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CON900-001: Final Report

Construction, demolition and excavation waste arisings, use and disposal for England 2008

An analysis of existing data, supplemented by some original survey research, to provide estimates for the levels of arisings, use and disposal of the full range of construction, demolition and excavation wastes in England in 2008.

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WRAP's vision is a world without waste, where resources are used sustainably.

We work with businesses and individuals to help them reap the benefits of reducing waste, develop sustainable products and use resources in an efficient way.

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Front cover photography: Major construction site - Capita Symonds Ltd.

Executive summary

The downturn in construction activity that started in mid-2008 led to a fall in the production of construction, demolition and excavation waste (CDEW). This report seeks to establish the changes that occurred between 2005 and 2008. Most of the differences identified can be accounted for by reduced tonnages of excavation waste.

Considerable care must be exercised when interpreting estimates for non-inert CDEW, because so much of it is handled more than once by licensed waste facilities, with residues from treatment then mixed with other wastes. Nevertheless, there is clear evidence that about 85% of all CDEW is either recovered or beneficially re-used without further processing.

This report pays particular attention to what happens to the non-inert fraction when it is in the custody of waste treatment and transfer facilities.

In 2005 estimates were generated for certain key components of mainly-inert CDEW in England. This project has sought to update those estimates, and to extend the coverage of the estimates to include the non-inert waste streams (wood, plastics, metals etc).

The headline figures and 'like-for-like' comparisons are shown in Table 1. Subject to the *caveat* that the data were collected in different ways in 2005 and 2008, and that therefore the categories are not always directly comparable, they show that arisings of the mainly inert fractions of CDEW fell by 7% over the 3-year period, and that the tonnage of largely inert CDEW sent to landfill fell by 30% (with the fall in beneficially used CDEW being steeper, reflecting at least in part the reduction in landfilling of municipal waste, and the reduced need for engineering materials). It is highly likely that the total level of arisings rose in 2006 and 2007 before falling in 2008, with the final year-on-year fall being appreciably steeper than the fall since 2005. A fuller discussion on these estimates is contained in Chapter 7.

Table 1: Comparison between estimated arisings of CDEW in 2005 and 2008 (million tonnes)

	2005	***2008***	***Change***
'Hard inert' CDEW generating recycled aggregate	42.07	43.52	+3%
Inert CDEW recovered as recycled soils	4.36	9.21	+111%
Waste (mainly excavation waste) spread on exempt sites	15.44	10.98	-29%
Mainly inert CDEW beneficially used for landfill engineering / capping	9.61	10.60	-47%
Mainly inert CDEW beneficially used to restore former quarries	10.24		
Other largely inert CDEW deposited at landfills as waste	7.90	8.93	+13%
Sub-total (largely inert CDEW)	89.63	83.24	-7%
of which deposited at permitted landfills	27.75	19.53	-30%
Non-inert CDEW deposited at permitted landfills as waste	Not estimated	2.87	n/a
Non-inert CDEW sent for external recovery	Not estimated	0.82	n/a
Total (all lines)	n/a	86.93	n/a

Notes: See detailed discussion in Chapter 7.
Source: Capita Symonds

The rise in production of recycled aggregate, and the rise in the proportion that is graded (and therefore capable of playing a more demanding role) is likely to have been helped by investments in improved recovery systems and techniques (e.g. soil and aggregate washing) encouraged by WRAP's (Waste & Resources Action Programme) capital support programmes.

The non-inert fraction of CDEW that is not landfilled is much harder to track and measure because the waste management processes through which it passes are organised more like a web than a processing line, with many fractions passing from facility to facility before the residual waste is landfilled, much of it no longer recognisable as CDEW. Consequently it would be highly misleading simply to add together the outgoing tonnages from all

treatment and transfer facilities in order to estimate how much is treated (or how much arises in the first place), because of the double counting that this would introduce. Nor is it possible to know how much CDEW ends up described as 'post-treatment waste' (i.e. coded as EWC code 19 12 12). What is known is that 0.42 million tonnes of non-inert waste that is disposed of in landfills carries codes that are recognisably linked to CDEW. However, some landfills also include treatment and transfer facilities, and have 'outgoing' waste, which further complicates matters. Nevertheless, it is clear is that the very large majority of CDEW that cannot be used as it arises is subjected to some form of treatment, with the objective of recovering value from it before the residual fraction is landfilled, or burned.

Given these uncertainties, the figure of 86.93 million tonnes given in Table 1 should not be regarded as definitive, since it certainly omits some metals, as well as a proportion of some CDEW materials (such as wood and plastics) which are recovered, but only after they have been mixed with other comparable wastes from other sectors of the economy, and have therefore 'lost' their CDEW-related waste codes.

Most of the component parts which make up these estimates are derived from official site returns made to the Environment Agency, but subject to a fair degree of interpretation, which is explained in detail in the main report. The way in which the other data have been collected and estimated would not support the generation of statistically-derived bands of uncertainty around the central estimates.

Some suggestions which would increase the precision of future estimates have been made at the end of the report.

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- the information provided by the National Federation of Demolition Contractors, via WRAP;
- the survey returns provided by recycled aggregate producers and landfill operators;
- the cooperation of all the operators of waste treatment and transfer facilities who allowed members of the project team to visit their facilities; and
- the contribution of Simon Ingleby of Alfatek Redox UK who provided specialist expertise on the waste treatment and transfer sector as a member of the project team.

1.0 Introduction

1.1 Scope of the project

Project CON900-001 has been concerned with updating information on construction, demolition and excavation waste (CDEW). Its purpose was to determine (for England in the year 2008):

- the tonnages of different CDEW streams that were recovered through recycling and beneficial re-use; and
- the tonnages of different CDEW streams that were disposed of to landfill.

The output from the project is required to enable WRAP to identify areas for improved resource efficiency, and to inform work on the management and recovery of CDEW in line with the target of 'Halving Waste to Landfill' by 2012.

Capita Symonds' approach has been to make best use of such data as are already collected by the Environment Agency via site returns from permitted sites and from the operators of those sites where activities covered by registered exemptions are taking place. Only where such data do not provide sufficient coverage or detail have original data been collected. Such original data collection was focused on two main areas:

- the recycling of inert CDEW into aggregate and/or soil; and
- methods used to sort, treat and recover value from the mixed CDEW stream classified under European Waste Catalogue (EWC) code 17 09 04 ('mixed construction and demolition wastes other than those mentioned in 17 09 01, 17 09 02 and 17 09 03').

Appendix 1 sets out all of the EWC codes[1] which have been considered for the purposes of this project to comprise CDEW, and the ways in which those codes have been grouped together. As can be seen there, as well as almost all of Chapter 17 (but not including dredging waste) this includes other codes, including some from Chapter 19 and one each from Chapters 10 and 20, and some from the no-longer extant Chapters 21, 22, 24 and 26 of the 'UK Waste Classification System: Waste Composition Categories (16th draft)', which was withdrawn around 2000. Such codes have been included where it is clear from the user's own descriptions that the waste concerned was very probably CDEW.

Whereas reasonable quality estimates covering the arisings, use and disposal of the mainly inert fractions of CDEW have previously been generated and published by Government[2], only preliminary estimates covering the more varied non-inert fraction which is central to the attainment of 'Halving Waste to Landfill' have been made.

WRAP's original Tender Invitation Document (TID) required the data to be collected over the course of this project to be able to identify:

- the recovery of aggregates and soils through fixed recycling sites, including waste transfer stations (WTSs) and materials recovery facilities (MRFs) and on-site demolition activities;
- the recovery of other materials, such as wood, plastic, glass, plasterboard, metals and refuse-derived fuel (RDF) at waste treatment and transfer facilities;
- the beneficial use of inert CDEW at 'paragraph9&19 registered exempt sites';
- the beneficial use of inert CDEW, under an exemption from landfill tax, for the infilling of a quarry where such infilling results from a site restoration obligation created by a planning condition;
- the beneficial use of inert CDEW for the purposes of site restoration or engineering at permitted landfills; and
- the residual tonnage of CDEW disposed of to landfill, and its constituent materials.

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[1] The codes are referred to throughout this report as EWC codes, though they are in effect the same codes as are set out in the List of Waste Regulations which came into force in England on 16 July 2005.

[2] See, for example, 'Survey of Arisings and Use of Alternatives to Primary Aggregates in England, 2005: Construction, Demolition and Excavation Waste' by Capita Symonds in association with WRc, published February 2007 by the Department for Communities and Local Government, ISBN 978 1 85112 875 4. Comparable estimates were generated and published 2, 4 and 6 years earlier.

1.2 Approach taken

1.2.1 Overview

Capita Symonds has previously been responsible for the collection, analysis and interpretation of statistics on the arisings, use and disposal of the inert fraction of CDEW, via a series of national surveys commissioned by DCLG and its predecessor departments. (See the footnote on the previous page for details. Those projects are referred to later in this report as 'previous national CDEW surveys').

Those previous national CDEW surveys were primarily concerned to establish the level of aggregate recycling and the potential for further recycling in future, but inevitably required the collection of some data on the non-recycled fraction, in order to quantify the extent to which further recycling might be feasible. Data were collected at necessary bottlenecks (to avoid problems with double counting), namely at the point of processing (for the recycled element), and at the point of use or disposal (for unprocessed waste). Data were therefore collected from operators of mobile crushers and screens, from landfill operators and from those responsible for sites with exemptions from waste management licensing involving the beneficial re-use of soil, CDEW and certain other largely inert waste materials.

Typically the surveys took between 10 and 12 months to complete, with a substantial element of the time taken up with the preparatory phase, particularly for surveys of operators of mobile crushers and screens. On this occasion it was agreed that the research team would:

- run a limited survey of inert CDEW recyclers;
- draw on information collected from its members by the National Federation of Demolition Contractors to provide a 'second opinion' on the state of the sector;
- make maximum use of data collected by the Environment Agency (i.e. site returns from operators of landfills, waste treatment and transfer facilities; and data provided by those who have registered a relevant exemption to environmental permitting);
- collect targeted information (primarily on the waste fraction that is sent to landfill) from operators of waste treatment and transfer facilities; and
- run a formal survey of selected landfill operators.

Because there is overlap between some of these groups (notably those recyclers of inert waste who also handle and/or recycle the non-inert fraction of CDEW) it was important to coordinate the various data collection exercises to avoid over-taxing the good will of operators in this sector.

1.2.2 Recovery of aggregate and soil

Recovery of aggregate and soil can take place at the point of arising (i.e. on those demolition / construction sites which have enough space to allow materials to be crushed and/or screened prior to beneficial re-use at the same location) or at a fixed recycling centre (typically permitted by the Environment Agency as a waste treatment or transfer facility, but possibly associated with a landfill, quarry or other facility).

Carrying out a full survey of this sector, using mobile crushers as the 'grossing-up' factor as has been done for previous national CDEW surveys, is a time-consuming exercise. This is because it is necessary to update the operator database before starting any survey activities (because there has always been considerable 'churn' from year to year, with new operators entering the sector, and some old ones either changing their scale of operation or, in a few cases, leaving the sector altogether).

The method on this occasion took advantage of the fact that Capita Symonds had access to over 200 original survey returns for 2005, from active aggregate recyclers spread across England. Since those data were collected in 2006 under a guarantee of confidentiality, that undertaking had to be fully respected. By re-surveying the same groups of operators in 2009 asking about their levels of activity in 2008 it was possible to generate a series of 'anonymous but matched data pairs' as well as a series of totals and sub-totals from the responding group. This means that it has been possible to quantify very precisely the changes experienced by the responding group between 2005 and 2008, and then to project those changes onto the national estimates from 2005 to generate an equivalent estimate for 2008.

This approach has also utilised one of the key findings from the 2005 survey, namely that operators differ in their scale of recycling activity depending on whether they are based in the urban fringe or in more urban or more rural areas.

The details of the survey method and processes are set out in Appendix 2, and the findings are reported in Chapter 2.

1.2.3 Recovery of the non-inert fraction

Many waste treatment and transfer facilities sort materials in preparation for their subsequent treatment and/or recovery. The residual fraction may then go to landfill, or to another waste management facility such as an incinerator. In some cases it goes to another waste treatment or transfer facility.

Capita Symonds has previously wrestled with the complexities of this segment of the recycling industry[3], and concluded based on that experience that conventional surveys of such facilities are of very limited value (not because it is impossible to ask the questions whose answers would provide the information required, but because such a complex form would be unlikely to elicit a sufficiently large or representative response).

The preferred approach was to obtain 'raw data' from the Environment Agency's site returns for all waste treatment and transfer facilities, and then to analyse their returns (both incoming and outgoing tonnages), concentrating on those EWC codes that cover CDEW (as detailed in Appendix 1).

This was expected:

- to generate information on the numbers and types of sites that accept different sorts of CDEW;
- to quantify what proportions of total relevant tonnages can be accounted for by large, medium and small sites (defined by the total tonnages that they actually accept in a year); and
- to provide a better understanding of that fraction of the waste which leaves treatment and transfer facilities bound for a landfill or incinerator.

Having done the above, it was possible to send team members to visit selected clusters of waste treatment and transfer facilities for relatively short visits (1-2 hours per visit), with the objective of reviewing all relevant facilities in three contrasting geographical areas (defined by local authority boundaries). The purpose was to gain a snapshot of the full picture facing construction companies in those areas. Where it was not possible to persuade the operator of a relevant site to allow a formal visit, limited conclusions about their operations based on websites, published data, and observations made from public land were to be drawn. The objective in all cases was to understand the nature (and variability) of typical loads of mixed residual waste bound for landfill, and to do this in the context of the operational constraints and practices at the sites concerned.

The analysis of Environment Agency site returns is set out in Appendix 3, and the activities associated with the site visits are detailed in Appendix 4.

Chapter 3 provides an overview of the sector, and Chapter 4 deals more specifically with the ways in which mixed CDEW is handled and recovered at waste treatment and transfer facilities.

1.2.4 Beneficial re-use of inert CDEW at Paragraph 9&19 Sites

The approach proposed was to subject 'raw data' from 2008 on Paragraph 9&19 exemptions from the Environment Agency to the same process of sorting, filtering and analysis as was done in 2006 for the previous national report on CDEW arisings, re-use and disposal (as described in Chapter 6 of the DCLG Project Report cited above). This could be expected to generate a directly comparable estimate for beneficial re-use at registered exempt sites.

Appendix 5 sets out the processes and analyses to which the Environment Agency data were subjected, and Chapter 5 describes the key findings.

[3] *See the report on WRAP project WAS011 'Recycling Rates for non-Inert C&D Waste', June 2007.*

1.2.5 *Beneficial re-use of inert CDEW at licensed landfills, and disposal as waste of the residual waste streams*

Capita Symonds' proposal was to analyse landfill site returns data from the Environment Agency, in order to quantify (without any sampling error or similar) the total tonnage of CDEW entering landfills in 2008. It was also proposed to make a comparison with information from HM Revenue & Customs collected as a consequence of Landfill Tax collection. Data were also received and analysed on the relatively minor tonnages of wastes dispatched by landfills to other waste management facilities.

It was recognised that although this would allow a comparison to be made between the total relevant tonnages reported in 2008 and the estimates generated via the 2005 survey (referenced above), there would be no categorisation into beneficial use and disposal as waste. In order to make that necessary categorisation it was proposed that a postal survey be run of all relevant landfills, based very closely on the survey form used in 2006.

Appendix 6 sets out an analysis of the site returns data provided by the Environment Agency, and Appendix 8 describes the survey method that was used.

Chapter 6 presents the key findings from the analysis and survey, distinguishing between beneficial use of materials within landfills, and disposal of waste (including a breakdown of the materials concerned).

2.0 The recovery of aggregate and soil

2.1 Previous survey results

The demolition, quarrying and waste management industries have all contributed to a situation in which large volumes of mainly inert CDEW are recovered and re-used as aggregate and soil, often on the sites where the waste originally arises. The Mineral Products Association Sustainable Development Report for 2009 estimates that over Great Britain as a whole 25% of the supply of aggregate materials comes from the recycled and secondary materials, meaning that in many parts of England the figure is between 25% and 30%.

The last national survey of recycling activity took place in 2006, and covered activity in the year 2005. The key findings of that survey are summarised in Table 2.1 below. References to population density bands should be interpreted as follows:

- all density calculations used 2001 Census data as reported at local authority level;
- 'low density' (or rural) areas comprise those areas where the population density was 1,000 or fewer persons per km²;
- 'medium density' (or urban fringe) areas comprise those areas where the population density was greater than 1,000 persons per km² but no more than 2,000;
- 'high density' (or urban) areas comprise those areas where the population density exceeded 2,000 persons per km².

Table 2.1: Key results for the recycling of aggregate and soil in 2005, by population density band

	Low density	***Medium density***	***High density***	***Total***
Mean tonnes of recycled aggregate per crusher	44,869	66,271	41,658	46,968
Mean tonnes of recycled soil per crusher	3,856	9,519	4,755	4,819
Grossed-up production of recycled aggregate (million tonnes)	24.33	8.41	9.34	42.07
Grossed-up production of recycled soil (million tonnes)	2.09	1.21	1.07	4.36

Source: Survey of Arisings and Use of Alternatives to Primary Aggregates in England, 2005: Construction, Demolition and Excavation Waste (DCLG, 2007)

2.2 2008 results

A directly comparable survey covering 2008 results was run during 2009. The 2009 survey form used very much the same wording for questions as had been used in 2006, and was sent to the companies that had responded in 2006. Further information on the questions and the process of survey organisation can be found in Appendix 2.

Table 2.2 gives the key results, comparing the returns provided by the 80 companies that responded in 2009 with the returns provided by that identical group of respondents three years earlier.

However, when looking at Table 2.2 it is important to appreciate that the 80 respondents were not fully representative of the national population of aggregate recyclers (being more urban than average), with the consequence that the growth in recycled aggregate that they reported needs to be re-weighted before a national estimate can be obtained, just as it was in 2006.

Table 2.2: Recycled aggregate and soil - key comparisons between 2005 and 2008 from 80 respondents, by population density band

	Low density	*Medium density*	*High density*	*Total*
Number of mobile crushers, 2005	56	9	21	86
Number of mobile crushers, 2008	68	10	25	103
% change 2005 to 2008	+21.4%	+11.1%	+19.0%	
Tonnes of graded aggregate, 2005	981,731	373,447	1,230,395	2,585,573
Tonnes of graded aggregate, 2008	1,474,859	607,799	1,960,911	4,043,569
% change 2005 to 2008	+50.2%	+62.8%	+59.4%	
Tonnes of ungraded aggregate, 2005	1,637,673	166,788	291,549	2,096,010
Tonnes of ungraded aggregate, 2008	725,417	33,250	174,317	932,984
% change 2005 to 2008	-55.7%	-80.1%	-40.2%	
Total tonnes of recycled aggregate, 2005	2,619,404	540,235	1,521,944	4,681,583
Total tonnes of recycled aggregate, 2008	2,200,276	641,049	2,135,228	4,976,553
% change 2005 to 2008	-16.0%	+18.7%	+40.3%	
Tonnes of recycled soil, 2005	203,617	26,806	69,897	343,081
Tonnes of recycled soil, 2008	286,845	129,682	27,657	276,539
% change 2005 to 2008	+40.9%	+383.8%	-60.4%	

Source: Capita Symonds, 2009 survey

What Table 2.2 shows goes well beyond an overall growth of 6.3% from these specific respondents in their production of recycled aggregate (from 4.68 to 4.98 million tonnes). It shows that there was a very large shift in the share of output taken by graded aggregate (reversing the switch reported in 2005, when most of the growth came from ungraded aggregate), and a very different picture in the three population density bands. Specifically, growth was much stronger in high and medium density areas (40.3% and 18.7% respectively), whereas output actually fell by 16.0% in low density areas, which is where most recycling has traditionally occurred.

Applying these three separate growth rates to the three components of the 2005 grossed-up estimate for recycled aggregate (as reported in Table 2.1) results in the following outcome:

- 24.33 million tonnes minus 16.0% in low density areas (i.e. 20.44 million tonnes);
- 8.41 million tonnes plus 18.7% in medium density areas (i.e. 9.98 million tonnes);
- 9.34 million tonnes plus 40.3% in high density areas (i.e. 13.10 million tonnes); giving
- a total estimate for 2008 of 43.52 million tonnes (an overall rise of 3.4% over the 2005 total).

This would be consistent with strong output growth in 2006 and 2007, and a decline in 2008 ranging from modest (in urban areas and the urban fringe) to precipitate (in rural areas).

Such differences between urban and rural areas would be at least partly explained by projects in urban areas being larger, and therefore taking longer to get through committed work (whereas smaller projects which have not started can more easily be put on hold).

The clear switch from ungraded to graded recycled aggregate may also be explained in part by WRAP's capital support programme, which has favoured higher recovery rates and better quality outputs (via, for example, washing plants which enable materials which would have simply been used as general fill to be recovered as graded aggregate).

When the same process is gone through for soil recovered by aggregate recyclers, the outcome is as follows:

- 2.09 million tonnes plus 40.9% in low density areas (i.e. 2.94 million tonnes);
- 1.21 million tonnes plus 383.8% in medium density areas (i.e. 5.85 million tonnes);
- 1.07 million tonnes minus 60.4% in high density areas (i.e. 0.42 million tonnes); giving
- a total estimate for 2008 of 9.21 million tonnes (an overall rise of 111.2% over the 2005 total).

Considerable caution should be attached to this estimate, because soil recovery is both a secondary and a relatively minor activity for these operators, subject to much greater swings. There are also fewer grounds for

assuming that in this case respondents' responses will be fully representative of the industry as a whole. That said, some of the newer equipment (such as washing plants) could expect to increase their recovery rates.

2.3 Underlying evidence of change

The 2005 results were based on returns from 207 recycling operators. They owned 225 mobile crushers between them (145 working in low density areas, 30 in medium density areas, and 50 in high density areas). As Table 2.2 shows, on this occasion (2009), replies were received from 80 of those same operators.

In 2005 those 80 operators owned 86 mobile crushers (56, 9 and 21 in low, medium and high density areas respectively), whereas by 2008 their crusher fleet had expanded to 103 machines (68, 10 and 25 by density band). This suggests that prior to the very obvious downturn in construction activity experienced during the second half of 2008, the recycling sector had continued to expand since 2005.

Over the period 2001-05 output of recycled aggregate had grown by 3.7% a year. Had that rate continued unabated, output of recycled aggregate would have reached 46.91 million tonnes by 2008. Based purely on the number of crushers owned by the 80 respondents, an even higher rate of growth would have been expected (given that a growth from 86 to 103 over three years represents year-on-year growth of just over 6.1%).

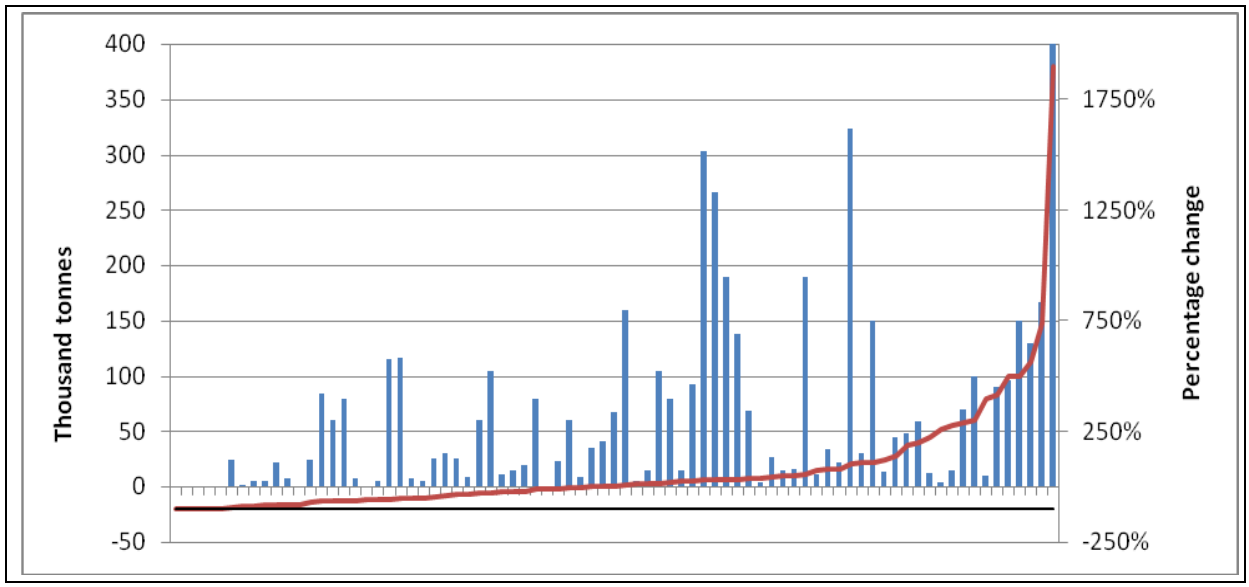
Underlying these results is a full set of 80 individual returns, from which the key results have been extracted into Table A2.1 in Appendix 2. As can be seen there, the changes in throughput reported by individual respondents were much more varied than might have been expected, ranging from -100% to >+100%, and certainly not clustered around ± 10%, as might have been expected. For every respondent that had experienced a steep drop-off in business, another had experienced an equivalent expansion, emphasising the dangers of relying on anecdotal evidence.

Although it is very difficult to capture these results in a single graphic, Figures 2.1 to 2.3 illustrate different aspects of the changes, based on recycled aggregate (i.e. not split between graded and ungraded materials). Figures 2.1 to 2.3 contain 79 data pairs, and omit one return which reported recycling soil but not aggregate in both 2005 and 2008.

- Figure 2.1 shows the percentage changes (plotted as a line) encountered by each respondent (between 2005 and 2008), arranged from the largest falls (five sites with -100%, resulting in zero tonnes in 2008) to the highest growth. The data bars represent the tonnages reported by each respondent in 2008.
- Figure 2.2 shows exactly the same percentage change line, and the same sequence of sites, but plots the 2005 tonnages as data bars. This confirms that the most spectacular growth was experienced at sites where the original tonnage was relatively modest.
- Figure 2.3 shows exactly the same percentage change line, but shows the absolute tonnage change between 2005 and 2008 as data bars.

