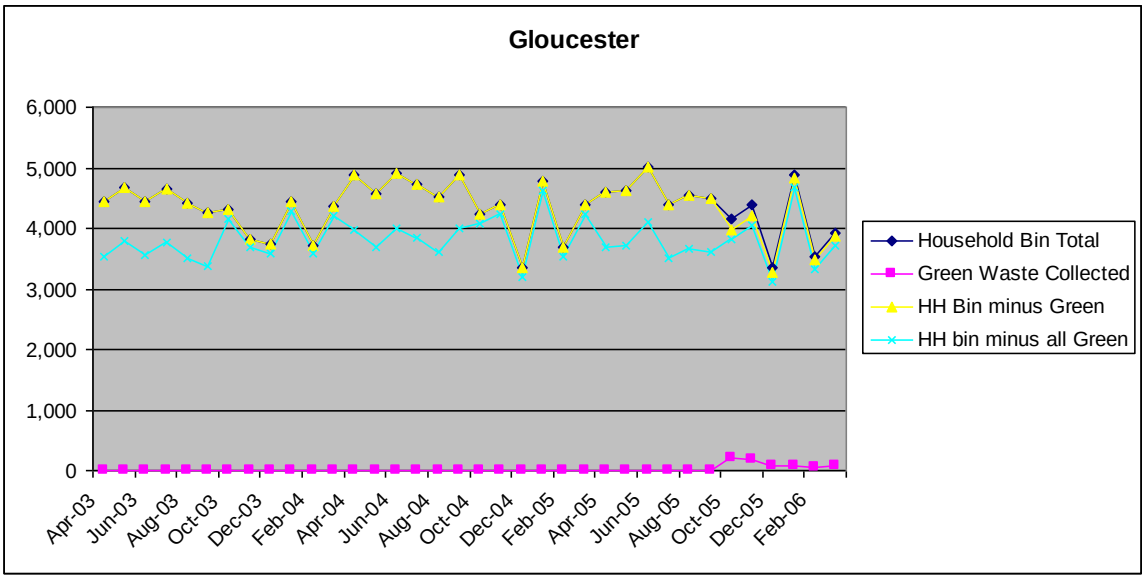


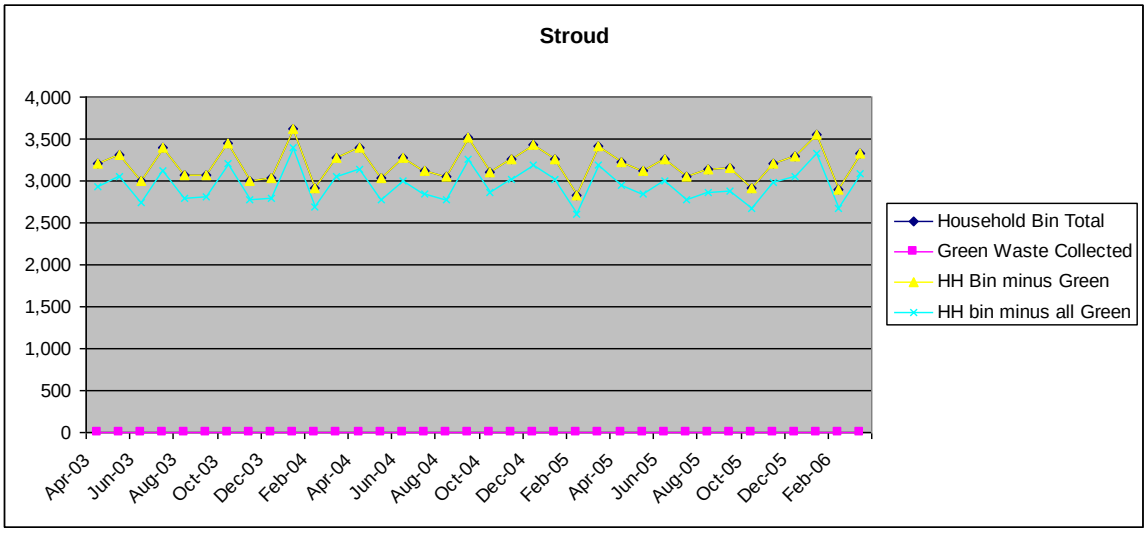
Figure 1 above shows the arisings by month since 1998. Of note is the fact that the linear trend on bin waste minus separately collected green (the green line) is almost flat, where when green waste is included (the red line) there is a clear upward slope. This suggests that recent arisings growth may be largely attributable to additional green waste collected through separate kerbside collections. This is investigated further in the following charts which break the above data down by district.

