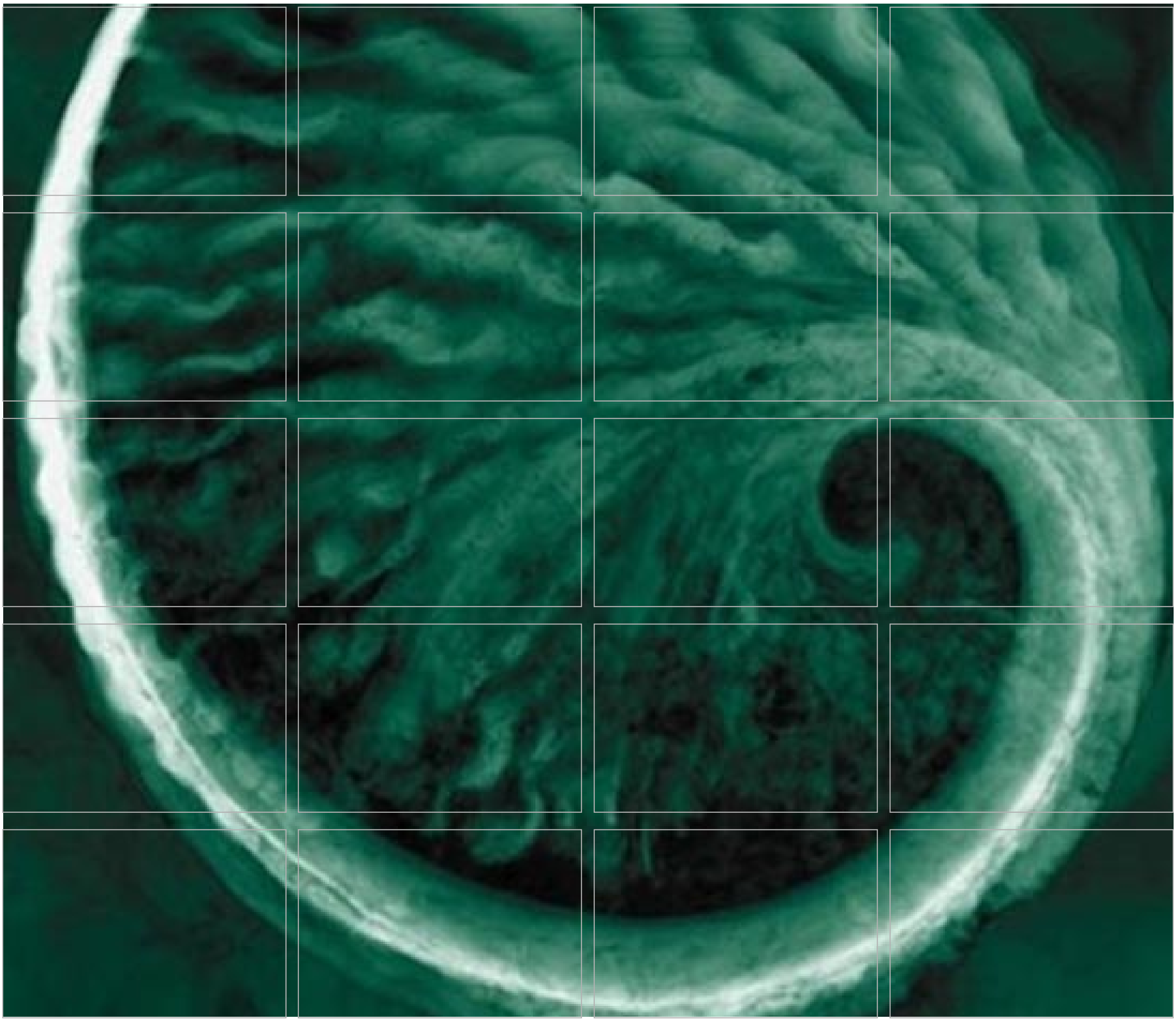

Waste Arisings and Capacity Study for Thurrock

Final Report

May 2007

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Waste Arisings and Capacity Study for Thurrock

May 2007

Final Draft

Prepared by: Philip Short and Simon Aumônier

For and on behalf of
Environmental Resources Management

Approved by: Simon Aumônier

Signed:

Position: Partner

Date: 25th May 2007

CONTENTS

1 INTRODUCTION

1.1 BACKGROUND TO STUDY

As a unitary authority, Thurrock Council is responsible for both the collection and disposal of municipal solid waste, as well as being the waste planning authority. Thurrock's Municipal Waste Strategy and Position Statement establishes the framework for the management of municipal waste for the period 2005-2010. Thurrock Council is currently producing a new and longer term Municipal Waste Strategy, which forms the basis for some of the assumptions and scenarios in this report relating to municipal solid waste.

The following report is a need assessment for the period 2006-2021. It provides an assessment of the capacity of existing and planned waste management infrastructure in Thurrock. It assesses the need for further facilities in order to inform the preparation of policy in Local Development Documents (LDD) and to meet the various targets set for Thurrock (see *Section 2.2.5*).

In order to demonstrate the additional capacity required to manage expected future arisings by treatment type, the study includes predictions of existing and planned capacity at sub-regional level and compares these with estimates of waste arisings, intra-authority movements, and the apportionment of imports to the East of England region.

The objectives of the study were to:

- assess current site capacity;
- produce a need assessment for Thurrock, looking at the potential requirements for waste management facilities for the period 2006-2021; and
- develop policy recommendations for the emerging Local Development Framework.

1.2 STRUCTURE OF THE DOCUMENT

This report is set out according to the following structure:

- *Section 2* – Arisings section;
- *Section 3* – Capacity section;
- *Section 4* – Capacity gap analysis; and
- *Section 5* – Conclusions.

2 ARISINGS SECTION

2.1 INTRODUCTION AND METHODS

Arisings data is provided for municipal solid waste (MSW), commercial and industrial (C&I) waste, construction and demolition (C&D) waste and hazardous waste. The data was provided where possible by Thurrock Council. The MSW data provided is also being used in the Thurrock Municipal Waste Management Strategy (MWMS) to ensure that both documents are consistent and use the same baseline data. The growth rates used in Thurrock Council's own work were applied to this baseline data.

C&I data for Greater Essex that was used in the SWMA was disaggregated for Essex, Thurrock and Southend-on-Sea. The data was split by ERM using a breakdown of the number of businesses and their relative size in the three areas. This resulted in an 80%/11%/9% split for Essex/Thurrock/Southend-on-Sea [(1)]. C&D data was taken from the latest Symonds survey from 2005 [(2)].

C&I and C&D data were drawn from a number of different sources. Growth forecasts were based on local economic data. S*ection 2.2* shows how these were developed. Baseline data for C&I and hazardous wastes were taken from Environment Agency (EA) data, in the form of the Strategic Waste Management Assessment (SWMA) survey data from 2003. The relative size of the businesses in each area was assumed to be relative to the number of employees. On average Thurrock had 'larger' businesses, and, as such, the proportion of waste arising in the three areas was adjusted to reflect this.

The following section takes each waste stream in turn and explains the method that was employed to create a growth forecast. This forecast was then applied to the baseline arisings.

2.2 MUNICIPAL SOLID WASTE

2.2.1 Description

Municipal solid waste is waste which is collected by local authorities. It is mainly composed of household waste, but also includes street sweepings, waste from reuse and recycling centres, as well as local authority collected commercial and industrial waste.

(1) http://www.nomisweb.co.uk/reports/lmp/la/2038431778/report.aspx
(2) Survey of Arisings and Use of Alternatives to Primary Aggregates in England, 2005 Construction, Demolition and Excavation Waste, Symonds

2.2.2 *Waste Arisings*

The baseline used for this study comes from 2005/06. The figure provided by Thurrock Council for MSW produced in that year was 72,670 tonnes. Of this, 70,900 was household waste.

The trend in MSW arisings in Thurrock since 2002 has been a gradual decrease. The recycling and composting rate in Thurrock has increased by over 10% in the same period.

Table 2.1 Municipal Solid Waste Produced in Thurrock 2000 - 2006

	2001/2002	2002/2003	2003/2004	2004/2005	2005/2006
Waste arisings (including fridge/freezer tonnage				73,930	72,670
Change in arisings					-1,260
Recycling and composting rate (%)(included soil/hardcore in 2001/02)	11.3	9.8	11.5	16.5	20.0

Projections of future arisings were made using this MSW baseline figure. *Section 2.2.3* discusses the various growth scenarios used to make these projections.

2.2.3 *Growth Forecast Development*

Three MSW growth scenarios were developed. The growth scenario used by Thurrock is based upon the data and scenario in the emerging Municipal Waste Strategy (of 2007) and assumes an increase growth rate over the strategy period to 2021. The other two growth rates are taken from previous work carried out by ERM in the East of England Region [1]. This study used a range of scenarios for MSW, with best and worst case scenarios established to provide the bounds of the potential range in outcomes. The scenarios are shown in *Table 2.2*.

(1) Waste Management Capacity and Future Needs in the East of England, 2005

Table 2.2 *Growth Scenarios for MSW*

Scenario	Description
Best case scenario	A 0% growth rate in housing and waste production was modelled to give a static arisings growth profile
MWMS scenario	Waste growth is estimated to be at 0.5% per annum in the MWMS. This made up of an estimated 1.5% increase in housing per annum and a 1% decrease in waste arisings per household per annum.
Worst case scenario	Predicted housing increase from previous ERM study* plus a constant 2% waste growth

*This housing increase is not at the same level as in the MWMS scenario as the housing increase was aggregated for the regional study. The level was 1%, decreasing to 0.9% after 2012.

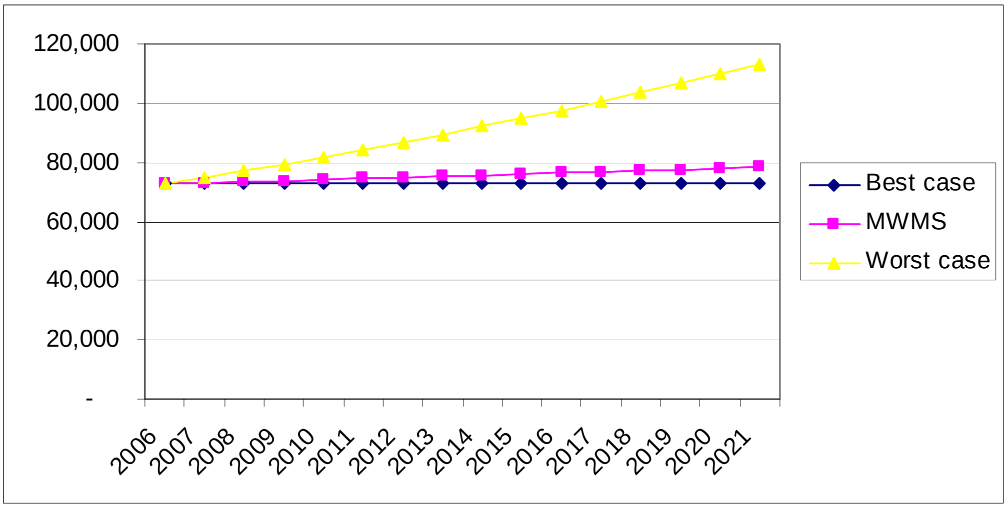
The results for MSW are shown for all three scenarios in the following section. These results are intended to show the range of arisings that could be seen in the Thurrock area over the strategy period.

Following the application of these growth scenarios, the next stage assesses what treatment methods will be required/ selected in the area. It was assumed that the treatment processes may produce up to 30% residual material by mass that, depending on the treatment process, may be unsigned to non-hazardous or inert landfill. The arisings and capacity sections of the report have taken this tonnage into account.

2.2.4 *Results*

The results from the growth forecasts are shown in *Figure 2.1* [1].

Figure 2.1 ***MSW Growth Forecast Results (tonnes)***



(1) The emerging Thurrock MWMS may present a short term solution by 2009/10, this will increase recovery capacity.

2.2.5 *Residual Waste Arisings*

For all growth scenarios, new treatment capacity is assumed to come online in 2008/09, in line with the Thurrock Council MWMS. *Table 2.3* shows the effect of the growth scenarios on predicted arisings of residual waste for landfill for certain years. A full table can be found in *Annex A*.

Table 2.3 ***Residual Waste for Landfill by Growth Scenario (tonnes)***

MSW	2006	2010	2013	2017	2021
Best case	64,000	36,000	27,000	16,000	1,400
MWMS	64,000	37,000	27,000	16,000	1,600
Worst case	64,000	41,000	27,000	22,000	2,200

The table and figure above show that there is a significant difference between the outcomes of the different growth scenarios in the amount of landfill voidspace that will be needed. The residual MSW consigned to landfill in 2021 varies from 1,500 tonnes to 2,300 tonnes. These figures are compared to the capacity data found in *Section 3* to provide the Capacity Gap Analysis in *Section 4*. In arriving at these figures, it is assumed that Thurrock will meet both its Landfill Allowance Trading Scheme (LATS) and regional recovery targets in the Regional Spatial Strategy (RSS) [1].

2.2.6 *Targets*

In comparing waste arisings with capacity, consideration was given to different capacity types and the destination of different components of the waste stream. RSS Recovery and MWMS Recycling and composting targets were used to determine how much waste was to be sent to these facilities, and Thurrock's LATS target was used to determine how much should be set against landfill capacity.

The figures below are examples of the split of waste to different facility types. The three facility types assessed are landfill, recycling/composting and recovery. *Annex A* contains a full set of figures for projections of arisings projected to go to the different facility types.

All scenarios assume a level of recovery rising from current levels to 50% by 2010, 70% by 2015 and 98% by 2021, in line with the RSS targets. Additionally, recycling targets proposed in the MWMS are used in the same way. These targets are 25.5% recycling and composting by 2007/08, 29% by 2008/09 and 35% by 2009/2010. The final target is used for the remainder of the modelling (up to 2021).

(1) Figures for 2006 may not be accurate to the amount that was landfilled as they were based on the assumptions listed, not actual data.

Figure 2.2 shows that, under the best case scenario, waste production stays static. Recycling has to increase dramatically in the short term to allow LATS targets to be met for the landfilling of waste. Treatment capacity comes online in 2008/09, and, at this point, recycling can fall back to its target rate due to the assumption that Thurrock will landfill up to its LATS allowance.

Figure 2.2 ***Destination of Waste Assuming Best Case Growth Scenario (tonnes)***

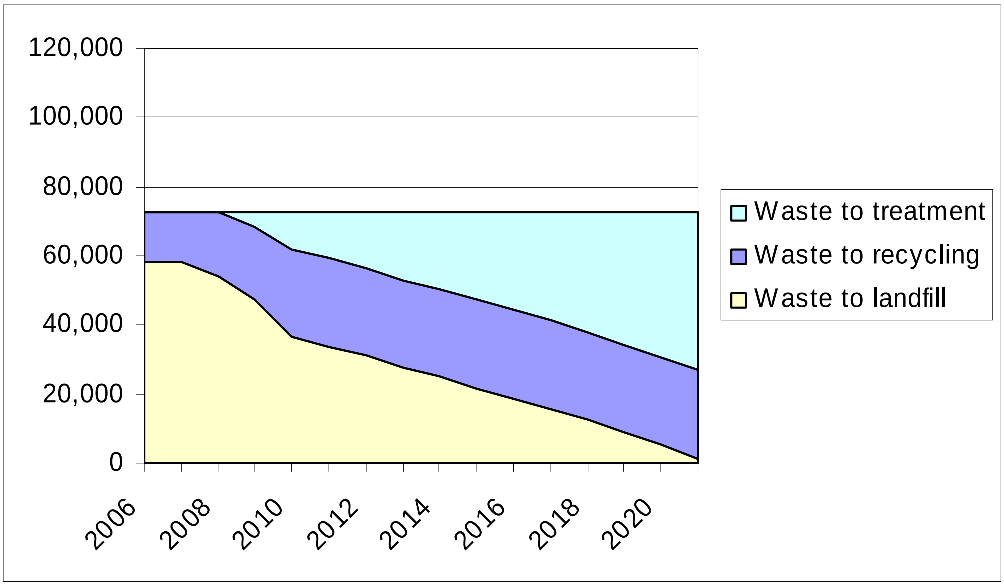


Figure 2.3 and *Figure 2.4* show the split in destinations for the arisings, for the other two growth scenarios.

Figure 2.3 ***Destination of Waste Assuming MWMS Growth Scenario (tonnes)***

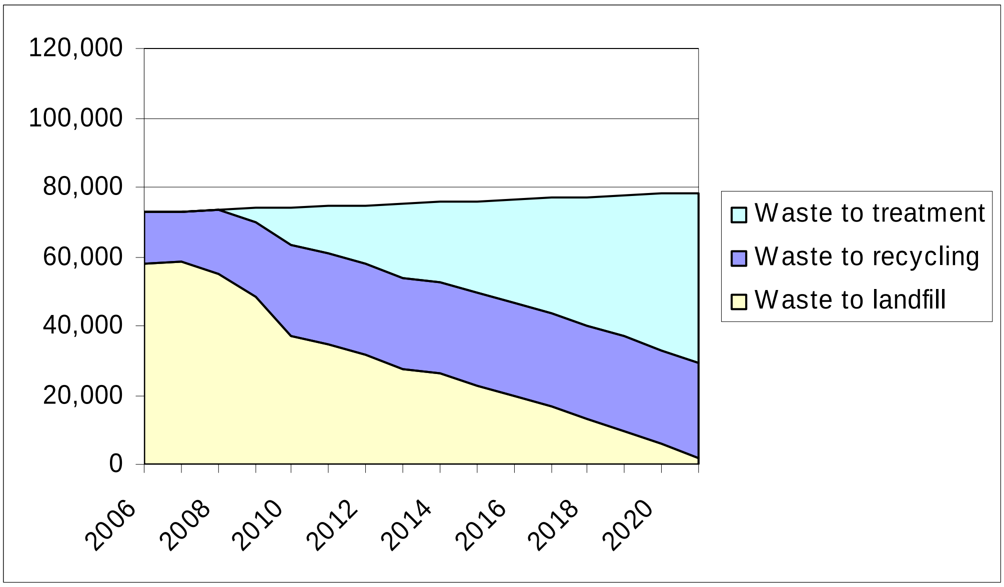
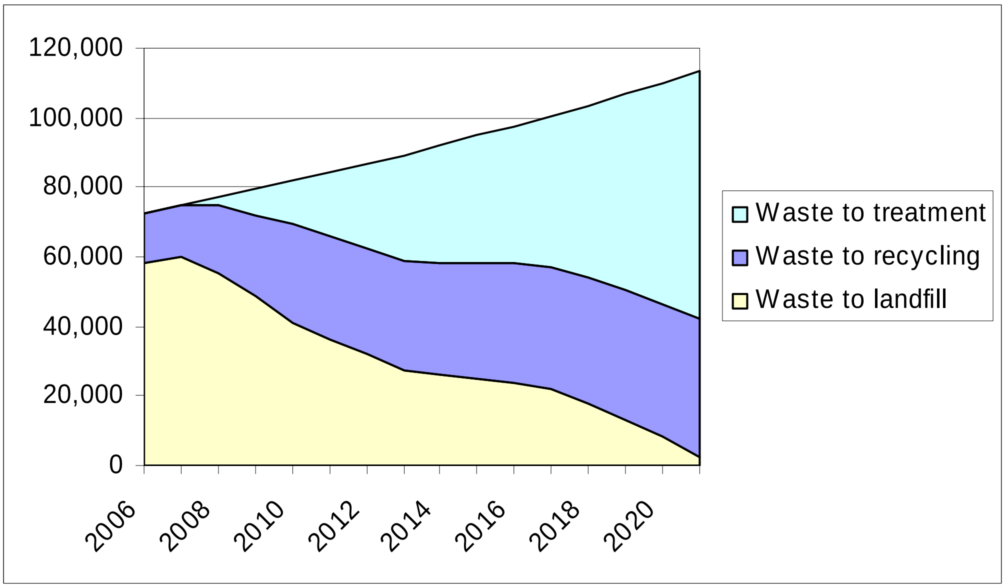


Figure 2.4 Destinations of Waste Assuming Worst Case Growth (tonnes)



2.3 C&I WASTE

2.3.1 *Description*

Commercial waste is waste from premises used wholly or mainly for the purposes of a trade or business or for the purpose of sport, recreation, education or entertainment, but not including household, agricultural or industrial waste. **Industrial waste** is waste arising from the provision of public services and industrial activities, but excluding construction and demolition material.

2.3.2 *Waste Arisings*

In order to forecast future arisings of C&I waste, a number of assumptions were made with the available data. C&I waste arisings data for Essex (which included Southend-on-Sea and Thurrock) for 2003 were taken from the East of England SWMA (1).

In order to estimate how much C&I waste was produced by Thurrock, the proportion of employees in Essex, Thurrock and Southend was combined with data on the relative size of businesses in the three areas. The total amount of waste produced by 'Greater Essex' was split of 80% Essex, 11% Thurrock and 9% Southend, according to the total size of the Sector, in employee terms, in each Authority. It is important to recognise the uncertainty associated with this assumption. However, more accurate and up to date data were not available. This split differs from that in the Proposed Changes to the East of England Plan that was based on an earlier EERA assessment. It is understood

(1) Strategic Waste Management Assessment, 2003, http://www.environment-agency.gov.uk/subjects/waste/1031954/315439/147529/147534/

that EERA's more recent representations on the Proposed Changes to the East of England Plan, present a percentage split more in line with the assessment included within this study.

2.3.3 *Growth Forecast Development*

Three waste growth forecast scenarios were developed for the baseline of C & I waste produced in Thurrock. The scenarios have been developed as a 'growth profile' or a rate of growth per year, to be applied to the arisings of waste in the baseline year of 2002/03. These are shown in *Table 2.4.*

Table 2.4 Growth Scenarios for C&I Waste

Scenario	Description
Economic growth scenario	Changes in C & I waste growth based on economic growth. This was based on economic growth studies conducted in the Thames River Basin District by ERM (1). This economic growth rate did not include the impact of additional housing and associated increases in waste generation.
Variable C&I waste growth scenario	Based on progressively decoupling waste production from economic growth
Static growth scenario	A 0% growth rate in waste production was modelled to give a static arisings growth profile

The scenarios show a range of outcomes over the long term, with production linked to economic growth leading to the highest increase in arisings.

2.3.4 *Results*

When the growth scenarios in *Table 2.4* were applied to the baseline arisings, the following forecasts emerge. These show that the economic growth rate scenario estimates C&I arisings to reach 340,000 tonnes per annum by 2021.

(1) RBD Article 5 Economic Analysis of Water Use, Supporting Document – Thames River Basin District, December 2004

Figure 2.5 *C&I Growth Forecasts (tonnes)*

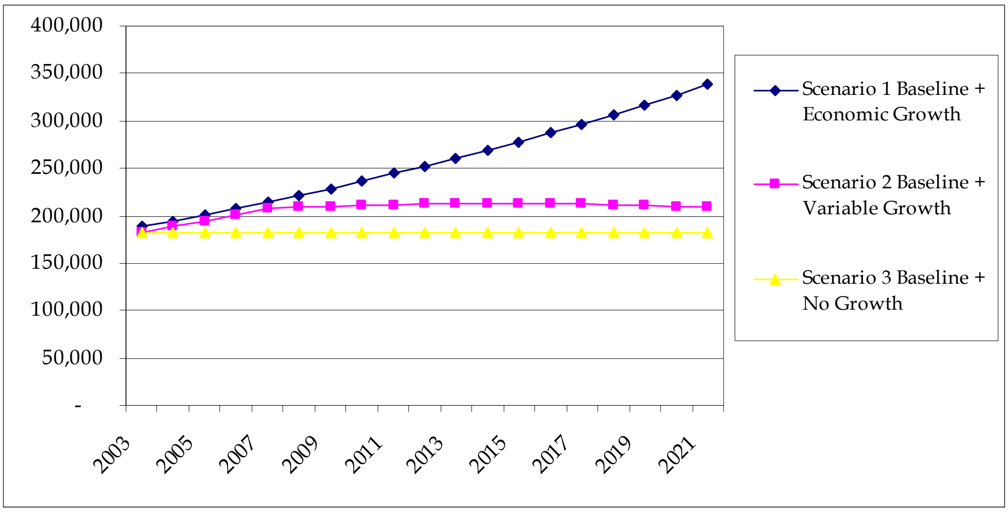


Table 2.5 *C&I Waste Forecasts (tonnes)*

C&I	2006	2010	2013	2017	2021
Economic Growth Forecast	208,000	237,000	261,000	297,000	338,000
Variable C&I waste growth scenario	201,000	211,000	213,000	213,000	209,000
Static growth scenario	183,000	183,000	183,000	183,000	183,000

Further investigation into C&I waste production in the Thurrock area is needed to enable accurate predictions of the level of C&I arisings over the period.