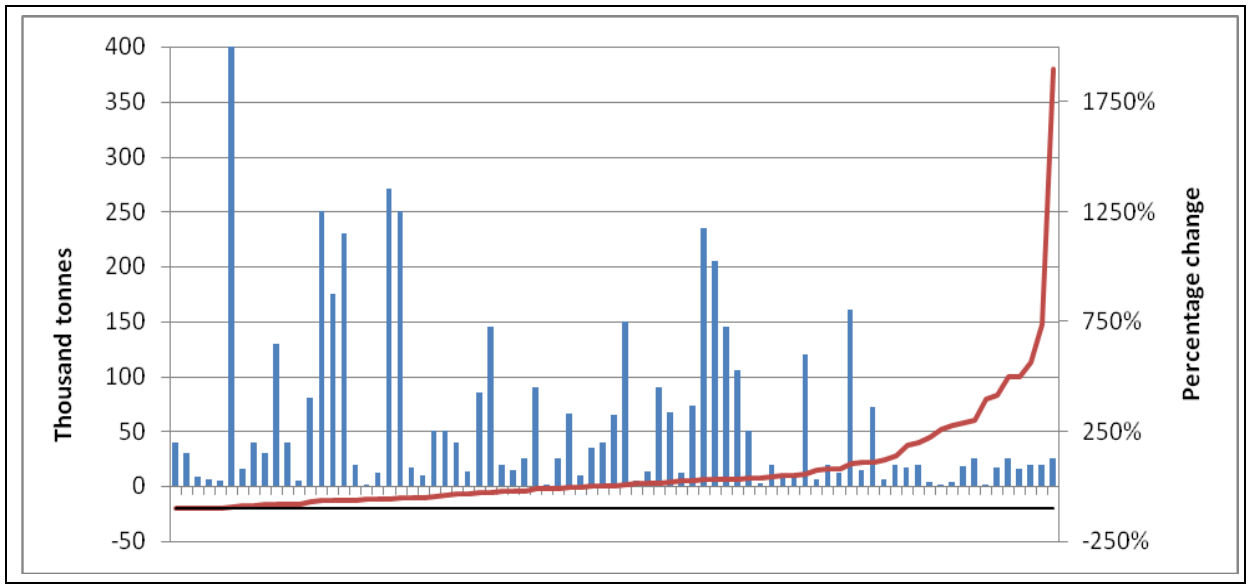
In all three Figures there is a horizontal line at -100%.

Figure 2.1: Percentage changes since 2005 and resultant (2008) tonnages at respondents' aggregate recycling businesses



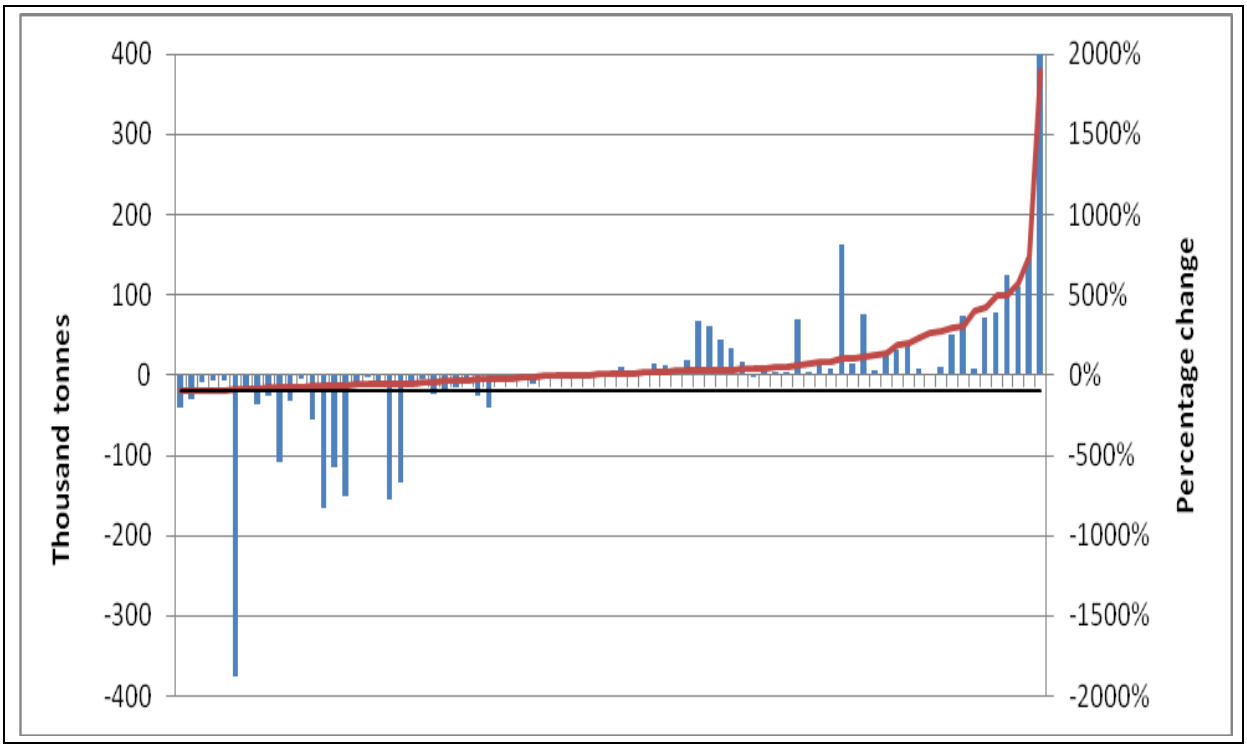
Source: Capita Symonds, 2009 survey

Figure 2.2: Percentage changes since 2005 and starting (2005) tonnages at respondents' aggregate recycling businesses



Source: Capita Symonds, 2009 survey

Figure 2.3: Percentage changes (plotted as a line) and tonnage changes (plotted as bars) between 2005 and 2008 at respondents' aggregate recycling businesses



Source: Capita Symonds, 2009 survey

2.4 Comparison with data from the National Federation of Demolition Contractors

The National Federation of Demolition Contractors (NFDC) collects and collates data from its members on their recycling activity. These data are produced each year, and aggregated regionally. Although it is easy to remove returns from Scotland and Northern Ireland, those from Wales are included with the English midlands. The 2008 returns show a total of 21.62 million tonnes of hardcore produced in England and Wales, split as follows:

- 1.60 million tonnes used on site without processing;
- 12.00 million tonnes processed and used on site;
- 3.33 million tonnes processed on site for use elsewhere; and
- 4.70 million tonnes removed from site for processing (or use) elsewhere.

This compares with a total of 17.97 million tonnes in 2005, suggesting that there has been a 21% increase over three years. This is broadly consistent with the returns to the survey carried out for this study reported by crusher operators in high and medium population density areas, which is where most active demolition work (as opposed to civil engineering work) would be expected to be found.

The same NFDC members also reported:

- 1.05 million tonnes of non-hardcore waste sent for some form of recovery;
- 0.85 million tonnes of waste sent to non-hazardous waste landfills; and
- 0.64 million tonnes of waste sent to hazardous waste landfills.

This would be consistent with the following ratios:

- for every 1,000 tonnes of hard inert CDEW: 117 tonnes of other (non-soil) CDEW from demolition; and
- for every 1,000 tonnes of hard inert CDEW: at least 69 tonnes of other (non-soil) CDEW from demolition sent to landfill, plus 49 tonnes sent for recovery (of which some is bound to be landfilled as unrecoverable residue).

This does not take any account of CDEW generated during the construction phase of any project (i.e. after the demolition contractor has left the site). The inert:non-inert ratio during construction would be very different.

3.0 Overview of the waste treatment and transfer sector's role in handling CDEW

3.1 Waste treatment and transfer facilities: an introduction

Waste Transfer Stations (WTSs) have been an established feature of the waste management sector for decades. At their simplest they accept waste in small containers, 'make bulk' by combining those small shipments with other directly comparable wastes, and send the wastes on their way in larger containers, possibly after physical consolidation to increase the density, thereby reducing the cost of onward transport. Gradually, activities such as sorting, shredding and crushing were introduced, with those activities still regulated under the same waste management licences (and, latterly, environmental permits) that the sites concerned had held for many years, via a process of amendment.

If some of the more complex facilities were being set up today, they would not be described and permitted as WTSs, but as Waste Treatment Facilities, or Materials Recovery Facilities (MRFs).

Consequently when considering waste treatments and (more particularly) preparatory processes, it is necessary to regard waste treatment and transfer facilities as two components of a single population, while accepting that some WTSs will simply handle waste without treating it in any way.

Matters are further complicated by the fact that some waste treatment and transfer facilities (not to mention composting facilities) are located at landfills, between the 'gate' and the tipping area, with the non-landfill activities nevertheless carried out under an 'umbrella' permit that is still principally concerned with landfilling. This may originally have arisen as a consequence of landfill operators seeking to recover materials that they could use within their landfills (e.g. for engineering, capping or restoration). More recently, the ability to save landfill tax has incentivised operators to divert useable or recoverable materials from landfill, either for sale, or for on-passing to a specialist recovery process. As with those WTSs that have moved into processing by amending their original permits, landfill operators have tended to do this under their landfill-based permit, greatly complicating the process of consolidating into one place all Environment Agency site returns dealing with waste recovery and treatment. There are even some instances where the landfill for which the permit was originally issued has closed, but the treatment and transfer activities remain.

As reported below (in Chapter 6), the indications are that about 4% of all waste that arrives at landfills is then either recovered for re-use elsewhere, or diverted to other waste management facilities (and this does not include those materials which are separated or treated and then beneficially used within the reporting landfills).

The remainder of this section is based on an analysis of data supplied by the Environment Agency attributed to waste treatment and transfer facilities (including some household waste recovery centres, or HWRCs, which are grouped with WTSs in returns to the Agency). The data are presented in much greater detail in Appendix 3.

It is also important to bear in mind that neither the main analysis in Appendix 3 nor most of the discussion in this chapter take account of the tonnages of more general non-CDEW EWC codes (such as 19 12 12, which covers 'other wastes, including mixtures of materials, from mechanical treatment of waste other than those mentioned in 19 12 11'). Although such waste will include a substantial proportion of post-processing mixed CDEW, it will also include residues from many other non-CDEW waste streams. Some data on EWC code 19 12 12 is given in the final section of this Chapter, and at the end of Appendix 3.

3.2 An overview of the number, type and distribution of facilities

3.2.1 Waste treatment facilities

The data file provided by the Environment Agency gives details of the waste entering all treatment facilities in 2008. CDEW, as defined in Appendix 1, was accepted by 270 treatment facilities (a figure which was made up of 47 biological, chemical or physico-chemical treatment plants, 27 composting sites and 196 physical treatment plants or general MRFs). For 184 of these facilities, an outgoing tonnage of CDEW was also reported. Outgoing tonnages of CDEW were also reported by 31 treatment facilities for which no incoming CDEW tonnages were reported in 2008. Twenty of these apparent anomalies were accounted for by small or very small facilities.

With these sorts of facility numbers, they would have to be regarded as relatively specialist (arguably of 'sub-regional significance' in planners' current jargon), and certainly not as offering a neighbourhood service available to all.

As reported in Table A3.7, these facilities received 6.85 million tonnes of CDEW in 2008, and dispatched 3.54 million tonnes for further treatment or disposal (with this figure broken down into 1.31 million tonnes going to other recycling[4] or reprocessing facilities, 0.54 million tonnes going to landfill or incineration and 1.68 going to unidentified destinations). Roughly 95% of these tonnages were accounted for by the physical treatment facilities and MRFs (see Table A3.10), with between two thirds and three quarters of the tonnages being accounted for by the 48 sites that handled more than 40,000 tonnes per year (the size bands that are used in the tables being defined in the introduction to Appendix 3).

As explained in Appendix 3, as well as reporting the total tonnages of CDEW logged by the Environment Agency as passing through the treatment and transfer system, an analysis has been carried out based on those 108 treatment facilities that:

- were described as physical treatment facilities or MRFs;
- did not specialise exclusively in liquid wastes and sludges from soil and groundwater remediation;
- received more than 1,000 tonnes of CDEW (taking all categories listed in Appendix 1 into account); and
- reported both an incoming tonnage and an outgoing tonnage.

These 108 facilities between them received a total of 5.12 million tonnes of CDEW, and dispatched 3.25 million tonnes onwards. This reflects the fact that many of the 'missing incoming / outgoing' tonnage figures affect small facilities.

3.2.2 Waste transfer facilities

The data provided by the Environment Agency gives details of the CDEW entering 1,661 waste transfer facilities in 2008 (a figure which included 337 HWRCs, which were formerly known as CA sites). For 1,568 of these an outgoing tonnage of CDEW was also reported. Outgoing tonnages were also reported by 371 transfer facilities for which no incoming waste tonnages were reported in 2008. Many of these apparent anomalies were accounted for by small HWRCs (where waste is typically delivered by householders, without any formal documentation, but dispatched with a waste transfer note).

Were these facilities to be evenly spread around England, the average exclusive catchment radius would be about 5km. Although reality is inevitably a bit different, at least in numerical terms, most construction firms have a good choice of waste transfer facilities.

As reported in Tables A3.11 and A3.12, these facilities received 16.11 million tonnes of CDEW in 2008, and dispatched 14.20 million tonnes for further treatment or disposal, with over 95% of the weight accounted for by 'true' WTSs. The outgoing tonnage can be broken down into 7.93 million tonnes going to other recycling, reprocessing or treatment facilities (with the same *caveat* as is outlined in the footnote on this page), 3.55 million tonnes going to landfill or incineration, 2.39 million tonnes going to unidentified destinations, and 0.33 million tonnes going to other WTSs.

As Table A3.12 shows, although small and medium-sized facilities handle much less CDEW per facility, there are enough of them to constitute a significant force in the sector, which is much less dominated by large and very large facilities than the treatment sector.

As explained in Appendix 3 as well as reporting the total tonnages logged by the Environment Agency, an analysis has been carried out based on those 861 transfer facilities that:

- were WTSs but not HWRCs;
- received more than 1,000 tonnes of CDEW (taking all categories listed in Appendix 1 into account); and
- reported both an incoming tonnage and an outgoing tonnage.

[4] NB: In this report, a declaration that waste is going for 'recycling' has been interpreted as meaning that it is going for some form of recovery treatment. It could be argued that some respondents really meant that the waste coming out of their facility had been recovered, and was actually going elsewhere for use as a recycled product.

This group of 861 WTSs received a total of 14.83 million tonnes of CDEW, and dispatched 12.55 million tonnes onwards. As with the treatment facilities, this outgoing tonnage does not include any mixed CDEW by then incorporated into more general non-CDEW EWC codes such as 19 12 12.

3.3 Performance of the selected facilities

The data that are reported above make it clear that there is a considerable degree of inter-facility movement where CDEW is concerned. Specifically:

- some WTSs simply bulk up and pass on CDEW to a mixture of other WTSs, treatment facilities and landfills (or incinerators);
- some facilities extract and process certain waste streams (such as hard inert CDEW which can be crushed for use as aggregate, or wood that can be recovered or burned) before passing on some or all of the rest to other better-equipped facilities (which can extract other useful materials before sending the residue to landfill or incineration) and landfilling the rest;
- most of the CDEW reaching treatment facilities (using the Agency's data file breakdown) has probably already passed through at least one transfer facility.

One implication of this is that the true tonnage of CDEW actually entering the 'treatment and transfer system' is considerably less than the 22.96 million tonnes that is obtained by adding up all facilities' incoming CDEW tonnages. The more complex analysis presented in Chapter 7, which takes into account other CDEW flows, suggests that the tonnage entering such facilities directly from the construction sector is 7.82 million tonnes, though this estimate would rise appreciably if the destinations described as 'recycling' were found to involve re-use rather than further recovery processes.

Notwithstanding the considerable caution that should be induced by the considerations set out in the previous text, fortunately there are some valid conclusions that can be drawn, particularly by reference to the detailed breakdown that can be found in Table A3.1 (in Appendix 3).

Subject to the *caveat* that the more the individual components of CDEW are combined into groups, the greater the possibility that clarity may be lost, a reasonable impression of how the various different types of facilities perform (in terms of reducing various categories of mixed wastes, while increasing the share of sorted products) can be gained by looking at Tables A3.2 to A3.5 (also in Appendix 3).

Comparable tables for a selected sub-group of 861 facilities (which reported both incoming and outgoing waste, and can therefore be regarded as more of a closed group than the full data set) can also be found (Tables A3.16 to A3.19 for overall performance, and Tables A3.20 to A3.22 for individual facility types).

The main points to come out of these tables are as follows:

- Over three quarters of the mixed CDEW entering the 'treatment and transfer' system as a whole appears to undergo some form of recovery process. The key evidence in support of this statement is based on the fact that whereas 8.67 million tonnes of EWC code 17 09 04 came into this group of facilities, only 1.90 million tonnes went out unchanged.
- The treatment of this waste stream is likely to have contributed to the increase in (for example) wood, metals, soil and hard CDEW.
- However, it would be wrong to assume that all, or even much, of the rest of the 'missing' tonnage was recovered: a substantial proportion is likely to have ended up being sent onwards as EWC code 19 12 12.

By contrast:

- There were only small differences in the incoming and outgoing tonnages of asbestos and other insulation products, and gypsum. This suggests (as would be expected) that many of the facilities that handle these materials collect them, and pass them on to others for treatment or disposal.
- There was an almost complete removal of liquid and sludge wastes from the treatment of contaminated soil and groundwater, with the treated residue likely to have been discharged to sewer.

Table A3.14 looks specifically at where outgoing waste went next, and certainly merits more than a cursory glance, and is therefore reproduced here as Table 3.1. Table 3.2 then shows (in percentage terms) 'what happened next' to each group of CDEW materials, while Table 3.3 shows the percentage make-up of the tonnage going to each destination type. (This means that the rows in Table 3.2 sum to 100%, whereas in Table 3.3 it is the columns that do so.)

Table 3.1: Subsequent destinations of different waste streams leaving treatment and transfer facilities (tonnes of CDEW, 2008)

	Transfer station	***Landfill***	***Incin-eration***	***Recycl-ing***	***Reproc-essing***	***Treat-ment***	***Un-known***
Hard	43,008	606,472	10	3,555,604	792,140	21,981	1,565,941
Asphalt etc	19,132	31,147	2	81,302	6,177	1,353	23,769
Soils	110,351	2,365,808	1,521	2,784,613	761,088	72,249	1,795,310
Mixed	112,078	932,675	23	396,840	83,911	3,386	499,395
Wood	4,249	13,828	20,154	251,431	121,880	5,827	61,420
Metals	53,593	2,811	2	109,851	84,968	353	66,150
Plastic	90	5,017	0	6,689	13,051	0	6,208
Gypsum	495	527	0	41,482	29,281	186	47,897
Asbestos / insulation	684	106,862	48	9,234	1,335	735	5,010
Liquid / sludge	0	100	0	3,757	108	44	0
Total	343,681	4,065,248	21,761	7,240,802	1,893,938	106,114	4,071,099

Source: Capita Symonds, based on returns made in 2008 to the Environment Agency

Table 3.2: 2008 % share (by weight) of each waste stream going to different destination types after leaving treatment and transfer facilities

	Transfer station	***Landfill***	***Incin-eration***	***Recycl-ing***	***Reproc-essing***	***Treat-ment***	***Un-known***
Hard	0.7%	9.2%	0.0%	54.0%	12.0%	0.3%	23.8%
Asphalt etc	11.7%	19.1%	0.0%	49.9%	3.8%	0.8%	14.6%
Soils	1.4%	30.0%	0.0%	35.3%	9.6%	0.9%	22.8%
Mixed	5.5%	46.0%	0.0%	19.6%	4.1%	0.2%	24.6%
Wood	0.9%	2.9%	4.2%	52.5%	25.5%	1.2%	12.8%
Metals	16.9%	0.9%	0.0%	34.6%	26.7%	0.1%	20.8%
Plastic	0.3%	16.2%	0.0%	21.5%	42.0%	0.0%	20.0%
Gypsum	0.4%	0.4%	0.0%	34.6%	24.4%	0.2%	40.0%
Asbestos / insulation	0.6%	86.2%	0.0%	7.5%	1.1%	0.6%	4.0%
Liquid / sludge	0.0%	2.5%	0.0%	93.7%	2.7%	1.1%	0.0%
Total	1.9%	22.9%	0.1%	40.8%	10.7%	0.6%	22.9%

Source: Capita Symonds, based on returns made in 2008 to the Environment Agency

Table 3.3: 2008 % share (by weight) of the different waste streams entering each destination type after leaving treatment and transfer facilities

	Transfer station	*Landfill*	*Incin-eration*	*Recycl-ing*	*Reproc-essing*	*Treat-ment*	*Un-known*
Hard	12.5%	14.9%	0.0%	49.1%	41.8%	20.7%	38.5%
Asphalt etc	5.6%	0.8%	0.0%	1.1%	0.3%	1.3%	0.6%
Soils	32.1%	58.2%	7.0%	38.5%	40.2%	68.1%	44.1%
Mixed	32.6%	22.9%	0.1%	5.5%	4.4%	3.2%	12.3%
Wood	1.2%	0.3%	92.6%	3.5%	6.4%	5.5%	1.5%
Metals	15.6%	0.1%	0.0%	1.5%	4.5%	0.3%	1.6%
Plastic	0.0%	0.1%	0.0%	0.1%	0.7%	0.0%	0.2%
Gypsum	0.1%	0.0%	0.0%	0.6%	1.5%	0.2%	1.2%
Asbestos / insulation	0.2%	2.6%	0.2%	0.1%	0.1%	0.7%	0.1%
Liquid / sludge	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%

Source: Capita Symonds, based on returns made in 2008 to the Environment Agency

Since the distinction between recycling, reprocessing and treatment may not always be entirely clear, there is some merit in combining these three categories together (described as 'recovery'), and this is what has been done for the purposes of the following summary. Subject to the *caveat* that some materials may undergo multiple handling, which would distort the following conclusions, there appear to be reasonable grounds for concluding that:

- just over half of all CDEW is sent on to some form of recovery facility[5];
- almost all liquid and sludge waste that is dispatched onwards goes to a recycling facility[6];
- most asbestos and insulation wastes are landfilled rather than treated;
- wood is very likely to be recovered to some degree (via chipping, incineration or some other process);
- whereas only just over 60% of metal wastes go to recovery facilities, almost all the rest is either sent to another WTS (from where it may well be recovered), or to an unknown destination, which is likely to involve some element of recovery;
- even though less than a quarter of the mixed CDEW entering the treatment and transfer 'system' was passed on untouched (and unsorted), less than half of that unsorted fraction went to landfill, and a quarter went for some further processing; and
- most of the CDEW going to landfills is likely to be suitable for some form of beneficial use (being hard CDEW suitable for engineering uses, and soils suitable for site restoration).

One other point to emerge from Table A3.1 is that much of the structural steel removed by demolition contractors is not captured by these statistics (given that the total tonnage of iron and steel is under 100,000 tonnes, which is comparable to the tonnage of gypsum, and only a quarter of the weight of wood). Returns made by a separate group of facilities (MRSs, or metal recovery sites) show that they received 1.5 million tonnes of CDEW-related metals (mainly steel) in 2008. It is likely that some other steel went direct to electric arc furnace steel mills. This report does not deal further with those waste flows.

Those same MRSs also received a small amount of non-metallic CDEW, but this did not exceed 30,000 tonnes in total, and its omission from this report should not represent a cause for concern.

[5] The proportion would probably be higher if the identities of the 'unknown' facilities were known, since there are grounds for believing that landfills, incinerators and WTSs are more likely to be known to the waste dispatchers who complete the records than some other forms of recovery facilities. It can be confirmed by checking the percentages in Table 3.3 that the make-up of the fraction going to unknown facilities is very similar to that of the materials going for some form of recovery.

[6] This evidence demonstrates clearly that this portion of outgoing waste that is classified as being sent for 'recycling' is indeed being sent for further processing, not simply for re-use.

3.4 EWC code 19 12 12 (post-treatment mixed waste)

EWC code 19 12 12 covers 'other wastes, including mixtures of materials, from mechanical treatment of waste other than those mentioned in 19 12 11'. (EWC code 19 12 11 is very similar, but contains dangerous substances).

It is possible to postulate, and test, the hypothesis that EWC code 19 12 12 waste is mainly composed of CDEW. The justification for this would be that CDEW is such a major waste stream, and much EWC code 19 12 12 waste clearly includes CDEW. The consequences of adding 19 12 12 to the list of codes in Appendix 1 would be considerable, so it is well worth exploring the extent to which it explains the apparent 'losses' of CDEW reported in Appendix 3.

Although most of the data tables (in Appendix 3, and elsewhere in this report) exclude any consideration of EWC code 19 12 12 waste, there is a discussion at the end of Appendix 3 regarding what the original data sets reveal, and how this fits in with the findings reported in Tables A3.7 and A3.11.

Table A3.7 shows that those treatment facilities that accepted CDEW accepted 3.30 million tonnes more of it than they then passed on. After excluding non-English data, the original dataset shows that all treatment facilities taken as a group:

- accepted 0.20 million tonnes of EWC code 19 12 12 waste; and
- dispatched 1.39 million tonnes of EWC code 19 12 12 waste; effectively
- 'creating' 1.19 million tonnes of EWC code 19 12 12 waste.

Table A3.11 shows that those transfer facilities that accepted CDEW accepted 1.91 million tonnes more of it than they then passed on. Repeating the process described above, but for transfer facilities only, it is possible to see that they:

- accepted 0.54 million tonnes of EWC code 19 12 12 waste; and
- dispatched 5.43 million tonnes of EWC code 19 12 12 waste; effectively
- 'creating' 4.89 million tonnes of EWC code 19 12 12 waste (i.e. over twice as much as the 'missing' CDEW).

Based on logic and a knowledge of what happens when CDEW is sorted and treated (resulting in a smaller tonnage of more 'concentrated' waste as the more useful fractions are extracted), some of the gap between incoming and outgoing CDEW can undoubtedly be attributed to EWC code 19 12 12 waste. However, these data, and in particular the tonnages from transfer facilities, show clearly that it would be highly misleading to treat EWC code 19 12 12 as part of the 'true' CDEW dataset.

[Although the two sets of figures (those for 'missing' CDEW and those for EWC code 19 12 12 waste) do not come from exactly the same group of facilities (albeit that the 'missing' CDEW data come from a sub-group of the wider population) this does not affect the logic of the argument. What is being tested here is the hypothesis that EWC code 19 12 12 waste is largely or wholly CDEW. If that was true, including non-CDEW treatment and transfer facilities in the population being tested would not make any difference, because they would not (under this hypothesis) contribute any EWC code 19 12 12 waste.]

Adding the two datasets (from treatment and transfer facilities) together produces a much closer match (between 5.21 million tonnes of 'missing' CDEW and 6.08 million tonnes of EWC code 19 12 12 waste), but the fact that there are mismatches at the level of the two individual components shows that this is a coincidence rather than providing evidence of cause and effect.

This issue has also been further explored in the final section of Appendix 3, where it is shown that half of the largest waste treatment and transfer facilities (i.e. 17 of the 33 such facilities that accepted 100,000 tonnes or more of CDEW in 2008) generated no EWC code 19 12 12 waste at all. As can be seen from Table A3.26, the other 16 facilities generated net tonnages (i.e. after deducting incoming wastes with the same codes) of 399,059 tonnes of EWC Chapter 19 wastes (comprising 276,927 tonnes of EWC code 19 12 12 waste, 57,265 tonnes of wood, 14,931 tonnes of metals, 7,726 tonnes of plastic, 718 tonnes of glass, and 42,929 tonnes of other non-CDEW Chapter 19 wastes, namely screenings, paper, card, textiles and RDF).

On the other side of the equation, it also appears that the rate of recovery (of, for example, wood, metals and plastics) was higher than might otherwise appear, given that CDEW probably contributed a substantial share to

outgoing waste flows of these materials coded under EWC Chapter 19. None of these indications should be over-interpreted, however, given the evident tendency for waste treatment and transfer facilities to circulate both mixed and separated waste streams amongst themselves, making it unsafe simply to add waste flows together uncritically.