Figure 2. Gloucester Bin Waste Arisings By Month



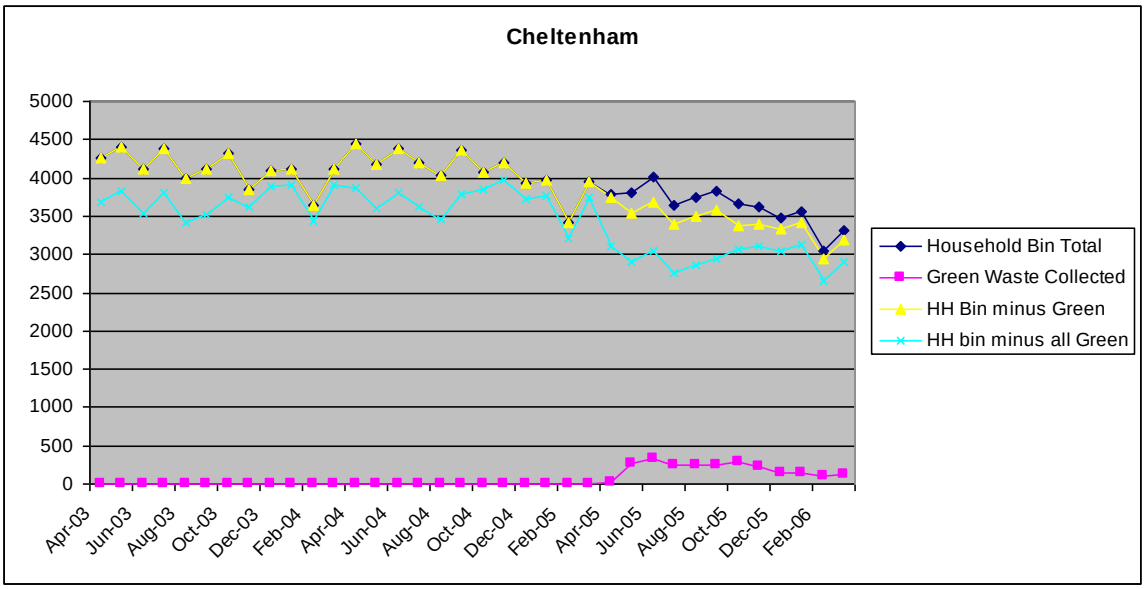
Although Gloucester introduced separate green waste collection services in 2005 these did not have a significant impact, partly due to the extent of the roll out of the service and partly due to the roll out occurring over winter months. Also of note is that the seasonal peaks in the total bin waste are flattened out when the green in the residual is accounted for.