2.3.5 *C&I Waste Management*

Figure 2.6 shows the amount of recovery predicted for C&I wastes in Thurrock over the next 15 years. The targets assumed to be met are the National Recovery targets set out in the National Waste Strategy (consultation draft) 2006. Growth in recycling has been assumed to be a smooth increase from 66% to 72% between 2006 and 2010, and then on to 75% by 2015.

Figure 2.6 ***C&I Waste Recovery in Thurrock based on National Strategy Targets and ERM Growth Forecasts (tonnes)***

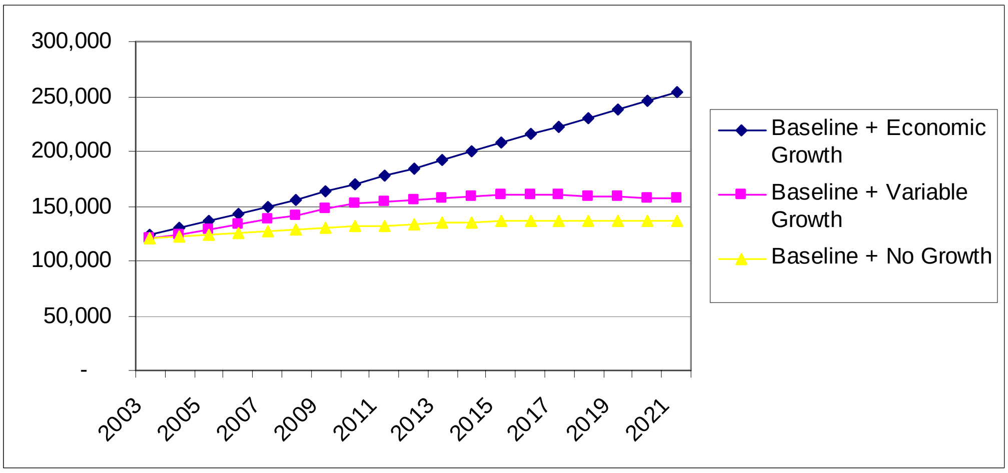
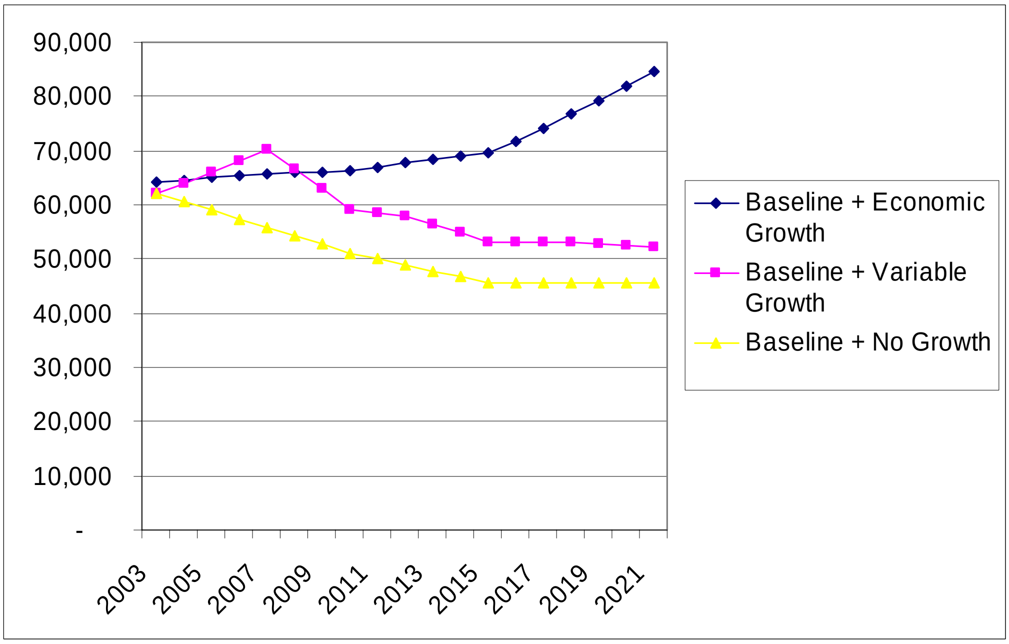


Figure 2.7 shows the amount of C&I waste remaining after recovery that will require landfill. As with *Figure 2.6,* a gradual increase from 66% recovery in 2006 to 75% recovery in 2021 was assumed.

Figure 2.7 ***C&I Waste Requiring Landfilling based on RSS Targets (tonnes)***



The split between 'recovery' in recycling/composting and in energy recovery, was calculated using the current recycling rate and a target of achieving 35% recycling by 2009/10. This is shown graphically for the best and worst case scenarios in *Figure 2.8.*

Figure 2.8 Amount of Arisings and their Destinations Forecast over Time (Best Case Scenarios) (tonnes)

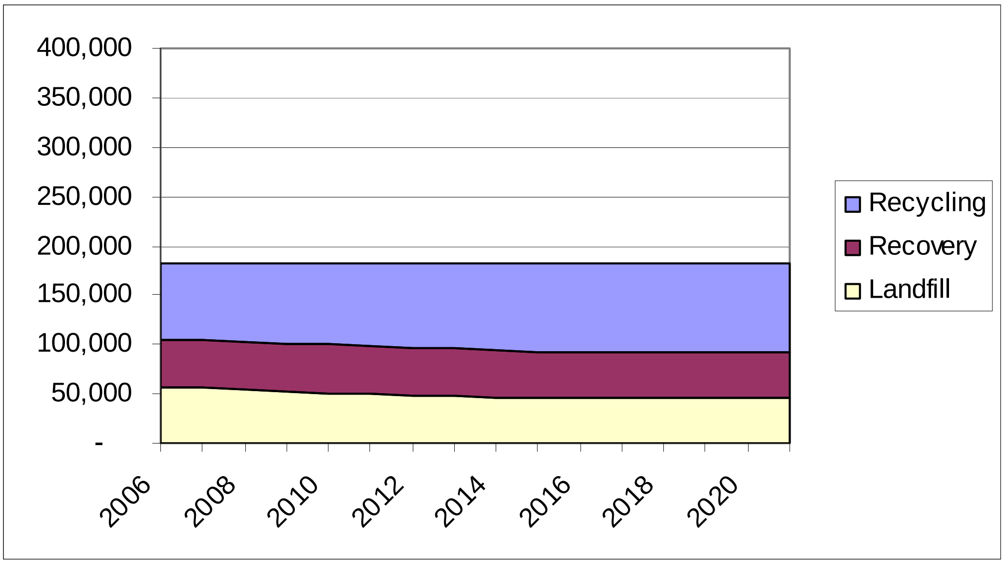


Figure 2.9 Amount of Arisings and their Destinations Forecast over Time (Worst Case Scenarios) (tonnes)

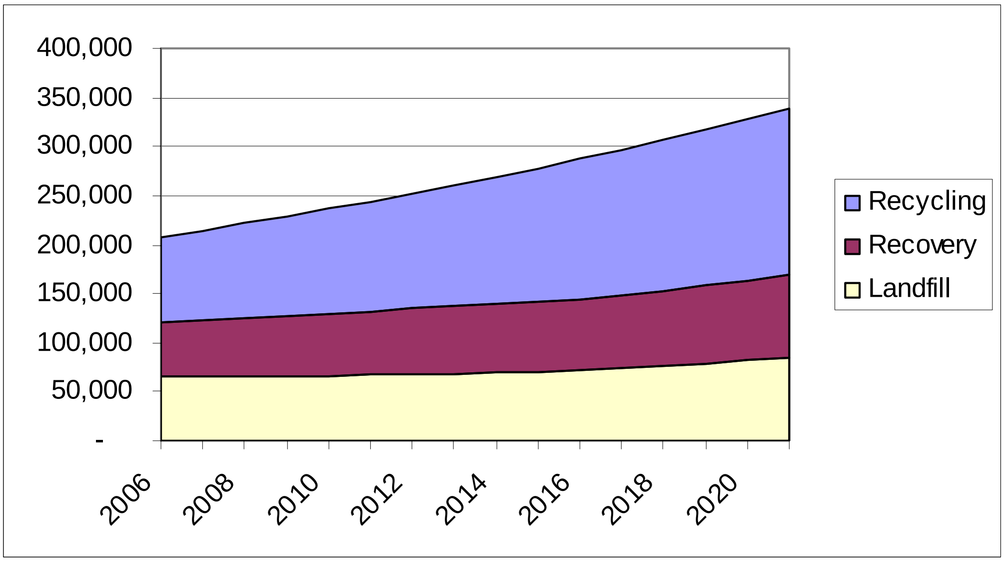


Table 2.6 C&I Waste to be Managed over Time by Waste Management Type and Growth Scenarios, by Treatment Type (tonnes)

		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Recycled/ Composted	Economic growth	87,000	100,000	97,000	102,000	107,000	112,000	118,000	124,000	130,000	137,000	144,000	148,000	153,000	159,000	164,000	169,000
	Variable Growth	80,000	82,000	84,000	87,000	89,000	92,000	95,000	98,000	100,000	103,000	106,000	106,000	106,000	106,000	105,000	105,000
	No Growth	77,000	78,000	79,000	81,000	82,000	84,000	85,000	87,000	88,000	90,000	91,000	91,000	91,000	91,000	91,000	91,000
Recovery	Economic growth	55,000	57,000	59,000	61,000	64,000	65,000	67,000	69,000	70,000	72,000	72,000	74,000	77,000	79,000	82,000	84,000
	Variable Growth	53,000	55,000	58,000	60,000	62,000	61,000	60,000	59,000	58,000	56,000	53,000	53,000	53,000	53,000	53,000	52,000
	No Growth	48,000	48,000	49,000	49,000	49,000	49,000	48,000	48,000	48,000	47,000	46,000	46,000	46,000	46,000	46,000	46,000
Landfilled	Economic growth	65,000	66,000	66,000	66,000	66,000	67,000	68,000	68,000	69,000	70,000	72,000	74,000	77,000	79,000	82,000	84,000
	Variable Growth	68,000	70,000	67,000	63,000	59,000	59,000	58,000	56,000	55,000	53,000	53,000	53,000	53,000	53,000	52,000	52,000
	No Growth	57,000	56,000	54,000	53,000	51,000	50,000	49,000	48,000	47,000	46,000	46,000	46,000	46,000	46,000	46,000	46,000

Table 2.7 C&I Waste to be Managed over Time by Waste Management Type and Growth Scenarios, Totals per Scenario

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Economic growth	208,000	215,000	222,000	229,000	236,000	244,000	252,000	261,000	269,000	278,000	287,000	297,000	307,000	317,000	327,000	338,000
Variable Growth	201,000	208,000	209,000	210,000	211,000	212,000	213,000	213,000	213,000	213,000	213,000	213,000	212,000	211,000	210,000	209,000
No Growth	182,000	182,000	182,000	182,000	182,000	182,000	182,000	182,000	182,000	182,000	182,000	182,000	182,000	182,000	182,000	182,000

2.4 *C&D WASTE*

2.4.1 *Waste Arisings*

A similar method to that for C&I Waste was used to calculate C&D waste arisings. C&D waste arisings data for the East of England for 2005 were taken from the recently published Symonds survey for 2005 [1]. To extrapolate to data for Thurrock, information on the number of people employed in industry by region were obtained from the National Census 2001[2].

In order to calculate the amount of C&D waste produced by Thurrock, the percentage of population in Thurrock employed in the construction and mining and quarrying sectors was applied to the total C&D waste arisings data from the Symonds survey. The figure produced was then applied to a growth forecast model to predict future C&D waste arisings in Thurrock. It is important to recognise the uncertainty associated with these assumptions. More accurate and up to date data were not available.

2.4.2 *Growth Forecast Development*

As with C&I waste, three waste growth scenarios have been developed to apply to the baseline of C&D waste produced in Thurrock. The scenarios used for C&I waste were also used to forecast C&D arisings, as it is considered that these forecasts apply to both waste types. Additional growth was added through applying a house-building growth rate. Scenarios 1 and 2 incorporate this growth rate, whilst Scenario 3 does not. The house-building growth rate was set at approximately 2.20% per annum [3]. The growth rates are shown below.

Table 2.8 Growth Scenarios for C&D Waste

Scenario	**Description**
Economic growth scenario	Changes in C&D waste growth based on economic growth. This was based on economic growth studies conducted in the Thames River Basin District by ERM [4]. House-building growth rate also incorporated.
Variable C&D waste growth scenario	This is based on progressively decoupling waste production from economic growth. House-building growth rate also incorporated.
Static growth scenario	A 0% growth rate in waste production was modelled to give a static arisings growth profile. This growth rate did not include the impact of additional housing and associated increases in waste generation.

(1) Survey of Arisings and Use of Alternatives to Primary Aggregates in England, 2005 Construction, Demolition and Excavation Waste, Symonds

(2) http://www.statistics.gov.uk/downloads/census2001/KS_LA_E&W_part1.pdf

(3) House-building growth rate determined by the expected number of new developments (28,000) being split over the period to 2021 evenly.

(4) RBD Article 5 Economic Analysis of Water Use, Supporting Document – Thames River Basin District, December 2004

As with C&I waste, the economic growth scenario results in the greatest forecast increase in waste arisings.

2.4.3 *Results*

Applying the growth scenarios described in *Section 2.4.2* to the baseline figure for C&D waste leads to the following results.

Figure 2.10 C&D Growth Forecasts (tonnes)

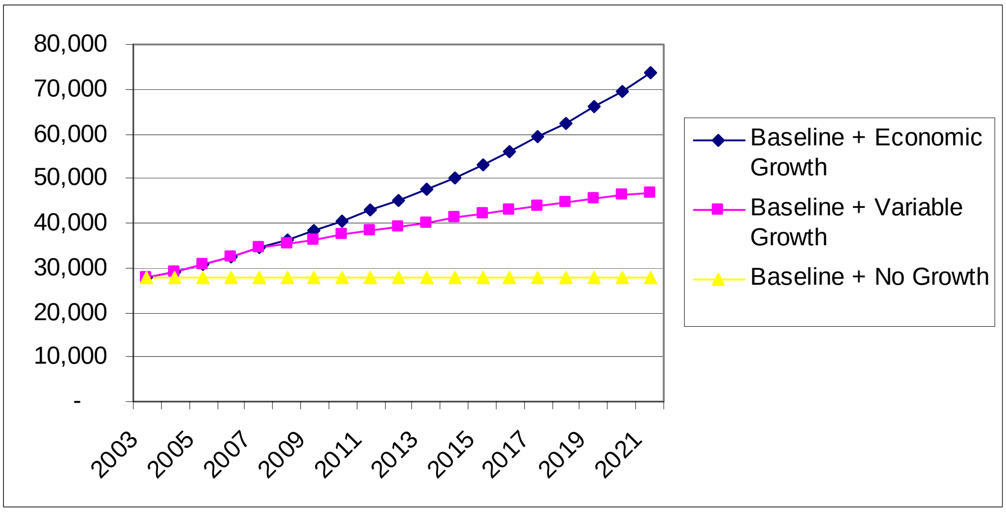


Table 2.9 C&D Waste Forecasts (tonnes)

C&D	2006	2010	2013	2017	2021
Economic Growth Forecast	33,000	40,000	48,000	59,000	74,000
Variable C&D waste growth scenario	33,000	37,000	40,000	44,000	47,000
Static growth scenario	28,000	28,000	28,000	28,000	28,000

In 2005, 49% of all C&D waste in the East of England Region was recycled, 29% was landfilled and 22% was spread on exempt sites. This split is used to estimate the capacity of inert landfill required in Thurrock by applying it to the total arisings figure. Results are shown in *Figure 2.11*.

Figure 2.11 *Landfill Capacity Required in Thurrock to Dispose of Residual C&D Waste Following Recycling/Beneficial Use (tonnes)*

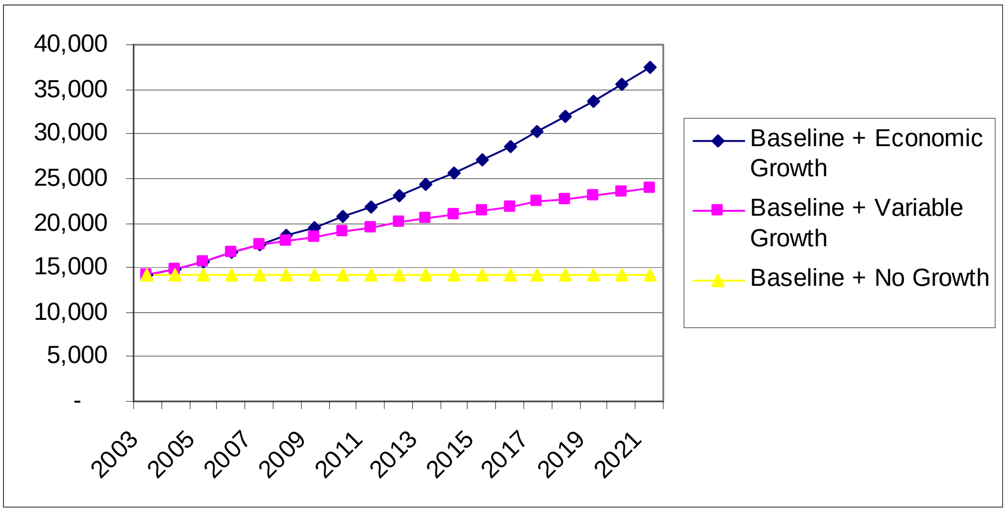


Table 2.10 shows the fate of C&D waste in Thurrock if the trends seen in the latest Symonds survey (2005) were to continue until 2021.

Table 2.10 ***Estimated Fate of C&D Waste in Thurrock 2006-2021 (tonnes)***

		2006	2010	2013	2017	2021
Recycled aggregate and soil	Scenario 1	16,000	20,000	23,000	29,000	36,000
	Scenario 2	16,000	18,000	20,000	22,000	23,000
	Scenario 3	14,000	14,000	14,000	14,000	14,000
Used/Disposed of at landfills/Exempt Sites	Scenario 1	17,000	21,000	24,000	30,000	37,000
	Scenario 2	17,000	19,000	20,000	22,000	24,000
	Scenario 3	14,000	14,000	14,000	14,000	14,000

A full forecast of C&D waste by destination can be found in *Annex E*.

2.5 *HAZARDOUS WASTE*

2.5.1 *Description*

Hazardous waste is waste that, because of its characteristics, poses a present or potential hazard to human health or the environment.

2.5.2 *Waste Arisings*

The baseline data from 2004 shows that approximately 25,000 tonnes of hazardous waste were produced in Thurrock [(1)]. *Table 2.11* shows the fate of hazardous waste once it has left the consignors' possession.

Table 2.11 Thurrock Hazardous Waste Tonnage by Fate (2004) (tonnes)

Waste Fate	Total
Incineration with energy recovery	0.01
Incineration without energy recovery	113.12
Landfill	15,839.81
Recycling / reuse	1,843.61
Transfer (short term)	1,671.72
Treatment	6,080.16
Grand Total	**25,548.43**

The arisings data from 2004 is the most recent full set of data available. However, the data contained in it is less reliable than for other waste streams. This is due to the recent changes in hazardous waste legislation.

The Hazardous Waste (England and Wales) Regulations 2005 can be viewed at www.opsi.gov.uk/si/si2005/20050894.htm

The List of Waste (England) Regulations 2005 can be viewed at www.opsi.gov.uk/si/si2005/20050895.htm

There are a number of issues specific to hazardous wastes that are affecting current arisings and future capacity needs. These are summarised below in *Box 2.1* and *Box 2.2* and should be kept in mind when reading the remainder of this section.

(1) Data taken from Environment Agency source for 2004

Box 2.1 Changes to Regulation of Hazardous Waste Landfills

Historically the UK has practiced what is known as co-disposal, whereby special wastes have been landfilled together with non-special wastes. On 16 July 2004, the co-disposal of hazardous waste with non-hazardous wastes ceased as a result of the Landfill Regulations 2002. Currently, if hazardous wastes are sent to landfill they must to be sent to a site that deals solely with hazardous wastes or to one with an appropriate hazardous waste cell.

All landfills are now classified as one of the following:

- Hazardous;
- Non-Hazardous;
- Non-Hazardous with Stable Non-Reactive Hazardous Waste Cell (SNRHC); or
- Inert.

Non-hazardous landfills with SNRHCs can accept stable non-reactive hazardous wastes in a separately constructed area. These sites will continue to accept asbestos waste as well as other stabilised hazardous wastes, such as treatment residues.

From 16 July 2005, all treated hazardous waste accepted into hazardous landfills or special 'cells' of a non-hazardous landfill site must comply with the full Waste Acceptance Criteria (WAC), *ie* require pre-treatment, as required by the Landfill Regulations 2002.

Box 2.2 Hazardous Waste Regulations and List of Wastes Regulations

Two sets of Regulations were implemented on 16 July 2005:

- the *Hazardous Waste (England and Wales) Regulations 2005*; and
- the *List of Wastes (England) Regulations 2005*.

The Hazardous Waste Regulations:

- require producers of hazardous waste to notify their premises to the EA;
- end the requirement to pre-notify the consignment of wastes to the EA as currently required under the Special Waste Regulations;
- ban the mixing of hazardous waste and require their separate storage on site;
- provide cradle-to-grave documentation for the movement of hazardous waste;
- require consignees to keep thorough records of hazardous waste and provide the Environment Agency with quarterly disposal and recovery information.

The *List of Wastes (England) Regulations 2005* introduced the revised European Waste Catalogue (EWC). This changed the current definition of 'special waste' to bring it into line with the European definition of hazardous waste. The change in classification has resulted in more waste being defined as hazardous waste, than under the previous definition of special waste.

The EWC lists all wastes, whether hazardous or not. Wastes with a hazardous property are highlighted as either Absolute or Mirror entries. A waste given as an absolute entry means this will be in all circumstances a hazardous waste regardless of any threshold concentrations, whereas a mirror entry will be a hazardous waste if dangerous substances are present above threshold concentrations.

Box 2.3 summarises the other pieces of legislation that are likely to have an effect on the amount of hazardous wastes produced and hence on processing technologies and capacities.

Box 2.3 Other Regulatory Developments Impacting on Hazardous Waste

Waste Electrical and Electronic Equipment (WEEE) Directive

The UK WEEE Regulations came into force on 2 January 2007. The Regulations set targets and requirements for the collection, treatment and recycling of WEEE. Waste electrical and electronic equipment is classified according to 10 categories. It covers all types, shapes and sizes of equipment from electric toothbrushes to medical devices found in hospitals to vending machines. It is also makes distinctions between household WEEE and business WEEE and 'historic' and 'new' WEEE.

The costs for collection, treatment, recycling and disposal are to be borne by the producers (broadly speaking, the manufacturers, importers and retailers) of the EEE, hence it is a 'Producer Responsibility' Directive.

For household WEEE, the UK is required to ensure that there is an adequate network of collection points for householders to separate their WEEE from other waste. There is no obligation on consumers to separate WEEE, they are encouraged to do so. There are no direct legal obligations placed on local authorities, although they are encouraged to establish their CA sites or transfer stations as designated collection facilities (DCFs). Producers are required to finance the collection of household WEEE from DCFs along with subsequent treatment and recycling.

Distributors or 'retailers' of household equipment also have legal obligations. They must either offer free takeback of WEEE when they sell a new item of EEE or pay into the 'Distributor Takeback Scheme' which subsequently finances the costs of establishing the DCFs.

For business WEEE, producers are required to ensure they have a system in place to ensure their equipment is treated, recycled and recovered when their customers discard the equipment (even if it is sometime later). In the case of historic WEEE, producers must finance the treatment and recycling costs only if the customer is buying a new similar product. Producers must finance the costs of treating and recycling all new WEEE. It is important to note that a producer can contractually oblige their customers to meet the costs in both cases.

Treatment and Recycling of WEEE
All separately collected household WEEE and all business WEEE will in future be required to be treated to new standards and meet specified recycling and recovery targets. The recycling and recovery targets are category specific (eg Category 1. large household domestic appliances must be recovered to a level of 80% by average weight of appliance, with 75% being attributed to reuse or recycling of components, materials or substances).

Treatment requirements include removal of certain components and materials from WEEE (eg mercury containing components, plastics containing brominated flame retardants, cathode ray tubes) and then in some cases specialist treatment of the removed component (eg removal of fluorescent coating from cathode ray tubes). Guidance is available on interpretation of these requirements. The removal of materials or components does not necessarily need to take place before the shredding process.