The final section of Appendix 3 then looks at all of the waste treatment and transfer facilities which generated EWC code 19 12 12 in 2008 (i.e. not just the ones which handled CDEW). What this shows is that whereas just over 75% of the EWC code 19 12 12 waste that was sent to landfill (i.e. 4.08 out of 5.31 million tonnes) came from treatment and transfer facilities that handled CDEW, the tonnage of mixed CDEW received by those facilities was eclipsed by the tonnage of mixed municipal waste that they also received.

4.0 Overview of the management of mixed CDEW

4.1 The range of technical solutions

The range of technical solutions encountered at treatment and transfer facilities is not as wide as might be expected. For those facilities that receive mixed skip waste, the quality of output is heavily influenced by the amount, shape and character of the space available, since the combination of these factors may well determine how many processes can be accommodated on site. As a consequence, the most space-constrained sites are likely to send out the least heavily-modified outputs.

In general the processes involve physical separation (manual picking, screening, flotation etc), and some crushing, chipping or shredding, rather than any chemical or biological processes. They tend to run in sequence rather than parallel. Having said that, some of the best-performing sites run selected waste streams through the same equipment more than once, in order to achieve their desired outcomes.

Although there are few if any processes which cannot be carried on in the open, there is no doubt that sites with good quality indoor space, which provides sufficient room for vehicles to move around safely and efficiently, tend to achieve the highest rates of diversion from landfill, as well as imposing fewer adverse environmental effects (e.g. noise, dust and run-off) on the land and neighbouring land users. Where waste is stored in the open it is prone to wetting, which increases its weight, and can make it less suited to effective processing and recovery. It may also give rise to contaminated run-off.

Most facilities carry out some form of hand sorting, ranging from hand-picking to the removal of large items using mechanical loaders, back-hoes or similar. In general the objective is to remove obvious 'contraries', larger items or pieces (e.g. doors, window frames or other large pieces of wood, drums etc) and items with particular characteristics that subsequent sorting techniques may not handle particularly well (e.g. cable, non-ferrous metals or some plastics). Some sites where there is sufficient space available use a system of selective tipping, under which incoming waste that is mostly soil would be tipped in a different area from more mixed wastes and/or waste which is predominantly wood or metals. This avoids further mixing of incoming wastes, and represents the first stage of 'bulking' comparable wastes before processing them (or sending them off-site).

At sites where the incoming waste is relatively consistent and dominated by soil, hand-picking may be the only pre-sorting that takes place prior to a combination of crushing and screening to separate the residual waste into recycled aggregate, soil and residual waste. At those mainly-inert sites where the aim is to generate higher quality sands and aggregates, washing processes may be employed. Washing plants involve a high level of capital investment, and although they create higher value outputs (products), they also generate residues (e.g. silts) that are more problematic.

For more typical mixed skip waste, the next process after hand-picking is likely to be based around a trommel screen. If the screen is to be fed by a bucket loader or similar, then it probably requires a large capacity hopper (capable of holding about three times the bucket's capacity). The hopper outlet should feed a slow-moving dosing belt which in turn feeds a faster conveyor, which can deliver a more consistent flow rate to the screen.

Most trommel screens handling mixed CDEW are horizontal, about 5-6m long, and with a strong elliptical auger, because inclined screens do not work particularly well with very variable wastes[7]. The drum needs to be large enough for the feed conveyor to extend into the mouth, and it should turn at such a rate that the materials inside are tumbled within the drum. If the screen is set at about 180mm, this will remove sufficient fines and smaller pieces of waste to make the residue (the oversize fraction) suitable for further separation. The resultant fines can easily be further screened to separate contraries from soil (see below).

Before passing to a picking station, the oversize fraction should ideally be sorted into heavy and light materials using some form of air separator (in which heavy items fall one way, while light ones are carried vertically or laterally by the air flow, created by a fan. The belt onto which the heavy fraction falls is likely to be the single most frequently replaced item of equipment. After passing beneath a magnet, the heavy fraction (containing hardcore, wood, some plastics, non-ferrous metals and large items such as batteries) should pass though a manual picking station. Depending on the consistency of the heavy fraction and the number of operatives available, the picking station can be used either to remove those materials that are most wanted (positive pick),

[7] *Inclined trommels are more common on sites which process less variable wastes (e.g. sands, soils, hardcore etc).*

or to improve the quality of the main residual flow (negative pick). Materials can be directed through the picking station more than once to achieve the desired output quality.

The 0-180mm fraction (separated by the trommel screen) can be further screened to remove long parts, and then passed beneath a magnet before being further screened into 0-20mm fines and a larger (20-180mm) fraction. The larger fraction can be passed through the air separator (see above) to remove paper, light plastics etc. A visual check may mean that the remaining materials can be incorporated into the hardcore / aggregate fraction.

Optical sorting, eddy-current separators and other relatively high-tech techniques are unlikely to be cost effective for sorting highly mixed and variable CDEW.

4.2 The choice available to the construction sector

The data file provided by the Environment Agency contained returns from about 2,400 treatment and transfer facilities (split 250 treatment to 2,150 transfer facilities). The reason why the counts can only be given as approximations is that the numbers of sites with incoming waste in 2008 did not quite match the numbers with outgoing waste. In addition, there are some further facilities not included in these figures that are covered by wider environmental permits (notably those linked to landfills). Those landfill-related facilities are excluded from the following discussion.

The actual numbers of different facilities, broken down by type and capacity, can be found in Tables A3.6 to A3.13 in Appendix 3.

Interpretation of those data may be assisted if the following statements are borne in mind, all of which apply to a land mass the size of England:

- If there are 500 examples of a particular type of facility, and they are evenly spread around the country, each such facility will have a 'home' catchment area with a radius of just under 10km.
- If there are 1,000 examples evenly spread around the country, each will have a 'home' catchment with a radius of about 6.5km, and any customer should have two facilities within 10km.
- If there are 1,500 examples evenly spread around the country, each will have a 'home' catchment with a radius of about 5.5km, and any customer should have three facilities within 10km.
- If there are 2,000 examples evenly spread around the country, each will have a 'home' catchment with a radius of about 4.5km, and any customer should have four facilities within 10km.
- If there are only 50 examples of a particular type of facility, and they are evenly spread around the country, each such facility will have a 'home' catchment area with a radius of just under 30km.

On this basis, most construction companies will have a range of options as regards straightforward WTSs (there being over 2,000 facilities nation-wide), but somewhat (to very) limited choice where waste treatment facilities are concerned (there being only about 250), particularly for the more specialist processes.

This was borne out by the three clusters of treatment and transfer facilities that were visited for this project.

- The northern industrial city with its more rural hinterland (comprising one unitary authority area of between 500 and 600km^2) had six physical treatment facilities / MRFs, one more specialist treatment facility and 27 other WTSs that received CDEW during 2008. Seven of these facilities were known to handle EWC code 17.09.04, including one very large facility.
- The 55km segment of the M25 corridor (comprising three outer London Boroughs and six adjacent districts) had 25 physical treatment facilities / MRFs, one more specialist treatment facility and 25 other WTSs that received CDEW during 2008. Thirteen of these facilities were known to handle EWC code 17.09.04, including one very large facility and two large ones.
- The coastal area, comprising a length of about 50km of coastline centred on one larger town, with a semi-circle of inland hinterland (comprising nine local authority districts), had 19 WTSs that received CDEW during 2008. Eight of these facilities were known to handle EWC code 17.09.04, including two large facilities.

4.3 Findings from the programme of site visits

4.3.1 EWC codes 17 09 04 and 19 12 12

The project team members who carried out site visits were generally accompanied by site operational staff, who were fully familiar with the processes being carried out, but not necessarily responsible for matters such as waste coding.

However, by taking lots of photographs of both incoming and outgoing waste it has been possible to build up a clear picture of the range of both incoming and outgoing wastes. The selection of photographs below illustrates the range of materials which is typically described as incoming mixed CDEW (EWC code 17 09 04), and the residual waste (19 12 12) which leaves sites after sorting and/or treatment.

As regards the incoming waste, what is striking is how varied it is in terms of the soil content and general degree of mixing. Some of the most mixed is not very different from outgoing waste, illustrating the point that the difference is very much one of concentration: once the recoverable fractions have been removed, what remains is a heavily mixed residue for which the only realistic non-landfill option is incineration as RDF.

These photographs, and many more, can be found in Appendices 8 and 9 at the end of this report.

Figure 4.1: Typical incoming mixed skip waste from a small construction site, where the skip was accessible to the public. The recovery of otherwise clean soil and 'hard' CDEW will be complicated by the inclusion of both other CDEW and non-CDEW.

Figure 4.2: Incoming waste dominated by soil, from a construction site where the operator had kept to a minimum the inclusion of 'contraries'.

Figure 4.3: More heavily mixed incoming CDEW.

Figure 4.4: Mainly 'hard' incoming CDEW (from the demolition process), but with some soil, wood and plastics mixed in.

Figure 4.5: Much more heavily mixed incoming CDEW, from the construction phase.

Figure 4.6: Outgoing waste with most of the more easily-recovered fractions gone (This was actually photographed as incoming waste, but it was another MRF's outgoing waste).

Figure 4.7: Outgoing waste from a site with limited processing capacity (prior to being dispatched to another MRF).

Figure 4.8: Outgoing waste going to landfill from a site with limited processing capacity.

Figure 4.9: Outgoing waste going to landfill from a site with limited processing capacity.

4.3.2 EWC coding: general finding

An observation that cannot be avoided, is that the term 'mixed CDEW' is sometimes used as a description for all incoming mixed skip waste, irrespective of its origins and nature. One consequence of this is that the tonnages reported to the Environment Agency by site operators will tend to overstate the amount of 'true' CDEW.

As waste separation improves on construction sites, there is a reasonable prospect that the proportion of card, plastic etc mixed in with other CDEW will fall, and that it will more accurately be coded as packaging waste (Chapter 15 of the EWC).

4.3.3 Local networks

It was very evident that some (but by no means all) operators of waste treatment and transfer facilities cooperate with each other (though it should be stressed that this comment is limited to how the wastes received

are dealt with: the basic business of skip hire shows all the signs of being fiercely competitive, with skip hire prices being constantly adjusted, and in some cases a ready supply of small operators prepared to enter the market at very low margins in an effort to build up a business).

Where one operator specialises in – say – the processing or recovery of wood, others will consign to that operator wood that they either collect or separate from mixed waste. Such networks were observed to exist among sites that were broadly comparable in their levels of sophistication and size. This is clearly part of the explanation behind the considerable tonnage that circulates between broadly similar facilities.

There is a separate issue which was also evident, namely that of the 'local super-MRF': a large, well-equipped facility which is able not only to extract more materials from its own waste, but also accepts residual waste from other treatment and transfer facilities in order to extract the hardest-to-recover fractions, after those other facilities have put it through basic recovery processes. These networks may involve inter-facility transfers of 30km or more.

4.3.4 Difficult materials

A reasonably consistent message received during the site visits to the two southern clusters was that treatment and transfer facilities are able to separate plastics, but do not always do so because of a lack of buyers for the resultant materials. This goes well beyond CDEW, though some of the materials concerned are, by default (see above), being described as CDEW even where they are clearly old wheelie bins, traffic cones etc. Some waste sent to transfer stations during the site clearance process is described as CDEW even though it reached the site from which it is being cleared by being fly tipped there.

In the northern industrial cluster, despite a strong workload of civil engineering works linked to urban regeneration, it was clear that recycled aggregates were not winning the market share that might have been expected. There is also a large landfill that can take fines, though the recycling companies reckon that this will have to be the next item to be addressed.

There is also widespread interest in turning more of the residual fraction into RDF, despite the fact that one of the 'established' markets for RDF (cement kilns) has not delivered the hoped-for demand, particularly for more mixed waste. In the north there has been talk of coal-fired power stations taking RDF, but this would have to compete with biomass, which has the considerable advantage of being much more predictable. As a consequence some operators are considering developing their own energy from waste plants, with a number of different technologies, but very little actual investment is currently scheduled.

4.3.5 Integration with inert CDEW recycling

Most of the treatment and transfer facilities that were visited carried out some degree of inert CDEW recycling (either crushing and screening hard CDEW and soil themselves, or separating it so that it could be sent elsewhere for further processing). However, only in a relatively small proportion of cases was inert CDEW recovery the dominant activity. In general, large inert CDEW recyclers do not accept mixed skip waste, and those who accept skip waste do not receive large amounts of inert CDEW.

Only two of the sites described in Appendices 8&9 (Nos 17 and 19) deal primarily with site-separated inert CDEW. For the rest, the emphasis is largely or wholly on mixed CDEW.

5.0 Beneficial use of inert CDEW at registered exempt sites

A dataset containing information on the tonnages of materials expected to be spread (or in some cases reported as having been spread) on Paragraph 9&19 registered exempt sites was provided to WRAP by the Environment Agency for the purposes of this project. Details of how that file was filtered and manipulated in order to reach a reasonable estimate of the tonnage of CDEW spread on such sites during 2008 is provided in Appendix 5.

A similar analysis of Agency-supplied data was previously undertaken in 2006. On that occasion, the estimated tonnages were as follows:

- 4.76 million tonnes spread on Paragraph 9A(1) sites;
- 10.69 million tonnes spread on Paragraph 19A(2) sites; giving
- a total of 15.44 million tonnes.

Any such estimate necessarily reflects the assumptions on which it is based (because the underlying data sets are inevitably incomplete, and because activity on many of the exempt sites concerned is spread over several years, and is not entirely even from year to year). The 2006 analysis was also based on data provided at the very start of a new site registration regime. With the benefit of hindsight (and more specifically with the benefit of access to several years' data) it can be seen that one of the underlying assumptions used in 2006 was probably wrong. This was recognised at the time to be a possible area of concern, and an alternative total tonnage estimate (of 12.99 million tonnes) based on what can now be seen to be probably more realistic assumptions was also reported.

The estimate for 2008 reported in Appendix 5 is:

- 2.94 million tonnes spread on Paragraph 9(1) sites;
- 8.03 million tonnes spread on Paragraph 19(2) sites; giving
- a total of 10.98 million tonnes.

On the face of it, this implies that the tonnage of CDEW spread on Paragraph 9&19 sites fell by 2 million tonnes (or 15%) between 2005 and 2008, using the 'alternative' 2005 estimate (of 12.99 million tonnes). However, most of the uncertainty surrounding both of these estimates is linked directly to the assumptions that underpin them (most notably as regards the tonnage to be spread on sites where that value was not recorded, and the period of time over which sites were (or will be) active where neither start nor end dates were recorded). The full set of assumptions used in generating the 2008 estimate are explained in Appendix 5, as are some of the main implications of varying them.

However, if it is accepted that the tonnage of CDEW spread on such sites did actually fall between 2005 and 2008 this would not be entirely unexpected. After all, a tighter regulatory regime and financial charges were both introduced in mid-2005, both of which changes would discourage the use of registered exempt sites, irrespective of the state of the economy.

Furthermore, in 2007 the administrative regime applicable to registered exemptions changed again (and is due to change again, this time fundamentally, in 2010). Under such circumstances, and given the uncertainties surrounding all such estimates, detailed year-on-year comparisons may be unwise.

In truth, some of the site works that in the 1990s and early 2000s would have been carried out under exemptions can now be done without any such controls, because the sites are deemed by the Agency (under current guidance) not to require them (e.g. where inert materials are being moved and re-used within a single site). In effect materials which would previously have been regulated as waste are no longer considered to be waste (and therefore not to be subject to regulation as waste[8]). Such changes should not be adduced as evidence of genuine change (as measured by actual outcomes).

[8] *See also 'The Definition of Waste: Development Industry Code of Practice' (CL:AIRE, undated but believed to have been issued in September 2008). ISBN 978-1-905046-14-0.*

6.0 Use and disposal of CDEW at landfills

6.1 Overview of landfill site returns made to the Environment Agency

Data from site returns made to the Environment Agency by landfill operators were provided to WRAP, and analysed for this study. Both the data and the detailed findings are given in Appendix 6, and summarised below in Table 6.1 (which is the same as Table A6.4 in Appendix 6). As with some of the tables in Appendix 3, the important mixed waste fraction represented by EWC code 17 09 04 is shown separately in Table 6.1.

Table 6.1: Summary of CDEW remaining in landfills 2008 (tonnes)

	Inert	***17 09 04***	***Non-haz***	***Haz***	***Total***
Hard	2,222,824	0	0	49,680	2,272,504
Asphalt etc	12,493	0	0	2,773	15,266
Soils	16,296,307	0	291	382,136	16,678,734
Mixed	0	1,139,177	183,085	152,834	1,475,097
Wood	0	0	31,813	0	31,813
Metals	0	0	41,675	54	41,729
Plastic	0	0	309	0	309
Gypsum	0	0	4,222	31	4,253
Asbestos / insulation	0	0	4,269	269,766	274,035
Liquid / sludge	0	0	360	69,406	69,766
Total	18,531,624	1,139,177	266,025	926,680	20,863,506

Note: The figures in this Table represent the difference between the tonnages of incoming and outgoing waste recorded at landfills.
Source: Capita Symonds, based on returns made in 2008 to the Environment Agency

These data come from operators of facilities that are described by the Agency as landfills, but in reality include some associated treatment and transfer facilities that divert some of their incoming waste from disposal to recovery. This is because facilities with the capacity to treat waste (through, for example, composting it), and which sit inside the ring fence of a landfill (or even a former landfill), are covered by Environmental Permits which are considered by the Agency to have been primarily aimed at landfilling activity. As a consequence, the materials going to such treatment and transfer facilities are included within the site returns made to the Agency by their operators. Others sites which are classified by the Agency as landfills incorporate facilities which do not treat incoming waste, but sort some or all of it prior to diverting some of it for re-use or recovery elsewhere (as well as sorting the waste which does go into the landfill in order, for example, to sort soils suitable for capping and restoration from a more mixed waste stream).

As can be seen, neither Table 6.1 nor Table A6.2 include waste that comes under the important EWC code 19 12 12 (which contains much of the heavily mixed CDEW that remains after more useful fractions have been recovered, but also contains elements of many other non-CDEW waste streams, and therefore should not simply be counted as CDEW). The total tonnage of EWC code 19 12 12 waste crossing English landfill weighbridges in 2008 was 10.68 million tonnes[9] (with just 38 tonnes subsequently re-diverted elsewhere).

Adding together the 21.51 million tonnes reported in Table A6.2 , the 10.68 million tonnes of EWC code 19 12 12 waste and the 21.22 million tonnes of all other wastes (i.e. neither CDEW nor EWC code 19 12 12), results in a grand total of 53.41 million tonnes of all types of waste entering facilities described as landfills.

By comparison, the tonnage reported as leaving landfill sites (which is reported in Appendix 6 as 2.34 million tonnes) is relatively small. Just over one third of this (0.83 million tonnes) was CDEW.

Therefore CDEW, including material used for site engineering and inert fill restoring former quarries, accounted for 40.8% of all waste going to permitted landfills in 2008[10].

[9] As well as the 5.31 million tonnes from the waste treatment and transfer facilities considered in this report, a very substantial tonnage comes from the non-metal content of scrap vehicles and other waste handled by scrap yards and metal reprocessors.

[10] 40.8% is calculated by dividing 20.86 million tonnes (see Table 6.1) by 51.07 million tonnes (i.e. 53.41 – 2.34 million tonnes).

Of the 19.25 million tonnes of inert CDEW entering all landfills (and as reported in Table A6.2):

- 8.57 million tonnes (44.9%) was reported by inert landfills; and
- a further 0.71 million tonnes (3.7%) was reported by landfills which although permitted to take a wider range of wastes, actually only accepted inert wastes (as defined in Appendix 1, unconfirmed by any other evidence).

Some 0.72 million tonnes of this inert CDEW was re-exported by landfills, 0.52 million tonnes of this coming from inert landfills. This still left 18.53 million tonnes remaining in landfills (see the first data column in Table 6.1 above).

The same sites as are referred to in the last-but-one paragraph also reported accepting 0.44 million tonnes of waste classified as EWC code 17 09 04. This coding can be applied equally correctly to a consignment of soil with a small proportion of concrete and bricks, or to a skip-load of mixed wood, plasterboard, paint tins, soil and asphalt[11], and there are perfectly good grounds for believing that in these cases the material concerned was inert or very largely inert.

There do appear to be grounds for believing that the reported outgoing tonnages (as detailed in Table A6.3) may be an underestimate. One of the four non-landfills previously referred to provided no reports of outgoing tonnages (and even if the landfill had re-opened, which is thought to be highly unlikely, it would be necessary to question why an inert landfill was accepting so much mixed waste, including municipal waste). There is no effective way of telling how significant such unreported tonnages may be, but what is clear is that every unrecorded outgoing tonne results in the tonnage disposed of to landfill being overestimated by the same amount.

As well as uncertainty over the precise amount and make-up of CDEW entering landfills for disposal, there is also uncertainty over the shares that are (1) beneficially used, and (2) disposed of as waste. Beneficial use includes:

- materials used for landfill engineering (internal site roads, bunding, drainage, daily cover etc);
- materials used in capping or site restoration; and
- materials which although disposed of as waste, are being used to backfill and restore former quarry workings in fulfilment of a planning obligation.

6.2 Evidence from returns made to HM Customs & Revenue

The returns made to HM Revenue & Customs (HMRC) in connection with Landfill Tax (and subsequently reported in their 'Landfill Tax Bulletin', which is available via the uktradeinfo.com website) throw some light on the issue of waste which is diverted from landfill, having initially been recorded passing over sites' weighbridges. This is because whereas Environment Agency returns measure waste as it arrives at facilities, HMRC returns only count waste that enters the actual landfills and which was assessed for Landfill Tax. All such waste is then either taxed, or treated as exempt.

This comparison confirms that the Agency's figures overstate the tonnage of waste actually being disposed of to landfill.

HMRC's 'Landfill Tax Bulletin' data cover the UK as a whole, and therefore need to be reduced to yield a smaller estimate for England. Using human population as a reasonable proxy for adjusting UK totals to English totals (i.e. by multiplying the UK figures by 0.836) yields the following estimates:

- 29.4 million tonnes of waste taxed at the standard rate;
- 8.1 million tonnes of waste taxed at the lower rate; and
- 10.6 million tonnes of waste accepted as exempt from landfill tax.

The first element agrees almost exactly with the figure of 29.33 million tonnes of non-hazardous and hazardous CDEW plus the non-CDEW wastes recorded by the Environment Agency in 2008[12] as remaining in landfills. The

[11] *See Figures 4.1 to 4.5 for illustrations of a range of materials that might equally well be classified as EWC code 17 09 05.*

[12] *29.33 million tonnes is reached by taking 51.34 million tonnes entering landfills minus 2.34 million tonnes which then left those same landfills, and then subtracting the 18.53 million tonnes accounted for by inert CDEW and 1.14 million tonnes accounted for by EWC code 17 09 04.*

combined total of the second and third elements (i.e. 18.7 million tonnes) is about 5% lower than the 19.67 million tonnes recorded by the Agency as remaining in landfills, and as reported in the first two data columns of Table 6.1. Furthermore, it should be recognised that EWC code 17 09 04 will actually be split between inert waste (largely soil with a few pieces of concrete or bricks mixed in) and the more heavily mixed CDEW that can be seen in Figures 4.4, 4.5, 4.8 and 4.9, and in several of the photographs in Appendices 8 and 9.

There are therefore good grounds for believing that the 10.6 million tonnes of waste treated by HMRC as being exempt from Landfill Tax is a very good proxy for the tonnage of CDEW beneficially used at landfills.

Before accepting this conclusion at face value, however, it is worth comparing the equivalent HMRC figures for 2005 (i.e. the UK returns multiplied by 0.836 to generate estimates for England) with the estimates generated via the 2005 CDEW survey carried out for DCLG, not least because some wastes gain exemption from landfill tax because they come from site remediation, and some tax is deferred (e.g. where waste is used to create a haul road which is subsequently buried within the landfill, at which point the deferred tax becomes due).

The 2005 CDEW survey carried out for DCLG generated estimates of 27.75 million tonnes of 'hard' C&D waste and soil-based waste being used or disposed of as waste at landfills, of which 4.20 million tonnes were used for engineering, 5.41 million tonnes were used for capping, and 10.24 million tonnes although classified as waste, were reckoned to be being used to restore former quarries (yielding a total estimate of 19.85 million tonnes of CDEW being beneficially used at landfills). In addition, an estimated 7.90 million tonnes were estimated to have been disposed of as waste at landfills that were not former quarries. Some 2.70 million tonnes of this may well not have qualified for the lower rate of landfill tax. On this basis, the total tonnage qualifying for the lower rate of tax or outright exemption would have been expected to be 25.05 million tonnes (i.e. 19.85 million tonnes plus 7.90 million tonnes minus 2.70 million tonnes).

Although this figure is clearly higher than HMRC's 2005 figure of 23.3 million tonnes[13], the difference (of 1.75 million tonnes) is 7.0% of the higher figure and 7.5% of the lower one. Certainly the HMRC-derived figure is comfortably within the applicable confidence limits attached to the 2005 survey results. On balance, therefore, the HMRC figures can be treated as providing a very good indication of the amount of CDEW being beneficially used in landfills.

Nevertheless, in order to throw more light on this (i.e. the balance between CDEW that was beneficially used in 2008, and directly comparable CDEW that was disposed of as waste), a separate survey was undertaken (see below).

6.3 Structured survey of landfills

As reported in Appendix 6, the level of survey returns was very disappointing, with the overall level being 12.9%. There was evidence (from comments made in telephone calls to the project team) of survey fatigue, and an unwillingness to expand on information already provided to the Environment Agency.

Given this low response rate, it would be unwise to over-interpret the data that were received. However, the returns that were received are consistent with a reduced level of both use and disposal of inert CDEW since 2005. The fall appears to be greatest as concerns clean excavation waste, and smallest as regards the use of hard inert CDEW for site engineering purposes.

This would be consistent with two quite separate factors, both of which were observable during 2008:

- a reduced level of construction activity, resulting in less CDEW seeking landfill space; and
- less municipal waste going to landfill, and therefore a reduced demand for engineering and capping materials.

[13] i.e. 16.06 million tonnes of exempt waste multiplied by 0.836 = 13.42 million tonnes, plus 11.82 million tonnes of lower rate waste multiplied by 0.836 = 9.88 million tonnes.

7.0 Overview of findings

7.1 Introduction

As stated in Chapter 1, WRAP's original Tender Invitation Document (TID) required the data to be collected over the course of this project to be able to identify:

- the recovery of aggregates and soils through fixed recycling sites, including waste transfer stations (WTSs) and materials recovery facilities (MRFs) and on-site demolition activities;
- the recovery of other materials, such as wood, plastic, glass, plasterboard, metals and refuse-derived fuel (RDF) at waste treatment and transfer facilities;
- the beneficial use of inert CDEW at 'paragraph9&19 registered exempt sites';
- the beneficial use of inert CDEW under an exemption from landfill tax where such infilling results from a site restoration obligation created by a planning condition;
- the beneficial use of inert CDEW for the purposes of site restoration or engineering at permitted landfills; and
- the residual tonnage of CDEW disposed of to landfill, and its constituent materials.