Figure 3. Stroud Bin Waste Arisings By Month



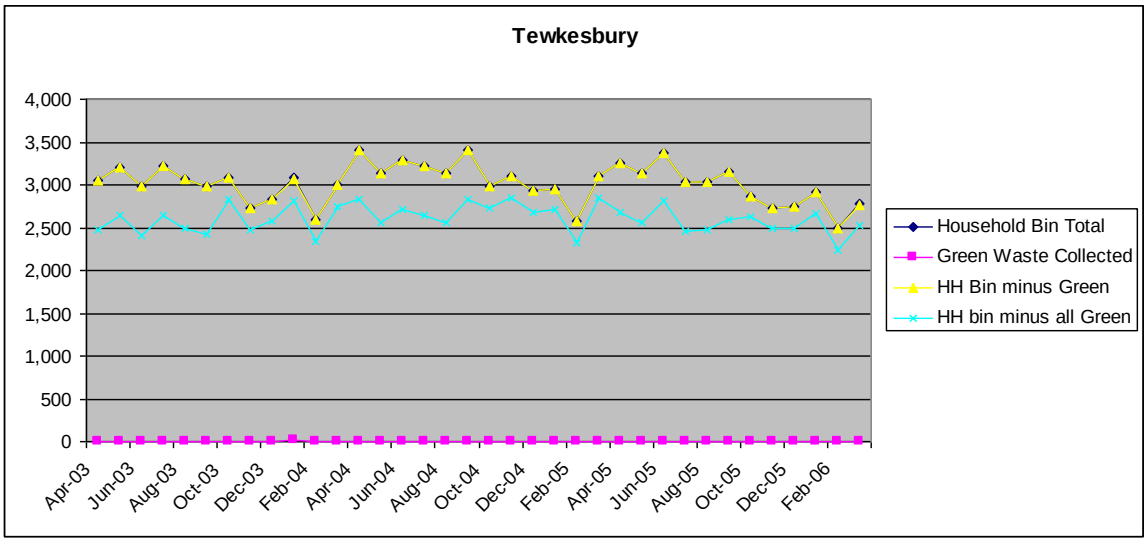
Stroud's arisings have remained remarkably flat with little in the way of seasonal peaks. This also illustrated in the fact that removing the green in the residual makes little difference to the shape of the line. The low level of green waste in the residual is consistent with Stroud having a sack based refuse collection service.

Figure 4. Cheltenham Bin Waste Arisings By Month



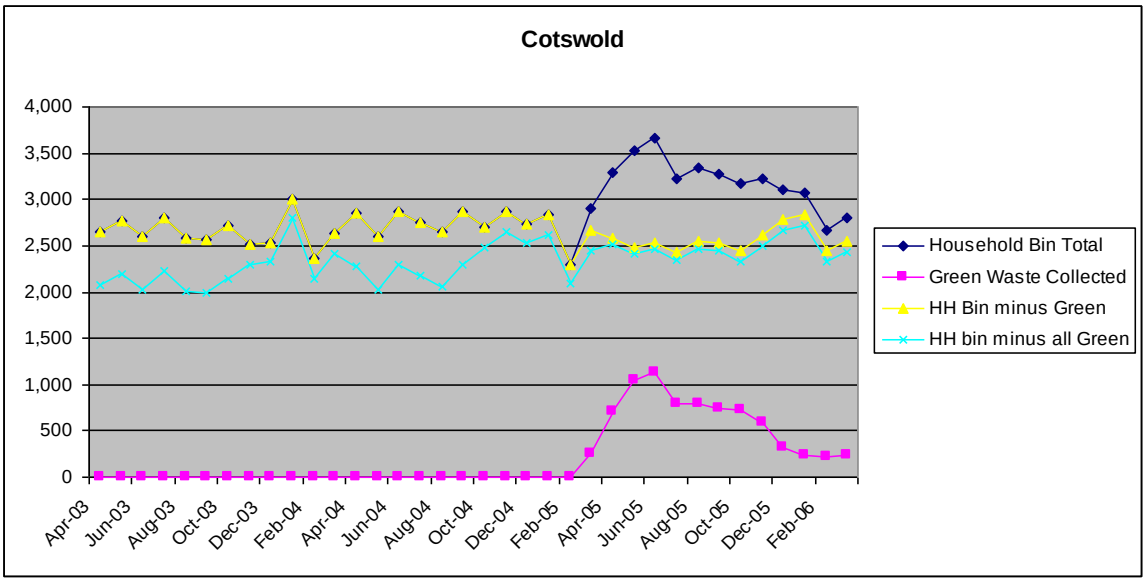
Cheltenham is the one authority that showed a decline in bin waste quantities. It is not clear from the data what is driving this decline. The introduction of green waste collection services reduces the slope of the decline but does not change it substantially.