Restriction of Hazardous Substances (RoHS) Directive

The RoHS Directive uses the same scope as the WEEE Directive but prohibits the existence of six hazardous substances in new EEE placed onto the EU market from 1 July 2006. The six substances are: lead; cadmium; mercury; hexavalent chromium; PBB; and PBDE (the last two being brominated flame retardants). EEE that does not meet the RoHS Directive's requirements as of 1 July 2006 cannot be sold within the EU.

As a result of this legislation, the quantities of these substances entering the waste stream will reduce over the coming years. The legislation allows for other substances to be added in the future to the initial list of six, as well as allowing for certain exemptions.

End-of-Life Vehicles (ELV) Directive

The End of Life Vehicles (ELV) Directive has the objective of reducing waste from ELVs and improving levels of recycling and reuse. It aims to minimise the impact of such vehicles on the environment, e.g. by reducing the amount of waste going to landfill from vehicles reaching the end of their life by:

- introducing controls on the 'scrapping' of ELVs (by restricting treatment to authorised facilities);
- implementing new environmental treatment standards; and
- setting rising re-use, recycling and recovery targets.

The targets require 85% of ELVs to be re-used or recovered (80% re-used or recycled) by January 2006, and 95% of all ELVs to be re-used or recovered (85% re-used or recycled) by 2015.

The ELV Directive encourages the limitation of hazardous materials in new vehicles in order to reduce the amount of hazardous waste eventually produced and to ease recycling. It will divert hazardous elements from mixed waste management disposal to targeted recycling and treatment. Manufacturers are already seeking to utilise materials that are easier to recycle and there will be a long-term downward trend in unit quantities of hazardous material being used in new vehicles and consequently arising in ELVs.

Batteries Directive

The European Commission has drawn up a proposal which will require the collection and recycling of all types of batteries. The Batteries Directive will result in an increase in the number of battery waste streams and the quantities segregated for treatment/disposal. The new Directive will ban the use of mercury in batteries immediately: all batteries containing more than 5ppm of cadmium by weight are scheduled to be banned by January 2008.

The current timeframe is that the Directive will be ratified in June 2006, meaning that the Directive will be transposed into national law by January 2008 with the first target of 25% collection of all waste batteries within the scope being set for 2012.

As a result of this Producer Responsibility legislation, specialised treatment, recycling and disposal facilities will be needed to handle the increase in the amount of separately collected hazardous battery waste. Currently there is just one battery reprocessing plant in the UK, G & P Batteries in the West Midlands, which has the capacity to handle up to 600 tonnes per annum. The majority of the UK's waste batteries are currently exported to other EU member states for reprocessing and recycling. Further facilities in the UK are planned by G & P and other companies are likely to enter the market should it prove financially viable.

Waste Incineration Directive (WID)

The Waste Incineration Directive (WID) updates the requirements of the 1989 Municipal Waste Incineration Directives and, merging them with the 1994 Hazardous Waste Incineration Directive, consolidates new and existing incineration controls into a single piece of European legislation. WID also upgrades technical requirements to reflect technological advances, and broadens the scope of the waste incineration regime to cover wastes that were not previously regulated.

WID is likely to necessitate the expensive upgrading of some incinerators and plants burning wastes as fuel. The impact of the regime on market economics may inhibit some plants from burning wastes such as waste oil, raising the possibility of an increase in the illegal disposal of waste.

With limited incentives for oil recycling, the impact of the Directive is likely to be to increase the amount of waste oil entering the waste management system, at the same time as reducing the number of disposal sites. Off site treatment options for waste oils, other than recycling, include blending to make cement kiln or power station fuels.

As a result of the Directive virgin fuel sources may replace waste oils. This will result in waste oil being primarily used when firing up coal fired power stations (where financially viable) and cement kilns. Producers of waste oil may in the future have to pay for its disposal, where as at present it has a positive value as a fuel.

Solvent Emission Directive (SED)

The SED limits the emissions of Volatile Organic Compounds (VOCs) due to the use of organic solvents by certain sectors. The aim is to play a part in reducing the release of more harmful VOCs and reducing ozone pollution in the EU.

Levels of organic solvents used will drop in the period 2003 – 2007, the extent will depend on how producers respond to the pressures on VOC emissions brought about by the SED. Existing installations have until 31 October 2007 to meet the requirements of the Directive. New installations must meet the requirements immediately.

Pollution Prevention and Control (PPC) Regulations

The PPC Regulations make provision for the permits to include waste minimisation and opportunities for re-use on site. This should lead to a reduction in the quantities of hazardous waste generated.

For those waste handling companies operating facilities covered by PPC, the rigorous permitting process and associated cost implications (through increased process management and engineering), will result in some re-evaluation of the economic benefits of running such facilities. In a market where margins are low, this may lead to a contraction in capacity at a time when a net increase is required.

Asbestos Regulations

The Control of Asbestos at Work Regulations 2002 introduces a duty to proactively manage asbestos with effect from 21 May 2004.

Asbestos is commonly found in sprayed coatings and loose packing (such as fire breaks, partitions and ceiling panels or tiles), lagging around pipes and boilers and insulation board. Although the Regulations can be anticipated to have their most substantial impact on urban commercial and industrial premises, it is also not uncommon to find asbestos in and around farm buildings. It is important to remember that the Regulations impose a duty only to manage asbestos – not necessarily to remove all asbestos.

Landfill Tax

The UK Government has set a landfill tax escalator in place which will increase by £3 per year the amount paid on every tonne of waste sent to landfill from £18 in 2005 to £33 in 2010. The Government hopes that this fiscal tool will encourage the use of alternative methods for treatment and disposal to reduce the amount of waste going to landfill.

2.5.3 *Growth Forecast Development*

The changes in legislation highlighted above make the forecasting of future arisings of hazardous wastes difficult. As with the other waste types, a range of three forecasts has been assessed.

Table 2.12 Growth Scenarios for Hazardous Waste

Scenario	Description
Economic growth scenario	Changes in C&I waste growth based on economic growth. This was based on economic growth studies conducted in the Thames River Basin District by ERM [1]. This economic growth rate did not include the impact of additional housing and associated increases in waste generation.
Variable C&I waste growth scenario	Based on progressively decoupling waste production from economic growth
Static growth scenario	A 0% growth rate in waste production was modelled to give a static arisings growth profile

The results of combining these with the baseline information are shown in the following section. The economic growth scenario again has the highest growth rate.

2.5.4 *Results*

As explained above, following the recent changes in legislation, hazardous waste growth is difficult to predict. The following table shows the forecasts ERM has made regarding hazardous waste in Thurrock.

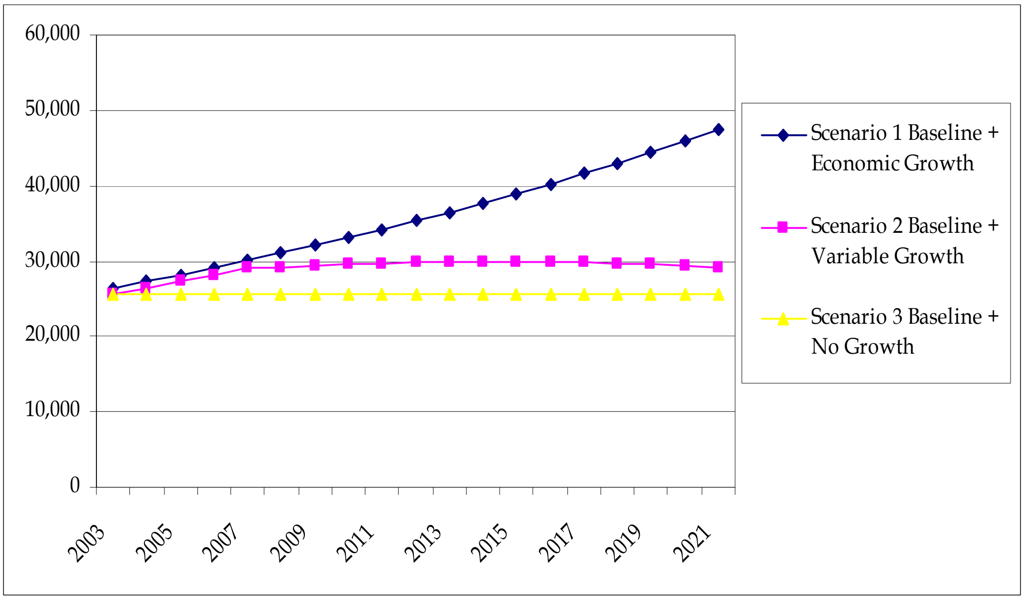
Table 2.13 Hazardous Waste Forecasts (tonnes)

	2006	2010	2013	2017	2021
Economic growth scenario	29,000	33,000	37,000	42,000	47,000
Variable C&I waste growth scenario	28,000	30,000	30,000	30,000	29,000
Static growth scenario	26,000	26,000	26,000	26,000	26,000

The economic growth scenario leads to the greatest projected growth in arisings, and shows hazardous waste rising to almost 50,000 tonnes in Thurrock by 2021.

(1) RBD Article 5 Economic Analysis of Water Use, Supporting Document – Thames River Basin District, December 2004

Figure 2.12 ***Hazardous Waste Growth Forecasts (tonnes)***



2.6 *AGRICULTURAL WASTE*

2.6.1 *Description*

Agricultural waste became a 'controlled waste' in 2006. These controls will apply to all agricultural wastes. The regulations include exemptions and exclusions for many of the most significant waste streams produced by agricultural practices, such as manures and slurries where applied to land for agricultural benefit. They also require licensing for reuse and recycling and registration for waste carriers.

2.6.2 *Waste Arisings*

The baseline figure used for agricultural wastes is an estimate based on data from the Defra agricultural waste survey in 2003. It is estimated that 400,000 tonnes of agricultural waste is produced annually throughout England and Wales. Geographical Information Systems (GIS) were used to calculate the total area of agricultural land in the UK. This figure was used alongside the agricultural waste estimate to ascertain an average tonnage of agricultural waste per hectare. This average was then applied to the area of agricultural land in Thurrock to produce an estimate of agricultural waste generated. The result is an estimate of 415 tonnes of non-hazardous agricultural waste and 55 tonnes of hazardous agricultural waste, giving a total of 470 tonnes of agricultural waste.

2.6.3 *Growth Forecast Development*

As with the other non-municipal waste types, the growth factors applied to the agricultural waste baseline were based on economic growth, variable growth and a static growth scenario. These are shown in *Table 2.14.*

Table 2.14 Growth Rates for Agricultural Waste

Scenario	Description
Economic growth scenario	Changes in C & I waste growth based on economic growth. This was based on economic growth studies conducted in the Thames River Basin District by ERM (1). This economic growth rate did not include the impact of additional housing and associated increases in waste generation.
Variable C&I waste growth scenario	Based on progressively decoupling waste production from economic growth
Static growth scenario	A 0% growth rate in waste production was modelled to give a static arisings growth profile

2.6.4 *Results*

When these growth scenarios are applied to the baseline agricultural waste figure, the following forecasts result. It should be noted that, as 11% of this waste is hazardous, this will require treatment or disposal at hazardous waste sites. *Table 2.15* provides the breakdown of hazardous and non-hazardous tonnages over time. The hazardous elements within the waste are recognised to be:

- waste oils;
- batteries; and
- asbestos.

The hazardous and non-hazardous wastes have been included together throughout this assessment as the hazardous waste represents such a small figure compared with the general hazardous waste arisings described in *Section 2.5* that it is likely that this tonnage could be easily treated or disposed of at the hazardous waste facilities required to manage them.

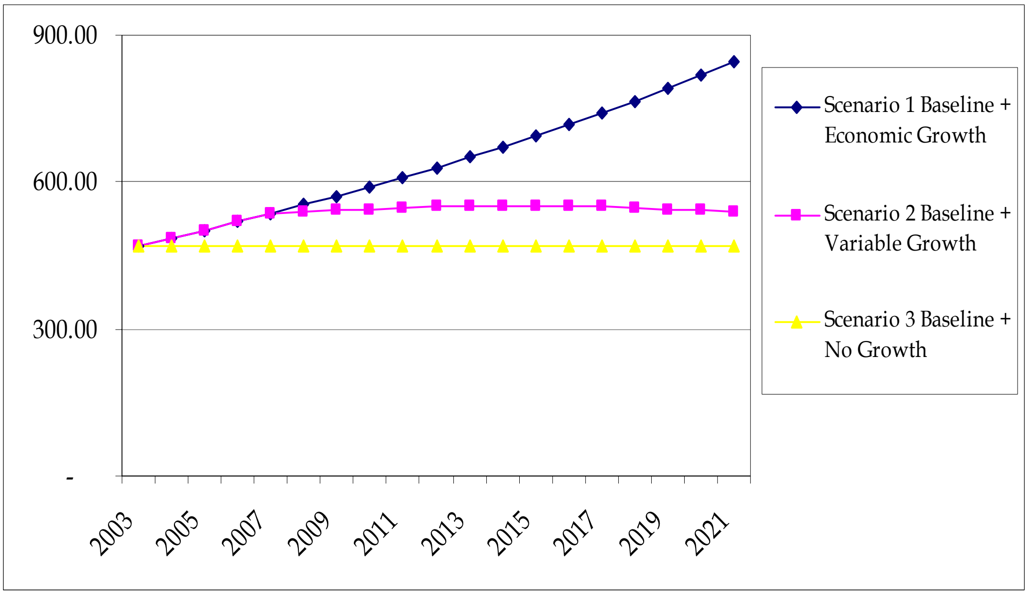
(1) RBD Article 5 Economic Analysis of Water Use, Supporting Document – Thames River Basin District, December 2004

Table 2.15 Agricultural Waste Forecasts (tonnes)

Growth Scenario	**Waste Type**	**2006**	**2010**	**2013**	**2017**	**2021**
Economic growth scenario	Hazardous	57	57	57	57	57
	Non - Hazardous	429	473	539	594	676
	TOTAL	**486**	**530**	**596**	**651**	**733**
Variable C&I waste growth scenario	Hazardous	55	61	64	64	64
	Non – Hazardous	415	458	480	485	485
	TOTAL	**471**	**519**	**544**	**549**	**549**
Static growth scenario	Hazardous	55	55	55	55	55
	Non - Hazardous	415	415	415	415	415
	TOTAL	**471**	**471**	**471**	**471**	**471**

The forecasts for agricultural wastes are shown in *Figure 2.13* below. The economic growth scenario again leads to the highest estimate of waste arisings over time. As arisings of agricultural wastes are so low, they are not deemed significant to the rest of the capacity gap calculations. In addition, since there is no basis upon which to estimate how much of these arisings can be recycled, it is not possible to suggest how management should be split between landfill and recycling. Agricultural wastes have been assumed to go to landfill, with the split between non-hazardous and hazardous landfill drawn from *Table 2.15*.

Figure 2.13 Agricultural Waste Forecasts (tonnes)



2.7 WASTE IMPORTS FROM LONDON

In the Regional Spatial Strategy, EERA has apportioned London's exported waste to its constituent Waste Planning Authorities, including Thurrock. The apportionment draws on several factors, including proximity to London, available voidspace, geology, hydrogeology and transport. Thurrock was apportioned 12.8% of the total exports to the East of England. *Table 2.16* shows what this equates to in tonnes. All wastes from London have been assumed to be sent direct to landfill. *Annex D* contains a sensitivity analysis for the alternate apportionment of London's waste to Thurrock of 13.4%. The alternative apportionment figures are shown in *Table 2.17*.

Table 2.16 Imports of Waste from London to Thurrock (tonnes) (12.8% apportionment)

Thurrock	**2005/06**	**2006/07**	**2007/08**	**2008/09**	**2009/10**	**2010/11**	**2011/2**	**2012/3**
Tonnes imported	304,000	283,000	262,000	242,000	221,000	201,000	180,000	159,000
Thurrock	**2013/14**	**2014/15**	**2015/16**	**2016/17**	**2017/18**	**2018/19**	**2019/20**	**2020/21**
Tonnes imported	139,000	118,000	98,000	97,000	97,000	97,000	97,000	97,000

Table 2.17 Imports of Waste from London to Thurrock (tonnes) (13.4% apportionment)

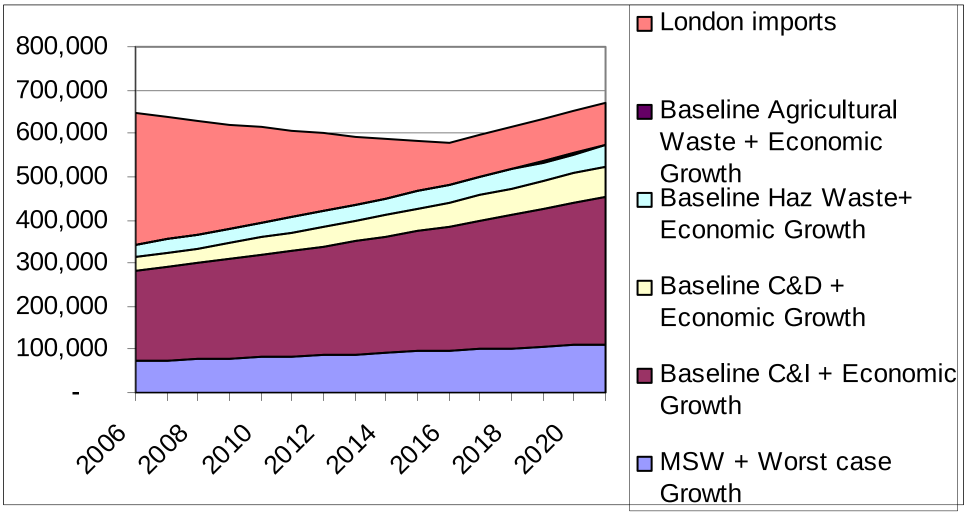
Thurrock	**2005/06**	**2006/07**	**2007/08**	**2008/09**	**2009/10**	**2010/11**	**2011/2**	**2012/3**
Tonnes imported	318,000	296,000	274,000	253,000	231,000	210,000	188,000	166,000
Thurrock	**2013/14**	**2014/15**	**2015/16**	**2016/17**	**2017/18**	**2018/19**	**2019/20**	**2020/21**

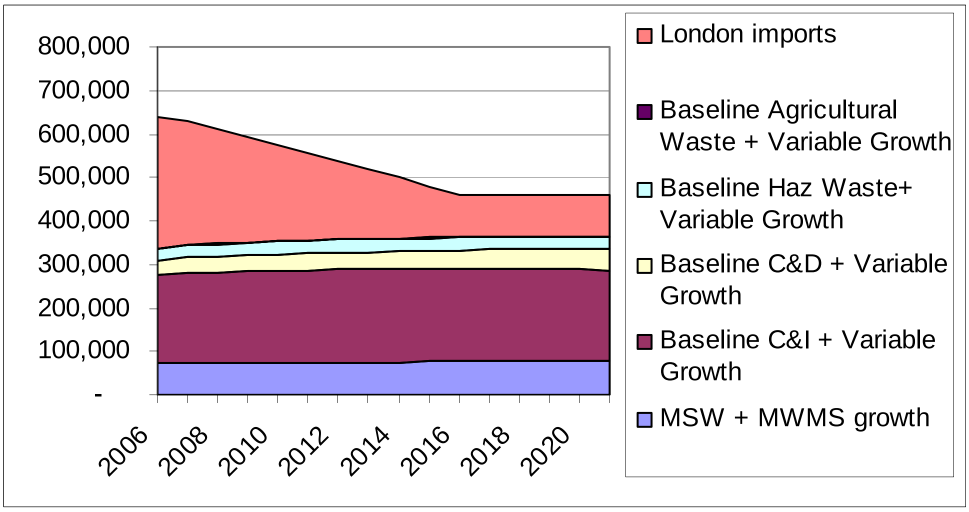
Thurrock	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/2	2012/3
Tonnes imported	146,000	124,000	103,000	102,000	102,000	102,000	102,000	102,000

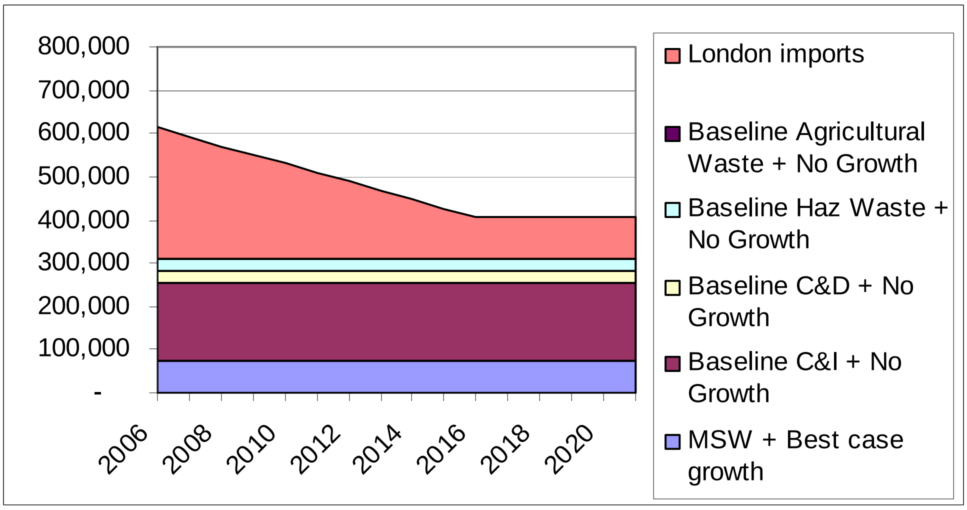
2.8 *TOTAL WASTE ARISINGS FORECASTS*

As there are three growth scenarios for each waste type, there are a large number of combinations of overall forecasts of waste arisings. In this section of the report, the scenarios are grouped as best case, central estimate and worst case scenarios. *Figure 2.14* shows these scenarios. The alternative apportionment figures are not shown below due to the highly similar nature of the figures.

Figure 2.14 Total Waste Arisings Best Case, Central Estimate and Worst Case (tonnes)





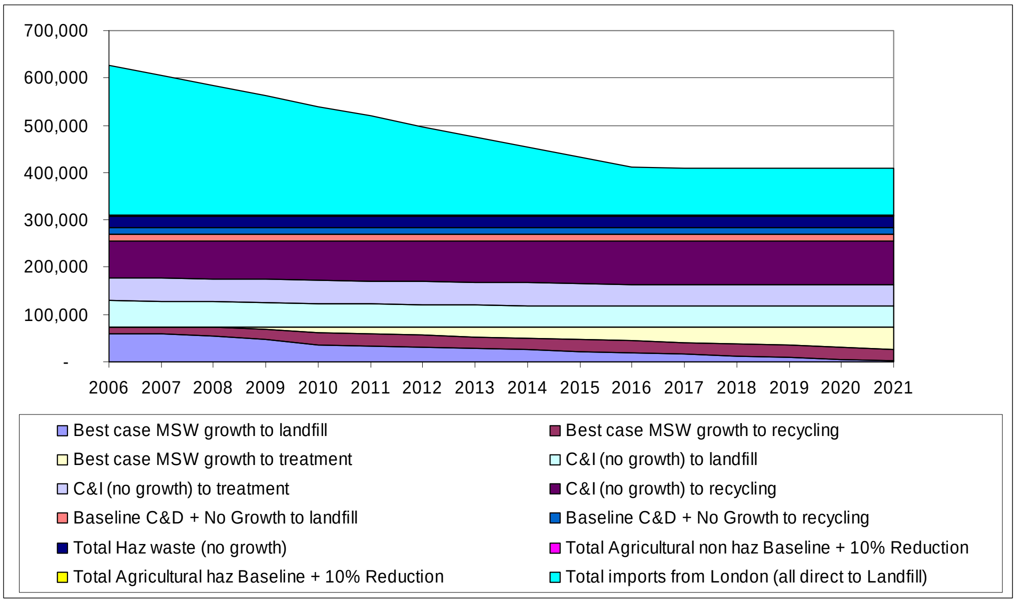


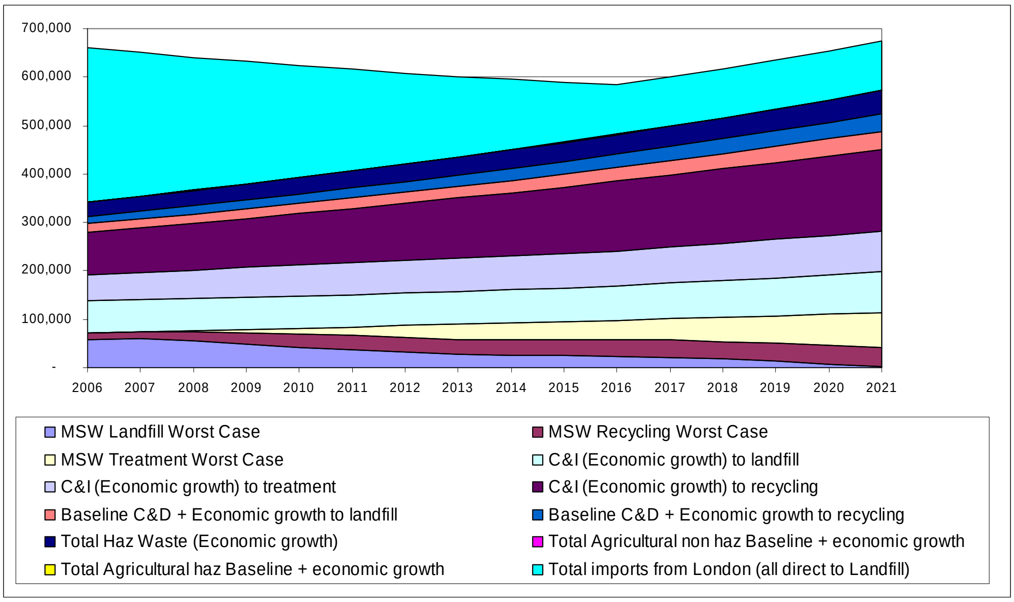
These figures show the total amount of all wastes forecast to be produced in Thurrock, irrespective of their intended destination, whether it be disposal via landfill, recycling, composting or some form of treatment.