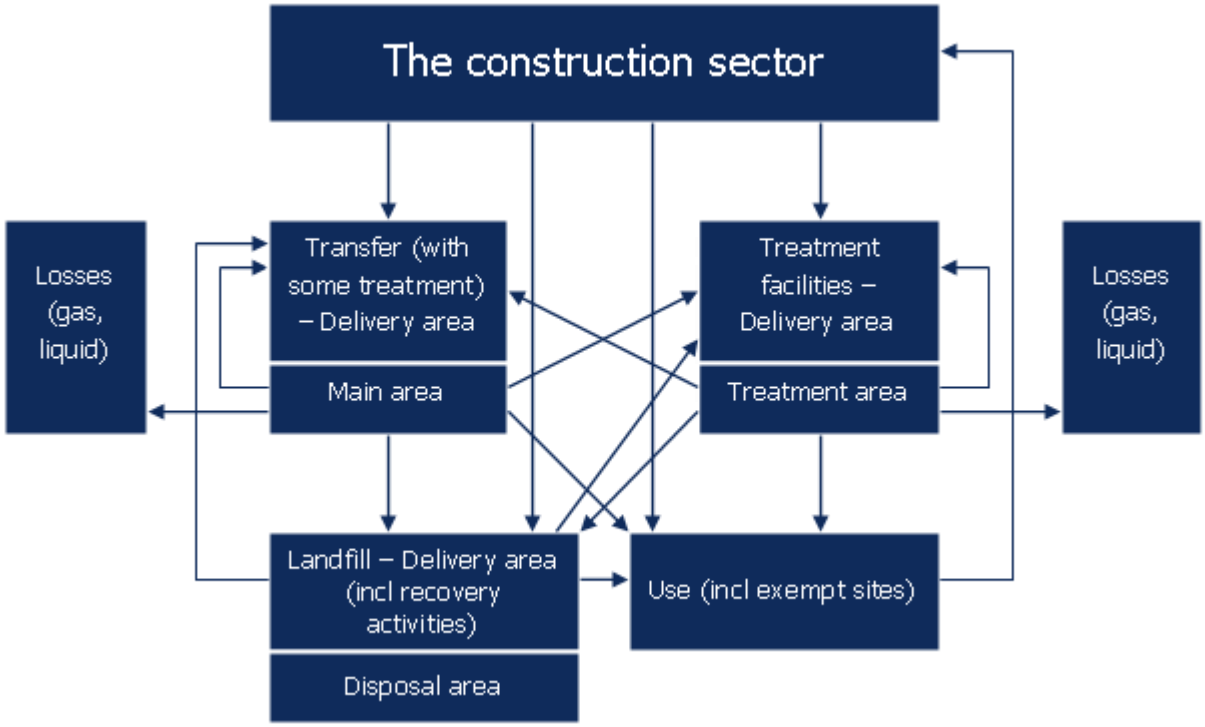
Although it has not been possible to quantify all waste streams as precisely as might have been hoped, primarily because there is no satisfactory way of knowing to what degree materials such as wood, plastics and metals are being double handled within the waste treatment and transfer system, the overall picture that has emerged is both broadly consistent with what was expected at the outset, and more detailed than had previously been achieved, particularly as regards the non-inert fraction of the waste stream.

The wider picture only emerges when all of the relevant waste streams are considered, and the next section of this Chapter seeks to describe the full range of flows and processes in a coordinated manner.

7.2 Stocks and flows of CDEW

Figure 7.1 provides a simple process flow diagram which could be used to track waste flows arising from the construction sector (including demolition and site preparation activities and civil engineering works) through to recovery or disposal, and losses along the way.

Figure 7.1: CDEW stocks and material flows



Source: Capita Symonds

This model recognises that the waste transfer sector as recorded by the Environment Agency includes many facilities that undertake some recovery and recycling activities.

Where waste treatment and transfer facilities are concerned, it employs the convention that:

- all facilities have a delivery area;
- all waste that is received at the delivery area moves through to some form of handling, separation or treatment (in the main part of the facility); but
- some of the materials that leave the main part of the facility may (as one of several options) be diverted back to another such facility.

Where landfills are concerned any recovery or treatment that may occur is deemed to happen within the delivery area. This is largely to avoid undue complication in Figure 7.1. Also, incinerators are not separately identified, being of relatively minor significance where CDEW is concerned.

In principle any waste material could be tracked through this system. In practice it will seldom be possible to complete such a 'mass balance' exercise because, although there are tonnage returns for many of the flows, and some of the others could be calculated (by difference), others are not available. In the case of materials such as waste wood, which can appear either to be 'created' (by removing wood from mixed waste) or 'destroyed' (by chipping, burning or other uses) along the way, little or no useful information would be generated.

7.3 EWC code 17 09 04 (mixed CDEW)

Despite the lack of data on some waste flows, the model can be used to see what can deduced about EWC code 17 09 04 (mixed CDEW), to see what they indicate. In this particular case it can be assumed that none of this waste stream will be used without any processing; and that processing involves no substantive losses of gases or liquids. It is also assumed for the sake of illustration that such waste as leaves treatment and transfer facilities under this EWC code bound for an unknown destination actually went for further treatment.

On the basis of these assumptions, and working in units of 1,000 tonnes (kt), it is reported that in 2008:

- 6,924 kt entered transfer facilities, of which 110 kt came from other WTSs and 1 kt came from treatment facilities. By simple difference, it appears that 6,813 kt reached transfer facilities direct from the construction sector.
- 1,744 kt entered treatment facilities, of which 419 kt (plus 326 kt coded as 'unknown destination') arrived from transfer facilities, and 20 kt (plus 123 kt coded as 'unknown destination') arrived from other treatment facilities, and 84 kt (plus 3 kt coded as 'unknown destination') arrived from landfills. By simple difference, it appears that 769 kt reached treatment facilities direct from the construction sector.
- 1,226 kt entered landfills and 87 kt left again, giving a nett incoming amount of 1,139 kt, of which 792 kt came from transfer facilities and 113 kt came from treatment facilities. By simple difference, it appears that 234 kt went direct from the construction sector to landfills.

If these approximations and their implications are deemed reasonable, then the construction sector would appear to have generated a total of 7.82 million tonnes of EWC code 17 09 04 waste in 2008 (6,813 kt plus 769 kt plus 234 kt). This is 21% lower than the estimate (of 9.89 million tonnes) which would be generated by simply adding together the tonnages entering transfer facilities, treatment facilities and landfills (6,924 kt plus 1,744 kt plus 1,225 kt).

On the basis of these same assumptions, it would appear that 6.79 million tonnes (i.e. 7.82 million tonnes minus both 792 kt and 233 kt) underwent some form of treatment. Unknown proportions of those 6.79 million tonnes will have become useful (recovered or recoverable) materials, or been incorporated into EWC code 19 12 12 (residual mixed waste).

7.4 All CDEW handled by waste treatment and transfer facilities and landfills

The limitations of the model can quickly be seen if the same process is gone through for all CDEW handled by waste treatment and transfer facilities and landfills (as defined in Appendix 1, but treated as a single waste stream), because the tonnage reported as going from transfer to treatment facilities is greater than the total

tonnage received at treatment facilities. By far the most likely explanation for this is that many of the treatment facilities to which the waste was actually dispatched were classified as transfer stations. To deal with that anomaly in the calculations that follow that particular outgoing waste flow has been arbitrarily allocated to transfer rather than treatment facilities.

If this is done, then the reported tonnages for 2008 show that:

- 16,111 kt entered transfer facilities, of which 333 kt came from other WTSs (plus a further 7,931 kt plus 2,388 kt coded as going for treatment and 'unknown destination' respectively) and 10 kt came from treatment facilities. By simple difference, it appears that 5,449 kt reached transfer facilities direct from the construction sector.
- 6,846 kt entered treatment facilities, of which 1,310 kt (plus 1,683 kt coded as 'unknown destination') arrived from other treatment facilities, and 521 kt (plus 313 kt coded as 'unknown destination') arrived from landfills. By simple difference, it appears that 3,019 kt reached treatment facilities direct from the construction sector.
- 21,698 kt entered landfills and 835 kt left again, giving a nett incoming amount of 20,863 kt, of which 3,547 kt came from transfer facilities and 540 kt came from treatment facilities. By simple difference, it appears that 16,776 kt went direct from the construction sector to landfills.

There is also the consideration that, unlike EWC code 17 09 04, some of the material that was coded as going for recycling will almost certainly have gone for use rather than further processing, and it is unrealistic to assume that there is no way out of 'the system' for such recovered materials. The figure of 7.24 million tonnes of materials going for recycling can be found in Table A3.14, of which 6.42 million is inert waste which, when recovered, would be captured either by the survey of recycled aggregate production or the returns associated with Paragraph 9&19 registered exemptions.

Although even these approximations clearly do not tell the whole story, their implications could be deemed to provide a helpful overview of reality. Those implications are that the construction sector sent a total of 18.82 million tonnes of CDEW in 2008 to treatment and transfer facilities and landfills. This figure is obtained by adding 5,449 kt plus 3,019 kt plus 16,776 kt to get a figure of 25.24 million tonnes, and then deducting 6.42 million tonnes which represents double counting. This is well below half of the estimate (of 44.66 million tonnes) which would be generated by simply adding together the tonnages entering transfer facilities, treatment facilities and landfills (16,111 kt plus 6,846 kt plus 21,698 kt), and confirms the extent to which CDEW circulates among waste management facilities.

7.5 CDEW: the full picture

Table 7.1 draws together information outlined above and elsewhere in this report

Table 7.1: Comparison between estimated arisings of CDEW in 2005 and 2008 (million tonnes)

	2005	***2008***	***Note***
'Hard inert' CDEW generating recycled aggregate	42.07	43.52	(1)
Inert CDEW recovered as recycled soils	4.36	9.21	
Waste (mainly excavation waste) spread on exempt sites	15.44	10.98	(2)
Mainly inert CDEW beneficially used for landfill engineering / capping	9.61	10.60	(3)
Mainly inert CDEW beneficially used to restore former quarries	10.24		
Other largely inert CDEW deposited at landfills as waste	7.90	8.93	
Non-inert CDEW deposited at landfills as waste	Not estimated	2.87	(4)
Non-inert CDEW sent for external recovery	Not estimated	0.82	(5)
Sub-total (excluding two previous rows)	89.63	83.24	(6)
Total (all lines)	n/a	86.93	

Notes: See below.
Source: Capita Symonds

Notes	
(1)	See Chapter 2, Section 2.2 for an explanation of both the 2005 and 2008 data. The rise in aggregate over 3 years was 3.4%; for recycled soil it was 111.2%. The estimate for soil is considered to be less reliable, and there is a case to be made for not including the soil element in the total arisings of CDEW, on the grounds that at least some of it probably represents double counting of soil used on exempt sites or landfills.
(2)	See Chapter 5 for additional explanation. The drop over 3 years was 28.9%. However, as discussed in Chapter 5, evidence now available suggests that the 2005 estimate should have been lower (12.99 million tonnes instead of 15.44), in which case the drop would have been 15.5%.
(3)	The 2005 data for CDEW entering landfills (27.75 million tonnes), together with an explanation of how the 'beneficially used' portions of this total were estimated, can be found on pages 42 to 43 of the report on the 'Survey of Arisings and Use of Alternatives to Primary Aggregates in England, 2005: Construction, Demolition and Excavation Waste' (DCLG, 2007). The figure of 10.60 million tonnes beneficially used in 2008 comes from Chapter 6, Section 6.2. The figure of 8.93 million tonnes was derived as follows: 18.53 million tonnes of inert waste (taken from the first data column of Table 6.1 in Chapter 1), plus 1 million tonnes of EWC code 17 09 04 (representing the large majority of the tonnage reported in the second data column of Table 6.1 in Chapter 6 – see further explanation below), minus 10.60 million tonnes of beneficially used CDEW (see the line above). The total tonnage of EWC code 17 09 04 covers a range of materials from mainly soil to highly mixed CDEW. The total tonnage entering landfills in 2008 was 1.14 million tonnes (see the second data column in Table 6.1). For the purposes of this comparison that tonnage has been arbitrarily split into two portions of 1 million tonnes of largely inert mixed waste, and 139,177 tonnes of more heavily mixed waste (see Note (4) below). The drop in beneficially used CDEW over 3 years was 46.6%; the drop in CDEW entering all landfills (beneficial use plus waste) was 29.6% (27.75 million tonnes to 19.53 million tonnes).
(4)	The figure of 2.87 million tonnes was derived as follows. The first element comes from the non-hazardous and hazardous wastes disposed of to landfill (see Table 6.1, which reports 266,025 tonnes plus 926,680 tonnes) plus 139,177 tonnes of EWC code 17 09 04 waste (see Note (3) above for further explanation on this), to give a sub-total of 1.33 million tonnes. The final remaining component comes from the proportion of EWC code 19 12 12 waste which comprises CDEW. Further information on this can be found in the final section of Appendix 3, which suggests that the proportion of CDEW-derived 19 12 12 waste coming out of those treatment and transfer facilities that handle CDEW is 37.7%. When this factor is applied to the 4.08 million tonnes of 19 12 12 waste that enters permitted landfills from that same group of treatment and transfer facilities, this produces an estimate of 1.54 million tonnes to be added to the above figure of 1.33 million tonnes, giving a total of 2.87 million tonnes of non-inert CDEW entering landfills as waste.
(5)	The figure of 0.82 million tonnes represents non-inert materials sent for external recovery or use. It is derived from data in Table A3.14, and represents the difference between 7.24 million tonnes (which is the total of the 'recycling' column) and 6.42 million tonnes (which is the inert fraction of this: see the penultimate paragraph of Section 7.4 above which points out that this element almost certainly represents double counting of materials recorded elsewhere in Table 7.1). Although there is a case for extending this figure by including non-inert materials sent for reprocessing, treatment and 'destination unknown', this would very probably introduce an element of double counting. The approach that has been taken is, therefore, a compromise.

(6)	The 2005 total (89.63 million tonnes) is correct. The very small difference between it and the total of the component parts comes from rounding errors. The 'like-for-like' comparison (omitting the non-inert CDEW which was not estimated in 2005) suggests that arisings of largely inert CDEW fell over the 3 years by 7.1% (from 89.63 million tonnes to 83.24 million tonnes). If the two figures for recycled soil are taken out of the calculation (on the grounds of potential double counting: see Note (1) for further explanation on this point), the drop over 3 years was 13.2% (85.37 million tonnes to 74.03 million tonnes).

The implications of this are that in 2008 total arisings of the main components of CDEW were 86.93 million tonnes. Of this, a total of 12.62 million tonnes (i.e. 14.5%) was landfilled as waste, meaning that 85.5% was recovered or beneficially re-used without further processing.

Of the total of 86.93 million tonnes, at least 3.69 million tonnes (i.e. 2.87 million tonnes of non-inert waste going to landfill, plus 0.82 million tonnes of non-inert materials recovered) is represented by materials that would not have been measured by the previous national CDEW surveys covering inert and largely inert wastes.

This, in turn, produces a ratio of 3.69:43.52 non-inert:'hard' inert CDEW, or 84 tonnes of non-inert CDEW for every 1,000 tonnes of inert. This is lower than would be expected based on the evidence of the NFDC members' annual returns as reported in Section 2.4 above, which show 118 tonnes of non-inert waste generated for every 1,000 tonnes of hardcore. This may reflect the fact that the Environment Agency data analysed for this project clearly exclude waste structural steel, and the fact that some (but an unknown fraction of) CDEW-derived recovered wood, metals and plastic are coded under EWC Chapter 19 codes, and therefore not captured in the figure of 3.69 million tonnes reported above. If the 1.5 million tonnes of structural steel sent to other waste facilities (as reported at the end of Section 3.3 above) is included in the calculation, then the resultant ratio of 5.19:43.52 non-inert:'hard' inert CDEW generates a rate of 119 tonnes of non-inert waste for every 1,000 tonnes of 'hard' inert CDEW, which is very close indeed to the NFDC members' ratio.

8.0 Lessons learned

The purpose of this Chapter is to set out conclusions and recommendations relevant to the process of future data collection.

Whereas in the absence of administrative reform there is no realistic alternative to running some form of survey in order to estimate the tonnage of inert CDEW that is being recovered as recycled aggregate, it now appears to be both possible and reasonable to use data collated by the Environment Agency, in combination with data from HMRC, as the basis for generating estimates of the other important elements of CDEW arisings, re-use and disposal. More importantly, it is highly unlikely that any bespoke data collection exercise based on voluntary surveys could generate more reliable estimates.

However, it must be recognised that there will always be some uncertainty over how many different facilities some CDEW passes through, and therefore over the extent to which double counting is occurring.

Actions which would enhance the quality and reliability of the resultant output are summarised below. Whereas these are all outwith WRAP's responsibilities, they are all matters which WRAP may wish to raise with the agencies concerned.

There is no significance to the order in which these actions are listed.

1	It would be very helpful if HMRC could present separately for England, Wales, Scotland and Northern Ireland its data on the tonnages of waste that are landfilled at different tax levels (or exempt from landfill tax). It would also be worth exploring whether further disaggregation (e.g. by English planning regions) would be feasible, given the planning system's appetite for robust regional data.
2	It would be very helpful if the Environment Agency could extract from the list of facilities that it treats as landfills for reporting purposes all those facilities where landfilling has ceased. These facilities could then be re-classified as waste treatment or transfer facilities.
3	It would be very helpful if the Environment Agency could add to its 'pick list' of possible destinations for waste leaving permitted facilities 'Use without further treatment (still waste)' and 'Use without further treatment (as a product)'.
4	It would be very helpful if Defra and the Environment Agency could split EWC waste code 17 09 04 into three sub-codes (e.g. '17 09 04 01: Mixed construction and demolition wastes other than those mentioned in 17 09 01, 17 09 02 and 17 09 03 comprising over 80% soil and stones by weight', '17 09 04 02: Mixed construction and demolition wastes other than those mentioned in 17 09 01, 17 09 02 and 17 09 03 comprising less than 20% soil and stones by weight' and '17 09 04 03: Mixed construction and demolition wastes other than those mentioned in 17 09 01, 17 09 02, 17 09 03, 17 09 04 01 and 17 09 04 02').
5	It would be very helpful if Defra and the Environment Agency could split EWC waste code 19 12 12 into three sub-codes (e.g. '19 12 12 01: Other wastes (including mixtures of materials) from mechanical treatment of wastes other than those mentioned in 19 12 11 comprising over 80% construction demolition and excavation waste by weight', '19 12 12 02: Other wastes (including mixtures of materials) from mechanical treatment of wastes other than those mentioned in 19 12 11 comprising less than 20% construction demolition and excavation waste by weight' and '19 12 12 03: Other wastes (including mixtures of materials) from mechanical treatment of wastes other than those mentioned in 19 12 11, 19 12 12 01 and 19 12 12 02'). If this action is taken forward, it will be necessary to consider whether further changes related to residues from scrap metal processing should be made at the same time.

6	It would be very helpful if the Environment Agency, when collecting information on Paragraph 9(1) and 19(2) registered exempt sites (or whatever regulatory regime takes the place of exemptions), could make some small adjustments to the form which applicants are required to complete (both before first starting work and annually thereafter if the work lasts longer than 12 months) in order to eliminate the confusion between the total tonnage of materials to be used over the life of the exemption, and any lesser amount to be used over the next 12 months. This could be achieved by explicitly asking applicants to give details about the waste that they propose to use 'over the 12 months covered by this application / renewal'.
7	At the end of the report on the most recent national CDEW survey it was recommended that as an alternative to running future voluntary surveys of operators of recycling crushers and screens, consideration should be given to requesting the necessary information as part of the administrative process of applying for, or renewing, the Part B authorisation. That recommendation remains valid. Some specific proposals (for collecting but not collating the data) were set out in Annex 12 to that same report. It was also noted at that time that any move to link Part B authorisations to the operational base of crushers rather than their point of ownership would also be beneficial to the process of data collection. That comment also remains valid.
8	Where voluntary surveys are deemed to be necessary, it is strongly recommended that they should be initiated at a time that allows survey forms to be circulated soon after the end of the year for which data are being collected. This may well require preparatory work to commence three or four months earlier, in order to allow the survey population to be properly updated and organised.

Appendix 1: Definition of CDEW

This Appendix provides the definition of the full range of CDEW, which was agreed with WRAP for use in this project. The basic definition is 'All waste streams which can be identified as arising wholly or mainly on construction sites, including those where preparatory activities such as demolition and earthworks are being carried out'. This definition should be interpreted by reference to the European Waste Catalogue.

The European Waste Catalogue (EWC) provides codes which are used by waste managers to classify and report wastes. CDEW as defined in this report is not limited to Chapter 17 of the EWC (which covers 'construction and demolition wastes (including excavated soil from contaminated sites)'), nor does it include all of the codes in Chapter 17 (in that it excludes two codes covering dredging spoil). It also excludes waste streams in which CDEW has been mixed with other wastes, and is therefore no longer recognisable as specifically derived from construction (most notably EWC code 19 12 12). It includes a small number of codes that cover directly comparable wastes (such as waste from the construction materials manufacturing industry, and used railway track ballast).

The EWC ends at Chapter 20. Notwithstanding, some waste managers are evidently still using codes starting with 21, 22, 24 and 26. These out-of-date codes almost certainly come from the 'UK Waste Classification System: Waste Composition Categories (16th draft)', but because this is how wastes are still actually being reported to the Environment Agency, such codes are included in Table A1.1.

All of the 70 codes shown in Table A1.1 have been further allocated to one of ten waste groups and four 'character' categories, as shown in the two right-hand columns of Table A1.1.

For ease of reference, most of the codes are then re-presented in Tables A1.2 to A1.9 grouped under those ten waste groups, which are as follows:

- Hard (those materials which would generally be suitable for crushing into aggregate);
- Asphalt etc (road surfacing or wastes with significant proportions of road surfacing);
- Soils (naturally occurring soil, stone and rock);
- Mixed;
- Wood;
- Metals;
- Plastic;
- Gypsum (plaster or plasterboard);
- Asbestos / insulation (asbestos in any form, or other insulation materials);
- Liquid / sludge (liquids and sludges generally from the remediation of contaminated soil or groundwater).

Tables for wood and plastics are not presented, since these waste streams are covered by a single EWC code each (17 02 01 and 17 02 03 respectively).

The 'character' categorisation (dividing the waste streams into inert, mixed, non-hazardous and hazardous) is indicative only, has been done solely for the purposes of this study, and does not purport to represent the views of WRAP or of any official body. Only those EWC codes that are marked with an asterisk are described as hazardous. Those waste streams that are likely to be considered in practice to be wholly or largely inert are described as inert, though it must re recognised that in practice and on some occasions they might be classified as non-hazardous. Similarly, those waste streams that would normally be expected (on the balance of probabilities and experience) to be classified as non-hazardous are described as such. The category described as 'mixed' only applies to EWC code 17 09 04, in recognition of the fact that the component elements are likely to be varied as well as mixed, and whereas the mixture might in some cases be classified as inert, this will certainly not generally be the case.

In Tables A1.2 to A1.9, and in other subsequent tables, some of the EWC descriptions have been abbreviated or summarised for convenience. If in doubt, readers should refer back to the full descriptions in Table A1.1.