Figure 5. Tewkesbury Bin Waste Arisings By Month



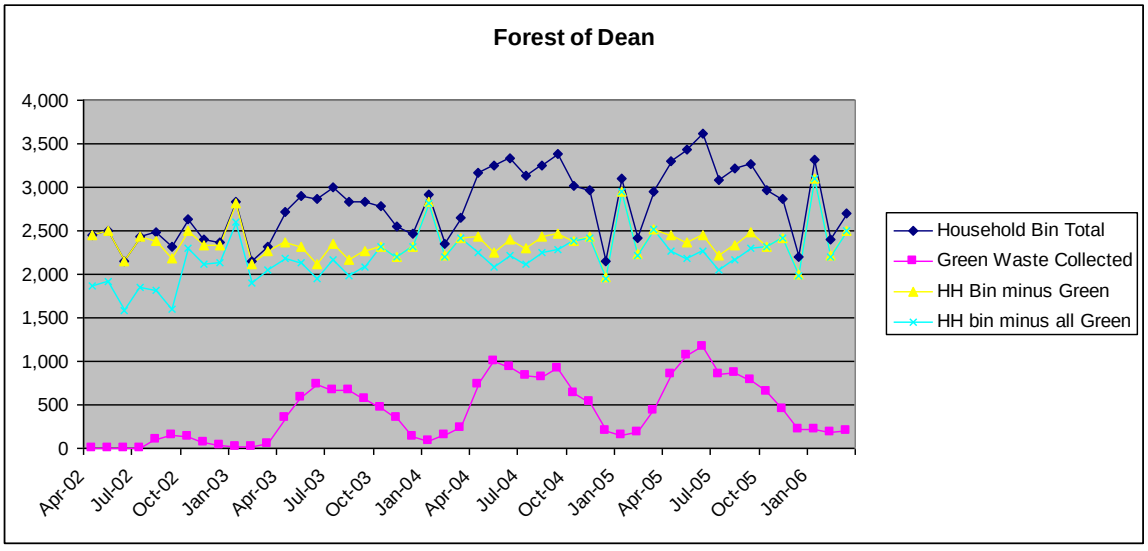
Tewkesbury has no green waste collection services and bin waste has remained fairly constant with seasonal peaks. These peaks are clearly flattened when the green waste in the residual is accounted for.

Figure 6. Cotswold Bin Waste Arisings By Month



Cotswold exhibits the classic pattern for when a wheeled bin based green waste collection is introduced, with a large seasonal peak substantially above the previous arisings levels. The data shows that when all green waste is taken out the pattern is much flatter.

Figure 7. Forest of Dean Bin Waste Arisings By Month



Forest of Dean shows a very similar classical pattern for where an authority is separately collecting green waste in a wheeled bin, with large seasonal peaks and a clear uplift in arisings from previous levels.