2.9 WASTE ARISINGS BY DESTINATION

The section shows figuratively the amount of waste from each waste stream and the forecast destination of these wastes. The proportion of each waste stream following each management route was estimated using the methods outlined above. The best and worst case scenarios are shown below.

Figure 2.15 Waste Forecasts by Type and Destination Best and Worst Case Growth Scenarios (tonnes)





3 *CAPACITY SECTION*

3.1 *METHOD*

ERM and Thurrock Council conducted a waste management site survey, establishing the number and type of sites in the area and the licensing status of those sites. This site list was then used by ERM to approach the site operators for capacity information.

Alongside this study, new estimates of landfill voidspace and fill rates were provided by Essex County Council, on behalf of Thurrock Council. Where new data was not available, data used in the ERM study for EERA - *Waste Management Capacity and Future Needs in the East of England* was used instead.

The site survey was carried out in conjunction with the Regional Assembly and will contribute to a new regional total waste management figure. An example of the survey forms can be found in *Annex C*.

Capacity information was gathered in the following format. Landfill data was gathered as remaining voidspace (m^3). This voidspace was specified as being the remaining void that can be filled with waste, thus not including restoration materials, capping etc.

Non-landfill capacity was gathered as total operational throughput (tonnes), where possible. If this data was unobtainable, then EA data on the maximum licensed throughput was used instead, either taken from the ERM study for EERA, or from the EA directly. The sites were categorised into the following types:

- landfill (inert);
- landfill (non-hazardous);
- landfill (hazardous);
- C&D recycling;
- recycling;
- composting;
- incineration;
- treatment;
- transfer;
- metal/ELV; and
- other.

These categories allowed the straightforward comparison of capacity and arisings presented in *Section 4*.

3.2 CAPACITY SCENARIOS

Several scenarios were developed for the capacity estimates in Thurrock. These are detailed in *Table 3.1*.

Table 3.1 Waste Management Capacity Scenarios

Scenario	Description
Scenario 1	Operational sites with planning permission/lawfully operating sites.
Scenario 2	This scenario uses all currently operational sites in Thurrock as the capacity figure. It does not take into account those facilities planned to come on stream.
Scenario 3	This scenario includes all sites (operational and planned), excluding those landfill sites that are currently classed as potential.
Scenario 4	This scenario is the best case scenario. It includes all sites for which data was made available. These sites are still being excavated and, as such, voidspace does not yet exist.

The figures used in the scenarios are shown in *Table 3.2*. These figures include some extrapolated values for non-landfill sites. Where no capacity data was available for a site the average of that site type was assigned to it. Note that for landfill figures are in cubic metres of total void, available at any time, and exhausted.

Table 3.2 Capacity Scenarios

All Scenarios	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Transfer (20% of transfer is recorded as recycling)	46,667 (9,333)	46,667 (9,333)	43,750 (8,750)	43,750 (8,750)
Treatment	43,920	43,920	43,920	43,920
Incinerator	0	0	0	0
Composting	0	0	0	0
Recycling	40,000	40,000	40,000	40,000
C&D recycling	1,843,750	1,843,750	1,843,750	1,843,750
Metal/ELV facility	2,299,370	2,299,370	2,299,370	2,299,370
CLOSED	-	-	0	3,000,000
Total (non landfill) tonnes per annum	**4,273,707**	**4,273,707**	**4,270,790**	**7,270,790**
Non-haz landfill	3,950,000	6,150,000	7,350,000	13,300,000
Inert landfill	2,270,000	2,270,000	2,630,000	8,376,000
Hazardous landfill	219,000	219,000	219,000	219,000
Total (Landfill) cubic metres	**6,439,000**	**8,639,000**	**10,199,000**	**21,895,000**

3.3 *RECOVERY CAPACITY*

The types of facility that fall under this sub-category are:

- C&D recycling;
- recycling;
- composting;
- incineration;
- treatment; and
- transfer.

Of transfer capacity, 20% was assumed to be dedicated to 'recycling' (ie 20% of capacity is for bulking of recyclables prior to dispatch to reprocesors). This 20% was then aggregated with the capacity of recycling and composting facilities to compare with MSW and C&I waste arisings. C&D recycling was used separately to compare against C&D wastes.

3.3.1 *Recycling and Composting*

Recycling and composting capacity (including 20% of transfer) was compared against the tonnage of recycling and composting required, designated by targets. The level of recycling and composting capacity in Thurrock is shown in *Table 3.3* and *Table 3.4.*

Table 3.3 Recycling and Composting Capacity by Scenario (tonnes)

Scenario	**Capacity (tonnes per annum)**
Scenario 1	49,000
Scenario 2	49,000
Scenario 3	49,000
Scenario 4	49,000

Table 3.4 C&D Recycling Capacity by Scenario (tonnes)

Scenario	**Capacity (tonnes per annum)**
Scenario 1	1,844,000
Scenario 2	1,844,000
Scenario 3	1,844,000
Scenario 4	1,844,000

3.3.2 *Treatment and Incineration*

Currently, there is no incineration capacity in Thurrock, so capacity gap calculations are made against current treatment facilities. This capacity is constant across all scenarios at 44,000 tonnes.

Table 3.5 Treatment Capacity by Scenario (tonnes)

Scenario	Capacity (tonnes per annum)
Scenario 1	44,000
Scenario 2	44,000
Scenario 3	44,000
Scenario 4	44,000

The amount of capacity required is dependent on the treatment facility type. As there is no breakdown of capacity in Thurrock, eg treatment types, it has been assumed that all current treatment capacity fits with the scenarios modelled. This assumption thus requires Thurrock to provide capacity to fill the gap, as with the recycling and composting calculations.

3.4 LANDFILL CAPACITY

Three types of landfill capacity were assessed in this report. These were non-hazardous landfill, inert landfill and hazardous landfill. Each was compared against the relevant different types of arisings.

3.4.1 *Non-Hazardous Landfill Capacity*

The non-hazardous landfill capacity scenarios vary due to the nature of the sites that are included in some scenarios and not in others. Capacity forecasts range from under 4 million cubic metres to over 13 million cubic metres. The scenarios are listed below. All figures in the table, and throughout this report, have been converted into tonnes using a bulk density conversion factor of 1 cubic metre per tonne for non-hazardous capacity.

Table 3.6 Non-hazardous Landfill Capacity by Scenario (tonnes)

Scenario	Capacity (tonnes)
Scenario 1	3,950,000
Scenario 2	6,150,000
Scenario 3	7,350,000
Scenario 4	13,300,000

3.4.2 *Inert Landfill Capacity*

Inert landfill capacity also varies across the scenarios, with Scenario 4 again having the most available capacity, with over 8 million cubic metres. The bulk density conversion factor for inert wastes assumed is 2 tonnes per cubic metre.

Table 3.7 Inert Landfill Capacity by Scenario (tonnes)

Scenario	Capacity (tonnes)
Scenario 1	2,270,000
Scenario 2	2,270,000
Scenario 3	2,630,000
Scenario 4	8,376,000

3.4.3 *Hazardous Landfill Capacity*

Hazardous landfill capacity is constant across all scenarios. There is only one recorded hazardous landfill in Thurrock, and this site has a void of 219,000 cubic metres, this is however a restricted access site that is only used by the local power station to dispose of ash. The power station is proposed to be decommissioned in 2015, with potentially a new power station to be built, this could have an effect on the amount of wastes produced and the voidspace of the site. The bulk density conversion factor assumed is one cubic metre per tonne for hazardous waste.

4 CAPACITY GAP ANALYSIS

4.1 METHOD

The following section compares the forecast arisings for Thurrock from 2006 - 2021 with the capacity of the operational and planned facilities in the area. This has been achieved by taking the amount estimated to be sent to landfill (*Section 2*) and calculating the cumulative quantity sent to landfill year by year. These totals are then compared to the available voidspace in order to indicate what remains, or the amount of new voidspace that will be required. The same method is employed with non-landfill capacity. However, in this case, this is split between recycling and composting and recovery/treatment.

4.2 RESULTS

4.2.1 *Recycling and Composting Capacity Gap Analysis*

The charts included in this section all show the *Worst Case Growth Scenario* for MSW and the *Economic Growth Scenario* for C&I waste, unless stated. The other scenarios have been excluded in order to provide a clear illustration of the worst case scenario for Thurrock, and the potential requirement for new waste facilities that will need to be planned for. The full range of waste growth scenarios for C&I and MSW are presented in *Annex B*.

Figure 4.1 MSW and C&I Waste Arisings against Recycling and Composting Capacity (tonnes)

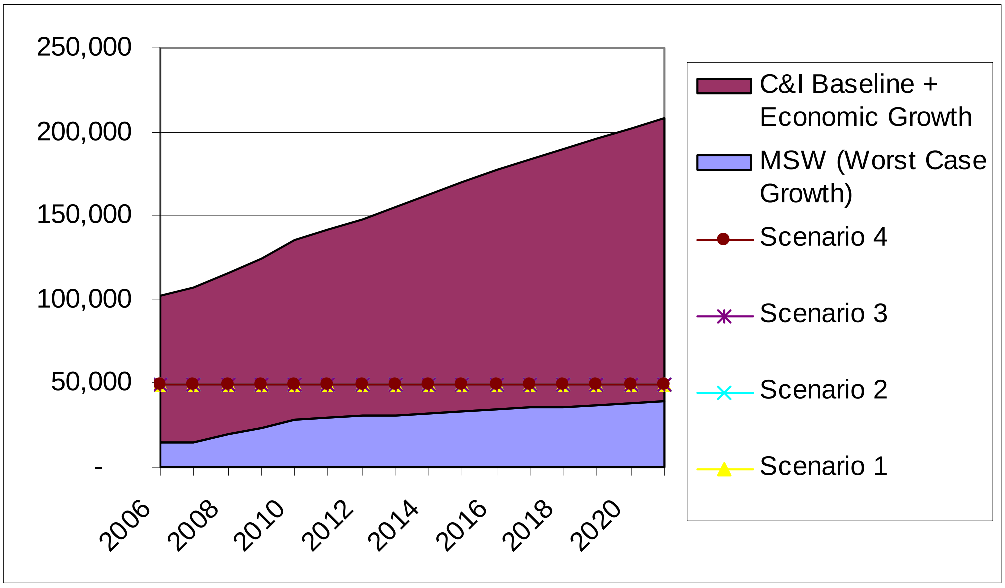


Figure 4.1 shows that the recycling and composting capacity in Thurrock is significantly below the level anticipated to be needed over the period to 2021

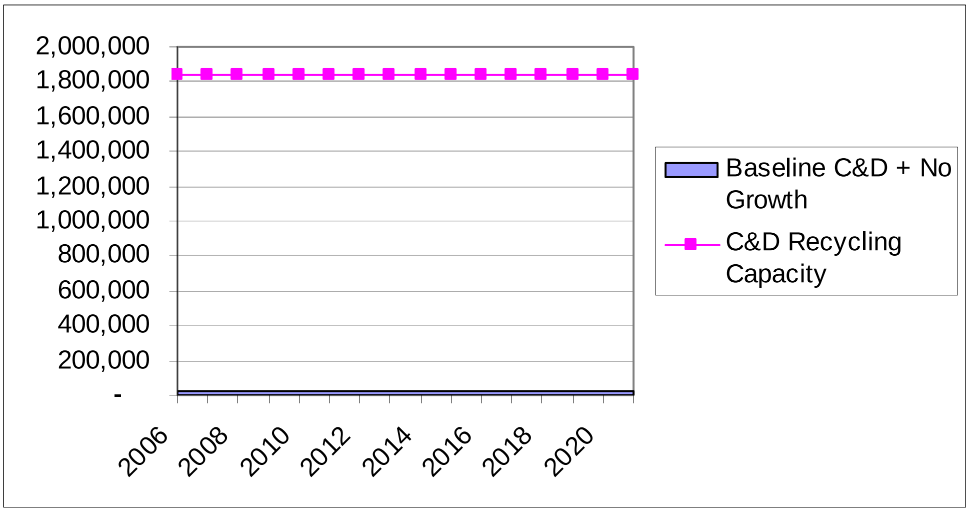
in all scenarios (due to the scenarios being the same or very similar, some may not appear on the chart). Thurrock urgently needs to provide for further recycling and composting facilities in order to deal with the projected demand and to meet its recycling and composting targets. The projected need in 2021 is for a further 160,000 tonnes of recycling capacity, mostly for C&I wastes.

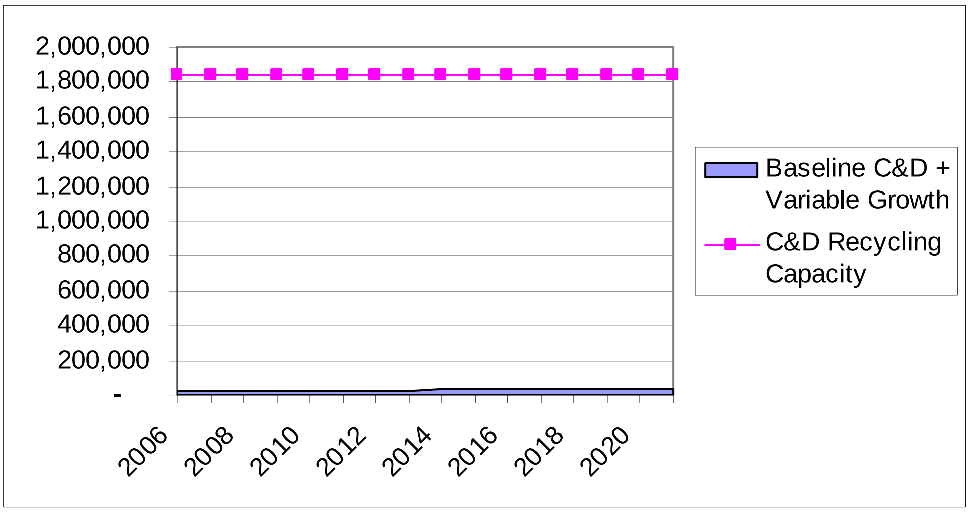
4.2.2 *C&D Recycling Capacity Gap Analysis*

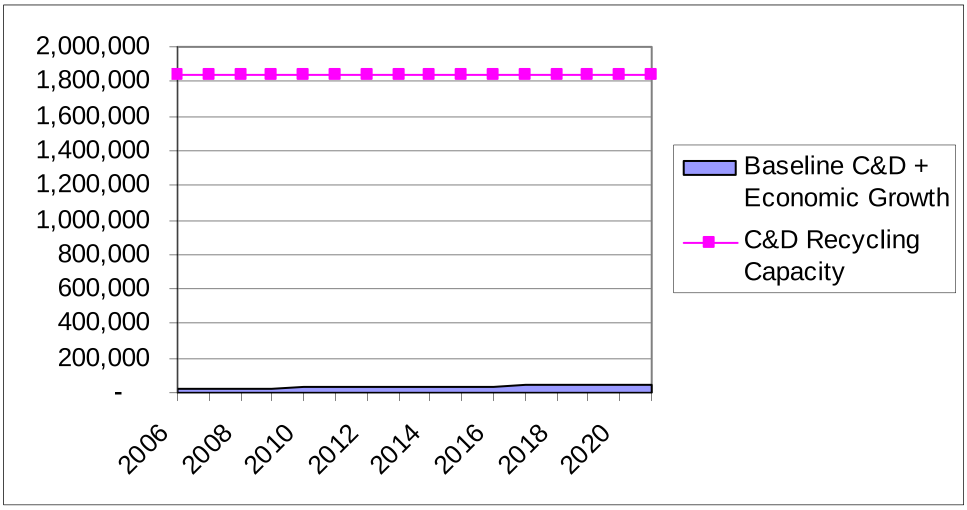
Available C&D recycling capacity is compared to C&D arisings that are designated to be recycled by the split of destination in the Symonds survey 2005 (*Section 2)*. The amount of arisings assumed to be produced in Thurrock is very small compared to the level of C&D recycling capacity as shown in *Figure 4.2*.

This suggests that either: the method for delivery C&D waste arisings is inaccurate, perhaps because the number of people employed in the Construction Sector in Thurrock does not reflect the amount of activity generating such as waste; or, that much of the C&D waste recycled is imported, from London, Greater Essex and potentially wider afield. Given the data available, it is not possible to be certain about either source of error and they are not mutually exclusive. Underutilisation of licensed C&D waste recycling capacity, a common occurrence, may also contribute to the picture, although given the scale of the discrepancy it seems unlikely to be the sole reason.

Figure 4.2 C&D Arisings to Recycling vs C&D Recycling Capacity for all Three Growth Scenarios Relevant to C&D Waste (tonnes)



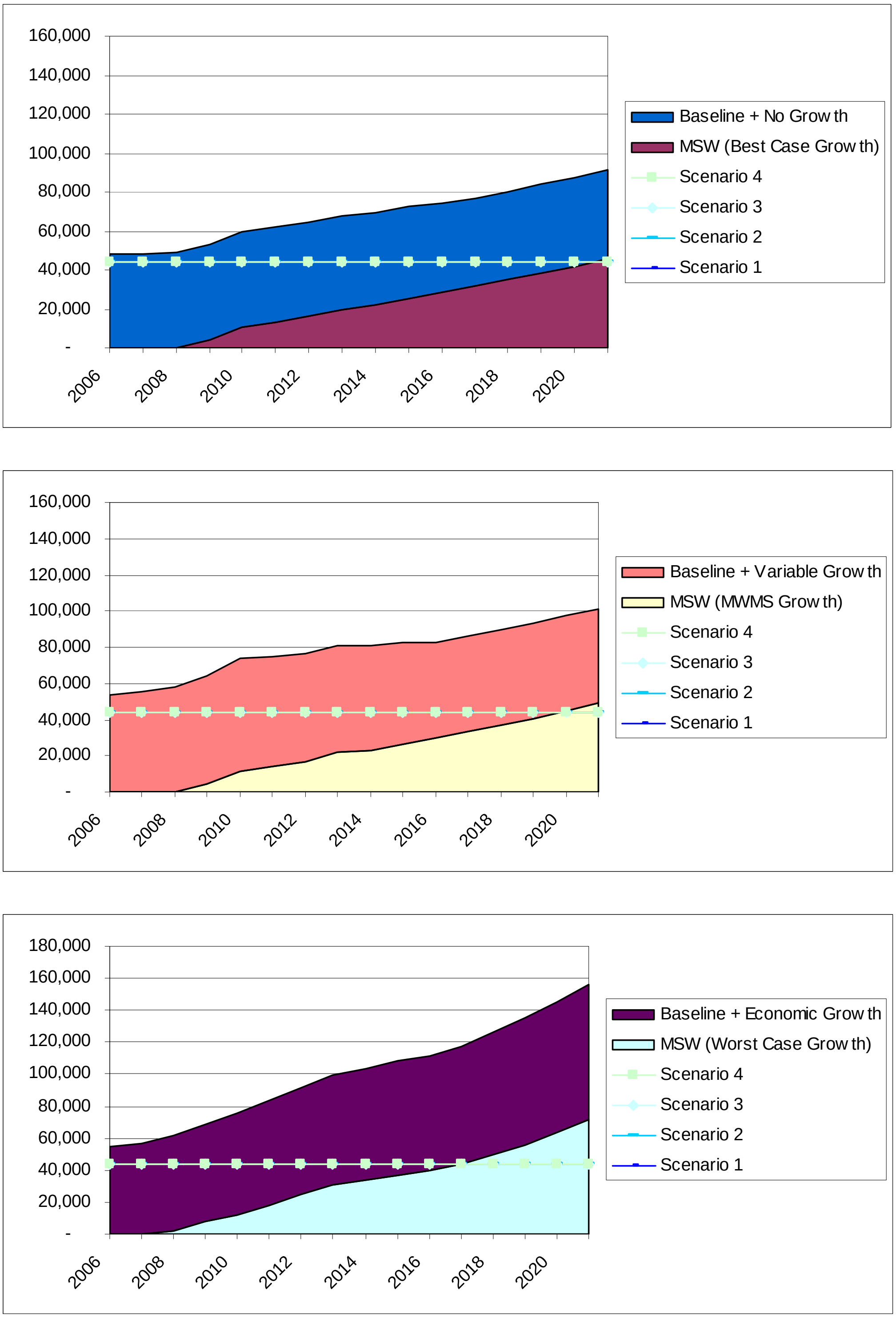




4.2.3 *Recovery Capacity Gap Analysis*

For all three growth rates, between 50,000 and 115,000 tonnes of capacity is required. This would mean that one relatively small-medium scale treatment plant would be sufficient for Thurrock to deal with the forecast amount of arisings to meet its recovery targets. All four capacity scenarios are the same, they appear as one single line on the charts below.

Figure 4.3 Treatment Capacity vs MSW and C&I Arisings (tonnes)



4.2.4 *Landfill Capacity Gap Analysis*

Non-hazardous landfill capacity was compared to the arisings assumed to be sent to landfill. These were based on the level of waste allowed to be landfilled via the LATS process. Residues, estimated at 30%, from treatment of MSW and C&I wastes are shown in the charts. These residues are included in the inert landfill charts/calculations as well, since the destination of such residues is currently unknown.

In Thurrock, existing and planned voidspace is sufficient to meet the demand up to 2021 in all but one scenario. The only scenario in which this becomes an issue is Scenario 1 with 2018/2019 the point where voidspace is exhausted. In this case, over 600,000 tonnes of voidspace is required by 2021. Scenarios 2-4 range from having 1.5 million cubic metres of void remaining to 7.5 million cubic metres of void remaining.

The alternative apportionment does not make a marked difference in the exhaustion point or the level of extra capacity required.

Figure 4.4 - *Figure 4.6* below show the capacity gap analysis. As a result of accommodating both sets of data on one graph (landfill capacity and arisings to landfill), the detail of the waste arisings is lost. In order to delineate the information more fully, it has been replotted as *Figure 4.7*. However even at this increase scale the agricultural waste forecasts do not appear, as they represent only a small proportion of waste.