Table A1.1: EWC codes included in the definition of CDEW for the purposes of this study

Code	*Description*	*Group*	*Character*
10 12 08	Waste ceramics, bricks, tiles and construction products (after thermal processing)	Hard	Inert
17 01 01	Concrete	Hard	Inert
17 01 02	Bricks	Hard	Inert
17 01 03	Tiles and ceramics	Hard	Inert
17 01 06*	Mixtures of, or separate fractions of concrete, bricks, tiles and ceramics containing dangerous substances	Hard	Haz
17 01 07	Mixtures of concrete, bricks, tiles and ceramics other than those mentioned in 17 01 06	Hard	Inert
17 02 01	Wood	Wood	Non-haz
17 02 02	Glass	Hard	Inert
17 02 03	Plastic	Plastic	Non-haz
17 02 04*	Glass, plastic and wood containing or contaminated with dangerous substances	Mixed	Haz
17 03 01*	Bituminous mixtures containing coal tar	Asphalt etc	Haz
17 03 02	Bituminous mixtures other than those mentioned in 17 03 01	Asphalt etc	Inert
17 03 03*	Coal tar and tarred products	Asphalt etc	Haz
17 04 01	Copper, bronze, brass	Metals	Non-haz
17 04 02	Aluminium	Metals	Non-haz
17 04 03	Lead	Metals	Non-haz
17 04 04	Zinc	Metals	Non-haz
17 04 05	Iron and steel	Metals	Non-haz
17 04 06	Tin	Metals	Non-haz
17 04 07	Mixed metals	Metals	Non-haz
17 04 09*	Metal waste contaminated with dangerous substances	Metals	Haz
17 04 10*	Cables containing oil, coal tar and other dangerous substances	Mixed	Haz
17 04 11	Cables other than those mentioned in 17 04 10	Mixed	Non-haz
17 05 03*	Soil and stones containing dangerous substances	Soils	Haz
17 05 04	Soil and stones other than those mentioned in 17 05 03	Soils	Inert
17 05 07*	Track ballast containing dangerous substances	Hard	Haz
17 05 08	Track ballast other than those mentioned in 17 05 07	Hard	Inert
17 06 01*	Insulation materials containing asbestos	Asbestos / insulation	Haz
17 06 03*	Other insulation materials consisting of or containing dangerous substances	Asbestos / insulation	Haz
17 06 04	Insulation materials other than those mentioned in 17 06 01 and 17 06 03	Asbestos / insulation	Non-haz
17 06 05*	Construction materials containing asbestos	Asbestos / insulation	Haz
17 08 01*	Gypsum-based construction materials contaminated with dangerous substances	Gypsum	Haz
17 08 02	Gypsum-based construction materials other than those mentioned in 17 08 01	Gypsum	Non-haz
17 09 01*	Construction and demolition wastes containing mercury	Mixed	Haz
17 09 02*	Construction and demolition waste containing PCB	Mixed	Haz
17 09 03*	Other construction and demolition wastes (including mixed wastes) containing dangerous substances	Mixed	Haz
17 09 04	Mixed construction and demolition wastes other than those mentioned in 17 09 01, 17 09 02 and 17 09 03	Mixed	Mixed
19 12 09	Minerals (for example sand, stones)	Hard	Inert
19 13 01*	Solid wastes from soil remediation containing dangerous substances	Mixed	Haz
19 13 02	Solid wastes from soil remediation other than those mentioned in 19 13 01	Mixed	Non-haz
19 13 03*	Sludges from soil remediation containing dangerous substances	Liquid / sludge	Haz

Code	*Description*	*Group*	*Character*
19 13 04	Sludges from soil remediation other than those mentioned in 19 13 03	Liquid / sludge	Non-haz
19 13 05*	Sludges from groundwater remediation containing dangerous substances	Liquid / sludge	Haz
19 13 06	Sludges from groundwater remediation other than those mentioned in 19 13 05	Liquid / sludge	Non-haz
19 13 07*	Aqueous liquid wastes and aqueous concentrates from groundwater remediation containing dangerous substances	Liquid / sludge	Haz
19 13 08	Aqueous liquid wastes and aqueous concentrates from groundwater remediation other than those mentioned in 19 13 07	Liquid / sludge	Non-haz
20 02 02	Soil and stones (from gardens, parks, cemeteries)	Soils	Inert
21 00 00	Inert, generally unspecified, but includes some soil and stones	Soils	Inert
21 01 00	Inert - natural rocks and sub-soils	Soils	Inert
21 01 01	Inert rock and stones	Hard	Inert
21 01 02	Inert sub-soils	Soils	Inert
21 02 00	Inert - ceramic and/or cemented materials	Hard	Inert
21 02 01	Inert - glass	Hard	Inert
21 02 02	Inert - ceramics	Hard	Inert
21 02 03	Concrete, mortar	Hard	Inert
21 03 01	Inert moulding sands and/or clays	Soils	Inert
22 01 00	Rock and soil with some organic content	Soils	Non-haz
22 01 01	General / biodegradable - uncontaminated top soil	Soils	Non-haz
22 02 00	General / biodegradable CDEW (sometimes incl coated roadstone)	Mixed	Non-haz
22 02 01	General / biodegradable CDEW (mixed)	Mixed	Non-haz
22 02 02	Coated roadstone	Asphalt etc	Non-haz
22 02 03	General / biodegradable - streetworks waste	Mixed	Non-haz
22 03 00	Plaster / plasterboard	Gypsum	Non-haz
22 03 01	Plaster	Gypsum	Non-haz
22 03 02	Plasterboard	Gypsum	Non-haz
22 06 05	General / biodegradable - mixture of vegetation, soil and stones	Mixed	Non-haz
24 04 00*	Contaminated CDEW	Mixed	Haz
26 00 00*	Unspecified asbestos	Asbestos / insulation	Haz
26 01 00*	Fibrous asbestos	Asbestos / insulation	Haz
26 02 00*	Bonded asbestos	Asbestos / insulation	Haz

Source: Capita Symonds, based on the EWC and returns made in 2008 to the Environment Agency

Table A1.2: EWC codes included in the definition of 'Hard CDEW' for the purposes of this study

Code	*Description*	*Character*
10 12 08	Waste new ceramics, bricks, tiles etc	Inert
17 01 01	Concrete	Inert
17 01 02	Bricks	Inert
17 01 03	Tiles and ceramics	Inert
17 01 06*	Hazardous mixed concrete, bricks, tiles etc	Haz
17 01 07	Mixed concrete, bricks, tiles etc	Inert
17 02 02	Glass	Inert
17 05 07*	Contaminated track ballast	Haz
17 05 08	Track ballast	Inert
19 12 09	Minerals (e.g. sand, stones)	Inert
21 01 01	Inert rock and stones	Inert
21 02 00	Ceramic and/or cemented materials	Inert
21 02 01	Glass	Inert
21 02 02	Ceramics	Inert
21 02 03	Concrete, mortar	Inert

Source: Capita Symonds, based on the EWC and returns made in 2008 to the Environment Agency

Table A1.3: EWC codes included in the definition of 'Asphalt etc' for the purposes of this study

Code	*Description*	*Character*
17 03 01*	Bituminous mixtures containing coal tar	Haz
17 03 02	Bituminous mixtures without coal tar	Inert
17 03 03*	Coal tar and tarred products	Haz
22 02 02	Coated roadstone	Non-haz

Source: Capita Symonds, based on the EWC and returns made in 2008 to the Environment Agency

Table A1.4: EWC codes included in the definition of 'Soils' for the purposes of this study

Code	*Description*	*Character*
17 05 03*	Contaminated soil and stones	Haz
17 05 04	Soil and stones	Inert
20 02 02	Soil and stones (from gardens, parks, cemeteries)	Inert
21 00 00	Inert waste, includes soil and stones	Inert
21 01 00	Inet - natural rocks and sub-soils	Inert
21 01 02	Inert sub-soils	Inert
21 03 01	Moulding sands or clays	Inert
22 01 00	Rock and soil with some organic content	Non-haz
22 01 01	Uncontaminated top soil	Non-haz

Source: Capita Symonds, based on the EWC and returns made in 2008 to the Environment Agency

Table A1.5: EWC codes included in the definition of 'Mixed' for the purposes of this study

Code	*Description*	*Character*
17 02 04*	Hazardous glass, plastic, wood	Haz
17 04 10*	Hazardous cables containing oil, coal tar etc	Haz
17 04 11	Cables	Non-haz
17 09 01*	CDEW containing mercury	Haz
17 09 02*	CDEW containing PCB	Haz
17 09 03*	Other hazardous CDEW (including mixed wastes)	Haz
17 09 04	Mixed CDEW	Mixed
19 13 01*	Solid hazardous soil remediation residues	Haz
19 13 02	Solid soil remediation residues	Non-haz
22 02 00	CDEW (sometimes incl coated roadstone)	Non-haz
22 02 01	Mixed CDEW	Non-haz
22 02 03	Streetworks waste	Non-haz
22 06 05	Mixed vegetation, soil and stones	Non-haz
24 04 00*	Contaminated CDEW	Haz

Source: Capita Symonds, based on the EWC and returns made in 2008 to the Environment Agency

Table A1.6: EWC codes included in the definition of 'Metals' for the purposes of this study

Code	*Description*	*Character*
17 04 01	Copper, bronze, brass	Non-haz
17 04 02	Aluminium	Non-haz
17 04 03	Lead	Non-haz
17 04 04	Zinc	Non-haz
17 04 05	Iron and steel	Non-haz
17 04 06	Tin	Non-haz
17 04 07	Mixed metals	Non-haz
17 04 09*	Hazardous metal waste	Haz

Source: Capita Symonds, based on the EWC and returns made in 2008 to the Environment Agency

Table A1.7: EWC codes included in the definition of 'Gypsum' for the purposes of this study

Code	*Description*	*Character*
17 08 01*	Contaminated gypsum-based materials	Haz
17 08 02	Gypsum-based materials	Non-haz
22 03 00	Plaster or plasterboard	Non-haz
22 03 01	Plaster	Non-haz
22 03 02	Plasterboard	Non-haz

Source: Capita Symonds, based on the EWC and returns made in 2008 to the Environment Agency

Table A1.8: EWC codes included in the definition of 'Asbestos / insulation' for the purposes of this study

Code	*Description*	*Character*
17 06 01*	Insulation containing asbestos	Haz
17 06 03*	Hazardous (non-asbestos) insulation	Haz
17 06 04	Non-hazardous insulation	Non-haz
17 06 05*	Construction materials containing asbestos	Haz
26 00 00*	Unspecified asbestos	Haz
26 01 00*	Fibrous asbestos	Haz
26 02 00*	Bonded asbestos	Haz

Source: Capita Symonds, based on the EWC and returns made in 2008 to the Environment Agency

Table A1.9: EWC codes included in the definition of 'Liquid / sludge' for the purposes of this study

Code	*Description*	*Character*
19 13 03*	Hazardous soil remediation sludges	Haz
19 13 04	Soil remediation sludges	Non-haz
19 13 05*	Hazardous groundwater remediation sludges	Haz
19 13 06	Groundwater remediation sludges	Non-haz
19 13 07*	Hazardous liquids from groundwater remediation	Haz
19 13 08	Liquids from groundwater remediation	Non-haz

Source: Capita Symonds, based on the EWC and returns made in 2008 to the Environment Agency

Appendix 2: Survey of recyclers of inert CDEW

The first part of this Appendix provides information on the processes followed in running the survey of inert CDEW recyclers. Some of the findings are reported here, and all of the findings are discussed in Chapter 2.

Running the survey

Survey forms were sent out to the 207 operators who had reported recycling activity at the time of the 2006 survey carried out for DCLG. These forms were posted to the addresses which had been valid in 2006 on 11 August 2009, with a follow-up mailing sent on 14 September 2009 (at which point the response rate was 28.5%). Only seven forms were returned showing that the addresses concerned were no longer valid.

The survey forms asked operators the following five questions.

Q1 Which of these products did you produce in 2008?
A Primary (quarried) aggregate
B Recycled aggregate / soil (made from crushed concrete, brick, general development site excavation waste etc)
C Recycled aggregate made from used asphalt (including asphalt planings)
D Recycled aggregate / soil made from utility trench arisings
E Recycled aggregate made from spent railway track ballast
F Crushed glass for use as aggregate / sand
G Aggregate made from other materials (e.g. from ash, slag, foundry sand etc)
H None of the above

Q2 How many tonnes of recycled aggregate and/or soil did you produce in 2008 under the following headings?
A Crushed with or without screening
B Screened without any crushing
C Total of the above (lines A and B)

Q3 How did the total tonnage given in answer to Q2 break down into the following materials (and what % was used on site)?
A Graded aggregate
B Ungraded aggregate (including general fill)
C Clean topsoil
D Other clean / useable soil (not topsoil)

Q4 How many mobile crushers and screens did you use to recycle aggregate and/or soil in 2008?

Q5 How many full-time machines (including ones that you hired in) is your answer to Q4 equivalent to? (For example:

- If you owned (or hired in) a crusher or screen for the full year, and you were the only person / company to use it, please count this as one full-time machine, however much or little you used it.
- If you hired in a crusher or screen for a week every month, please count this as a quarter of a machine.
- If you hired in a crusher or screen for a five-week period, please count this as one tenth (5/52) of a machine.)

The question asking about the % of material used on site (as part of Q3) was widely misinterpreted, and did not yield any useful information.

Individual operator returns

Table A2.1 presents the returns from 79 aggregate recycling operators (80 responses less one than only recycled soil in both 2005 and 2008). Aspects of these results are presented graphically in Chapter 2, but Table A2.1 provides information on the population density band in which each operator was working, as well as information on both graded and ungraded recycled aggregate which cannot be seen in the Figures in Chapter 2.

As with the Figures in Chapter 2, the results are sorted from largest percentage contraction to largest percentage expansion for total recycled aggregate (though within a single % value the order may not be identical).

Table A2.1: 79 individual operator returns

Pop'n density	*Graded agg 2005*	*Graded agg 2008*	*Graded agg % change*	*U'gr agg 2005*	*U'gr agg 2008*	*U'gr agg % change*	*Total agg 2005*	*Total agg 2008*	*Total agg % change*
H	30,000	0	-100%	0	0	n/a	30,000	0	-100%
L	0	0	n/a	9,000	0	-100%	9,000	0	-100%
L	0	0	n/a	6,000	0	-100%	6,000	0	-100%
L	0	0	n/a	5,500	0	-100%	5,500	0	-100%
L	0	0	n/a	40,000	0	-100%	40,000	0	-100%
L	0	24,000	n/a	400,000	0	-100%	400,000	24,000	-94%
L	13,200	1,540	-88%	3,000	0	-100%	16,200	1,540	-90%
L	0	0	n/a	40,000	5,000	-88%	40,000	5,000	-88%
L	20,000	1,000	-95%	10,000	4,000	-60%	30,000	5,000	-83%
L	5,000	0	-100%	125,000	22,500	-82%	130,000	22,500	-83%
L	20,000	7,500	-63%	20,000	0	-100%	40,000	7,500	-81%
M	5,000	0	-100%	0	1,000	n/a	5,000	1,000	-80%
L	80,000	25,000	-69%	0	0	n/a	80,000	25,000	-69%
H	70,000	0	-100%	180,000	85,000	-53%	250,000	85,000	-66%
L	100,000	20,749	-79%	75,000	39,364	-48%	175,000	60,113	-66%
H	200,000	80,000	-60%	30,000	0	-100%	230,000	80,000	-65%
L	20,000	0	-100%	0	7,500	n/a	20,000	7,500	-63%
L	0	0	n/a	2,000	800	-60%	2,000	800	-60%
L	0	0	n/a	12,000	5,000	-58%	12,000	5,000	-58%
L	225,049	65,498	-71%	45,374	50,782	12%	270,423	116,280	-57%
L	60,000	78,000	30%	190,000	39,000	-79%	250,000	117,000	-53%
M	5,000	8,000	60%	12,000	0	-100%	17,000	8,000	-53%
L	0	0	n/a	10,000	5,000	-50%	10,000	5,000	-50%
L	50,000	0	-100%	0	26,000	n/a	50,000	26,000	-48%
L	20,000	30,000	50%	30,000	0	-100%	50,000	30,000	-40%
H	39,459	552	-99%	0	24,904	n/a	39,459	25,456	-35%
L	0	0	n/a	13,895	9,000	-35%	13,895	9,000	-35%
M	65,414	60,952	-7%	19,788	0	-100%	85,202	60,952	-28%
M	85,000	105,000	24%	60,000	0	-100%	145,000	105,000	-28%
M	0	0	n/a	15,000	11,250	-25%	15,000	11,250	-25%
L	18,000	15,000	-17%	2,000	0	-100%	20,000	15,000	-25%
L	0	5,000	n/a	25,000	15,000	-40%	25,000	20,000	-20%
H	90,000	80,000	-11%	0	0	n/a	90,000	80,000	-11%
L	0	0	n/a	1,100	1,000	-9%	1,100	1,000	-9%
H	0	0	n/a	25,000	23,163	-7%	25,000	23,163	-7%
L	32,000	39,000	22%	33,700	22,000	-35%	65,700	61,000	-7%
L	0	0	n/a	9,757	9,295	-5%	9,757	9,295	-5%
H	35,000	35,000	0%	0	0	n/a	35,000	35,000	0%
M	40,000	40,000	0%	0	1,000	n/a	40,000	41,000	3%
L	10,000	68,000	580%	55,000	0	-100%	65,000	68,000	5%

Pop'n density	Graded agg 2005	Graded agg 2008	Graded agg % change	U'gr agg 2005	U'gr agg 2008	U'gr agg % change	Total agg 2005	Total agg 2008	Total agg % change
L	0	112,000	n/a	150,000	48,000	-68%	150,000	160,000	7%
L	4,000	2,500	-38%	500	2,500	400%	4,500	5,000	11%
L	5,000	0	-100%	8,000	15,000	88%	13,000	15,000	15%
L	90,000	100,000	11%	0	5,000	n/a	90,000	105,000	17%
L	24,000	44,000	83%	43,000	36,000	-16%	67,000	80,000	19%
L	0	14,845	n/a	12,247	471	-96%	12,247	15,316	25%
M	73,033	92,847	27%	0	0	n/a	73,033	92,847	27%
H	235,000	304,374	30%	0	0	n/a	235,000	304,374	30%
H	205,000	266,936	30%	0	0	n/a	205,000	266,936	30%
H	145,000	190,234	31%	0	0	n/a	145,000	190,234	31%
L	0	0	n/a	105,000	138,600	32%	105,000	138,600	32%
L	0	6,000	n/a	50,900	63,130	24%	50,900	69,130	36%
L	0	1,900	n/a	2,700	1,800	-33%	2,700	3,700	37%
L	5,000	12,963	159%	14,000	13,803	-1%	19,000	26,766	41%
L	10,000	12,000	20%	0	3,000	n/a	10,000	15,000	50%
L	11,000	15,042	37%	0	1,500	n/a	11,000	16,542	50%
M	60,000	190,000	217%	60,000	0	-100%	120,000	190,000	58%
H	0	0	n/a	6,549	11,250	72%	6,549	11,250	72%
L	16,000	34,500	116%	3,500	0	-100%	19,500	34,500	77%
L	0	0	n/a	12,000	21,695	81%	12,000	21,695	81%
H	160,936	324,315	102%	0	0	n/a	160,936	324,315	102%
M	15,000	31,000	107%	0	0	n/a	15,000	31,000	107%
L	72,107	150,000	108%	0	0	n/a	72,107	150,000	108%
L	3,000	5,834	94%	3,000	7,500	150%	6,000	13,334	122%
L	0	35,000	n/a	19,000	10,000	-47%	19,000	45,000	137%
L	16,875	32,000	90%	0	17,000	n/a	16,875	49,000	190%
H	20,000	59,500	198%	0	0	n/a	20,000	59,500	198%
L	0	0	n/a	4,000	13,000	225%	4,000	13,000	225%
L	0	397	n/a	1,000	3,177	218%	1,000	3,574	257%
L	0	0	n/a	4,000	15,000	275%	4,000	15,000	275%
L	10,000	70,000	600%	8,000	0	-100%	18,000	70,000	289%
M	25,000	80,000	220%	0	20,000	n/a	25,000	100,000	300%
L	2,000	10,000	400%	0	0	n/a	2,000	10,000	400%
L	0	90,500	n/a	17,500	0	-100%	17,500	90,500	417%
H	0	120,000	n/a	25,000	30,000	20%	25,000	150,000	500%
L	0	48,000	n/a	16,000	48,000	200%	16,000	96,000	500%
L	19,500	130,000	567%	0	0	n/a	19,500	130,000	567%
L	20,000	167,091	735%	0	0	n/a	20,000	167,091	735%
H	0	500,000	n/a	25,000	0	-100%	25,000	500,000	1900%

Source: Capita Symonds, 2009 survey

Appendix 3: Analysis of CDEW handled by waste treatment and transfer facilities

This Appendix provides details of CDEW handled by waste treatment and transfer facilities in England in 2008. The tonnage data have been extracted from site returns made to the Environment Agency by the sites' operators, and made available to WRAP for the purposes of this study. As well as analysing the full data set, there is a further more detailed analysis at the end of the Appendix covering those treatment and transfer facilities that handle the largest tonnages of CDEW.

General introduction

The facilities covered by this Appendix comprise all of the following site types:

- treatment facilities:
    - biological, chemical and physico-chemical treatment facilities;
    - composting sites; and
    - physical treatment facilities and MRFs;
- transfer facilities:
    - 'true' WTSs; and
    - household waste recovery centres (HWRCs).

All such facilities are expected to provide the Agency with a tonnage return for all incoming and outgoing materials which are classified and regulated as waste.

Facilities can be further classified by size, and for the purposes of this study the size bands were defined by tonnage throughput, as follows:

- very small = <1,000 tonnes of CDEW per year;
- small = 1,000 to 19,999 tonnes of CDEW a year;
- medium = 20,000 to 39,999 tonnes of CDEW a year;
- large = 40,000 to 99,999 tonnes of CDEW a year;
- very large = 100,000 tonnes of CDEW a year or more.

The actual process of categorisation was as follows:

- for each facility reporting incoming CDEW, the incoming tonnage of CDEW was computed, and the facility was assigned to the appropriate size band on the spreadsheet of incoming tonnages;
- for those facilities which reported both incoming and outgoing CDEW (i.e. 'matching' returns), the same size band was assigned to each facility on the spreadsheet of outgoing tonnages, and the facilities concerned were identified as having 'matching' returns;
- for those facilities that only reported outgoing CDEW, the outgoing tonnage of CDEW was computed, and the facility was assigned to the appropriate size band on the spreadsheet of outgoing tonnages.

Incoming and outgoing waste streams cannot be expected to balance, for five main reasons:

- wherever stockpiles are held, there will inevitably be differences between the tonnages added to and removed from those stockpiles over the period of a year;
- outgoing waste returns exclude recovered materials which have ceased to be regulated as waste;
- outgoing waste returns exclude liquids which were discharged to sewer or surface water;
- changes in moisture content (and therefore weight) may well occur due to evaporation or wetting;

- residues from the sorting or treatment of incoming CDEW may well be added to residues from other waste sorting and treatment processes, with the resultant mixed waste being classified as (for example) EWC code 19 12 12, which is not specific to CDEW, and therefore not reported here.

Main data set

Table A3.1 reports the total tonnage of waste reported under the EWC codes detailed in Appendix 1 at all waste facilities in England classified by the Environment Agency as either a treatment or transfer facility in 2008. A modest proportion of the outgoing tonnage is likely to have gone back to other WTSs (and therefore to represent an element of double counting).

Table A3.1: CDEW handled by all reporting treatment and transfer facilities in 2008 (tonnes)

Code	*Description*	*Incoming*	*Outgoing*
10 12 08	Waste new ceramics, bricks, tiles etc	14,362	4,542
17 01 01	Concrete	695,780	632,121
17 01 02	Bricks	249,569	508,924
17 01 03	Tiles and ceramics	5,455	2,489
17 01 06*	Hazardous mixed concrete, bricks, tiles etc	9,501	35,471
17 01 07	Mixed concrete, bricks, tiles etc	2,766,270	3,363,194
17 02 01	Wood	370,509	478,789
17 02 02	Glass	10,726	15,377
17 02 03	Plastic	23,736	31,055
17 02 04*	Hazardous glass, plastic, wood	17,114	1,404
17 03 01*	Bituminous mixtures containing coal tar	3,270	8,182
17 03 02	Bituminous mixtures without coal tar	229,292	142,306
17 03 03*	Coal tar and tarred products	2,648	1,345
17 04 01	Copper, bronze, brass	2,009	7,450
17 04 02	Aluminium	1,851	3,078
17 04 03	Lead	1,112	1,472
17 04 04	Zinc	24,520	291
17 04 05	Iron and steel	92,967	96,544
17 04 06	Tin	15	89
17 04 07	Mixed metals	125,714	208,618
17 04 09*	Hazardous metal waste	1,041	186
17 04 10*	Hazardous cables containing oil, coal tar etc	3	12
17 04 11	Cables	440	1,447
17 05 03*	Contaminated soil and stones	75,130	45,924
17 05 04	Soil and stones	5,828,736	5,822,714
17 05 07*	Contaminated track ballast	34,428	43,484
17 05 08	Track ballast	1,385,366	431,385
17 06 01*	Insulation containing asbestos	20,621	17,378
17 06 03*	Hazardous (non-asbestos) insulation	389	16
17 06 04	Non-hazardous insulation	4,805	4,347
17 06 05*	Construction materials containing asbestos	62,223	100,485
17 08 01*	Contaminated gypsum-based materials	1,111	30,434
17 08 02	Gypsum-based materials	106,924	88,019
17 09 01*	CDEW containing mercury	920	4,194
17 09 02*	CDEW containing PCB	699	765
17 09 03*	Other hazardous CDEW (including mixed wastes)	598	2,429
17 09 04	Mixed CDEW	8,669,151	1,903,709
19 12 09	Minerals (e.g. sand, stones)	76,781	1,493,998
19 13 01*	Solid hazardous soil remediation residues	6	1,925
19 13 02	Solid soil remediation residues	584	36,222
19 13 03*	Hazardous soil remediation sludges	45	0
19 13 04	Soil remediation sludges	237	3,449
19 13 05*	Hazardous groundwater remediation sludges	52	108

Code	*Description*	*Incoming*	*Outgoing*
19 13 06	Groundwater remediation sludges	510	452
19 13 07*	Hazardous liquids from groundwater remediation	413,202	0
19 13 08	Liquids from groundwater remediation	9,141	0
20 02 02	Soil and stones (from gardens, parks, cemeteries)	1,110,273	1,692,929
21 00 00	Inert waste, includes soil and stones	163,013	221,460
21 01 00	Inet - natural rocks and sub-soils	30,897	23,560
21 01 01	Inert rock and stones	13,769	40,367
21 01 02	Inert sub-soils	41,231	50,621
21 02 00	Ceramic and/or cemented materials	143	1,049
21 02 01	Glass	66	0
21 02 02	Ceramics	29,711	0
21 02 03	Concrete, mortar	26,818	12,754
21 03 01	Moulding sands or clays	0	6
22 01 00	Rock and soil with some organic content	18,312	21,944
22 01 01	Uncontaminated top soil	0	11,781
22 02 00	CDEW (sometimes incl coated roadstone)	87,829	49,573
22 02 01	Mixed CDEW	59,634	22,982
22 02 02	Coated roadstone	23,170	11,049
22 02 03	Streetworks waste	749	3,499
22 03 00	Plaster or plasterboard	966	693
22 03 01	Plaster	8,438	0
22 03 02	Plasterboard	610	722
22 06 05	Mixed vegetation, soil and stones	0	147
24 04 00*	Contaminated CDEW	0	0
26 00 00*	Unspecified asbestos	1,504	1,504
26 01 00*	Fibrous asbestos	9	9
26 02 00*	Bonded asbestos	169	169

Source: Capita Symonds, based on returns made in 2008 to the Environment Agency

Tables A3.2 to A3.5 re-present the same data, summarised by the waste groups and characters established in Appendix 1 (and using the heading '17 09 04' instead of 'mixed' on the grounds that this is likely to be more helpful in this context). These tables report the incoming and outgoing tonnages, and the absolute and percentage differences between them.

Table A3.2: CDEW entering all reporting treatment and transfer facilities in 2008 (tonnes)

	Inert	*17 09 04*	*Non-haz*	*Haz*	*Total*
Hard	5,274,816	0	0	43,929	5,318,745
Asphalt etc	229,292	0	23,170	5,918	258,380
Soils	7,174,149	0	18,312	75,130	7,267,591
Mixed	0	8,669,151	149,236	19,340	8,837,727
Wood	0	0	370,509	0	370,509
Metals	0	0	248,189	1,041	249,230
Plastic	0	0	23,736	0	23,736
Gypsum	0	0	116,938	1,111	118,048
Asbestos / insulation	0	0	4,805	84,915	89,720
Liquid / sludge	0	0	9,888	413,299	423,187
Total	12,678,258	8,669,151	964,782	644,682	22,956,873

Source: Capita Symonds, based on returns made in 2008 to the Environment Agency

Table A3.3: CDEW leaving all reporting treatment and transfer facilities in 2008 (tonnes)

	Inert	*17 09 04*	*Non-haz*	*Haz*	*Total*
Hard	6,506,201	0	0	78,955	6,585,156
Asphalt etc	142,306	0	11,049	9,527	162,882
Soils	7,811,290	0	33,726	45,924	7,890,940
Mixed	0	1,903,709	113,871	10,728	2,028,308
Wood	0	0	478,789	0	478,789
Metals	0	0	317,542	186	317,728
Plastic	0	0	31,055	0	31,055
Gypsum	0	0	89,434	30,434	119,868
Asbestos / insulation	0	0	4,347	119,562	123,908
Liquid / sludge	0	0	3,900	108	4,008
Total	14,459,798	1,903,709	1,083,711	295,424	17,742,643

Source: Capita Symonds, based on returns made in 2008 to the Environment Agency

Table A3.4: Change in CDEW (outgoing – incoming tonnes) at all reporting treatment and transfer facilities in 2008

	Inert	*17 09 04*	*Non-haz*	*Haz*	*Total*
Hard	1,231,385	0	0	35,026	1,266,411
Asphalt etc	-86,986	0	-12,121	3,610	-95,498
Soils	637,141	0	15,414	-29,205	623,350
Mixed	0	-6,765,441	-35,366	-8,612	-6,809,419
Wood	0	0	108,280	0	108,280
Metals	0	0	69,354	-856	68,498
Plastic	0	0	7,319	0	7,319
Gypsum	0	0	-27,504	29,324	1,820
Asbestos / insulation	0	0	-458	34,646	34,188
Liquid / sludge	0	0	-5,988	-413,191	-419,178
Total	1,781,539	-6,765,441	118,929	-349,258	-5,214,231

Source: Capita Symonds, based on returns made in 2008 to the Environment Agency

Table A3.5: % change in CDEW (outgoing – incoming tonnes) at all reporting treatment and transfer facilities in 2008

	Inert	*17 09 04*	*Non-haz*	*Haz*	*Total*
Hard	23.3%	n/a	n/a	79.7%	23.8%
Asphalt etc	-37.9%	n/a	-52.3%	61.0%	-37.0%
Soils	8.9%	n/a	84.2%	-38.9%	8.6%
Mixed	n/a	-78.0%	-23.7%	-44.5%	-77.0%
Wood	n/a	n/a	29.2%	n/a	29.2%
Metals	n/a	n/a	27.9%	-82.2%	27.5%
Plastic	n/a	n/a	30.8%	n/a	30.8%
Gypsum	n/a	n/a	-23.5%	2,640.5%	1.5%
Asbestos / insulation	n/a	n/a	-9.5%	40.8%	38.1%
Liquid / sludge	n/a	n/a	-60.6%	-100.0%	-99.1%
Total	14.1%	-78.0%	12.3%	-54.2%	-22.7%

Source: Capita Symonds, based on returns made in 2008 to the Environment Agency

Tables A3.6 to A3.13 show how responsibility for handling the total CDEW stream can be split down between different types of facilities, and by facility size. Table A3.6 shows how this process worked for all facility types taken as a single group, before they are broken out to show the equivalent performance of different facility types.