5.1.2 HRC

Figure 8. HRC Total & Inert Arisings By Month

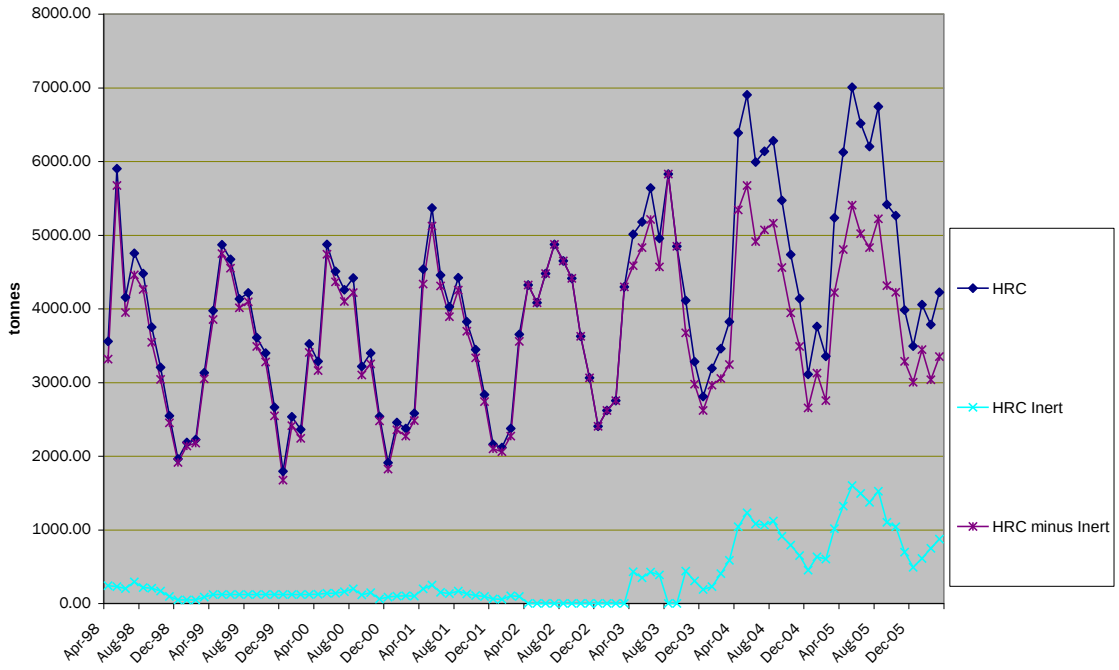
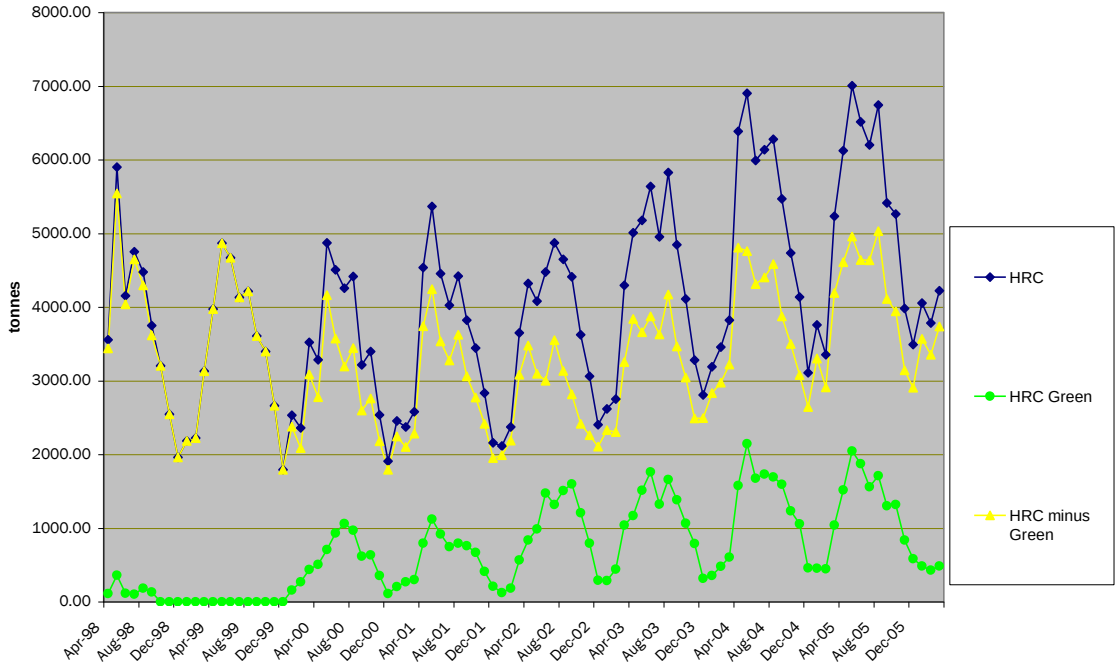


Figure 8 shows that a large proportion of the increase in arisings between 2003 and 2005 is inert waste. It is not possible from the data however to determine how much of this is 'new' material and how much was there before, and is simply being separated out better at the HRC sites.