Figure 4.4 Non-Hazardous Landfill Capacity (all Scenarios) vs Total Arisings to Landfill (Worst Case Growth) (tonnes)

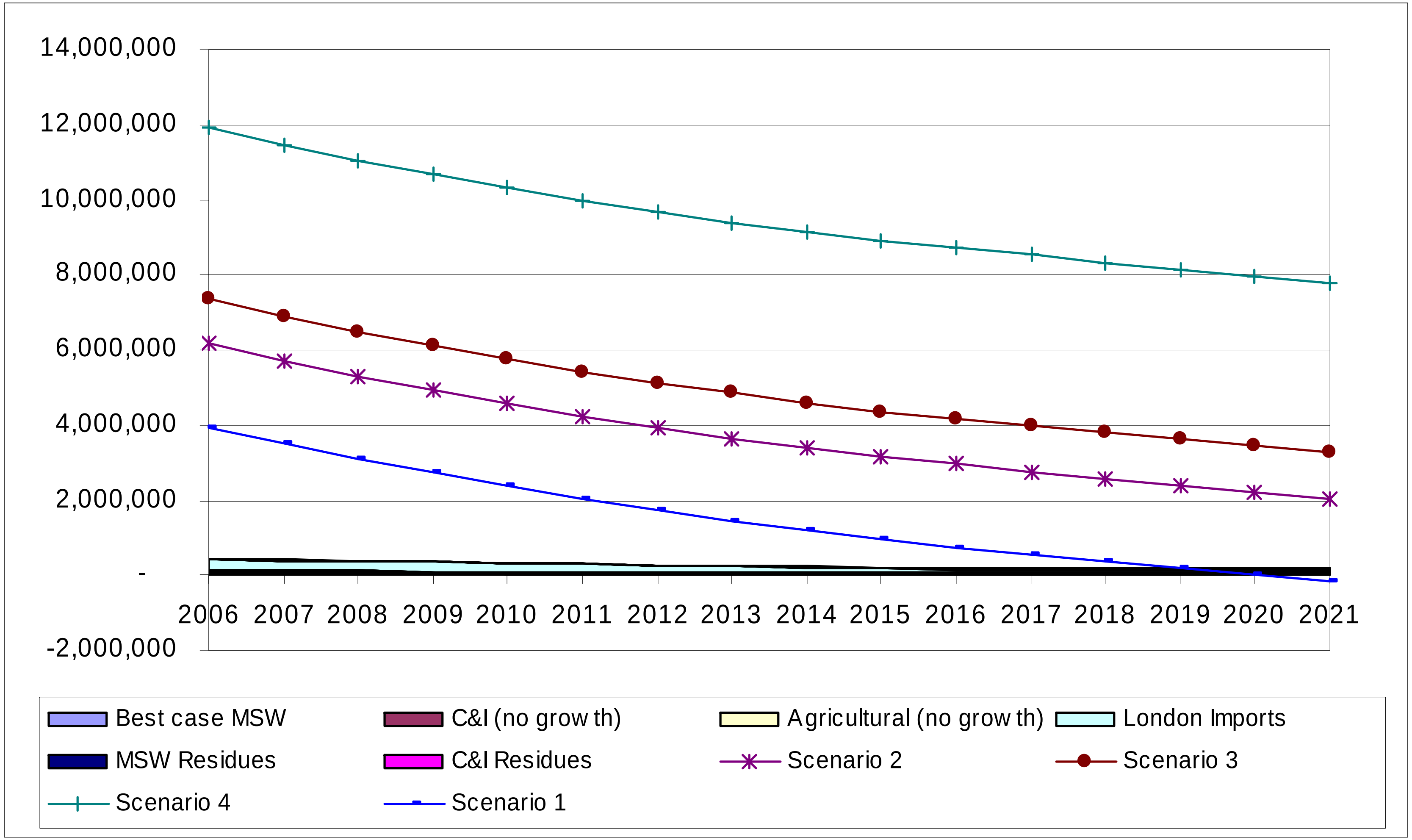


Figure 4.5 Non-Hazardous Landfill Capacity (all Scenarios) vs Total Arisings to Landfill (Best Case Growth) (tonnes)

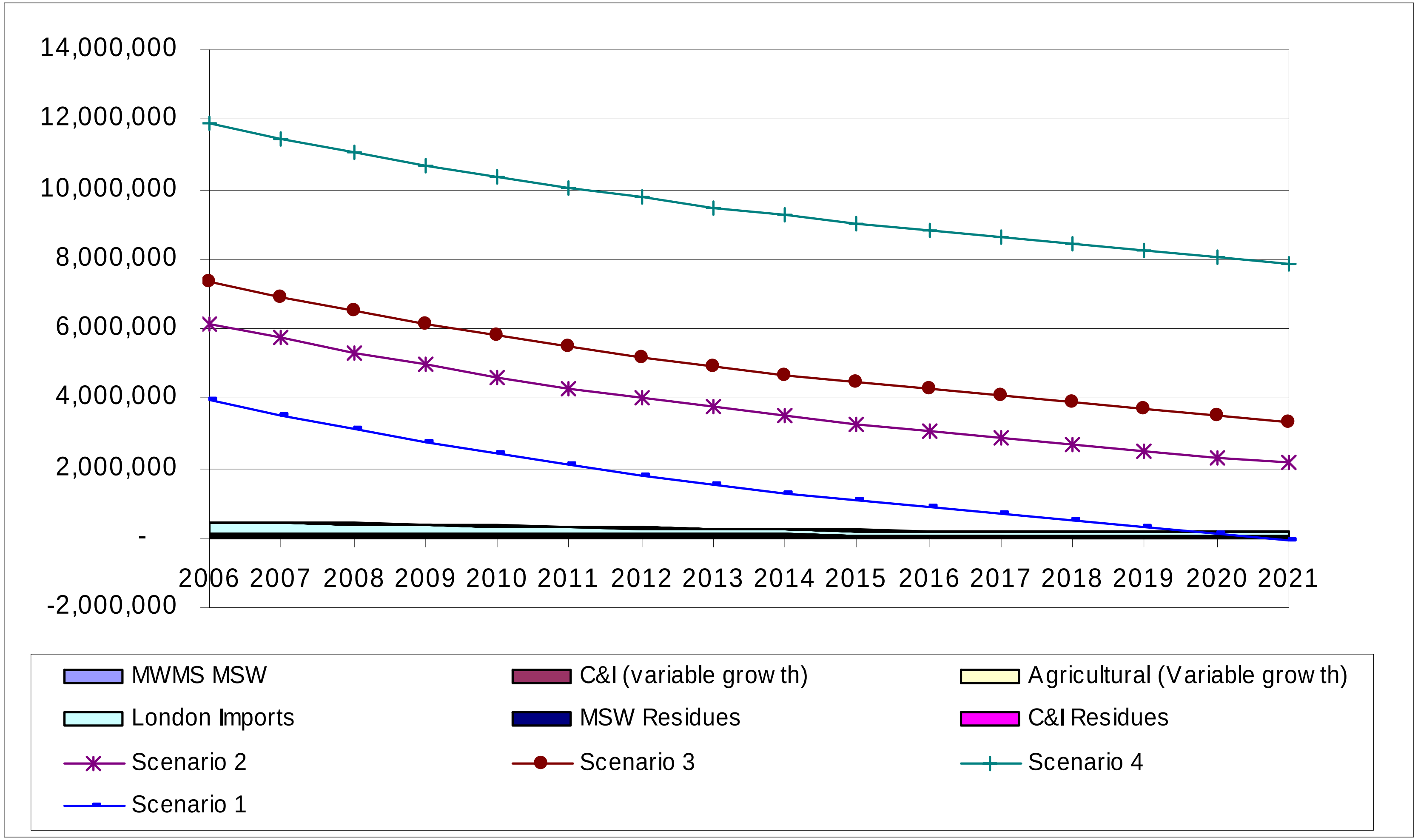


Figure 4.6 *Non-Hazardous Landfill Capacity (all Scenarios) vs Total Arisings to Landfill Including Alternate Apportionment – 13.4% (Worst Case Growth) (tonnes)*

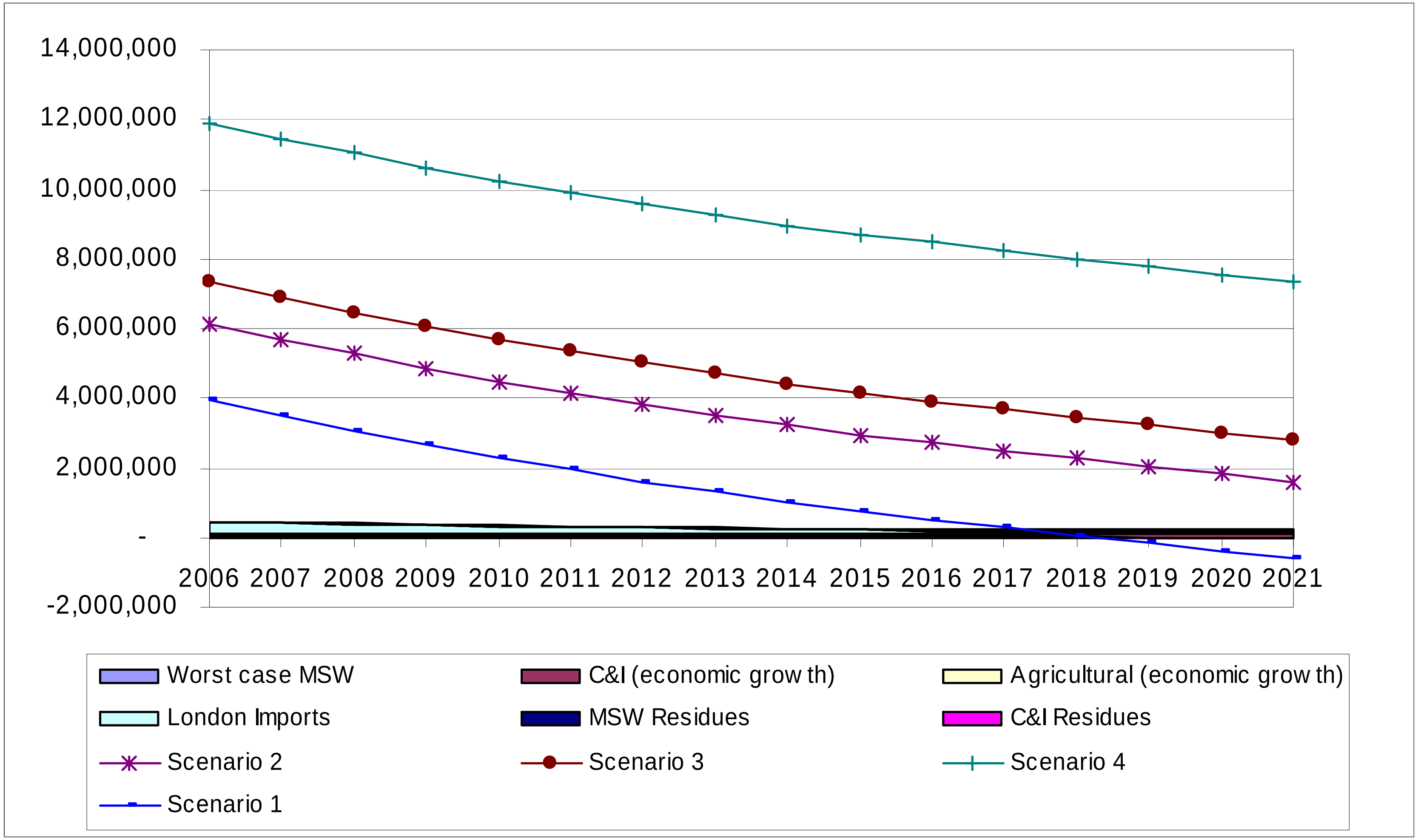
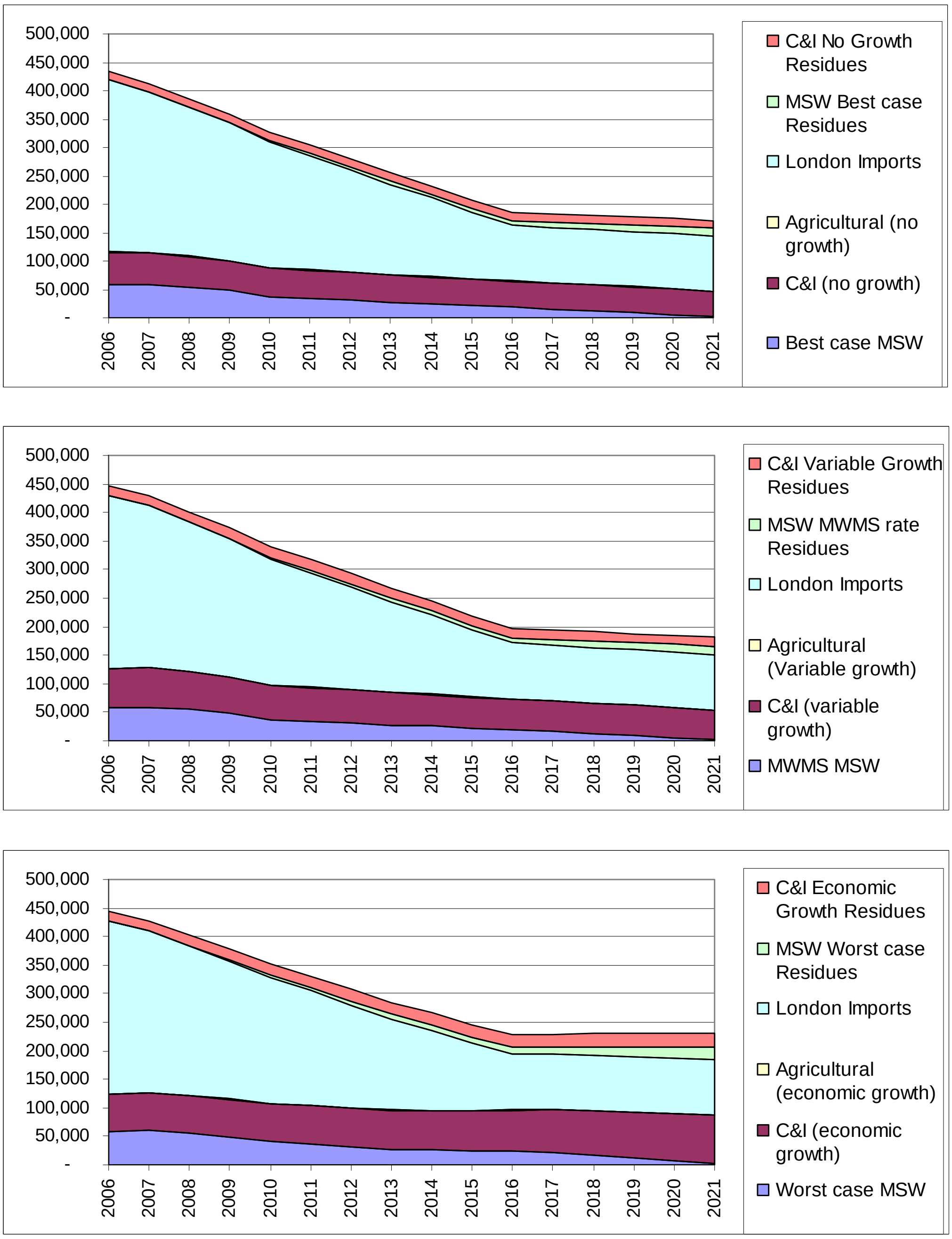


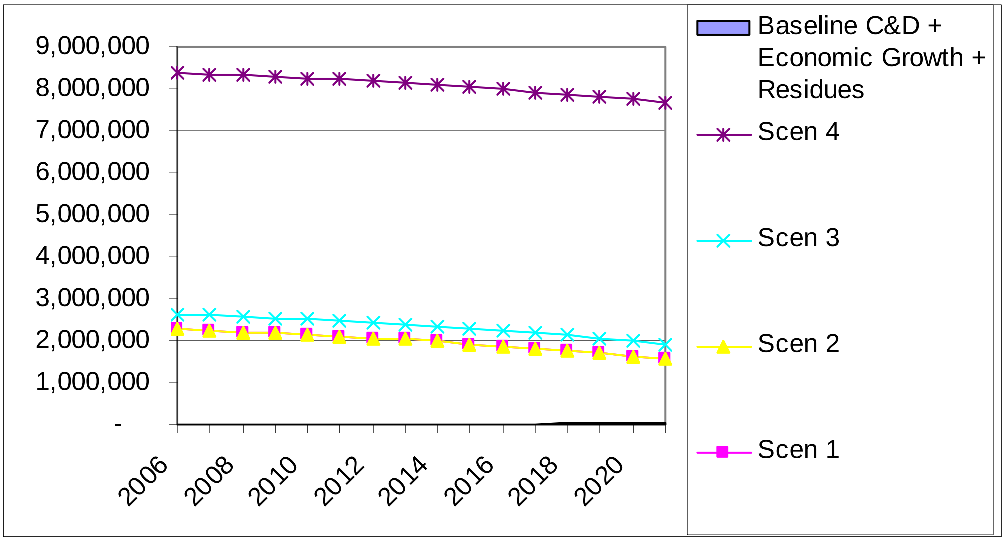
Figure 4.7 ***Waste Arisings Forecast to go to Non-Hazardous Landfill (tonnes) (3 scenarios)***



A separate calculation for inert landfill space was carried out, assessing the level of C&D waste arisings forecast to be sent to landfill against the various scenarios for inert landfill voidspace. However, there is such a small amount of arisings forecast for Thurrock that under all four scenarios there is more than enough capacity available assuming that current levels of recycling/reuse continue. This is subject to the proviso in *Section 4.2.2* that C&D waste arisings are not significantly underestimated because the method does not reasonably represent the amount of construction activity in Thurrock.

Figure 4.8 presents the worst case growth scenario. This shows that, even under Scenario 1, with the least inert landfill capacity, there is over 1.5 million tonnes worth of capacity remaining. This equates to a void of over 3 million cubic metres. It is conceivable that this extra voidspace may be being used by inert wastes being exported from London. The data for this has not been made available to this study and a survey of C&D wastes in Thurrock would provide more detail into the origin and amounts of C&D wastes found in the area.

Figure 4.8 ***Inert Landfill Capacity (All Scenarios) vs C&D Arisings Designated for Landfilling plus Residues from Treated Wastes (Worst Case Growth) (tonnes)***

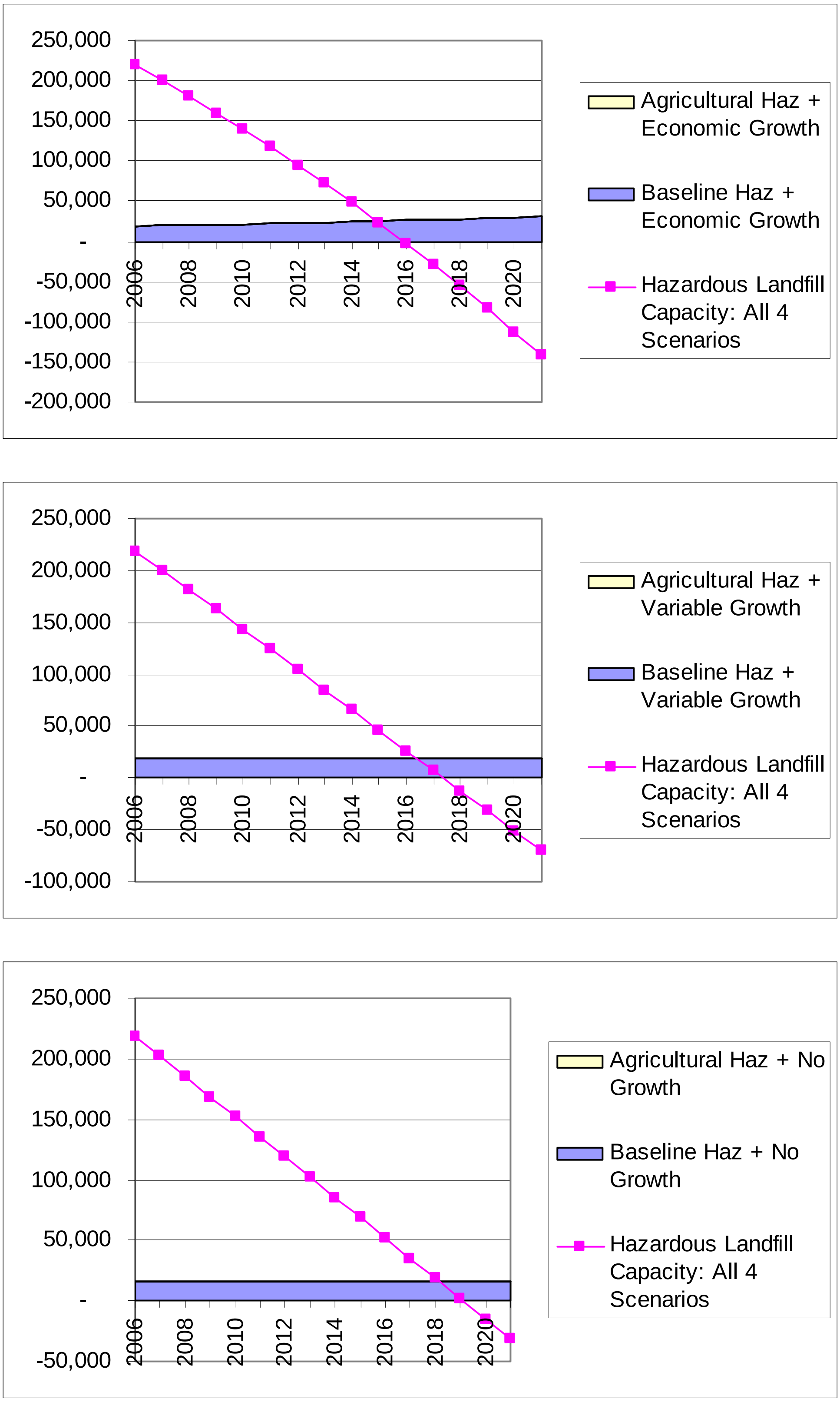


4.2.5 *Hazardous Waste Landfill Capacity Gap Analysis*

Hazardous waste capacity was only recorded in terms of landfill. Facilities recycling, reusing and recovering hazardous wastes were not identified. An average percentage of the amount of waste sent to landfill over the past four years was used to estimate how much would be sent to landfill over the plan period. This percentage of waste arisings was then compared to the hazardous waste landfill capacity identified in the capacity section. The hazardous waste landfill in Thurrock has been identified as restricted access and as such the forecast hazardous waste would not be sent there. The comparison has been carried out nonetheless to show the level of capacity required for these wastes.

Figure 4.9 shows the three different scenarios of waste growth used for the hazardous waste forecasts over the period to 2021. All four capacity estimates provided the same level of hazardous landfill capacity (219,000 cubic metres) and, as such, one line on the figure has been used to signify the four capacity estimates. The capacity gap calculations for the worst case growth scenario show that landfill capacity is predicted to become exhausted in 2016. The other two scenarios show the point of exhaustion to be 2018 and 2020 respectively. The range of extra capacity required in 2021 for the three scenarios ranges from 150,000 cubic metres to 35,000 cubic metres.

Figure 4.9 ***Hazardous Waste to Landfill (Average Percentage Landfilled in Last Four Years) vs Hazardous Landfill Capacity (tonnes) (All Four Capacity Scenarios and all Three Growth Forecasts)***



The results of the modelling show there is a gap between the anticipated level of arisings and the estimated current/planned recycling and composting capacity. As expected, the varying growth scenarios and capacity estimates give a range of results. However, even under the best case scenario, where C&I growth is zero and MSW growth is at its lowest, there is a need in 2021 for over 65,000 tonnes per annum of additional capacity. This estimate grows significantly when the highest growth rates are applied. At a maximum, over 160,000 tonnes per annum of capacity are needed.

For recovery targets to be met, the estimated necessary capacity ranges from 50,000 to 115,000 tonnes per annum, depending on the growth rate experienced over the next 15 years. This could be the difference between one or two small treatment plants, or a medium-sized facility. In all cases, the gap between current capacity and forecast arisings is likely to require a single additional plant, with the gap being a maximum of 20,000 tonnes per annum.

C&D waste recycling capacity in Thurrock is much greater than the arisings forecast up to 2021. For these facilities/capacity to be operational and profitable, they must be importing a large amount of waste from surrounding areas or the estimate of C&D waste generating activity in Thurrock is significantly at error. It is recommended that a survey into C&D waste arisings be carried out in Thurrock to provide a more robust set of data upon which to base such comparisons on, and to make representations with regard to apportionment.

As well as C&D recycling capacity being in abundance, inert landfill voidspace appears to be sufficient throughout the period to 2021 and beyond. Even using the worst case growth estimate and the lowest capacity estimate, there is predicted to be a surplus of 2 million tonnes of capacity – equating to 4 million cubic metres of voidspace.

Once again, importing waste from surrounding areas could have a large impact on this capacity. Imports from London are not quantified, but the Symonds report for ODPM/DCLG in 2003 suggested that London exports the majority of its C&D waste to surrounding regions. C&D waste data is particularly unreliable, and when combined with data only being available at a regional level, this leads to uncertainties that can not currently be overcome.

The passage in *Box 5.1* is taken from the East of England Regional Waste Management Strategy 2002. It shows that, whilst improving the data available on C&D wastes is important and useful for future planning, it does not present a large problem if this data can not be used due to the nature of the waste itself.

Box 5.1 RWMS - East of England

Inert construction and demolition wastes are not generally seen as presenting a waste management problem as the materials have considerable recycling potential, are needed for restoration of mineral workings and have other engineering uses. This has been clearly demonstrated in other countries, for example in the Netherlands where very high levels of recovery have been achieved through the development of specialised plant and attention to the quality of the product. Care at the production stage to reduce the amount of mixed waste could improve recycling rates (for example the builders' skip with its content of plasterboard, bricks, wood and metal waste and miscellaneous items such as discarded paint tins makes recycling difficult and expensive) and greater commitment to the use of recycled materials.