Table A3.6: Differences in performance, all treatment and transfer facilities (tonnes of CDEW, 2008)

	Very small	*Small*	*Medium*	*Large*	*Very large*	*Total*
Incoming reports (no)	682	959	138	117	35	1,931
Outgoing reports (no)	814	1,076	128	104	33	2,155
Incoming tonnes	215,181	5,534,321	3,847,377	7,109,568	6,250,426	22,956,873
Outgoing tonnes	575,967	5,711,521	3,058,287	4,735,553	3,661,316	17,742,643
Change in tonnes	360,786	177,200	-789,090	-2,374,015	-2,589,110	-5,214,231
% change	167.7%	3.2%	-20.5%	-33.4%	-41.4%	-22.7%

Source: Capita Symonds, based on returns made in 2008 to the Environment Agency

Table A3.7: Differences in performance, all treatment facilities (tonnes of CDEW, 2008)

	Very small	*Small*	*Medium*	*Large*	*Very large*	*Total*
Incoming reports (no)	108	84	27	36	15	270
Outgoing reports (no)	82	71	23	26	14	216
Incoming tonnes	22,567	637,395	756,717	2,351,981	3,077,251	6,845,911
Outgoing tonnes	71,022	447,296	582,702	1,183,829	1,256,910	3,541,759
Change in tonnes	48,454	-190,099	-174,015	-1,168,152	-1,820,340	-3,304,151
% change	214.7%	-29.8%	-23.0%	-49.7%	-59.2%	-48.3%

Source: Capita Symonds, based on returns made in 2008 to the Environment Agency

Table A3.8: Differences in performance, biological, chemical and physico-chemical treatment facilities (tonnes of CDEW, 2008)

	Very small	*Small*	*Medium*	*Large*	*Very large*	*Total*
Incoming reports (no)	40	5	1	1	0	47
Outgoing reports (no)	22	5	1	1	0	29
Incoming tonnes	4,779	36,176	28,653	46,888	0	116,496
Outgoing tonnes	1,731	16,907	19,529	17,615	0	55,781
Change in tonnes	-3,048	-19,270	-9,125	-29,273	0	-60,715
% change	-63.8%	-53.3%	-31.8%	-62.4%	0	-52.1%

Source: Capita Symonds, based on returns made in 2008 to the Environment Agency

Table A3.9: Differences in performance, composting facilities (tonnes of CDEW, 2008)

	Very small	*Small*	*Medium*	*Large*	*Very large*	*Total*
Incoming reports (no)	13	11	1	2	0	27
Outgoing reports (no)	7	9	1	1	0	18
Incoming tonnes	4,670	59,381	20,267	126,319	0	210,637
Outgoing tonnes	3,289	32,504	19,463	36,834	0	92,089
Change in tonnes	-1,381	-26,878	-805	-89,485	0	-118,548
% change	-29.6%	-45.3%	-4.0%	-70.8%	0	-56.3%

Source: Capita Symonds, based on returns made in 2008 to the Environment Agency

Table A3.10: Differences in performance, physical treatment facilities and MRFs (tonnes of CDEW, 2008)

	Very small	*Small*	*Medium*	*Large*	*Very large*	*Total*
Incoming reports (no)	55	68	25	33	15	196
Outgoing reports (no)	53	57	21	24	14	169
Incoming tonnes	13,119	541,838	707,796	2,178,775	3,077,251	6,518,778
Outgoing tonnes	66,002	397,886	543,710	1,129,380	1,256,910	3,393,889
Change in tonnes	52,883	-143,952	-164,086	-1,049,394	-1,820,340	-3,124,889
% change	403.1%	-26.6%	-23.2%	-48.2%	-59.2%	-47.9%

Source: Capita Symonds, based on returns made in 2008 to the Environment Agency

Table A3.11: Differences in performance, all transfer facilities (tonnes of CDEW, 2008)

	Very small	*Small*	*Medium*	*Large*	*Very large*	*Total*
Incoming reports (no)	574	875	111	81	20	1,661
Outgoing reports (no)	732	1,005	105	78	19	1,939
Incoming tonnes	192,614	4,896,926	3,090,660	4,757,587	3,173,175	16,110,962
Outgoing tonnes	504,945	5,264,224	2,475,585	3,551,723	2,404,405	14,200,883
Change in tonnes	312,331	367,299	-615,075	-1,205,863	-768,770	-1,910,079
% change	162.2%	7.5%	-19.9%	-25.3%	-24.2%	-11.9%

Source: Capita Symonds, based on returns made in 2008 to the Environment Agency

Table A3.12: Differences in performance, 'true' WTSs (tonnes of CDEW, 2008)

	Very small	*Small*	*Medium*	*Large*	*Very large*	*Total*
Incoming reports (no)	421	694	109	80	20	1,324
Outgoing reports (no)	480	775	104	77	19	1,455
Incoming tonnes	119,421	4,471,823	3,044,649	4,693,242	3,173,175	15,502,310
Outgoing tonnes	354,004	4,789,506	2,474,004	3,500,811	2,404,405	13,522,730
Change in tonnes	234,582	317,683	-570,645	-1,192,431	-768,770	-1,979,580
% change	196.4%	7.1%	-18.7%	-25.4%	-24.2%	-12.8%

Source: Capita Symonds, based on returns made in 2008 to the Environment Agency

Table A3.13: Differences in performance, HWRCs (tonnes of CDEW, 2008)

	Very small	*Small*	*Medium*	*Large*	*Very large*	*Total*
Incoming reports (no)	153	181	2	1	0	337
Outgoing reports (no)	252	230	1	1	0	484
Incoming tonnes	73,193	425,103	46,011	64,345	0	608,652
Outgoing tonnes	150,942	474,718	1,581	50,912	0	678,153
Change in tonnes	77,749	49,615	-44,431	-13,433	0	69,501
% change	106.2%	11.7%	-96.6%	-20.9%	0	11.4%

Source: Capita Symonds, based on returns made in 2008 to the Environment Agency

Table A3.14: Subsequent destinations of different waste streams leaving treatment and transfer facilities (tonnes of CDEW, 2008)

	Transfer station	*Landfill*	*Incin-eration*	*Recycl-ing*	*Reproc-essing*	*Treat-ment*	*Un-known*
Hard	43,008	606,472	10	3,555,604	792,140	21,981	1,565,941
Asphalt etc	19,132	31,147	2	81,302	6,177	1,353	23,769
Soils	110,351	2,365,808	1,521	2,784,613	761,088	72,249	1,795,310
Mixed	112,078	932,675	23	396,840	83,911	3,386	499,395
Wood	4,249	13,828	20,154	251,431	121,880	5,827	61,420
Metals	53,593	2,811	2	109,851	84,968	353	66,150
Plastic	90	5,017	0	6,689	13,051	0	6,208
Gypsum	495	527	0	41,482	29,281	186	47,897
Asbestos / insulation	684	106,862	48	9,234	1,335	735	5,010
Liquid / sludge	0	100	0	3,757	108	44	0
Total	343,681	4,065,248	21,761	7,240,802	1,893,938	106,114	4,071,099

Source: Capita Symonds, based on returns made in 2008 to the Environment Agency

Data from selected facilities

In this section of the Appendix the analysis reported above in several of the tables is repeated, but limited to a selected (but large) sub-group of facilities that met the following criteria:

- they were either physical treatment facilities, MRFs or WTSs;
- they received more than 1,000 tonnes of CDEW (taking all categories listed in Appendix 1 into account); and
- they reported both an incoming tonnage and an outgoing tonnage.

This selection yielded 969 facilities (108 treatment facilities and 861 transfer facilities) which between them handled 19.95 million tonnes of incoming CDEW and 15.78 million tonnes of outgoing CDEW. Although only representing about half of all reporting facilities, these 969 sites nevertheless accounted for over 85% of the CDEW handled.

Table A3.15: CDEW handled by selected treatment and transfer facilities in 2008 (tonnes)

Code	*Description*	*Incoming*	*Outgoing*
10 12 08	Waste new ceramics, bricks, tiles etc	14,210	4,542
17 01 01	Concrete	635,631	583,649
17 01 02	Bricks	217,666	458,680
17 01 03	Tiles and ceramics	4,812	1,977
17 01 06*	Hazardous mixed concrete, bricks, tiles etc	8,941	35,263
17 01 07	Mixed concrete, bricks, tiles etc	2,470,637	3,007,807
17 02 01	Wood	274,304	434,201
17 02 02	Glass	9,897	14,738
17 02 03	Plastic	22,069	27,600
17 02 04*	Hazardous glass, plastic, wood	17,069	960
17 03 01*	Bituminous mixtures containing coal tar	3,136	8,092
17 03 02	Bituminous mixtures without coal tar	187,789	136,224
17 03 03*	Coal tar and tarred products	1,111	18
17 04 01	Copper, bronze, brass	2,009	3,646
17 04 02	Aluminium	780	1,650
17 04 03	Lead	1,013	509
17 04 04	Zinc	19,401	291
17 04 05	Iron and steel	72,082	91,409
17 04 06	Tin	0	68
17 04 07	Mixed metals	109,991	193,829
17 04 09*	Hazardous metal waste	973	115
17 04 10*	Hazardous cables containing oil, coal tar etc	0	0
17 04 11	Cables	368	1,351

Code	*Description*	*Incoming*	*Outgoing*
17 05 03*	Contaminated soil and stones	44,727	37,829
17 05 04	Soil and stones	4,920,120	5,418,427
17 05 07*	Contaminated track ballast	33,223	43,484
17 05 08	Track ballast	1,385,238	431,373
17 06 01*	Insulation containing asbestos	17,883	8,699
17 06 03*	Hazardous (non-asbestos) insulation	1	1
17 06 04	Non-hazardous insulation	4,491	288
17 06 05*	Construction materials containing asbestos	53,533	71,867
17 08 01*	Contaminated gypsum-based materials	31	30,416
17 08 02	Gypsum-based materials	96,354	85,575
17 09 01*	CDEW containing mercury	915	4,194
17 09 02*	CDEW containing PCB	656	765
17 09 03*	Other hazardous CDEW (including mixed wastes)	52	2,222
17 09 04	Mixed CDEW	8,031,468	1,754,839
19 12 09	Minerals (e.g. sand, stones)	54,077	1,417,613
19 13 01*	Solid hazardous soil remediation residues	0	0
19 13 02	Solid soil remediation residues	583	16,788
19 13 03*	Hazardous soil remediation sludges	0	0
19 13 04	Soil remediation sludges	0	1,187
19 13 05*	Hazardous groundwater remediation sludges	0	0
19 13 06	Groundwater remediation sludges	311	308
19 13 07*	Hazardous liquids from groundwater remediation	0	0
19 13 08	Liquids from groundwater remediation	5	0
20 02 02	Soil and stones (from gardens, parks, cemeteries)	757,757	1,074,565
21 00 00	Inert waste, includes soil and stones	161,121	193,277
21 01 00	Inet - natural rocks and sub-soils	14,007	17,376
21 01 01	Inert rock and stones	13,769	26,928
21 01 02	Inert sub-soils	40,321	34,614
21 02 00	Ceramic and/or cemented materials	143	1,001
21 02 01	Glass	0	0
21 02 02	Ceramics	24,014	0
21 02 03	Concrete, mortar	26,284	12,754
21 03 01	Moulding sands or clays	0	0
22 01 00	Rock and soil with some organic content	17,772	21,802
22 01 01	Uncontaminated top soil	0	1,253
22 02 00	CDEW (sometimes incl coated roadstone)	87,158	49,426
22 02 01	Mixed CDEW	55,957	18,121
22 02 02	Coated roadstone	22,797	10,895
22 02 03	Streetworks waste	684	1,720
22 03 00	Plaster or plasterboard	966	693
22 03 01	Plaster	8,431	0
22 03 02	Plasterboard	610	610
22 06 05	Mixed vegetation, soil and stones	0	2
24 04 00*	Contaminated CDEW	0	0
26 00 00*	Unspecified asbestos	1,499	1,499
26 01 00*	Fibrous asbestos	0	0
26 02 00*	Bonded asbestos	146	146

Source: Capita Symonds, based on returns made in 2008 to the Environment Agency

Tables A3.16 to A3.19 re-present the same data, summarised by the waste groups and characters established in Appendix 1 (and using the heading '17 09 04' instead of 'mixed' on the grounds that this is likely to be more helpful in this context). These tables report the incoming and outgoing tonnages, and the absolute and percentage differences between them.

Table A3.16: CDEW entering selected treatment and transfer facilities in 2008 (tonnes)

	Inert	*17 09 04*	*Non-haz*	*Haz*	*Total*
Hard	4,856,379	0	0	42,164	4,898,543
Asphalt etc	187,789	0	22,797	4,247	214,833
Soils	5,893,325	0	17,772	44,727	5,955,825
Mixed	0	8,031,468	144,749	18,692	8,194,909
Wood	0	0	274,304	0	274,304
Metals	0	0	205,276	973	206,249
Plastic	0	0	22,069	0	22,069
Gypsum	0	0	106,361	31	106,391
Asbestos / insulation	0	0	4,491	73,062	77,553
Liquid / sludge	0	0	316	0	316
Total	10,937,493	8,031,468	798,135	183,896	19,950,993

Source: Capita Symonds, based on returns made in 2008 to the Environment Agency

Table A3.17: CDEW leaving selected treatment and transfer facilities in 2008 (tonnes)

	Inert	*17 09 04*	*Non-haz*	*Haz*	*Total*
Hard	5,961,062	0	0	78,748	6,039,810
Asphalt etc	136,224	0	10,895	8,111	155,229
Soils	6,738,259	0	23,055	37,829	6,799,143
Mixed	0	1,754,839	87,409	8,140	1,850,388
Wood	0	0	434,201	0	434,201
Metals	0	0	291,402	115	291,517
Plastic	0	0	27,600	0	27,600
Gypsum	0	0	86,878	30,416	117,294
Asbestos / insulation	0	0	288	82,212	82,500
Liquid / sludge	0	0	1,495	0	1,495
Total	12,835,545	1,754,839	963,223	245,570	15,799,177

Source: Capita Symonds, based on returns made in 2008 to the Environment Agency

Table A3.18: Change in CDEW (outgoing – incoming tonnes) at selected treatment and transfer facilities in 2008

	Inert	*17 09 04*	*Non-haz*	*Haz*	*Total*
Hard	1,104,683	0	0	36,584	1,141,267
Asphalt etc	-51,565	0	-11,902	3,863	-59,604
Soils	844,934	0	5,283	-6,898	843,319
Mixed	0	-6,276,629	-57,340	-10,552	-6,344,522
Wood	0	0	159,897	0	159,897
Metals	0	0	86,126	-858	85,268
Plastic	0	0	5,531	0	5,531
Gypsum	0	0	-19,483	30,385	10,903
Asbestos / insulation	0	0	-4,203	9,150	4,947
Liquid / sludge	0	0	1,179	0	1,179
Total	1,898,052	-6,276,629	165,087	61,674	-4,151,816

Source: Capita Symonds, based on returns made in 2008 to the Environment Agency

Table A3.19: % change in CDEW (outgoing – incoming tonnes) at selected treatment and transfer facilities in 2008

	Inert	*17 09 04*	*Non-haz*	*Haz*	*Total*
Hard	22.7%	n/a	n/a	86.8%	23.3%
Asphalt etc	-27.5%	n/a	-52.2%	91.0%	-27.7%
Soils	14.3%	n/a	29.7%	-15.4%	14.2%
Mixed	n/a	-78.2%	-39.6%	-56.5%	-77.4%
Wood	n/a	n/a	58.3%	n/a	58.3%
Metals	n/a	n/a	42.0%	-88.2%	41.3%
Plastic	n/a	n/a	25.1%	n/a	25.1%
Gypsum	n/a	n/a	-18.3%	99,298.7%	10.2%
Asbestos / insulation	n/a	n/a	-93.6%	12.5%	6.4%
Liquid / sludge	n/a	n/a	373.2%	n/a	373.2%
Total	17.4%	-78.2%	20.7%	33.5%	-20.8%

Source: Capita Symonds, based on returns made in 2008 to the Environment Agency

Tables A3.20 to A3.22 show how responsibility for handling the total CDEW stream can be split down between different types of facilities, and by facility size. Table A3.19 shows how this process worked for all of the selected facilities taken as a single group, before they are broken out to show the equivalent performance of treatment and transfer facilities.

Table A3.20: Differences in performance, all selected treatment and transfer facilities (tonnes of CDEW, 2008)

	Small	*Medium*	*Large*	*Very large*	*Total*
Facilities (no)	713	123	100	33	969
Incoming tonnes	4,722,099	3,421,856	6,117,581	5,689,457	19,950,993
Outgoing tonnes	4,596,105	2,966,957	4,574,907	3,661,208	15,799,177
Change in tonnes	-125,994	-454,899	-1,542,674	-2,028,249	-4,151,816
% change	-2.7%	-13.3%	-25.2%	-35.6%	-20.8%

Source: Capita Symonds, based on returns made in 2008 to the Environment Agency

Table A3.21: Differences in performance, selected treatment facilities (tonnes of CDEW, 2008)

	Small	*Medium*	*Large*	*Very large*	*Total*
Facilities (no)	50	21	24	13	108
Incoming tonnes	401,821	576,712	1,624,228	2,516,281	5,119,043
Outgoing tonnes	317,833	543,710	1,129,380	1,256,802	3,247,726
Change in tonnes	-83,988	-33,002	-494,848	-1,259,479	-1,871,317
% change	-20.9%	-5.7%	-30.5%	-50.1%	-36.6%

Source: Capita Symonds, based on returns made in 2008 to the Environment Agency

Table A3.22: Differences in performance, selected transfer facilities (tonnes of CDEW, 2008)

	Small	*Medium*	*Large*	*Very large*	*Total*
Facilities (no)	663	102	76	20	861
Incoming tonnes	4,320,278	2,845,144	4,493,353	3,173,175	14,831,950
Outgoing tonnes	4,278,272	2,423,247	3,445,527	2,404,405	12,551,450
Change in tonnes	-42,006	-421,897	-1,047,826	-768,770	-2,280,500
% change	-1.0%	-14.8%	-23.3%	-24.2%	-15.4%

Source: Capita Symonds, based on returns made in 2008 to the Environment Agency

Data from very large facilities

The final section of this Appendix looks in greater detail at the 33 'very large' waste treatment and transfer facilities (defined as accepting 100,000 tonnes or more of CDEW in 2008) that contribute one column of data to Table A3.20 above. In 2008 these 33 facilities accounted for 28.5% of all CDEW entering waste treatment and transfer facilities, and 23.2% of all CDEW leaving such facilities. Because they are all very large, there are sufficiently few of them to make it feasible to carry out a more detailed analysis of the materials that passed through them. Part of the focus of this further analysis has been to explore the relationship between CDEW and outgoing post-treatment mixed waste (EWC code 19 12 12), and to a lesser degree all other EWC Chapter 19 outgoing wastes.

The 33 very large facilities can helpfully be broken down further into:

- 17 facilities that did not generate any outgoing Chapter 19 waste (other than those EWC codes that have been included as CDEW for the purposes of this study, as set out in Appendix 1), of which:
    - six specialise in handling used railway track ballast; and
    - 11 can be regarded as more general treatment and transfer facilities.
- 16 facilities that did generate some outgoing non-CDEW Chapter 19 waste.

Tables A3.23 and A3.24 provide data on the various flows of CDEW passing through the first two sub-groups above (i.e. the six track ballast facilities and 11 others). These tables quantify the extent to which different waste flows changed due to activities at the sites concerned.

Table A3.23: CDEW handled by six very large railway track ballast treatment and transfer facilities (that did not generate Chapter 19 waste) in 2008

Code	*Description*	*Incoming tonnes*	*Outgoing tonnes*	*Change (tonnes)*	*Change as % of incoming*
17 01 07	Mixed concrete, bricks, tiles etc	0	2,914	2,914	n/a
17 05 04	Soil and stones	2,192	12,475	10,283	469.1%
17 05 07*	Contaminated track ballast	29,525	39,826	10,300	34.9%
17 05 08	Track ballast	1,078,063	390,075	-687,988	-63.8%
17 09 04	Mixed CDEW	29,912	39,337	9,425	31.5%
Total		1,139,692	484,625	-655,067	-57.5%

Source: Capita Symonds, based on returns made in 2008 to the Environment Agency

It is clear that the facilities covered by Table A3.23 were relatively simple, and that they dealt with large volumes of 'hard' CDEW (including track ballast). It is almost certain that most of the 'missing' tonnage was accounted for by recovered track ballast and recycled aggregate that left the premises classified as product rather than waste.

Although the 11 facilities covered by Table A3.24 handled a wider range of CDEW, it is also clear that their principal function was the recovery from 'hard' CDEW and soil of recycled aggregate, cleaned-up soil, wood, metals etc. It seems highly likely that (as with the track ballast depots considered above) much of the 'missing' tonnage was made up of product (primarily aggregate recycled under the relevant WRAP Protocol).

Table A3.24: CDEW handled by 11 very large waste treatment and transfer facilities (that did not generate Chapter 19 waste) in 2008

Code	*Description*	*Incoming tonnes*	*Outgoing tonnes*	*Change (tonnes)*	*Change as % of incoming*
17 01 01	Concrete	75,060	118,703	43,643	58.1%
17 01 02	Bricks	7,676	3,271	-4,405	-57.4%
17 01 07	Mixed concrete, bricks, tiles etc	486,794	528,569	41,775	8.6%
17 02 01	Wood	5,254	20,336	15,082	287.1%
17 02 03	Plastic	0	63	63	n/a
17 03 02	Bituminous mixtures w'out coal tar	4,663	683	-3,980	-85.4%
17 04 05	Iron and steel	0	233	233	n/a
17 04 07	Mixed metals	0	42,850	42,850	n/a
17 05 04	Soil and stones	785,322	457,138	-328,184	-41.8%
17 08 02	Gypsum-based materials	188	361	173	92.0%
17 09 04	Mixed CDEW	424,122	135,861	-288,261	-68.0%
19 12 09	Minerals (e.g. sand, stones)	0	26,352	26,352	n/a
21 00 00	Inert waste, includes soil and stones	70,860	70,860	0	0.0%
Total		1,859,939	1,405,279	-454,660	-24.4%

Source: Capita Symonds, based on returns made in 2008 to the Environment Agency

Matters are much more complex for the 16 facilities that classified some of their outgoing waste in 2008 as non-CDEW Chapter 19 wastes. Six of these facilities also accepted some non-CDEW Chapter 19 wastes from other sites. The complexities arise because:

- some of the materials recovered from CDEW (such as wood, metals and plastics) may well then have been included under Chapter 19 wastes;
- some residual CDEW may well have been classified as either EWC code 19 12 12 (post-treatment mixed waste) or 19 12 10 (refuse derived fuel).

Tables A3.25 and A3.26 need to be considered together. Table A3.25 provides information on all of the CDEW passing through the selected facilities (comparable to the two previous tables), and Table A3.26 provides equivalent information on all non-CDEW Chapter 19 wastes.

Table A3.25: CDEW handled by 16 very large waste treatment and transfer facilities (that did generate Chapter 19 waste) in 2008

Code	*Description*	*Incoming tonnes*	*Outgoing tonnes*	*Change (tonnes)*	*Change as % of incoming*
17 01 01	Concrete	65,384	22,803	-42,581	-65.1%
17 01 02	Bricks	13,110	169,276	156,166	1,191.2%
17 01 06*	Hazardous mixed concrete, bricks, tiles etc	55	0	-55	-100.0%
17 01 07	Mixed concrete, bricks, tiles etc	137,814	83,883	-53,931	-39.1%
17 02 01	Wood	19,216	24,746	5,530	28.8%
17 02 02	Glass	150	0	-150	-100.0%
17 02 03	Plastic	15	261	246	1,640.0%
17 02 04*	Hazardous glass, plastic, wood	567	0	-567	-100.0%
17 03 01*	Bituminous mixtures cont. coal tar	1,061	0	-1,061	-100.0%
17 03 02	Bituminous mixtures w'out coal tar	14,060	2,959	-11,101	-79.0%
17 04 01	Copper, bronze, brass	2	0	-2	-100.0%
17 04 02	Aluminium	0	138	138	n/a
17 04 03	Lead	19	0	-19	-100.0%
17 04 05	Iron and steel	20	0	-20	-100.0%
17 04 07	Mixed metals	2,173	9,319	7,146	328.9%

Code	Description	Incoming tonnes	Outgoing tonnes	Change (tonnes)	Change as % of incoming
17 04 11	Cables	2	0	-2	-100.0%
17 05 03*	Contaminated soil and stones	13,532	0	-13,532	-100.0%
17 05 04	Soil and stones	970,183	871,719	-98,464	-10.1%
17 05 08	Track ballast	151,393	422	-150,971	-99.7%
17 06 01*	Insulation containing asbestos	172	0	-172	-100.0%
17 06 05*	Constr. materials cont. asbestos	3	9	6	200.0%
17 08 01*	Contaminated gypsum-based materials	0	30,296	30,296	n/a
17 08 02	Gypsum-based materials	30,001	24,393	-5,608	-18.7%
17 09 01*	CDEW containing mercury	29	0	-29	-100.0%
17 09 02*	CDEW containing PCB	5	0	-5	-100.0%
17 09 03*	Other hazardous CDEW (including mixed wastes)	5	0	-5	-100.0%
17 09 04	Mixed CDEW	1,248,145	202,674	-1,045,471	-83.8%
19 12 09	Minerals (e.g. sand, stones)	0	302,077	302,077	n/a
19 13 02	Solid soil remediation residues	1	0	-1	-100.0%
20 02 02	Soil and stones (from gardens, parks, cemeteries)	22,713	26,331	3,618	15.9%
Total		2,689,830	1,771,306	-918,524	-34.1%

Source: Capita Symonds, based on returns made in 2008 to the Environment Agency

Table A3.26: Non-CDEW Chapter 19 waste handled by 16 very large waste treatment and transfer facilities (that did generate Chapter 19 waste) in 2008

Code	Description	Incoming tonnes	Outgoing tonnes	Change (tonnes)	Change as % of incoming
19 08 01	Screenings	0	36,462	36,462	n/a
19 12 01	Paper and cardboard	137	5,549	5,412	3,950.4%
19 12 02	Ferrous metal	0	10,314	10,314	n/a
19 12 03	Non-ferrous metal	2	4,619	4,617	230,850.0%
19 12 04	Plastic and rubber	190	7,916	7,726	4,066.3%
19 12 05	Glass	801	83	-718	-89.6%
19 12 07	Wood	0	57,265	57,265	n/a
19 12 08	Textiles	0	36	36	n/a
19 12 10	Combustible waste (RDF)	0	1,019	1,019	n/a
19 12 12	Other mixed wastes from mechanical treatment	99,220	376,147	276,927	279.1%
Total		100,350	499,409	399,059	397.7%

Source: Capita Symonds, based on returns made in 2008 to the Environment Agency

Finally Table A3.27 combines data from Tables A3.25 and A3.26 to provide a wider overview, using the waste groups used previously in this Appendix, plus some additional ones required to cover the non-CDEW Chapter 19 codes that do not easily fit into those previously-established groups. Those tonnage figures that include some non-CDEW Chapter 19 wastes are shaded light grey.