Figure 9. HRC Total & Green Waste Arisings by Month



Although green waste separated out at HRC sites has increased over time, green waste alone cannot account for the increase in arisings.

Figure 10. HRC Composition by Month

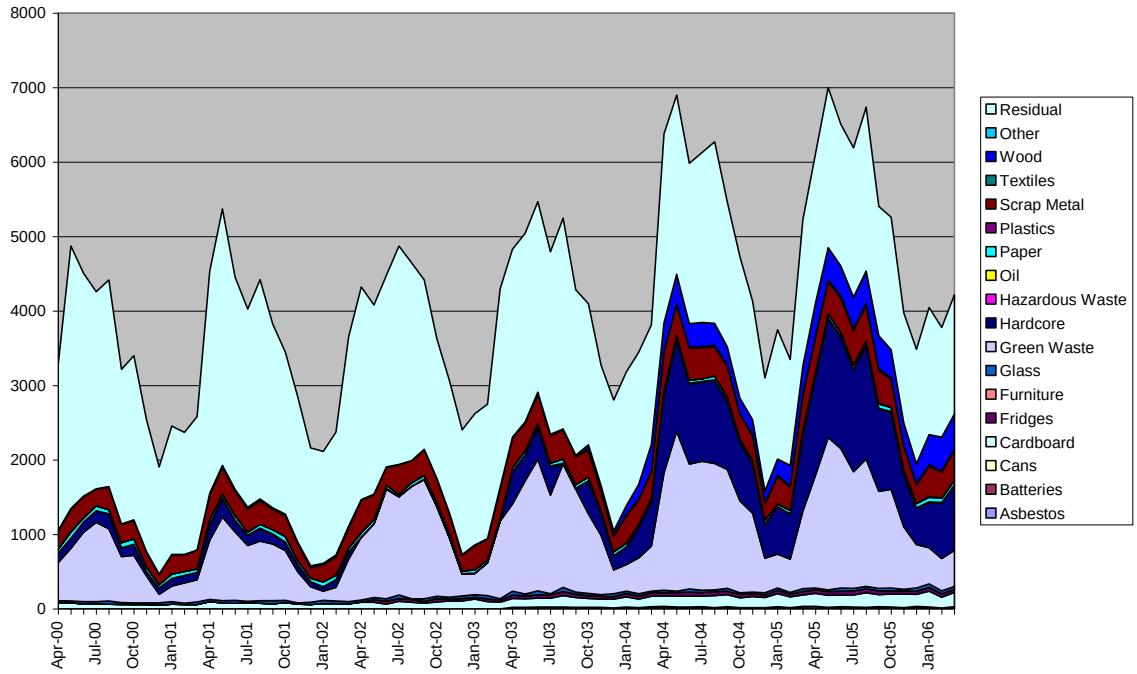


Figure 10 shows the relative impact of the different separately collected materials and residual waste. In addition to green and hardcore, wood and cardboard have increasingly been separated out in recent years.