A number of scenarios have been examined in relation to the need for non-hazardous landfill capacity. The lowest estimate of current capacity and the highest growth in arisings, would lead to current/planned voidspace becoming exhausted by 2020/2021. Once again, given the range of capacity estimates and growth projections, the estimated abundance in capacity is varied. Under all scenarios, no new facilities are required. Under the best case scenario, there is a surplus of 8 million cubic metres of voidspace in 2021.

Hazardous landfill capacity is shown to become exhausted between 2016 and 2020, requiring between 35,000 and 150,000 cubic metres of additional capacity by 2021. This is based on the assumption that the types of hazardous waste will not change, the method of disposal for these wastes will not change and that for hazardous waste the bulk density is 1 tonne per cubic metre. The landfill in Thurrock that provided the capacity is actually a restricted access landfill and is not therefore available as voidspace, these calculations are shown to provide a picture of the level of capacity required.

This study presents a range of scenarios in order to inform Thurrock Council's deliberations and to advise on the potential range of outcomes given the uncertainties inherent in the prediction of future arisings. It is important to note that the predicted need for provision for additional capacity will be informed by new sources of data and annual monitoring in line with PPS 10 during the plan period.

The capacity available assumes that targets for recovery etc are achieved at levels and to dates set in National Waste Strategy (consultation draft). Failure to achieve these levels will mean that more waste to landfill and that there is a consequent reduction in particular in non-hazardous landfill capacity over longer term.

Significant elements of planned landfill capacity in Scenarios 3 and 4 is not available to Thurrock as it is contracted to London waste.

Non-Hazardous Landfill capacity available for Thurrock is dependant in the longer term on potential voidspace at the right sites coming forward at the right time.

Robust monitoring and updating of arisings and capacity information is required to assess the implications of the above issues when planning for additional capacity in Thurrock.

Annex A

MSW Arisings Figures

Table 1.1 Total MSW (tonnes)

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Best case	73,000	73,000	73,000	73,000	73,000	73,000	73,000	73,000	73,000	73,000	73,000	73,000	73,000	73,000	73,000	73,000
MWMS	73,000	73,000	73,000	73,000	74,000	75,000	75,000	75,000	76,000	76,000	76,000	77,000	77,000	78,000	78,000	78,000
Worst case	73,000	75,000	77,000	79,000	82,800	84,000	87,000	89,000	92,000	95,000	98,000	101,000	104,000	107,000	110,000	113,000

Table 1.2 Waste to recycling (tonnes)

MSW	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Best case	15,000	15,000	19,000	21,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000
MWMS	15,000	15,000	19,000	21,000	26,000	26,000	26,000	26,000	26,000	27,000	27,000	27,000	27,000	27,000	27,000	27,000
Worst case	15,000	15,000	20,000	23,000	29,000	29,000	30,000	31,000	32,000	33,000	34,000	35,000	36,000	37,000	38,000	40,000

Table.1.3 Waste to treatment (tonnes)

MSW	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Best case	0	0	0	4,000	11,000	13,000	16,000	20,000	22,000	25,000	28,000	31,000	35,000	38,000	42,000	46,000
MWMS	0	0	0	4,000	11,000	14,000	17,000	22,000	23,000	27,000	30,000	33,000	37,000	41,000	45,000	49,000
Worst case	0	0	2,000	8,000	12,000	18,000	24,000	31,000	34,000	37,000	40,000	44,000	50,000	56,000	64,000	71,000

Table 1.4 Waste to landfill (tonnes)

MSW	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Best case	58,000	58,000	54,000	48,000	36,000	34,000	31,000	27,000	25,000	22,000	19,000	16,000	12,000	9,000	5,000	1,000
MWMS	58,000	58,000	54,000	48,000	37,000	35,000	32,000	27,000	26,000	23,000	20,000	17,000	13,000	10,000	6,000	2,000
Worst case	58,000	60,000	55,000	49,000	41,000	36,000	32,000	27,000	26,000	25,000	24,000	22,000	18,000	13,000	8,000	2,000

Table 1.5 Residues from treatment (tonnes)

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Best case	0	0	0	1,000	3,000	4,000	5,000	6,000	7,000	8,000	8,000	9,000	10,000	11,000	13,000	14,000
MWMS	0	0	0	1,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000	11,000	12,000	13,000	15,000
Worst case	0	0	600	2,000	4,000	5,000	7,000	9,000	10,000	11,000	12,000	13,000	15,000	17,000	19,000	21,000

All waste to recovery subject to 30% residue rate - the destination of which is assumed to be either non hazardous or inert landfill (both are shown in the report).

Note: This table is based on LATS diversion as not all the required facilities are operational. Diversion may take place at a greater rate if and when a facility is commissioned and operational.

Figure 1.1 MSW - Best Growth Scenario (tonnes)

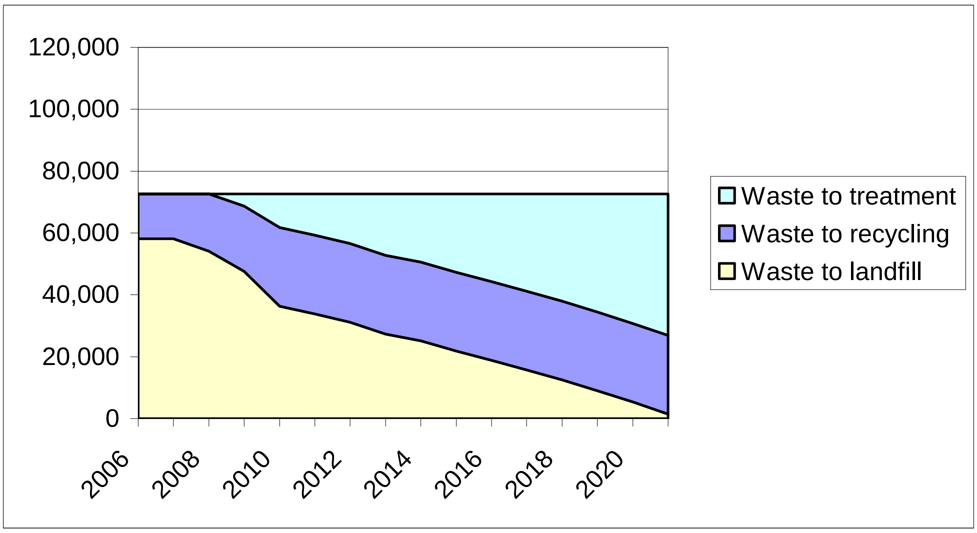


Figure 1.2 MSW - MWMS Growth Scenario (tonnes)

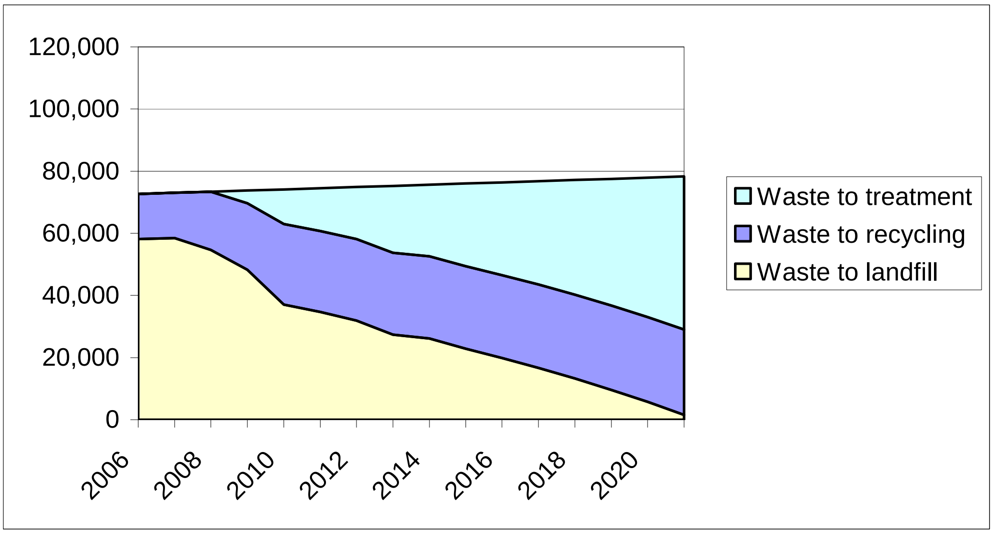
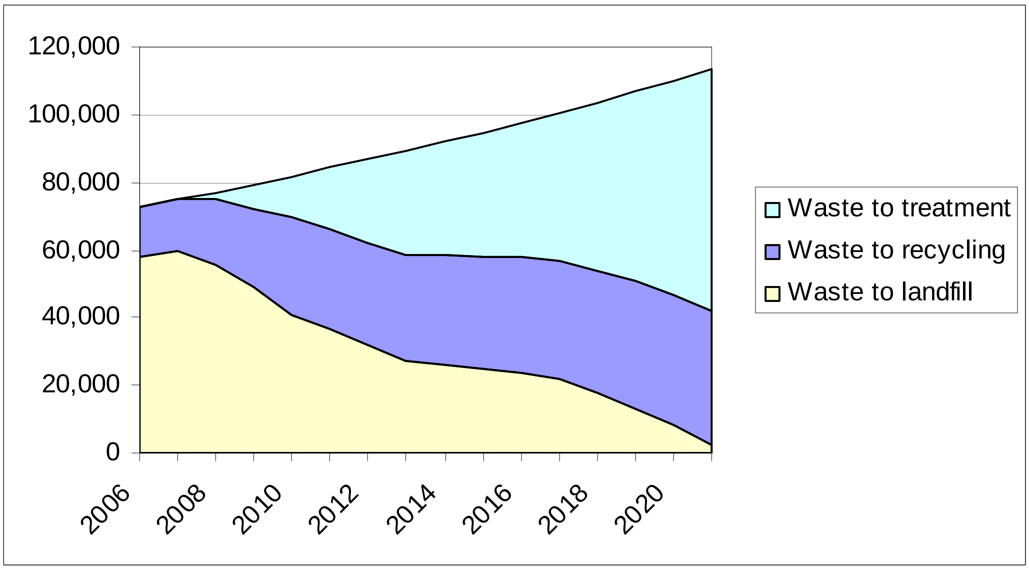


Figure 1.3 MSW - Worst Growth Scenario (tonnes)



Annex B

Waste Site Capacity Figures

1 CAPACITY OF SITE TYPES IN THURROCK

Table 1.1 Scenario 1 (tonnes)

	Capacity	No. Sites	Capacity blanks	Sites with capacity	Extrapolated value
Transfer	35,000	4	1	3	46,667
Treatment	10,980	4	1	3	43,920
Non Haz Landfill	3,950,000	2	0	2	3,950,000
Inert Landfill	2,270,000	5	0	5	2,270,000
Incinerator	-	0	0	0	0
Composting	-	0	0	0	0
Recycling	20,000	4	2	2	40,000
C&D recycling	1,475,000	5	1	4	1,843,750
Ignore	100,000	5	0	5	100,000
Metal/ELV Facility	2,299,370	10	0	10	2,299,370
CLOSED	-	1	0	1	-
Hazardous Landfill	219,000	1	0	1	219,000
Tf - recycling	7,000	4	1	3	9,333
TOTAL	10,379,350	41	5	36	10,812,707

Table 1.2 Scenario 2 (tonnes)

	Capacity	No. Sites	Capacity blanks	Sites with capacity	Extrapolated value
Transfer	35,000	4	1	3	46,667
Treatment	10,980	4	1	3	43,920
Non Haz Landfill	6,150,000	3	0	3	6,150,000
Inert Landfill	2,270,000	5	0	5	2,270,000
Incinerator	-	0	0	0	0
Composting	-	0	0	0	0
Recycling	20,000	4	2	2	40,000
C&D recycling	1,475,000	5	1	4	1,843,750
Ignore	100,000	5	-	5	100,000
Metal/ELV Facility	2,299,370	10	-	10	2,299,370
CLOSED	-	1	-	1	-
Hazardous Landfill	219,000	1	-	1	219,000
Tf - recycling	7,000	4	1	3	9,333
TOTAL	12,579,350	42	5	37	13,012,707

Table 1.3 Scenario 3 (tonnes)

	Capacity	No. Sites	Capacity blanks	Sites with capacity	Extrapolated value
Transfer	35,000	5	1	4	43,750
Treatment	10,980	4	1	3	43,920
Non Haz Landfill	7,350,000	4	0	4	7,350,000
Inert Landfill	2,630,000	6	0	6	2,630,000
Incinerator	-	0	0	0	0
Composting	-	0	0	0	0
Recycling	20,000	4	2	2	40,000
C&D recycling	1,475,000	5	1	4	1,843,750
Ignore	-	0	0	0	0
Metal/ELV Facility	2,299,370	10	0	10	2,299,370
CLOSED	-	0	0	0	0
Hazardous Landfill	219,000	1	0	1	219,000
Tf - recycling	7,000	5	1	4	8,750
TOTAL	14,039,350	39	5	34	14,469,790

Table 1.4 Scenario 4 (tonnes)

	Capacity	No. Sites	Capacity blanks	Sites with capacity	Extrapolated value
Transfer	35,000	5	1	4	43,750
Treatment	10,980	4	1	3	43,920
Non Haz Landfill	13,300,000	5	0	5	13,300,000
Inert Landfill	8,376,000	10	0	10	8,376,000
Incinerator	-	0	0	0	0
Composting	-	0	0	0	0
Recycling	20,000	4	2	2	40,000
C&D recycling	1,475,000	5	1	4	1,843,750
Ignore	-	6	0	6	-
Metal/ELV Facility	2,299,370	10	0	10	2,299,370
CLOSED	3,000,000	8	0	8	3,000,000
Hazardous Landfill	219,000	1	0	1	219,000

Table 1.5 All Scenarios (tonnes)

	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Transfer	46,667	46,667	43,750	43,750
Treatment	43,920	43,920	43,920	43,920
Non Haz Landfill	3,950,000	6,150,000	7,350,000	13,300,000
Inert Landfill	2,270,000	2,270,000	2,630,000	8,376,000
Incinerator	0	0	0	0
Composting	0	0	0	0
Recycling	40,000	40,000	40,000	40,000
C&D recycling	1,843,750	1,843,750	1,843,750	1,843,750
Ignore	100,000	100,000	0	-
Metal/ELV Facility	2,299,370	2,299,370	2,299,370	2,299,370
CLOSED	-	-	0	3,000,000
Hazardous Landfill	219,000	219,000	219,000	219,000
Tf - recycling	9,333	9,333	8,750	8,750
TOTAL	10,812,707	13,012,707	14,469,790	29,165,790
Total landfill	6,439,000	8,639,000	10,199,000	21,895,000
Total non landfill	4,273,707	4,273,707	4,270,790	7,270,790

Annex C

Capacity Gap Analysis

Figure 1.1 ***Best Case MSW and Worst Case C&I Waste Designated for Recycling vs Recycling Capacity (tonnes)***

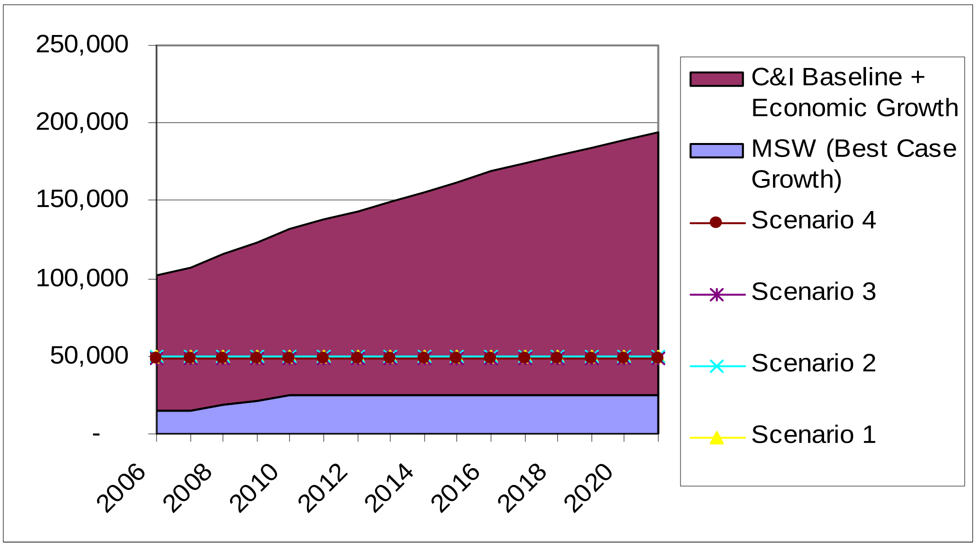


Figure 1.2 ***Best Case MSW and Medium Case C&I Waste Designated for Recycling vs Recycling Capacity (tonnes)***

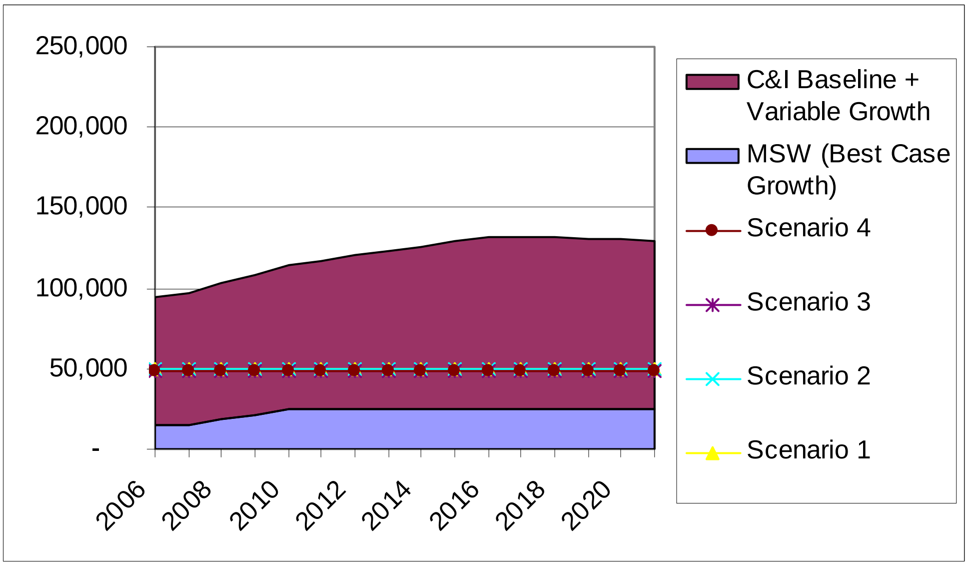


Figure 1.3 *Best Case MSW and Best Case C&I waste Designated for Recycling vs Recycling Capacity (tonnes)*

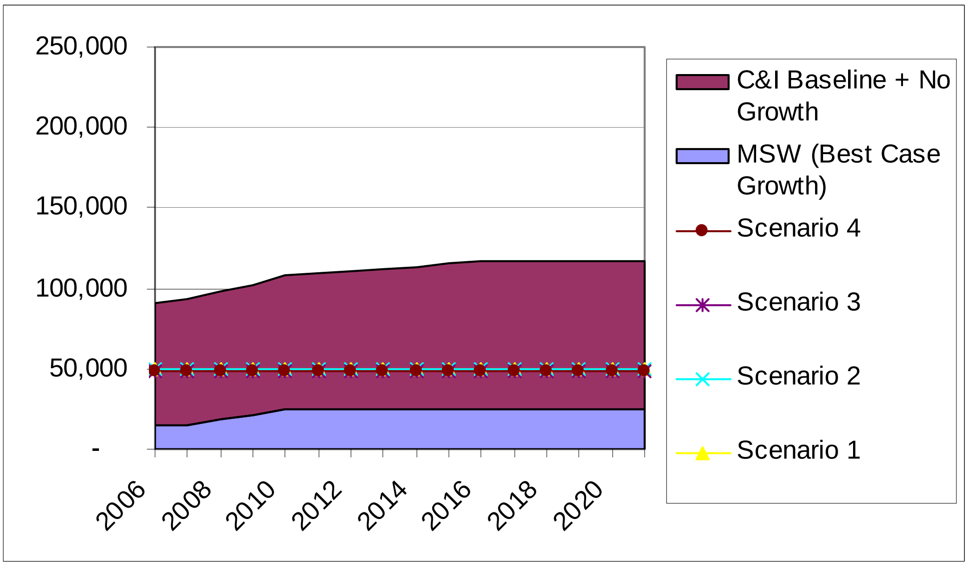


Figure 1.4 *Medium Case MSW and Worst Case C&I Waste Designated for Recycling vs Recycling Capacity (tonnes)*

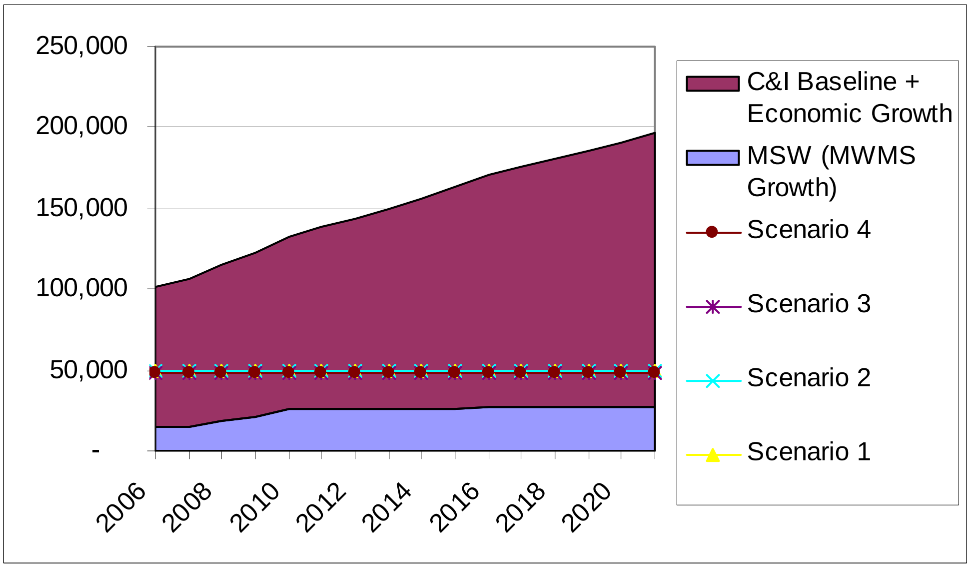


Figure 1.5 *Medium Case MSW and Medium Case C&I Waste Designated for Recycling vs Recycling Capacity (tonnes)*

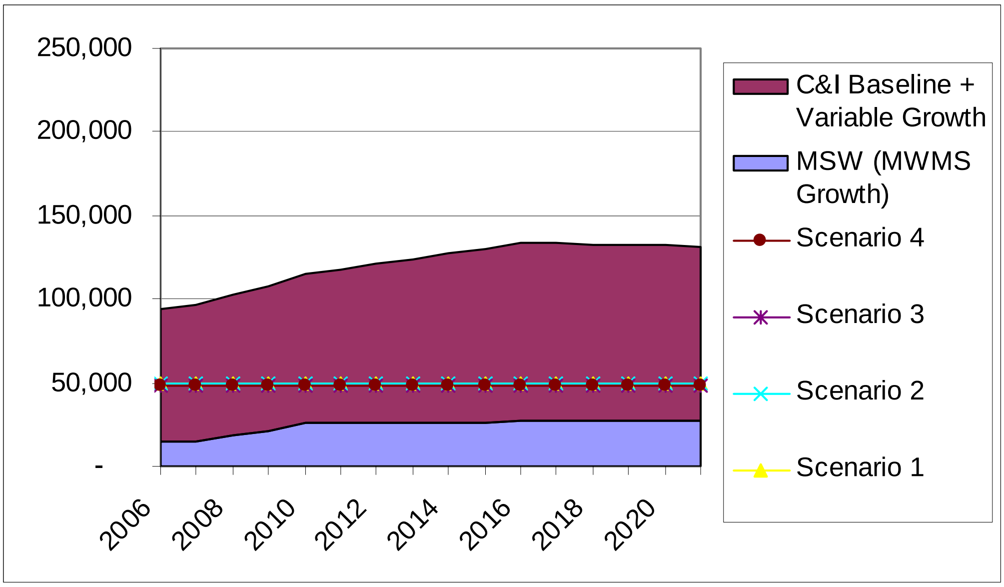


Figure 1.6 *Medium Case MSW and Best Case C&I Waste Designated for Recycling vs Recycling Capacity (tonnes)*