Table A3.27: CDEW and non-CDEW Chapter 19 waste handled by 16 very large waste treatment and transfer facilities in 2008

Waste group	*Incoming tonnes*	*Outgoing tonnes*	*Change (tonnes)*	*Change as % of incoming*
Hard	368,707	578,544	209,837	56.9%
Asphalt etc	15,121	2,959	-12,162	-80.4%
Soils	1,006,428	898,050	-108,378	-10.8%
Mixed (CDEW)	1,248,754	202,674	-1,046,080	-83.8%
Wood	19,216	82,011	62,795	326.8%
Metals	2,216	24,390	22,174	1,000.6%
Plastic	205	8,177	7,972	3,888.8%
Gypsum	30,001	54,689	24,688	82.3%
Asbestos / insulation	175	9	-166	-94.9%
Sub-total of the above	2,690,823	1,851,502	-839,321	-31.2%
19 12 12	99,220	376,147	276,927	279.1%
Sub-total of the above	2,790,043	2,227,649	-562,394	-20.2%
Other non-CDEW Chapter 19 wastes	137	43,066	42,929	31,335.0%
Total	2,790,180	2,270,715	-519,465	-18.6%

Note: Shaded cells include some non-CDEW Chapter 19 waste.
Source: Capita Symonds, based on returns made in 2008 to the Environment Agency

As can clearly be seen, although the gap represented by the 'missing' tonnage is partly closed once EWC code 19 12 12 waste and other Chapter 19 wastes are considered, a substantial gap still remains. Of the gap of 918,524 tonnes originally identified in Table A3.25:

- 8.6% is potentially explained when directly comparable Chapter 19 wastes are included (i.e. non-CDEW wood, metals etc in the section of Table A3.27 above the first sub-total);
- 38.8% is potentially explained when EWC code 19 12 12 waste is also taken into account;
- 43.5% is potentially explained when other non-CDEW Chapter 19 wastes are also taken into account.

As with the 17 facilities covered by Tables A3.23 and A3.24, much of the remaining gap can probably be explained by materials that became products rather than waste.

However, just as Chapter 19 wastes do not explain the full 'missing' tonnage gap, so Chapter 19 wastes do not come solely from CDEW. This conclusion is supported by the final analysis in this Appendix, which looks at the three largest generators of non-CDEW Chapter 19 waste. Between them these three facilities generated 247,441 tonnes of non-CDEW Chapter 19 waste in 2008, which represented 65.8% of the total tonnage generated by the 16 facilities covered by Table A3.26. Two of these facilities are in the London area, and one is in a northern industrial city.

Activity at the largest of the three facilities in 2008 can be summarised as follows:

- As well as a transfer station, the facility comprises a MRF with on-site anaerobic digestion and in-vessel composting.
- It accepted 2,680 tonnes of CDEW-derived wood, 55,537 tonnes of soil and stones, and 53,869 tonnes of mixed CDEW (a total of 112,086 tonnes of CDEW).
- It accepted 302 tonnes of other separated wood, 4,344 tonnes of separated glass, 2,957 tonnes of separated paper and card, 20 tonnes of waste tyres, 124 tonnes of catering waste, 66,120 tonnes of green waste and 6,530 tonnes of street cleaning waste (a total of 80,396 tonnes of non-CDEW waste, primarily from municipal sources).
- Most of the soil and stones (48,807 tonnes) went out again, split roughly 50:50 between landfill and further processing.
- 2,470 tonnes of paper and card went for processing, as did 1,085 tonnes of green and catering waste.
- 6,293 tonnes of wood, metals, plastic and glass went for recycling.

- 12,507 tonnes of mixed municipal waste went for some form of further processing.
- 120,717 tonnes went out as EWC code 19 12 12 waste, three quarters of it to landfill.
- The incoming and outgoing tonnages were very close (192,482 tonnes in; 191,878 tonnes out), despite the existence of a digester and in-vessel composting on site. In this case it seems highly likely that most of the mixed CDEW went to landfill as EWC code 19 12 12 waste.

Activity at the second largest of the three facilities (which is a reasonably conventional WTS / MRF, but with the advantage of being almost entirely under cover) can be summarised as follows:

- It accepted 1,170 tonnes of CDEW-derived wood, 306 tonnes of CDEW-derived mixed metals, 3,066 tonnes of gypsum-based materials, 21,517 tonnes of 'hard' CDEW, and 176,927 tonnes of mixed CDEW (a total of 202,986 tonnes of CDEW).
- It accepted 188 tonnes of other separated wood, 190 tonnes of separated plastic or rubber, 690 tonnes of separated paper and card, 288 tonnes of other separated wastes, and 38,498 tonnes of mixed municipal waste (a total of 39,854 tonnes of non-CDEW waste, primarily from municipal sources).
- By far the largest outgoing waste stream was 178,146 tonnes described as 'minerals (e.g. sand, stones)' which presumably included all of the 'hard' CDEW and much of the mixed CDEW. All of this was sent for further processing elsewhere.
- 1,171 tonnes of paper and card went for processing.
- 31,874 tonnes of wood, metals and plastic went for reprocessing.
- 39,093 tonnes went out as EWC code 19 12 12 waste, two thirds of it to landfill.
- The incoming and outgoing tonnages were very close (242,840 tonnes in; 250,284 tonnes out, presumably involving some reduction in stockpiles over the year). In this case it seems highly likely that most of the mixed CDEW was soil mixed with limited 'contraries', most of which was recovered for eventual re-use, and much of the EWC code 19 12 12 waste was derived from mixed municipal waste.

Activity at the smallest of the three facilities (which is a reasonably conventional WTS / MRF, with some facilities under cover, but generally open air) can be summarised as follows:

- It accepted 3,767 tonnes of CDEW-derived wood, 1,257 tonnes of CDEW-derived mixed metals and cables, 1,981 tonnes of gypsum-based materials, 21 tonnes of CDEW-derived glass and plastic, 1,390 tonnes of 'hard' CDEW, 1,418 tonnes of soil and stones, and 142,086 tonnes of mixed CDEW (a total of 151,919 tonnes of CDEW).
- The only non-CDEW waste stream accepted was 120 tonnes of paper and card packaging.
- By far the largest outgoing waste stream was 88,491 tonnes described as 'minerals (e.g. sand, stones)' which presumably included all of the 'hard' CDEW and some of the mixed CDEW. All of this was sent for recycling.
- 2,268 tonnes of paper and card went for processing.
- 27,268 tonnes of wood, metals and plastic went for recycling.
- 21,640 tonnes went out as EWC code 19 12 12 waste, all of it to landfill.
- The incoming and outgoing tonnages were reasonably close (152,040 tonnes in; 139,667 tonnes out, presumably involving some increase in stockpiles over the year). In this case it seems highly likely that whereas some of the mixed CDEW was soil mixed with limited 'contraries', a significant portion was much more mixed. It is also clear that all of the EWC code 19 12 12 waste was derived from mixed CDEW, given that this facility hardly accepted any non-CDEW waste.

What these three large sites show is that the ratio between CDEW and other wastes going into the sites concerned is quite variable (CDEW accounted for just under 60% of the incoming waste at the largest site, just under 85% at the second site, and almost 100% of the waste at the smallest of the three sites).

However, this does not fully reflect the wider picture as regards EWC code 19 12 12 waste, because some of the sites which generate most of this type of waste do not receive any CDEW at all, and others that do take CDEW are dominated (in tonnage terms) by other waste streams.

An analysis of the full Environment Agency data files from waste treatment and transfer facilities shows that in 2008 facilities in England sent a total of 5,305,461 tonnes of EWC code 19 12 12 waste to landfill, of which an estimated 23.2% came from sites that handled no CDEW at all. This estimate was derived as follows:

- a file was created containing all EWC code 19 12 12 waste sent to landfill by English waste treatment and transfer facilities;
- tonnages sent by one facility to different landfills were consolidated, such that there was just one data line per treatment or transfer facility, with a total of precisely 500 facilities that dispatched 19 12 12 waste to landfill;
- the file was split into the 50 largest facilities (in terms of their 19 12 12 'output') and the remaining 450 (with the 50 largest facilities accounting for over 55% of the total tonnage of 19 12 12 waste sent to landfill);
- a 10% sample of the remaining 450 was created, by sorting them in descending tonnage order, and taking the 5th, 15th, 25th etc;
- the 50 large facilities and 45 sample smaller facilities were further split into those that accepted CDEW and those that did not (the splits being 39/11 for the large sites, and 37/8 for the sample of smaller ones).

As a consequence of undertaking the above steps it was possible to derive the data in Table A3.28.

Table A3.28: Tonnes of EWC code 19 12 12 waste sent to landfill in 2008, split between two groups of waste treatment and transfer facilities

Waste group	***50 largest facilities***	***10% sample of 45 smaller facilities***	***Smaller facilities sample grossed up***	***Total estimated tonnages***
Sites that took CDEW	2,209,536	186,717	1,867,170	4,076,706
Sites that took no CDEW	803,534	43,106	431,060	1,234,300
Total	3,013,070	229,823	2,298,230	5,311,300

Source: Capita Symonds, based on returns made in 2008 to the Environment Agency

The total estimate derived in this way (5,311,300 tonnes) is 0.1% away from the true tonnage, and effectively indistinguishable from it. The percentage of EWC 19 12 12 waste which comes from sites that handled no CDEW at all is 23.2% (1,234,300 divided by 5,311,300).

The tonnage of EWC code 19 12 12 waste that came in part from CDEW in 2008 was therefore 4,076,706 tonnes, but before allocating a share of this total to CDEW, it was necessary to look at the overall balance of wastes entering these sites, paying particular attention to those EWC codes that are most likely to be associated with 19 12 12 waste (namely mixed CDEW and mixed household waste, without forgetting any 19 12 12 waste that entered the facility for further processing). When this was done, it generated the figures in Table A3.29 below.

Table A3.29: Tonnes of different wastes entering those waste treatment and transfer facilities that both accepted CDEW and sent EWC code 19 12 12 waste to landfill in 2008

Waste group	***50 largest facilities***	***10% sample of 45 smaller facilities***	***Smaller facilities sample grossed up***	***Total estimated tonnages***
EWC code 17 09 04 waste (mixed CDEW)	748,926	194,482	1,944,816	2,693,742
EWC codes 20 03 01 / 02 / 03 wastes (mixed municipal waste / markets waste / street waste)	2,289,066	216,117	2,161,170	4,450,236
Ratio between the two previous lines (%)	24.7:75.3	47.4:52.6	47.4:52.6	37.7:62.3
EWC code 19 12 12 waste (post-treatment waste)	36,204	18,852	188,518	224,721
All other EWC code wastes	854,957	301,824	3,018,240	3,873,197
Total	3,929,152	731,274	7,312,743	11,241,895

Source: Capita Symonds, based on returns made in 2008 to the Environment Agency

Compared to mixed CDEW and mixed household waste (and associated municipal wastes), the materials covered by the line in Table A3.29 entitled 'All other EWC code wastes' are only likely to generate modest amounts of EWC code 19 12 12 waste (and, for the avoidance of doubt, it can be confirmed that mixed packaging waste makes a very small contribution to the tonnages covered by this line). The ratio between mixed CDEW (17 09 04) and mixed household waste (20 03 01 / 02 / 03) in Table A3.29 is 37.7:62.3, and if the contributions of the two waste types is assumed to be equal, this would imply that 1.54 million tonnes of the EWC code 19 12 12 waste that went to permitted landfills in 2008 from waste treatment and transfer facilities came from CDEW (i.e. 37.7% of the 4.08 million tonnes identified in the first data line of Table A3.28).

To produce a more robust estimate of CDEW's contribution to EWC code 19 12 12 waste would almost certainly require a facility-by-facility data manipulation process covering all waste types, followed by a relatively complex regression analysis. This is beyond the scope of this project, but could be undertaken if required.

Appendix 4: Site visits to selected waste treatment and transfer facilities

Site visits were made to selected waste treatment and transfer facilities. This Appendix describes the selection and preparation process. The findings are reported in Appendices 8 and 9.

Strategy for visiting treatment and transfer facilities

The objective of carrying out a programme of site visits was to gain a better understanding of how different treatment and transfer facilities handle the mixed CDEW waste stream represented by EWC code 17 09 04, and to learn more about that fraction of the waste which leaves the facilities bound for a landfill or incinerator.

By way of initial preparation, the file containing the Environment Agency's site returns for all treatment and transfer facilities that accepted or treated any sort of CDEW in 2008 was sorted, and a selection was then made of the 720 sites that received mixed waste (EWC code 17 09 04). The total tonnage covered by this code was 8.67 million tonnes.

The large majority (73.4%) of this mixed CDEW was handled by the 144 (20%) largest sites. The other four quintiles could be seen to handle 18.4%, 6.4%, 1.6% and 0.2% respectively: a distribution which is clearly skewed. Dividing the 720 sites into six size bands (A to F) yielded the following outcome:

- 10 Group F sites handling >100,000 tonnes mixed CDEW each, and a total of 1.261 million tonnes;
- 45 Group E sites handling 40,000-99,999 tonnes each, and a total of 2.805 million tonnes;
- 61 Group D sites handling 20,000-39,999 tonnes each, and a total of 1,772 million tonnes;
- 266 Group C sites handling 3,000-19,999 tonnes each, and a total of 2,556 million tonnes;
- 111 Group B sites handling 1,000-2,999 tonnes each, and a total of 0.205 million tonnes; and
- 227 Group A sites handling <1,000 tonnes each, and a total of 0.070 million tonnes.

It was clear that very little would be lost by concentrating on the larger sites (i.e. Groups C to F).

The proposal was:

- to send team members to visit up to 30 CDEW treatment and transfer facilities for relatively short visits (1-2 hours per visit);
- to seek, as far as possible, to visit all relevant facilities in three selected geographical areas (one city centre, one on the urban fringe, and one rural area), in order to gain a snapshot of the full picture facing construction companies in those areas.

Three clusters of operators were then selected, taking into account:

- the locations / ownership of the largest transfer and treatment sites (Group F above);
- sites that were already known to the project team, and where there was a good chance of winning the cooperation of the operators; and
- geography (and 'natural' market catchments).

The three clusters were:

- a northern industrial city and its more rural hinterland (with seven facilities, including one Group F site);
- a segment of the M25 corridor, including three outer London boroughs and adjacent home county districts (with 13 facilities, including one Group F site and two Group E sites);
- a coastal area with a semi-circle of inland hinterland comprising nine local authority districts (with eight facilities including two Group E sites).

The three clusters therefore had 20% of the Group F sites, 9% of the Group E sites, 10% of the Group D sites and 4% of the Group C sites.

All cooperating operators were guaranteed anonymity to make it easier for them to speak their minds and to allow photographs to be taken without any concern as to the possible consequences. For this reason the three clusters are not mapped or specified more closely.

Pre-visit briefing

Prior to making visits, team members were provided with the following briefing.

Primary objective: To gain a better understanding of how different sites handle the mixed CDEW waste stream (principally EWC Code 17 09 04). This is the waste stream that cannot be used as it is when received, but contains mixtures of materials that would be of value if separated. We would expect this stream to contain a range of materials, including:

- soil and stones
- asphalt etc
- rubble (concrete, bricks, tiles etc)
- reinforcing rods and structural steel
- a very wide range of other metal elements, including plumbing fittings and containers (e.g. paint cans and similar)
- plaster / plaster board
- glass
- ceramics (sanitary ware)
- wood
- plastics
- furnishings and fittings
- composite multi-material products (e.g. cables, light fittings, windows, laminates etc)

The expectation is that most of the sites will:

- receive a flow of mixed CDEW
- carry out some separation and recovery activities
- send out a residual mixed CDEW stream

We need to be able to get from the operator a description of the incoming and outgoing mixed CDEW streams. If at all possible, we should aim to get photographs of representative skips / piles / flows, being 100% sure that we know whether this is incoming or outgoing. We also need to understand how representative the materials that they are handling at the time of the visit are, relative to their normal (year-round) flows.

For descriptive / categorisation purposes it may be appropriate to group the waste streams into a number of generic types, such as:

- heavily mixed with soil (soil >50% of total)
- not much soil, but a horrible mess of wet / sticky / broken 'stuff', possibly including contamination (e.g. paint, oil, varnish, sealants, waste pipes etc)
- mostly dry (but mixed) wastes (e.g. pieces of wood, pieces of metal, some bricks and concrete) that can be separated if worthwhile
- in between the three above

Ideally we would like to know what 100 tonnes of typical mixed CDEW can be turned into (e.g. 12 tonnes of metals, 18 tonnes of mixed / contaminated wood, 30 tonnes of aggregate / fill and 40 tonnes of unrecoverable mixed CDEW which goes to a non-haz landfill).

We then need to understand how the incoming mixed CDEW is handled / treated (in terms of the equipment available, and the combinations in which it is used) in order to achieve this result.

If the site receives two or more distinct types of mixed CDEW (e.g. one coming from skips from small builders and domestic renovation projects, and a second from skips of mixed CDEW from larger construction sites (i.e. the 'dump' skips that take everything that won't go into dedicated (metals, wood etc) skips), then we need to understand that, and ideally to get the same information for both waste streams.

If we are unable to persuade the operators of some sites within the chosen area(s) to allow us to visit, it may be possible to draw limited conclusions about their operations based on observations made from public land.

At the time of the initial telephone call:

- Explain the background to the work, and WRAP's involvement as client.
- Make sure they understand that the emphasis is on mixed CDEW.
- Check that some element of sorting / treatment is carried out. (There is not much point in visiting a very basic WTS which does no more than bulk materials for onward transit).
- Agree a time for a 1-2-hour visit, the specific address / postcode, the name of the person to be visited, the best mobile number in case of problems.

At the time of the site visit try to check the following:

- Does what can be seen match our expectations?
- Roughly how large is the site? How crowded? How well organised?
- How does waste come in (Skips? Bulkers? Other?)
- Do we have a photo of the typical incoming mixed CDEW stream or streams (17 09 04)?
- Do we understand the processes / equipment employed?
- Are the same processes / equipment used for other waste streams? (Which?)
- Do we have a photo of the typical outgoing mixed CDEW stream or streams (19 12 12)?
- Do we know where it's going?
- Does the site hold significant stockpiles of untreated / treated wastes?

Reports on the northern industrial cluster

There were seven treatment and transfer sites that accept CDEW on the Environment Agency's data file in the target area, all of them carrying out some degree of sorting or treatment.

One of these (Site 4) is much larger than the rest, accepting just over 200,000 tonnes of CDEW in 2008. It concentrates on demolition and mixed excavation waste, but also accepts much smaller tonnages of metals, wood and plasterboard. About 180,000 tonnes went back out as soil, with the remainder of the outgoing waste classified under non-CDEW EWC codes. A report on Site 4 can be found in Appendix 8.

Four of the other sites (Sites 7, 3, 6 and 2) received about 40,000, 30,000, 25,000 and 15,000 tonnes of CDEW respectively, with their main activity being the separation of the mixed fraction into soil, aggregate, metal and wood.

Sites 1 and 5 each received less than 5,000 tonnes, apparently mainly related to their own engineering contracting activities.

Some information on all seven sites, concentrating on the larger ones (Sites 4, 7 and 3), can be found in Appendices 8 and 9.

Reports on the M25 cluster

There were 14 treatment and transfer sites that accept CDEW on the Environment Agency's data file in the target area. Of these, one (Site 16) was not carrying out any sorting or treatment at all, and is mainly concerned with municipal waste. The Agency waste returns for Sites 9, 12 and 18 showed that no sorting of mixed CDEW took place, so visits to these sites were not considered justified.

The three largest facilities (Sites 19, 14 and 8), all of them located close to different junctions on the M25, accepted about 115,000, 90,000 and 55,000 tonnes respectively. The two smaller ones compete within the same local geographical catchment, and both generate significant portions of the waste from their own demolition activities. All three concentrate on CDEW, but accept some other mixed wastes (including waste from other treatment and transfer facilities). All three are well established, and extract high levels of recyclates from the incoming waste. Reports on all three of these sites are provided in Appendix 8.

Sites 10 and 11 each accepted about 45,000 tonnes of CDEW, from which they extracted some useful materials.

- Site 10 declined either to talk over the telephone or to accept a visit. A visual check from the gate showed that the site trades as a skip hire company. Incoming waste is tipped on the ground with large items being hand picked. There is a screen, picking station and magnet to separate ferrous metals, and an air system for separating light and heavy wastes. Piles of separated timber, plasterboard and quite clean aggregate could be seen. The site was very cramped, with no additional room for any further equipment.
- Site 11 reported over the telephone that the site only accepts timber for chipping, and that therefore a visit would be inappropriate. This is at variance with the data reported to the Agency for 2008, though that does show a considerable tonnage of wood being handled, alongside other CDEW.

Site 17 accepted about 30,000 tonnes, while three other relatively small facilities (Sites 15, 20, and 21) each accepted between 15,000 and 20,000 of CDEW and carried out basic sorting activities. Basic information on Site 17 is provided in Appendix 9, but none of the other three was prepared to accept a site visit. Site 21 has recently changed hands, and it was possible to look over the fence en route between two other site visits. It was evident that sorting is limited to a very simple hand pick of the major contaminants.

The smallest facility in this cluster (Site 13) only handled about 10,000 tonnes of CDEW. A report on this site can be found in Appendix 9.

Reports on the coastal cluster

There were eight treatment and transfer sites that accept CDEW on the Environment Agency's data file in the target area. Of these, two (Sites 26 and 28) are operated by the same company. None of the sites were very large, and none were very small. The catchment area was within 50km of some significantly larger treatment and transfer facilities, and some of their outgoing waste was moved to more specialist facilities outside the area.

Three of the sites (Sites 22, 23 and 26) each accepted between 40,000 and 60,000 tonnes of CDEW, most of it in the form of skip waste. Reports on all three sites can be found in Appendix 8.

Sites 24 and 29 each accepted between 30,000 and 40,000 tonnes. Site 29 has a policy of not participating in surveys or research. A report on Site 24 can be found in Appendix 9.

The other three (Sites 25, 27 and 28) each accepted between 10,000 and 20,000 tonnes, again largely as skip waste. Reports on these three sites can be found in Appendix 9.

Appendix 5: Analysis of data from registered exempt sites

Substantial tonnages of inert CDEW (mainly clean soil and other excavation waste) are used on sites covered by exemptions from environmental permitting. This Appendix describes how details of CDEW spread on such sites in England in 2008 have been extracted from reports made to the Environment Agency by the sites' operators, and made available to WRAP for the purposes of this study.

General introduction

There are two exemptions from environmental permitting described in Schedule 3 to the Environmental Permitting (England and Wales) Regulations 2007 (SI 2007 No.3538) which involve the spreading of significant tonnages of inert CDEW, and in particular clean excavation waste. These exemptions may only be registered and used subject to certain restrictions related to the underlying purpose of the work, the planning status of the work, the depth and volume of spreading, and the types and sources of waste which is to be used. Although the onus is on the owner of the site where such work is proposed to register an exemption, the registration process itself is controlled by the Environment Agency. Undertaking qualifying work without first registering an exemption is an offence.

In both relevant exemptions although other wastes may be used, over many years the dominant material in tonnage terms, by a very considerable margin, has been clean excavation waste. The relevant sub-paragraph numbers are:

- Paragraph 9(1): which allows certain wastes from specified sources to be used for the purposes of land reclamation or improvement; and
- Paragraph 19(2): which allows certain wastes from specified sources to be used for the purposes of construction.

In those cases where clean excavation waste is not deemed to be discarded by the holder, and is fit for purpose, without any form of treatment, for use on the site from which it arose, it does not fall under the waste regulatory regime, and can be used without either an environmental permit or an exemption from permitting.

A data file with information on sites where these exemptions had been proposed and/or registered by the Environment Agency was provided to WRAP by the Agency for the purposes of this project. The original file contained 32,493 data lines giving information on all exemptions covered by Paragraphs 9&19, and on all such exemptions registered over a period of many years. Among other things, each data line provided information on when information on the proposed exemptions concerned were submitted to the Agency, and when the applications were registered, as well as the decision on their acceptability (or otherwise).

The system of registration was significantly overhauled in mid-2005, with all holders of exemptions that pre-dated that point being required to re-register their exemptions, providing details of their sites. From that point onwards applicants were requested to specify what tonnage of waste they proposed to use, and over what period. Since then the application process has been changed again, but although the latest forms do not require tonnages to be declared, the Agency's data file does contain tonnage data (in three separate fields). Very few data lines contain all of the relevant information, but all contain at least some useful information from which certain conclusions can be drawn.

First round of 'data cleaning'

The file was prepared for further analysis by implementing the following operations, in the sequence described:

- Delete all data lines concerned with the storage of waste (i.e. all lines other than sub-paragraphs 9(1) and 19(2)).
- Delete all data lines with a notified end date during or prior to 2007.
- Delete all data lines with a notified start date during 2009.