5.2 Arisings Projections

Figure 11. Projection of Waste Arisings Attributable to the effect of Population and Household Increases

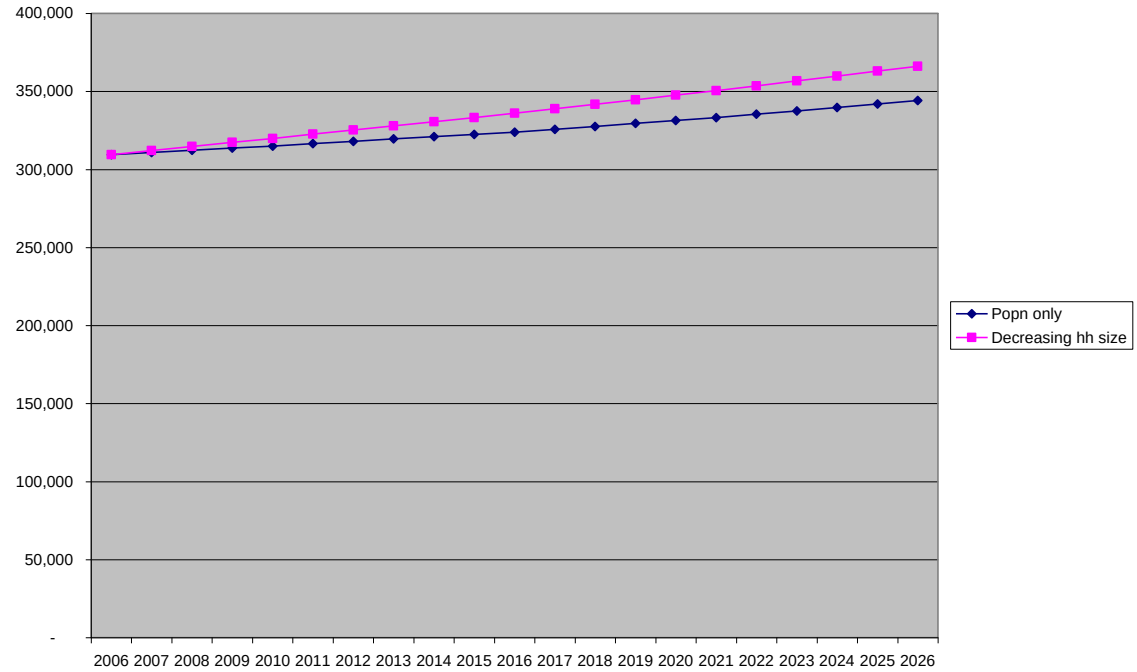
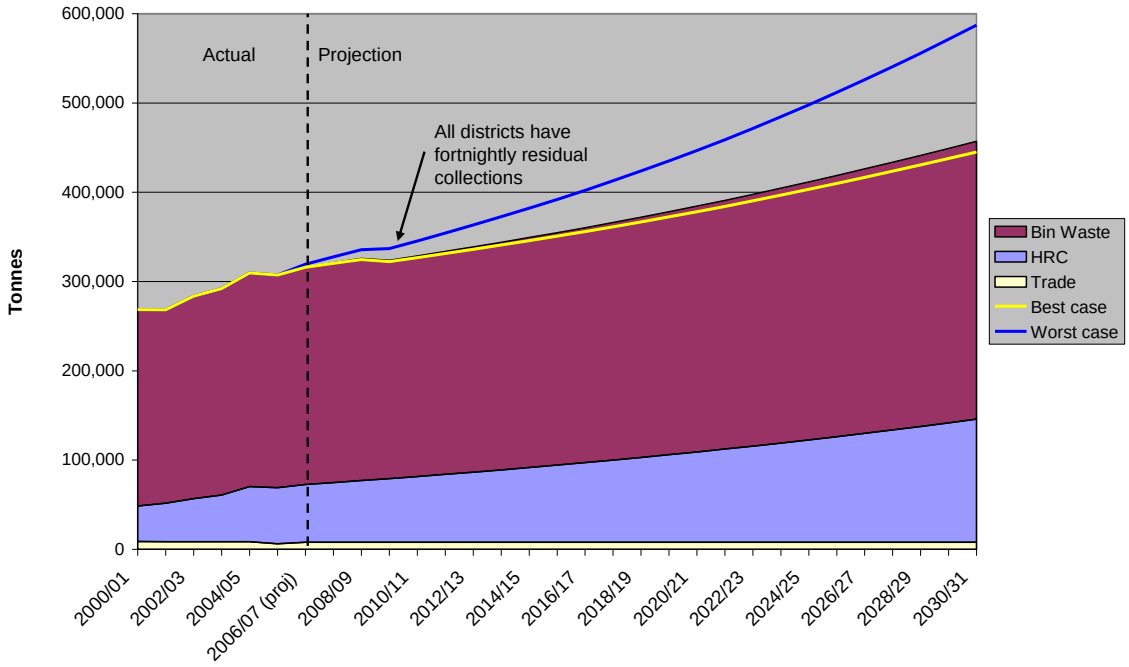