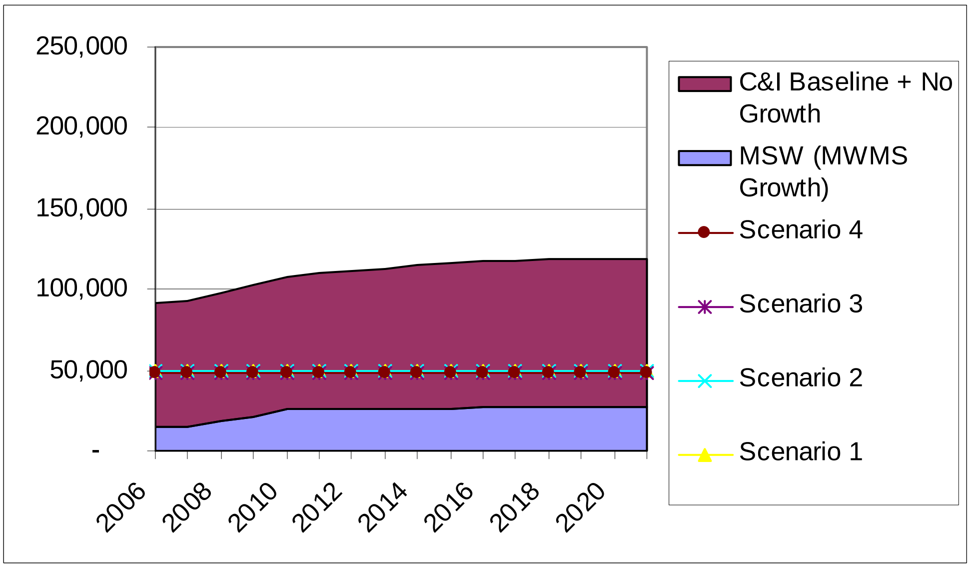


Figure 1.7 Worst Case MSW and Worst Case C&I Waste Designated for Recycling vs Recycling Capacity (tonnes)

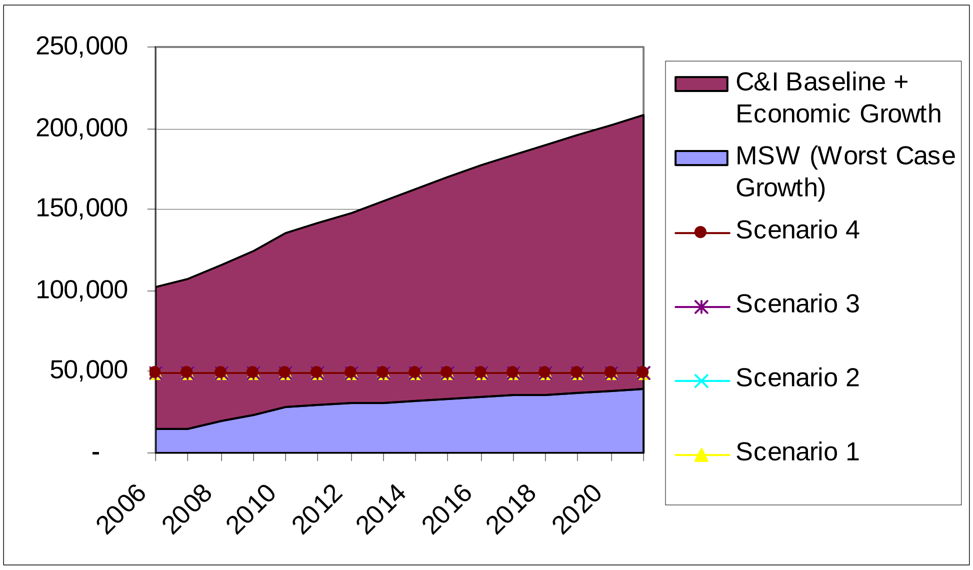


Figure 1.8 Worst Case MSW and Medium Case C&I Waste Designated for Recycling vs Recycling Capacity (tonnes)

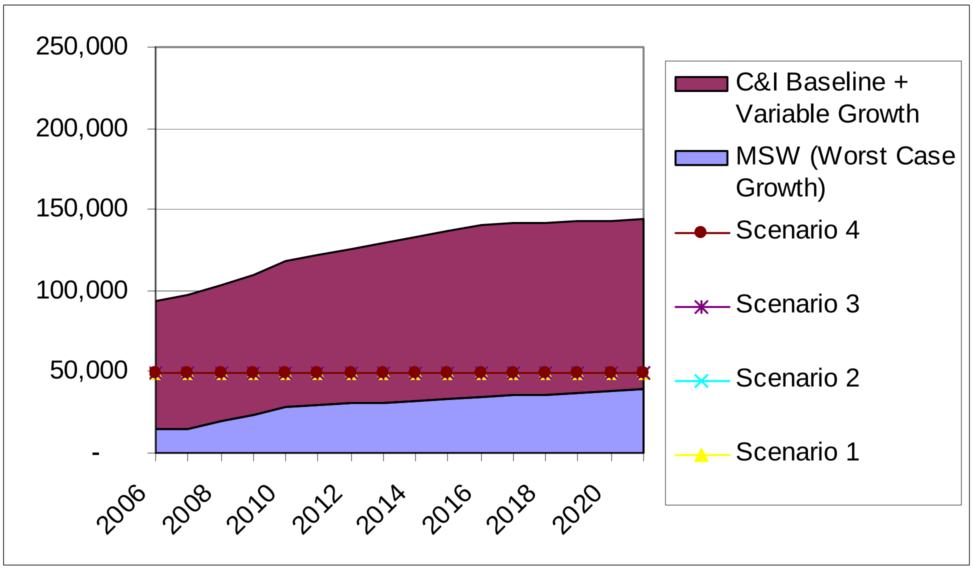


Figure 1.9 *Worst Case MSW and Best Case C&I Waste Designated for Recycling vs Recycling Capacity (tonnes)*

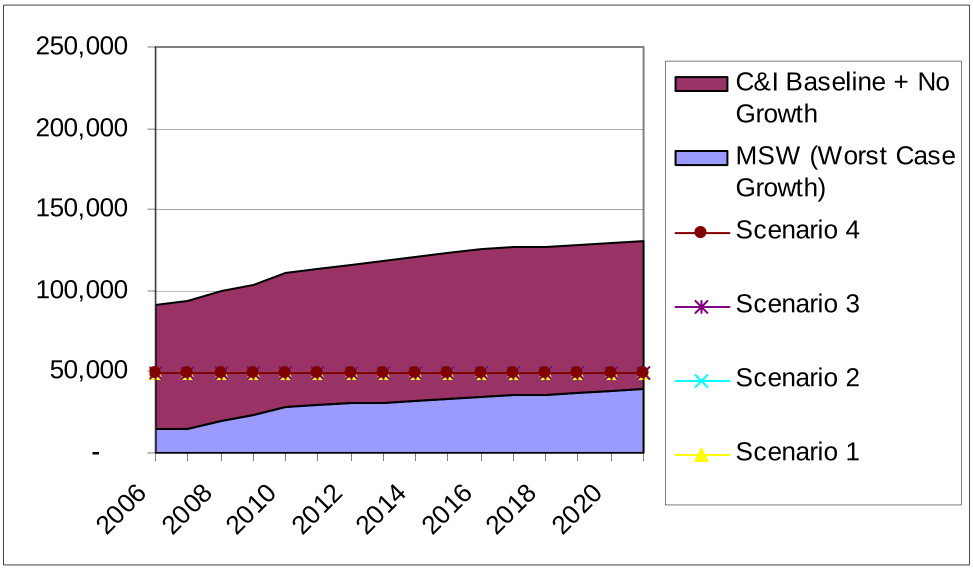
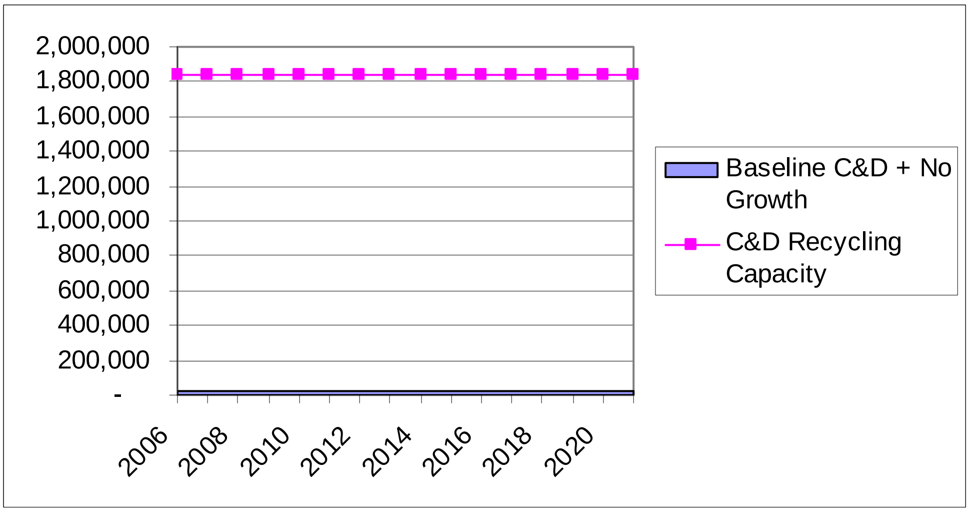
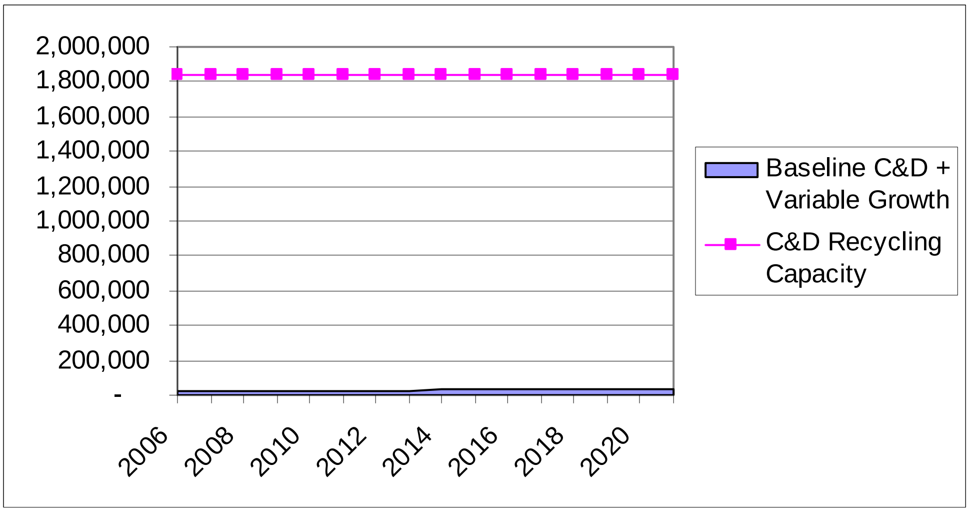


Figure 2.1 Three Growth Scenarios for C&D Waste Designated for Recycling vs C&D Recycling Capacity (Best, Medium, Worst) (tonnes)





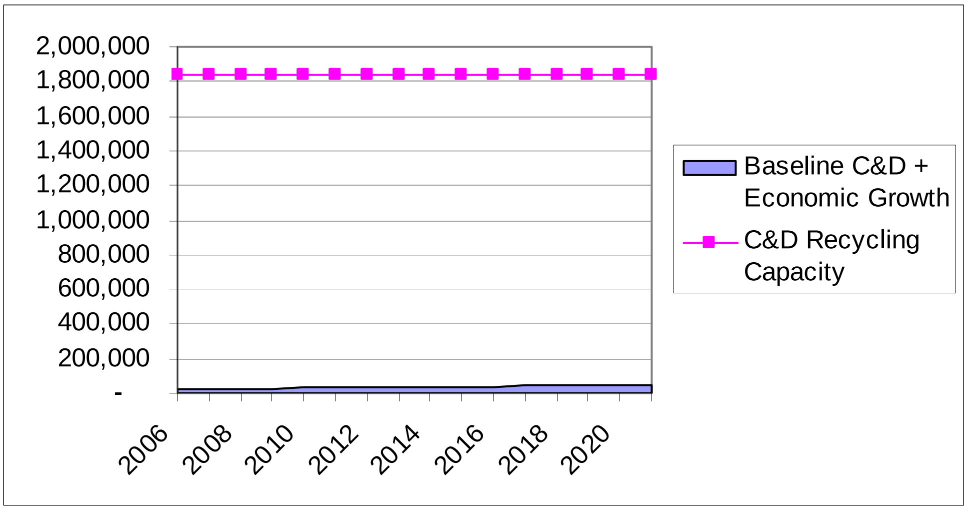
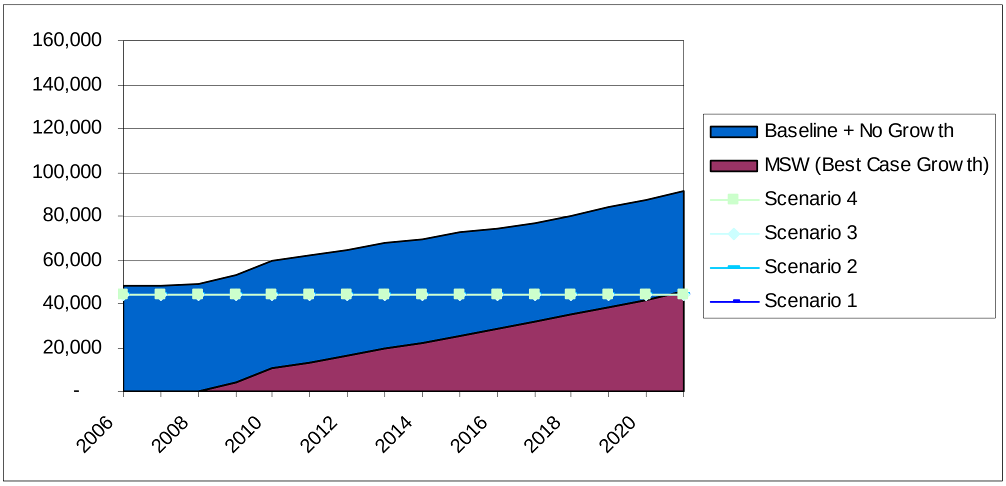
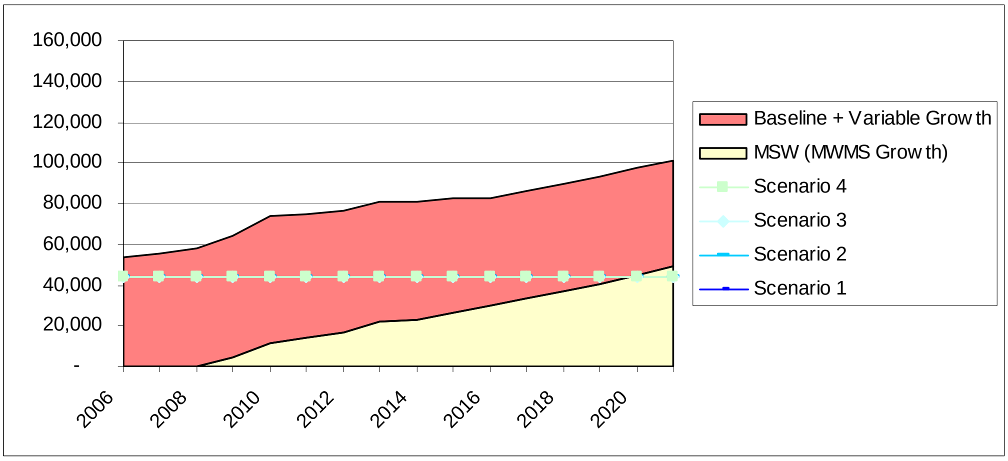


Figure 3.1 *MSW and C&I Waste Designated for Treatment vs Treatment Capacity (Best, Medium and Worst Case Scenarios) (tonnes)*





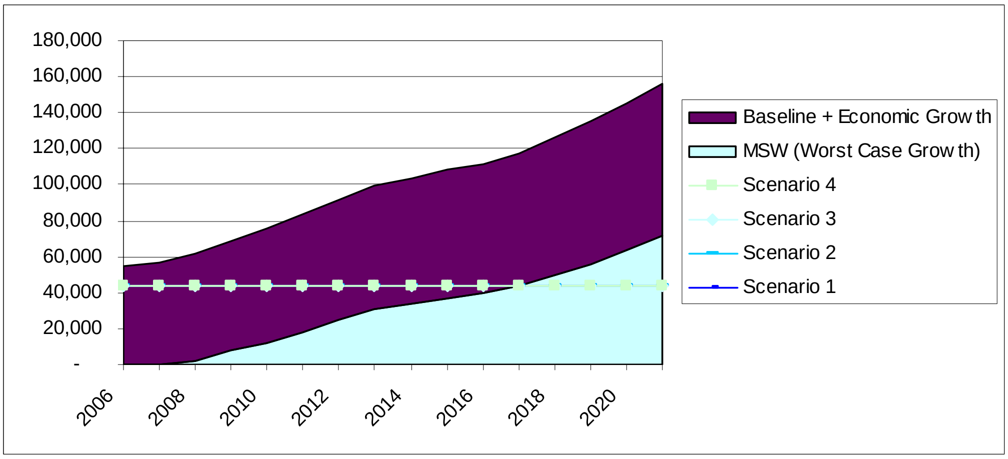


Figure 4.1 Best Case MSW, C&I, Agricultural and Treatment Residues, with 12.8% Apportionment of London's Waste vs Non Hazardous Landfill Capacity (tonnes)

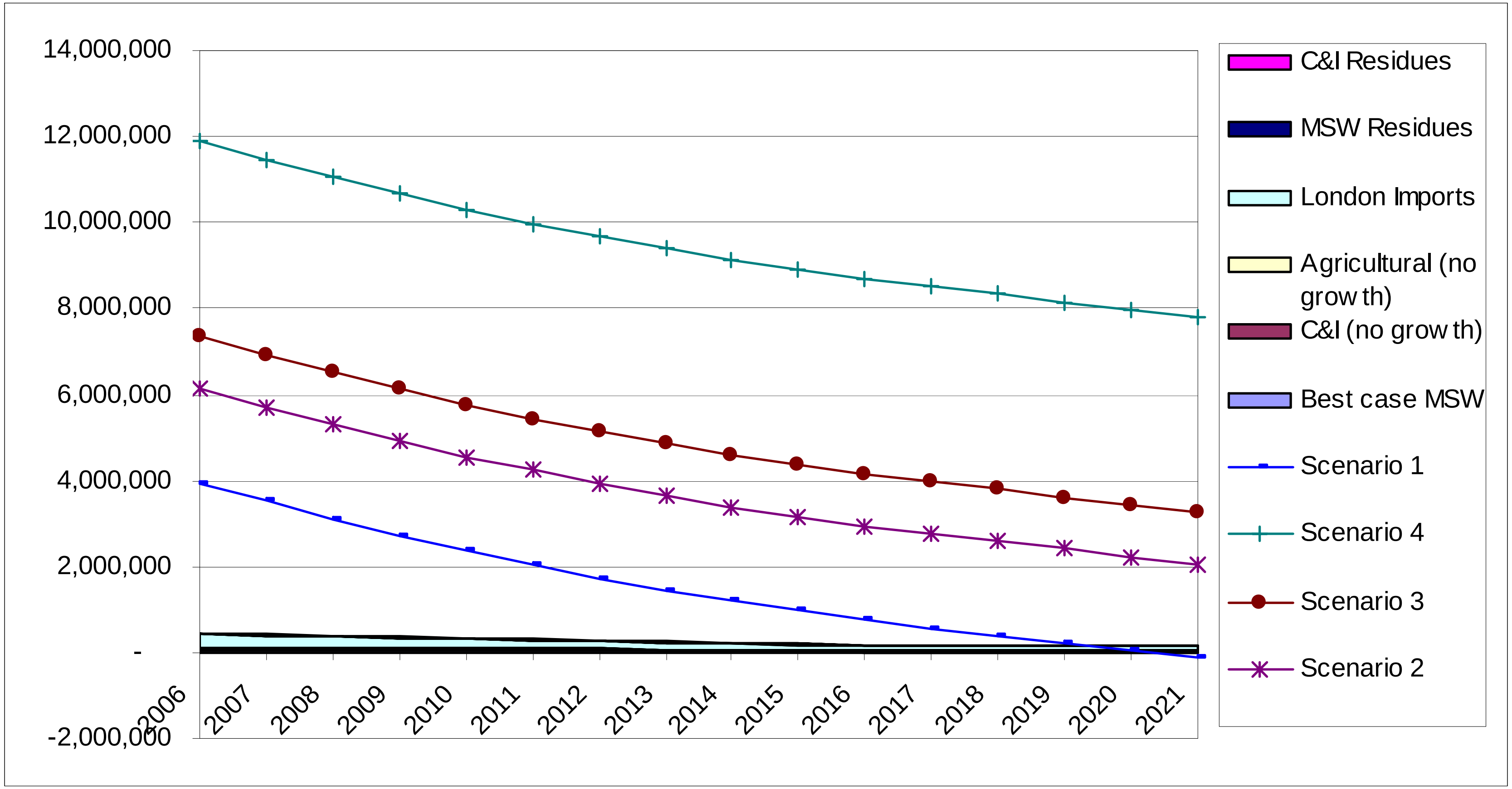


Figure 4.2 Medium Case MSW, C&I, Agricultural and Treatment Residues, with 12.8% Apportionment of London's Waste vs Non Hazardous Landfill Capacity (tonnes)

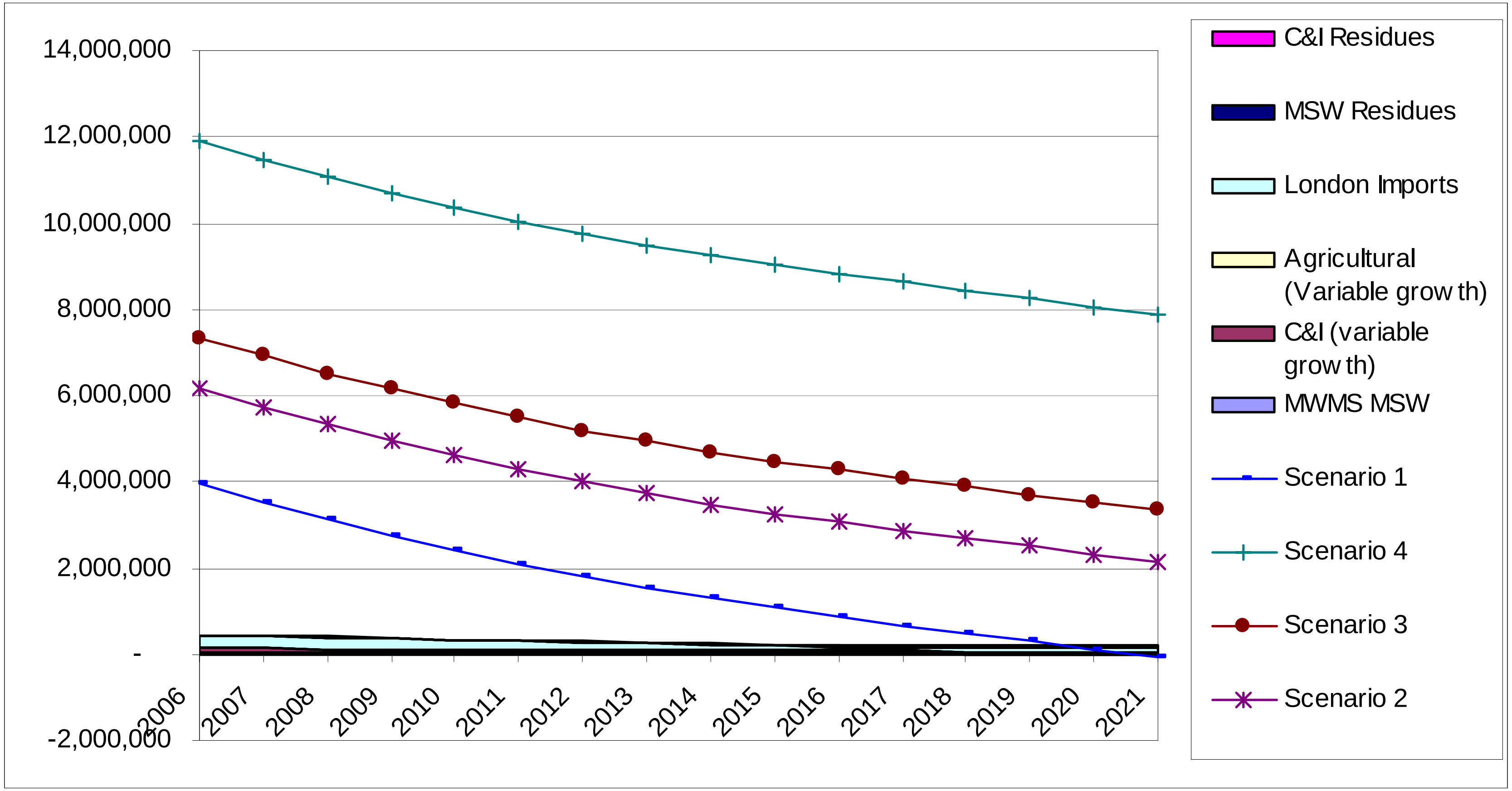


Figure 4.3 *Worst Case MSW, C&I, Agricultural and Treatment Residues, with 12.8% Apportionment of London's Waste vs Non Hazardous Landfill Capacity (tonnes)*