Figure 11 shows the impact of increasing population on waste arisings (the blue line) with all other factors held constant. This is equivalent to an annual growth rate of approximately 0.5% per annum. The pink line shows the impact of decreasing household size allowing for the fact that smaller households generate more waste per person. Taking account of this variable increases the annual growth rate to approximately 0.8% per annum

Figure 12. Gloucestershire Municipal Solid Waste Arisings Projection



The above projection shows that total arisings grow from 307,000 tonnes per year in 2005/6 to some 457,000 tonnes by 2030/1. This is equivalent to an annual growth rate of 1.6%.

The rate of growth developed for the projection depends heavily on the source of the material that drove the growth in HRC arisings between 2003/4 and 2004/5. If the source was material that had been in household bin waste, then the transfer of material to HRC effectively masked what would otherwise have been an uplift in household waste. This has to be factored into the projection.

In this instance, if all of the unaccounted additional HRC material was from households then the household waste growth rate would be approximately 2.8% from 2006/7. This is illustrated by the blue (worst case) line. If however, the increase in HRC material was new material entering the waste stream as a result of one off changes then the rate of growth will not be affected and a 1.1% figure is produced. This is illustrated by the yellow (best case) line.

As discussed in Section 4.4.2, based on the composition of material entering the HRC sites, it has been assumed that the majority (90%) of this material did not come from household bin waste and therefore the historic arisings uplift will not be a continuing trend in bin waste. The bin waste projection consequently calculates to 1.3% in the initial years (increasing to 1.5% by 2030 when general household waste is greater in proportion to the garden waste).

The above projection accounts for the impacts of decreasing household size. However the rate of decrease in household size is projected to slow down slightly over time. As discussed in Section 4.4.1, the impact of this was not included in the projection but as the change was very small it was determined that the impact (which would be to slightly lower the growth rate) would be extremely minor.

Table 2 below shows key outputs from the projection.

Table 2: Arisings Projections

Tonnes	2005/06 (Actual)	2010/11	2015/16	2020/21	2025/26	2030/31	Total Growth
HRC	62,925	73,785	86,531	101,287	118,353	138,074	75,148
Trade	6,150	7,743	7,743	7,743	7,743	7,743	1,593
Bin Waste	238,101	246,986	260,332	275,377	292,637	311,170	73,070
All MSW	307,177	328,514	354,606	384,406	418,733	456,987	149,811
5yr growth	2005/06 (Actual)	2010/11	2015/16	2020/21	2025/26	2030/31	Total Growth
HRC		17%	17%	17%	17%	17%	47%
Trade	Zero growth - average of 2003/04 to 2005/06 figures used						
Bin Waste		4%	5%	6%	6%	6%	19%
All MSW		7%	8%	8%	9%	9%	27%
Average Annual Growth	2005/06 (Actual)	2010/11	2015/16	2020/21	2025/26	2030/31	Average Growth
HRC		3.2%	3.2%	3.2%	3.2%	3.1%	3.2%
Bin Waste		0.7%	1.1%	1.1%	1.2%	1.2%	1.1%
All MSW		1.4%	1.5%	1.6%	1.7%	1.8%	1.6%