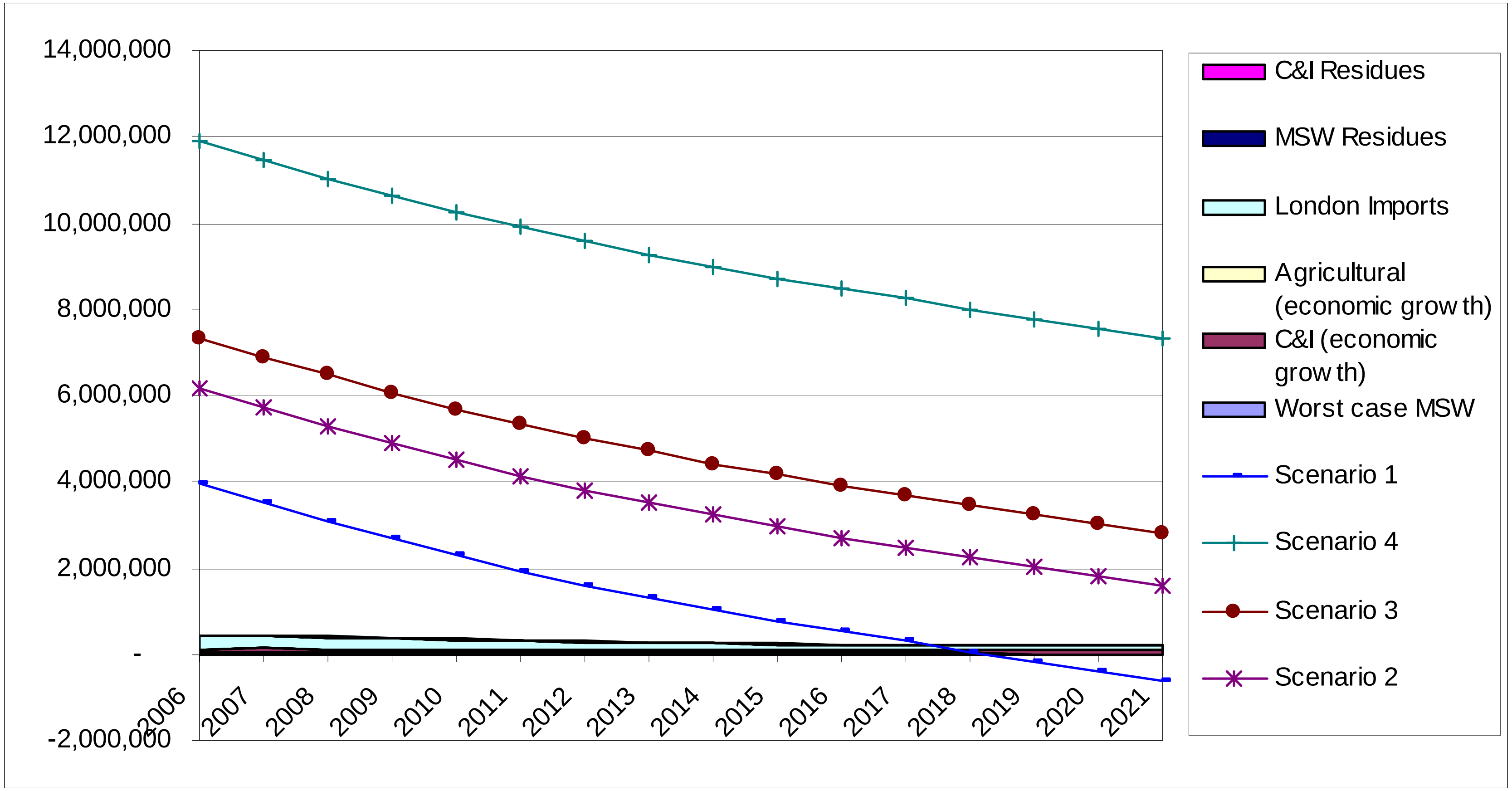


Figure 4.4 *C&D Waste for Landfill and Treatment Residues vs Inert Landfill Capacity (Worst Case Scenario) (tonnes)*

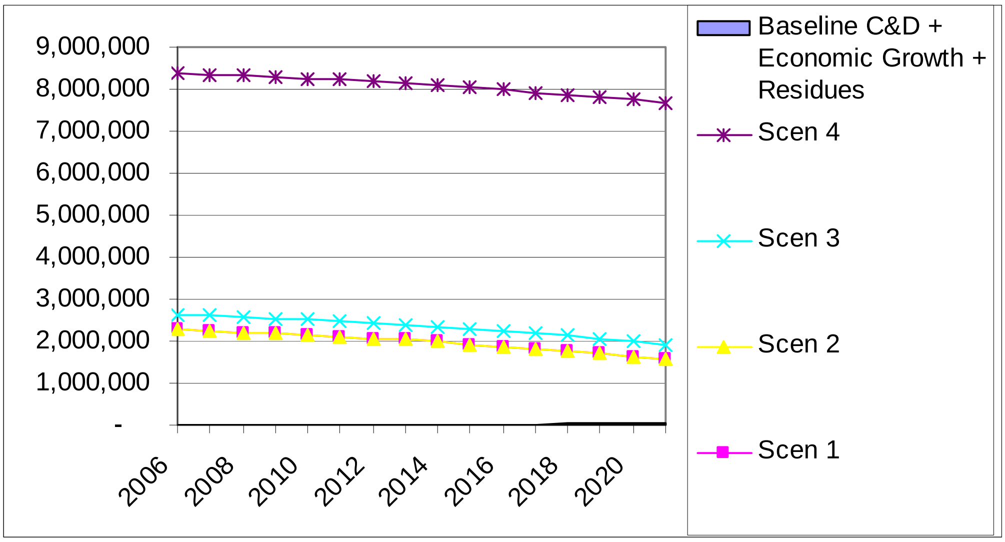


Figure 4.5 *C&D Waste for Landfill and Treatment Residues vs Inert Landfill Capacity (Medium Case Scenario) (tonnes)*

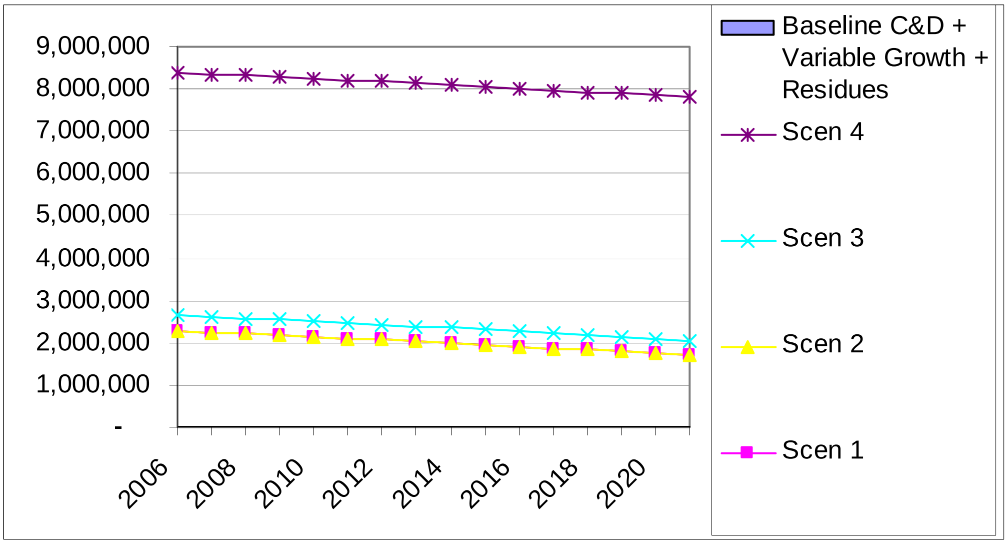
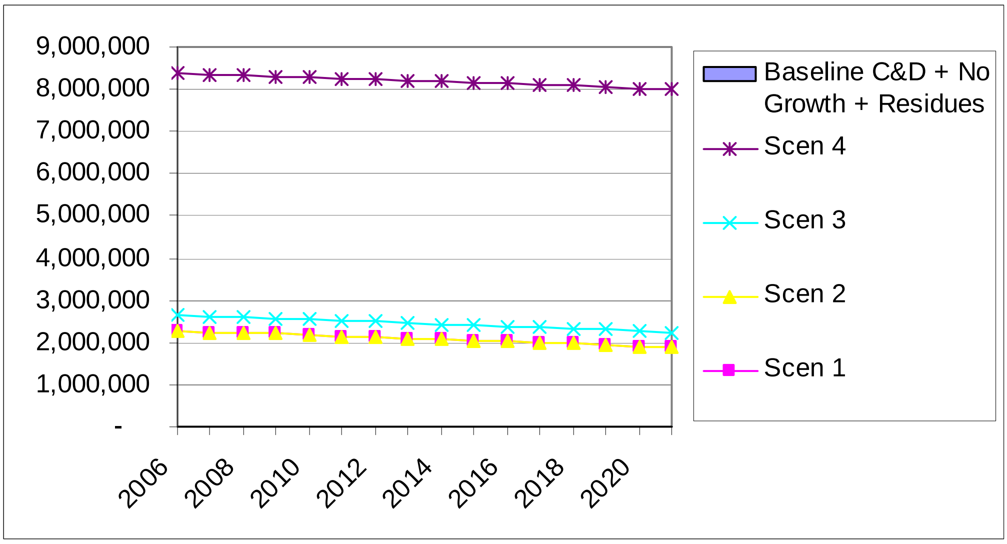


Figure 4.6 *C&D Waste for Landfill and Treatment Residues vs Inert Landfill Capacity (Best Case Scenario) (tonnes)*



Annex D

Apportionment Sensitivity Analysis

1 SENSITIVITY ANALYSIS

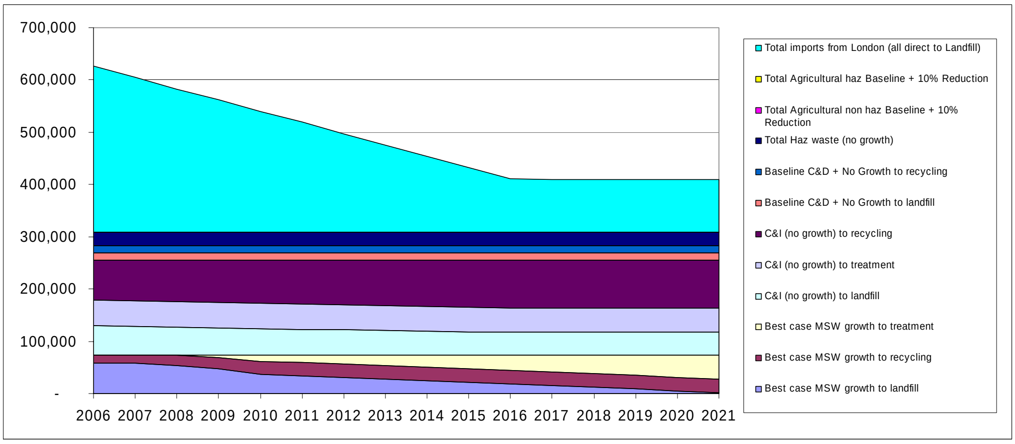
1.1 THURROCK ALTERNATE APPORTIONMENT

Table 1.1 Imports of Waste from London to Thurrock Based on Alternate 13.4% Apportionment (tonnes)

Thurrock	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/2	2012/3
Tonnes imported	318,250	296,266	274,281	253,344	231,359	210,422	188,438	166,453
Thurrock	**2013/14**	**2014/15**	**2015/16**	**2016/17**	**2017/18**	**2018/19**	**2019/20**	**2020/21**
Tonnes imported	145,516	123,531	102,594	101,547	101,547	101,547	101,547	101,547

The alternate apportionment above is 0.6% higher than that used in the report. The sections below show the relevant sections from the report with amendments associated with the new apportionment.

Figure 1.1 Total Arisings (New Apportionment) (tonnes)



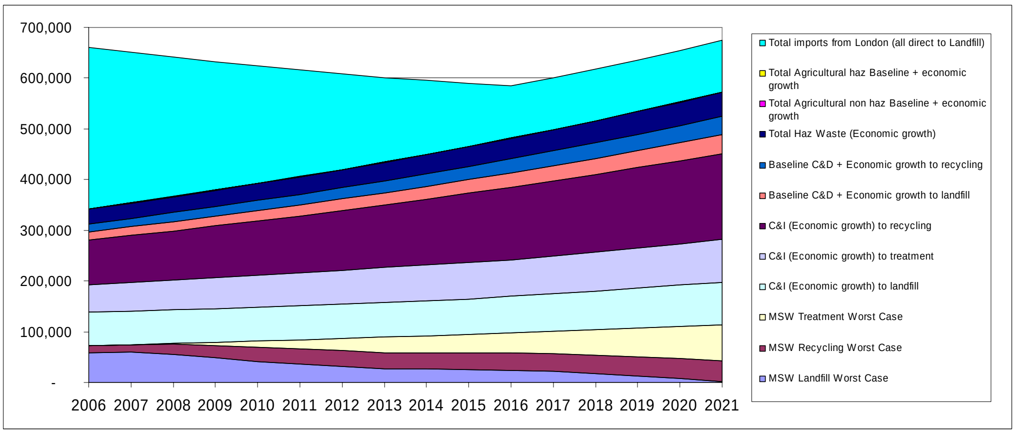
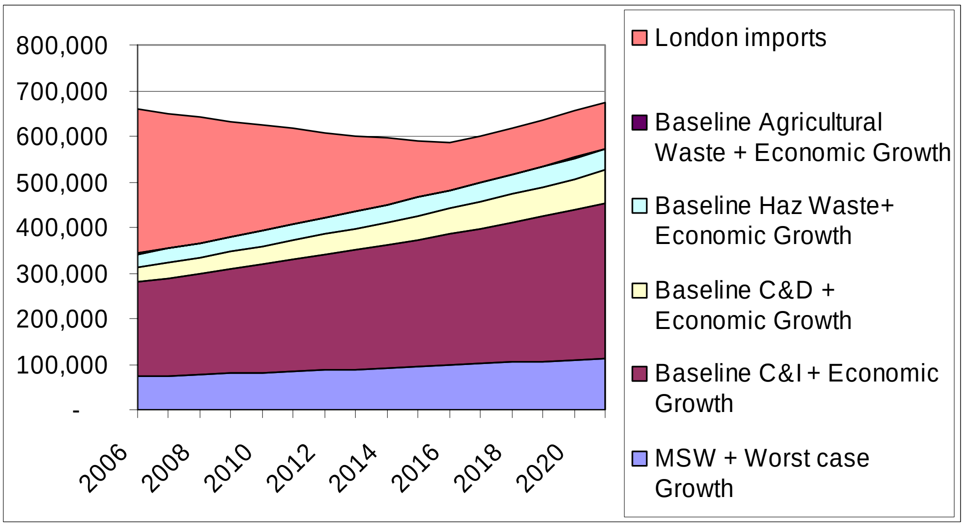
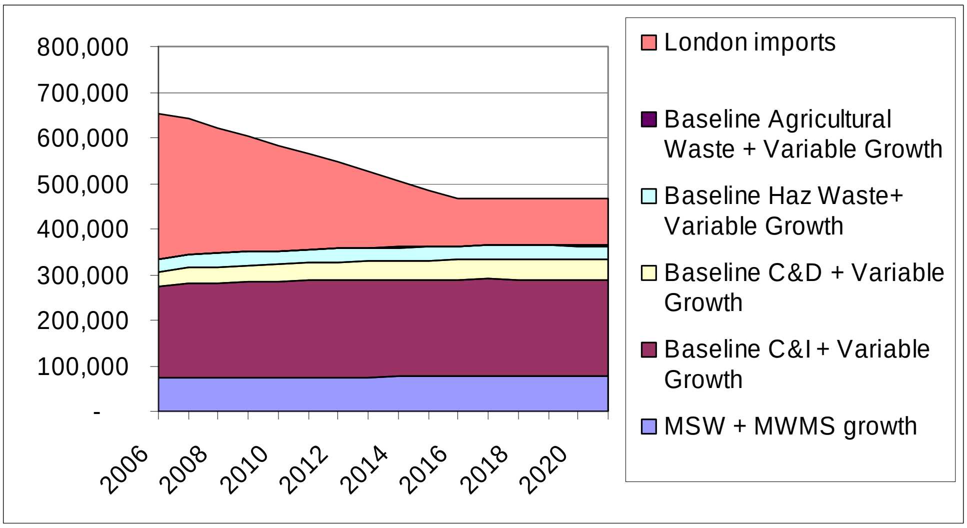


Figure 1.2 *Arisings by Destination (New Apportionment) (tonnes)*





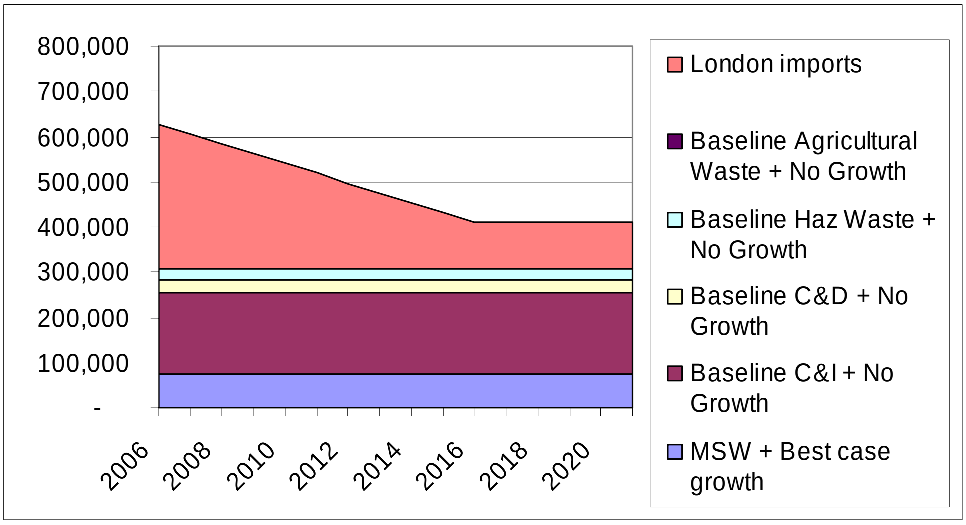
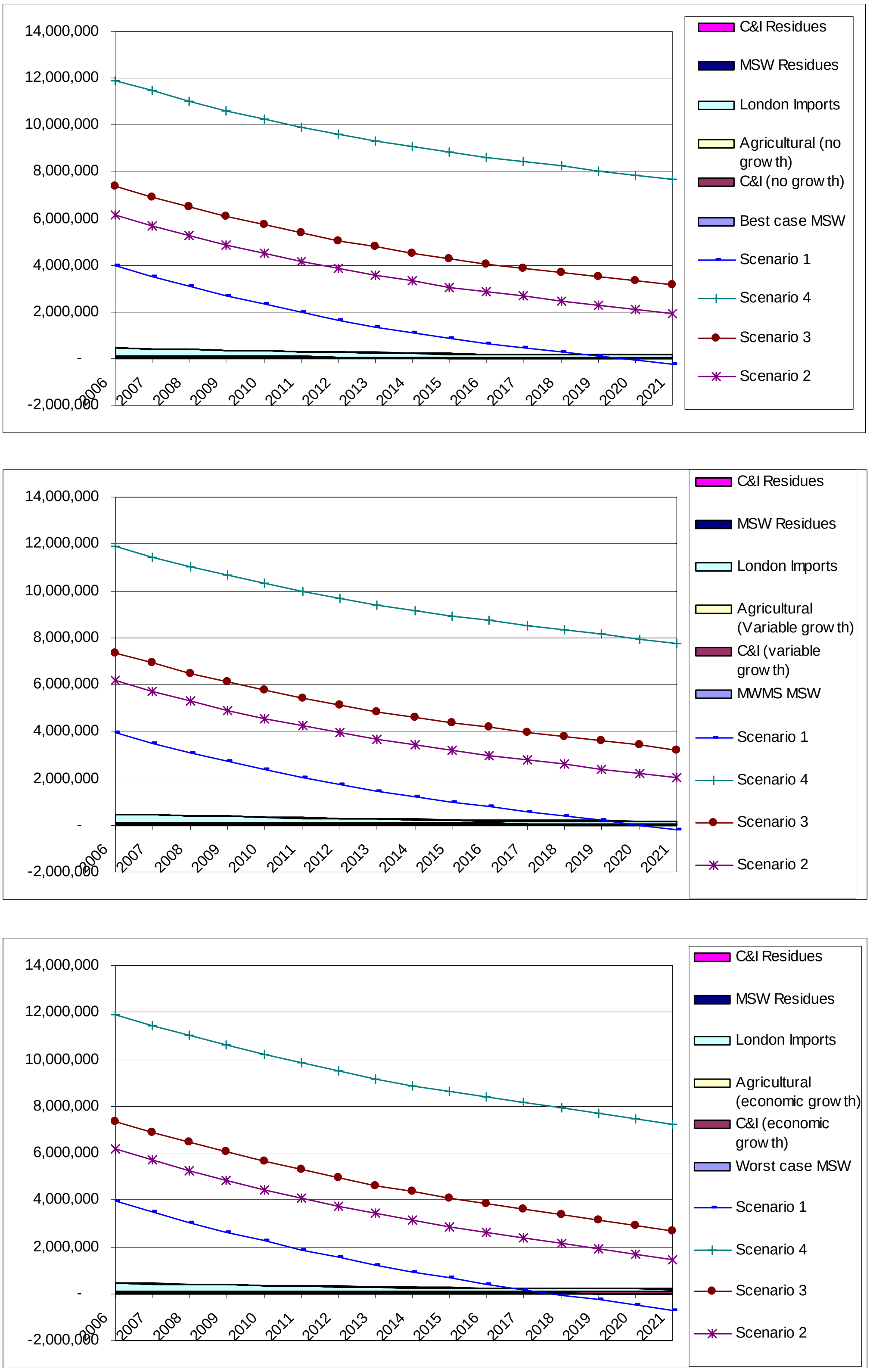


Figure 1.3 Arisings vs Non Hazardous Landfill (New Apportionment) (tonnes)



The charts show that the new apportionment has very little difference on the outcome of the study and that the effects are largely insignificant. By 2021, Thurrock would require an extra 140,000 tonnes of landfill under the worst case scenario compared with the apportionment used in the report. The date when landfill capacity is exhausted does not change, and in most cases is never reached.

Annex E

C&D Arisings Figures

Table 1.1 C&D Waste for Forecasts for Recycling (tonnes)

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Baseline + Economic Growth	16,019	16,912	17,853	18,848	19,898	21,006	22,176	23,411	24,715	26,091	27,545	29,079	30,698	32,408	34,213	36,119
Baseline + Variable Growth	16,019	16,912	17,370	17,840	18,323	18,819	19,329	19,754	20,188	20,631	21,084	21,548	21,911	22,280	22,656	23,038
Baseline + No Growth	13,615	13,615	13,615	13,615	13,615	13,615	13,615	13,615	13,615	13,615	13,615	13,615	13,615	13,615	13,615	13,615

Table 1.2 C&D Waste for Forecasts for Landfill (tonnes)

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Baseline + Economic Growth	16,585	17,508	18,483	19,513	20,600	21,747	22,958	24,237	25,587	27,012	28,516	30,105	31,781	33,551	35,420	37,393
Baseline + Variable Growth	16,585	17,508	17,982	18,469	18,970	19,483	20,011	20,451	20,900	21,359	21,828	22,308	22,684	23,067	23,455	23,851
Baseline + No Growth	14,096	14,096	14,096	14,096	14,096	14,096	14,096	14,096	14,096	14,096	14,096	14,096	14,096	14,096	14,096	14,096

Table 1.3 Total C&D Waste Forecast (tonnes)

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Baseline + Economic Growth	32,604	34,420	36,337	38,361	40,497	42,753	45,134	47,648	50,302	53,103	56,061	59,183	62,479	65,959	69,633	73,511
Baseline + Variable Growth	32,604	34,420	35,352	36,309	37,293	38,303	39,340	40,204	41,087	41,990	42,913	43,856	44,595	45,347	46,112	46,889
Baseline + No Growth	27,711	27,711	27,711	27,711	27,711	27,711	27,711	27,711	27,711	27,711	27,711	27,711	27,711	27,711	27,711	27,711