- Delete all data lines where the status of the exemption site was given as 'not exempt', 'refused', 'not registrable' or 'withdrawn'.
- Delete any remaining data lines where the status of the notification was given as 'not exempt' (irrespective of the status of the exemption site).
- Delete all data lines where the date of notification and the date of registration were both left blank (these would overwhelmingly be pre-2005 applications).
- Delete all data lines where the date of notification and the date of registration were both June 2005 or earlier.
- Delete all data lines where the date of notification was June 2005 or earlier, and the date of registration was left blank.
- Delete all data lines where the date of notification was 2007 or earlier, and the date of registration was left blank, and the status of the exemption site was given as 'complete'.
- Delete all data lines where the date of notification was 2009, and the status of the exemption site was given as 'registered' (on the grounds that such sites were not intended to start work until 2009 at the earliest).
- Delete all data lines where the site address was in Wales (NB not all applicants based in Wales were deleted: those few data lines with applicants based in Wales but sites in England were retained).
- Delete one of any pair of duplicate data lines (identified by using the 'site reference' field, and ensuring that any useful data in the deleted line was also contained in the retained data line).
- Delete all data lines where there was an obvious mis-match between dates (e.g. an application date well after the date of registration and the notified start date) and the logically correct date would have led to the data line being deleted based on the criteria set out above (this only resulted in a small number of deletions).
- Delete all data lines where the notified start date was 2006 or earlier, and the notified end date had been left blank, and the annual tonnage was the same as the total tonnage (including cases where both tonnages were left blank or recorded as '0').
- Delete all data lines with no tonnage data at all, and no notified start or end date, and where neither the date of notification nor the date of registration was either 2007 or 2008.

After all these procedures had been followed, the data file contained 2,180 data lines. Even so, some of these data lines covered sites where the activity was wholly or partly in years other than 2008, necessitating further 'data cleaning'.

A field called 'Assumed tonnes' was then created for use in subsequent calculations. This was done for each remaining data line, using the following guidance:

- Where a total tonnage was declared (in the 'Notif TTot' field), use that figure.
- Where no total tonnage was declared, use the value declared in the 'Notif TPA' field (if any).
- Where both the 'Notif TTot' and the 'Notif TPA' fields were left blank, use the value declared in the 'Notif TPH' field for calculation purposes (if any. In practice this yielded very few additional values).
- Leave all remaining values blank for the time being.

Further background information

Before describing the next phase of 'data cleaning', some further background information is required, in order to understand more clearly why the last step above, and certain later steps, were taken.

The 2006 CDEW Survey used a similar data file from the Environment Agency, covering a 12-month period starting on 1 July 2005 (i.e. shortly after the new registration system for Paragraph 9&19 exemptions had been implemented). On that occasion the sites were divided into two groups:

- predominantly large sites where the tonnage was known; and
- other sites where no tonnage was declared, and it was assumed that the tonnage would be less than the 'trigger level' of 2,500 m³ below which tonnage details were not required to be declared.

Based on a series of assumptions regarding the likely (statistical) distribution of soil volume and density, a default (or 'de minimis') figure of 2,510 tonnes per site was calculated, for use on all of the 'other' sites. It was agreed with WRAP that the same 'de minimis' value should be used for the 2008 data set.

This yielded the following estimates for the tonnage of CDEW being used on Paragraph 9&19 sites over the 12-month period concerned in 2005/06:

- 13.84 million tonnes on 'large' sites; and
- 1.60 million tonnes on 'de minimis' sites.

The estimate for 'large' sites was based on two important assumptions, namely that:

- where the working life of a site was not declared, it should be assume to be three years; and
- tonnage data from the 'Notif TPA' field should be treated at face value (i.e. even where the 'Notif TPA' value on a site which was expected to be active over several years was the same as the value for 'Notif TTot', the 'Notif TPA' figure was believed, and used).

Recognising the arbitrary nature of these assumptions, the estimate was also re-calculated on the basis that the true working life of sites might be either longer or shorter (four years or two), and that the 'Notif TTot' value might be more reliable than the 'Notif TPA' value. The findings were as follows:

- sensitivity to site working life was not particularly great: raising the period to four years reduced the tonnage from 13.84 million to 13.69 million tonnes, whereas reducing it to two years raised the estimate to 14.16 million tonnes; while
- sensitivity to the 'TTot/TPA' choice was rather greater: believing the 'Notif TTot' values reduced the tonnage from 13.84 million to 11.39 million tonnes.

By 2009 it can clearly be seen that the way in which most applications are logged makes no distinction between 'Notif TPA', 'Notif TPH' and 'Notif TTot', generally providing the same value for all three, frequently at levels which could never be achieved in a single year. It has therefore been concluded that on this occasion preference should be given to the 'Notif TTot' value, and the resultant estimate should more properly be compared with a revised 2005 estimate of 12.99 million tonnes (i.e. 11.39 million tonnes plus 1.60 million tonnes).

Whereas in 2005/06 all site operators with long-term sites had been required to re-register their exemptions, by 2008 it was necessary to take into account sites which were already operational at the start of 2008 as well as those started in 2008, and to take account of their likely end dates.

Since the period of time over which a site is likely to be active is almost certainly linked to the total tonnage expected to be used on it, it was decided on this occasion to split the data file into six tranches for further analysis, as described in the next step.

Second round of 'data cleaning'

Having populated the field named 'Assumed tonnes' the data file was sorted on that value, and divided into six groups, as follows:

- Group 5: 106 data lines with values of 100,000 tonnes or more. These sites reported a combined total of 23.52 million tonnes (to be used over several years) and an average of 222,000 tonnes;
- Group 4: 201 data lines with values of 30,000 to 99,999 tonnes, totalling 10.18 million tonnes and averaging 51,000 tonnes;
- Group 3: 262 data lines with values of 10,000 to 29,999 tonnes, totalling 4.34 million tonnes and averaging 16,500 tonnes;
- Group 2: 321 data lines with values of 2,511 to 9,999 tonnes, totalling 1.56 million tonnes and averaging 5,000 tonnes;
- Group 1: 672 data lines left values up to 2,510 tonnes, totalling 0.79 million tonnes and averaging 1,200 tonnes; and
- Group 0: 618 data lines with no tonnage value (i.e. 'de minimis' sites), to which a value of 2,510 tonnes per site then had to be applied.

[NB: As explained above, this 'de minimis' value was the same as was used in 2006. However, there were clearly some sites where this is likely to be a substantial underestimate, given that some of these sites declared expected end dates well into the future, suggesting relatively large-scale working. This caveat affects about 30 sites. If the true figure for 2008 on such sites was 20,000 tonnes rather than 2,510, this would raise the total estimated tonnage by about 525,000 tonnes. If the true figure was 30,000 tonnes per site, the total figure would rise by a further 300,000 tonnes.]

It was then necessary to make a series of assumptions for those data lines that did not provide notified start dates and/or notified end dates. These assumptions and their consequences (which were applied in sequence) were as follows:

- Where the status of the site was given as 'complete' (and in all such remaining cases neither a notified start nor end date was given), use the date of notification as the assumed end date, and generate an assumed start date based on the following rules:
    - three years before in the case of Group 4 and Group 5 sites;
    - two years before in the case of Group 3 sites; and
    - one year before in the case of Group 0-2 sites.
- Where the notified start date was left blank, use the date of notification as the assumed start date, and generate an assumed end date based on the rules above (after changing 'before' to 'after').

It was then necessary to carry out the following four procedures:

- Enter a start date for calculation purposes and an end date for calculation purposes using either the notified dates or (in their absence) the assumed dates derived via the previous set of procedures.
- Calculate and record the difference (in days) between the start and end dates.
- Calculate and record the number of days during 2008 when the site concerned was active.
- Express the number of days during 2008 when the site concerned was active as a percentage of the number of days between the start and end dates.
- Multiply the percentage value calculated in the previous step by the 'Assumed tonnes' value for the site concerned to create a value for '2008 tonnes'.
- Total the '2008 tonnes' values to generate the estimated tonnage of CDEW used on all Paragraph 9(1) and 19(2) sites.

In the interests of greater realism, Group 0 and 1 sites were re-checked manually, and if there was a 30-day period available in 2008 for the work to be done, it was assumed that all of the expected tonnage would have been spread during 2008. This had to be done manually, whereas most of the other calculations could be automated. In cases where there were fewer than 30 available days in 2008, the 2008 tonnage was calculated as the number of days actually available divided by 30, multiplied by the 'Assumed tonnes' value.

Once the above procedures had all been followed, the results reported in Table A5.1 and A5.2 were generated.

Estimated tonnage of CDEW spread on registered exempt sites

Table A5.1: Estimate of total CDEW spread on registered exempt sites (tonnes of CDEW, 2008)

	Paragraph 9(1)	***Paragraph 19(2)***	***Total***
Group 5	1,236,604	3,821,631	5,058,234
Group 4	837,918	1,641,680	2,479,598
Group 3	400,104	1,076,731	1,476,835
Group 2	255,948	779,061	1,035,010
Group 1	34,595	305,839	340,435
Group 0	178,796	408,795	587,591
Total	2,943,965	8,033,737	10,977,702

Source: Capita Symonds, based on information collated by the Environment Agency

Table A5.2: Estimate of average CDEW spread on registered exempt sites (tonnes of CDEW, 2008)

	Paragraph 9(1)	***Paragraph 19(2)***	***All sites***
Group 5	38,644	51,644	47,719
Group 4	13,965	11,643	12,336
Group 3	5,716	5,608	5,637
Group 2	3,656	3,104	3,224
Group 1	412	520	507
Group 0	1,090	900	951
Total	6,133	16,737	5,036

Source: Capita Symonds, based on information collated by the Environment Agency

Table A5.3 shows the effect of increasing by six months the period over which Group 2-5 sites without declared start and end dates were active (i.e. 3.5 years for Groups 4 and 5, 2.5 years for Group 3 and 1.5 years for Group 2). Table A5.4 shows the effect of reducing the period for the same sites by the same amount (other than Group 2 sites, where the working period is left as 1 year).

Table A5.3: First revised estimate of CDEW spread on registered exempt sites (tonnes of CDEW, 2008)

	Paragraph 9(1)	***Paragraph 19(2)***	***Total***
Group 5	1,117,864	3,299,757	4,417,621
Group 4	739,759	1,441,430	2,181,189
Group 3	325,963	886,883	1,212,846
Group 2	175,377	538,023	713,400
Group 1	34,595	305,839	340,435
Group 0	178,796	408,795	587,591
Total	2,572,354	6,880,728	9,453,082

Source: Capita Symonds, based on information collated by the Environment Agency

Table A5.4: Second revised estimate of CDEW spread on registered exempt sites (tonnes of CDEW, 2008)

	Paragraph 9(1)	***Paragraph 19(2)***	***Total***
Group 5	1,402,838	4,552,254	5,955,092
Group 4	975,341	1,922,029	2,897,370
Group 3	523,672	1,393,144	1,916,816
Group 2	255,948	779,061	1,035,010
Group 1	34,595	305,839	340,435
Group 0	178,796	408,795	587,591
Total	3,371,191	9,361,123	12,732,314

Source: Capita Symonds, based on information collated by the Environment Agency

These two variants result in total tonnage figures which are 16.1% lower and 13.8% higher than the main estimate reported in Table A5.1, respectively.

The consequences of some other sensitivity testing is reported in the foregoing text.

Appendix 6: Analysis of data from landfills

This Appendix reports the tonnage of waste classified as CDEW which entered landfills in England in 2008. The information was extracted from data files which were provided to WRAP for this project by the Environment Agency.

Overview of the landfill data sets

Two data files were provided to WRAP for this project by the Environment Agency, giving details of waste tonnages reported to the Agency in 2008 by operators of sites described as landfills.

- The first gave details of incoming waste tonnages. Each data line in the file identified the total tonnage of a specific EWC code delivered from a specific local authority area to a named facility during 2008. Each facility was identified by name and licence / permit number, and the data file provided the name of the licence holder, the type of landfill and its location (by local authority area). The file covered all landfills in England and Wales.
- The second gave details of outgoing waste tonnages. As well as providing details of the weight of leachate sent for treatment elsewhere, this gave tonnages of wastes diverted by treatment and transfer facilities co-located with landfills.

The Welsh landfills were deleted from both files, and all data lines reporting waste consigned to England from elsewhere in the UK or beyond were retained. Following a review a small number of further deletions were made. Specifically, data associated with cemeteries (both pet and human) and a memorial woodland were deleted. Data lines in the second file relating to waste being dispatched to other landfills were also deleted, to avoid double counting.

Following this process, the first data file held data from 502 landfills (or former landfills) which between them received 53,786,981 tonnes of waste in 2008 (including 375,680 tonnes entering facilities which, from their names alone, were clearly treatment and transfer facilities, not landfills). The second file held data from 203 landfills (or former landfills). Most of these 203 were only dispatching leachate to external treatment facilities, but 35 were dispatching CDEW (as defined in Appendix 1) to waste facilities other than landfills. Two of these 35 landfills did not appear on the first file, and several others had different licence details assigned to them on the two files. Some further information on outgoing waste is given in the second part of this Appendix.

CDEW handled at landfills

Table A6.1, which is based on the two files described above, shows the full range of CDEW (as defined in Appendix 1) both reported as entering and leaving facilities described as landfills in 2008, and the balance that should be assumed to enter the disposal area. The same data are subsequently summarised in Tables A6.2, A6.3 and A6.4, using the categories previously established in Appendix 3.

As can be seen, there are a few negative numbers in the final column. This could be explained by certain recovery activities (in which, for example, reinforced concrete is crushed, and turned into recycled aggregate and steel re-bar, and the re-bar that is sent elsewhere for recovery is mixed with other metal wastes, so that outgoing mixed metals weigh more than the small amounts of mixed waste metal that were originally dispatched to landfills and classified as such).

Several of the caveats outlined in the general introductory text to Appendix 3 also apply here, since the facilities that have outgoing tonnage are really part of the wider population of treatment and transfer facilities.

Table A6.1: All CDEW entering, leaving and remaining in landfills in 2008 (tonnes)

Code	*Description*	*Entering*	*Leaving*	*Remaining*
10 12 08	Waste new ceramics, bricks, tiles etc	1,887	1,485	402
17 01 01	Concrete	276,175	55,171	221,004
17 01 02	Bricks	77,335	18,945	58,391
17 01 03	Tiles and ceramics	71,422	0	71,422
17 01 06*	Hazardous mixed concrete, bricks, tiles etc	10,002	0	10,002
17 01 07	Mixed concrete, bricks, tiles etc	1,332,760	60,038	1,272,722
17 02 01	Wood	34,663	2,850	31,813
17 02 02	Glass	827	0	827
17 02 03	Plastic	330	21	309
17 02 04*	Hazardous glass, plastic, wood	54	0	54
17 03 01*	Bituminous mixtures containing coal tar	2,681	0	2,681
17 03 02	Bituminous mixtures without coal tar	12,493	0	12,493
17 03 03*	Coal tar and tarred products	93	0	93
17 04 01	Copper, bronze, brass	0	0	0
17 04 02	Aluminium	18	3	15
17 04 03	Lead	0	0	0
17 04 04	Zinc	0	0	0
17 04 05	Iron and steel	41,916	33	41,883
17 04 06	Tin	5	0	5
17 04 07	Mixed metals	141	368	-227
17 04 09*	Hazardous metal waste	54	0	54
17 04 10*	Hazardous cables containing oil, coal tar etc	0	0	0
17 04 11	Cables	2	0	2
17 05 03*	Contaminated soil and stones	382,136	0	382,136
17 05 04	Soil and stones	16,133,911	407,615	15,726,296
17 05 07*	Contaminated track ballast	39,678	0	39,678
17 05 08	Track ballast	10,076	0	10,076
17 06 01*	Insulation containing asbestos	62,354	0	62,354
17 06 03*	Hazardous (non-asbestos) insulation	1,585	0	1,585
17 06 04	Non-hazardous insulation	4,269	0	4,269
17 06 05*	Construction materials containing asbestos	205,834	27	205,807
17 08 01*	Contaminated gypsum-based materials	31	0	31
17 08 02	Gypsum-based materials	4,222	0	4,222
17 09 01*	CDEW containing mercury	6	0	6
17 09 02*	CDEW containing PCB	0	0	0
17 09 03*	Other hazardous CDEW (including mixed wastes)	1,360	0	1,360
17 09 04	Mixed CDEW	1,226,047	86,870	1,139,177
19 12 09	Minerals (e.g. sand, stones)	630,033	64,287	565,746
19 13 01*	Solid hazardous soil remediation residues	153,285	0	153,285
19 13 02	Solid soil remediation residues	76,355	0	76,355
19 13 03*	Hazardous soil remediation sludges	69,406	0	69,406
19 13 04	Soil remediation sludges	0	0	0
19 13 05*	Hazardous groundwater remediation sludges	0	0	0
19 13 06	Groundwater remediation sludges	360	0	360
19 13 07*	Hazardous liquids from groundwater remediation	0	0	0
19 13 08	Liquids from groundwater remediation	0	0	0
20 02 02	Soil and stones (from gardens, parks, cemeteries)	370,032	48,315	321,717
21 00 00	Inert waste, includes soil and stones	307,905	67,004	240,901
21 01 00	Inet - natural rocks and sub-soils	0	0	0
21 01 01	Inert rock and stones	870	0	870
21 01 02	Inert sub-soils	7,393	0	7,393
21 02 00	Ceramic and/or cemented materials	0	0	0
21 02 01	Glass	0	0	0
21 02 02	Ceramics	0	0	0

Code	Description	Entering	Leaving	Remaining
21 02 03	Concrete, mortar	21,364	0	21,364
21 03 01	Moulding sands or clays	0	0	0
22 01 00	Rock and soil with some organic content	291	0	291
22 01 01	Uncontaminated top soil	0	0	0
22 02 00	CDEW (sometimes incl coated roadstone)	8,430	10,404	-1,974
22 02 01	Mixed CDEW	117,636	8,934	108,702
22 02 02	Coated roadstone	0	0	0
22 02 03	Streetworks waste	0	0	0
22 03 00	Plaster or plasterboard	0	0	0
22 03 01	Plaster	0	0	0
22 03 02	Plasterboard	0	0	0
22 06 05	Mixed vegetation, soil and stones	0	0	0
24 04 00*	Contaminated CDEW	290	2,161	-1,871
26 00 00*	Unspecified asbestos	0	313	-313
26 01 00*	Fibrous asbestos	0	0	0
26 02 00*	Bonded asbestos	333	0	333

Source: Capita Symonds, based on returns made in 2008 to the Environment Agency

Summary tables

Table A6.2 summarises the data from the first tonnage column in Table A6.1.

Table A6.2: Summary of CDEW entering landfills 2008 (tonnes)

	Inert	17 09 04	Non-haz	Haz	Total
Hard	2,422,749	0	0	49,680	2,472,429
Asphalt etc	12,493	0	0	2,773	15,266
Soils	16,819,241	0	291	382,136	17,201,668
Mixed	0	1,226,047	202,423	154,995	1,583,466
Wood	0	0	34,663	0	34,663
Metals	0	0	42,079	54	42,133
Plastic	0	0	330	0	330
Gypsum	0	0	4,222	31	4,253
Asbestos / insulation	0	0	4,269	270,107	274,376
Liquid / sludge	0	0	360	69,406	69,766
Total	19,254,483	1,226,047	288,638	929,182	21,698,349

Source: Capita Symonds, based on returns made in 2008 to the Environment Agency

In total 203 facilities classified as landfills dispatched 2.34 million tonnes of waste (i.e. more than just CDEW) to other facilities. This can be broken down into:

- 0.97 million tonnes of leachate;
- 0.52 million tonnes of other non-CDEW waste (dominated, in tonnage terms, by pulverised fuel ash from four coal-fired power stations); and
- 0.84 million tonnes of CDEW, of which only 12,000 tonnes was going to other landfills (though some of the balance was coded as going to 'unknown destinations').

As well as the summary of outgoing CDEW provided below in Table A6.3, the destinations for CDEW not sent to other landfills (rounded to the nearest thousand tonnes) can be broken down as follows:

- 508,000 tonnes to recycling;
- 13,000 tonnes to reprocessing;
- <1,000 tonnes to WTSs;
- <1,000 tonnes to treatment facilities; and
- 313,000 tonnes (most of it soil) to unknown destinations.

Table A6.3: Summary of CDEW leaving landfills 2008 (tonnes)

	Inert	*17 09 04*	*Non-haz*	*Haz*	*Total*
Hard	199,925	0	0	0	199,925
Asphalt etc	0	0	0	0	0
Soils	522,934	0	0	0	522,934
Mixed	0	86,870	19,338	2,161	108,369
Wood	0	0	2,850	0	2,850
Metals	0	0	404	0	404
Plastic	0	0	21	0	21
Gypsum	0	0	0	0	0
Asbestos / insulation	0	0	0	340	340
Liquid / sludge	0	0	0	0	0
Total	722,859	86,870	22,613	2,501	834,843

Source: Capita Symonds, based on returns made in 2008 to the Environment Agency

Table A6.4 summarises the final data column from Table A6.1.

Table A6.4: Summary of CDEW remaining in landfills 2008 (tonnes)

	Inert	*17 09 04*	*Non-haz*	*Haz*	*Total*
Hard	2,222,824	0	0	49,680	2,272,504
Asphalt etc	12,493	0	0	2,773	15,266
Soils	16,296,307	0	291	382,136	16,678,734
Mixed	0	1,139,177	183,085	152,834	1,475,097
Wood	0	0	31,813	0	31,813
Metals	0	0	41,675	54	41,729
Plastic	0	0	309	0	309
Gypsum	0	0	4,222	31	4,253
Asbestos / insulation	0	0	4,269	269,766	274,035
Liquid / sludge	0	0	360	69,406	69,766
Total	18,531,624	1,139,177	266,025	926,680	20,863,506

Source: Capita Symonds, based on returns made in 2008 to the Environment Agency

Appendix 7: Survey of landfills that use or dispose of inert CDEW

A survey of landfills that received inert CDEW in 2008 was carried out. Unfortunately the response rate was disappointingly low. This Appendix describes the survey process, and the limited findings.

Pre-survey preparation

As reported in Appendix 6, a data file was provided to WRAP for this project by the Environment Agency giving details of all incoming waste tonnages reported by site operators to the Agency from sites described as landfills. Each facility was identified by name and licence / permit number, and the data file provided the name of the licence holder, the type of landfill and its location (by local authority area). The file covered all landfills in England and Wales, so the Welsh landfills were deleted in order to provide a full list of English landfills on which a survey could be based.

Following a review a small number of further deletions were made. Specifically, data associated with four treatment and transfer facilities linked to landfills or former landfills were deleted. It is recognised that some of the remaining landfills will have similar treatment and transfer facilities from which data have been reported, but in the absence of a recognisably non-landfill site name, such data cannot be stripped out. Finally, all site details associated with a small number of cemeteries (both pet and human) and a memorial woodland were deleted. Following this process, the data file held data from 498 landfills (or former landfills). Where there was more than one environmental permit in place (e.g. for the original landfill, with a separate permit for an extension), these were kept separate, so the 498 landfills represent rather fewer sites.

All data lines were then sorted into two groups according to their EWC codes: CDEW codes (as identified in Appendix 1) and 'other waste' codes. The 'other waste' codes were then consolidated, leaving a single line per landfill for non-CDEW wastes for each of the 309 landfills that accepted non-CDEW wastes in 2008.

The CDEW EWC codes were further grouped into four categories: inert CDEW, unspecified mixed CDEW (EWC Code 17 09 04, which would generally be expected to be inert, but might in some cases be non-hazardous), non-hazardous CDEW and hazardous CDEW.

It was then possible to divide the data file further into various non-overlapping groups, as summarised in Table A7.1.

All of the EWC code 19 12 12 waste (which includes some mixed CDEW, along with much other mixed waste) is included within the figure of 27.91 million tonnes of non-CDEW entering 'all other landfills', accounting for almost 40% of this very large waste flow.

Table A7.1: Groups of landfills that accepted CDEW in 2008

Landfill type	*No*	*Tonnes of inert CDEW*	*Tonnes of mixed CDEW*	*Tonnes of non-haz CDEW*	*Tonnes of hazardous CDEW*	*Tonnes of non-CDEW waste*
Inert landfills that only accepted inert CDEW	135	8,125,854				
Non-inert landfills that only accepted inert CDEW	27	552,178				
Inert landfills that only accepted inert CDEW and/or mixed CDEW	11	444,171	416,946			
Non-inert landfills that only accepted inert CDEW and/or mixed CDEW	4	153,256	108,606			
Landfills that did not accept any CDEW at all	51					3,897,550
Landfills that only accepted hazardous CDEW and/or other (non-CDEW) wastes	11				472,201	95,060
All other landfills	259	9,792,027	825,840	162,314	456,981	27,908,317
All landfills		19,067,485	1,351,393	162,314	929,182	31,900,927

Source: Capita Symonds, based on returns made in 2008 to the Environment Agency

Organisation of the landfill survey

It was agreed with WRAP that the survey would be split into two parts:

- the 177 landfills covered by the first four data rows of Table A7.1 above; and
- the 259 landfills described in Table A7.1 as 'all other landfills'.

Both of these groups of landfills can be further split into four tonnage bands (based on inert and mixed CDEW), as follows:

- up to 9,999 tonnes (53 inert / mixed CDEW landfills; 110 other landfills);
- 10,000 to 29,999 tonnes (44 inert / mixed CDEW landfills; 64 other landfills),
- 30,000 to 99,999 tonnes (48 inert / mixed CDEW landfills; 59 other landfills); and
- over 100,000 tonnes (32 inert / mixed CDEW landfills; 26 other landfills).

The tonnage shares of these four tonnage bands are:

- up to 9,999 tonnes (0.24 million tonnes plus 0.41 million tonnes);
- 10,000 to 29,999 tonnes (0.81 million tonnes plus 1.16 million tonnes),
- 30,000 to 99,999 tonnes (2.72 million tonnes plus 3.11 million tonnes); and
- over 100,000 tonnes (6.03 million tonnes plus 5.93 million tonnes).

The agreed approach (for both groups) was to survey all of the two larger sub-groups, and to sample the two smaller sub-groups (with the sample size determined by the number of landfills per sub-group, and the variance of the tonnages, given that their total tonnages were already known). This resulted in the following outcome:

- For the 177 inert / mixed CDEW landfills: 29 out of 53 of the <10K tonne sub-group were surveyed, and 26 out of 44 of the 10-30K tonne sub-group. All 80 of the >30K tonne sub-groups were surveyed.
- For the 259 other landfills: 42 out of 110 of the <10K tonne sub-group were surveyed, and 24 out of 64 of the 10-30K tonne sub-group. All 85 of the >30K tonne sub-groups were surveyed.

Sampling was based on an initially random selection, but with substitutes allowed where the chosen landfill was either closely linked to another landfill that fell into either of the >30K tonne sub-groups, or was a landfill for which no reliable mailing address was available. The reason for paying particular attention to landfills which are closely associated (e.g. an older landfill with one permit, and an extension with a different one) was to avoid the situation in which a landfill manager received one form, and – seeking to be as helpful as possible - filled it in for

both parts of the same site. In principle, the objective was to ensure that if a form was received for one part of the site, it would be accompanied in the same envelope by forms for all other parts of the same site.

Addresses

The file received from the Environment Agency identifies the licence holder and the local authority area where the landfill is located, but does not provide contact addresses. It was therefore necessary to go back to the mailing list that was used for the DCLG survey carried out in 2006, supplemented by other sources (e.g. HM Revenue & Customs and internet searches) to correct addresses that failed in 2006, or that were not included on that list.

Survey forms

There were minor differences between the survey forms sent to the two groups of landfills. Those sent to inert landfills did not include any reference to hazardous wastes. Guidance was provided on relevant EWC codes and some of the descriptive terms used.

The survey form sent to operators of non-inert landfills asked the following questions.

If the permit / licence identified on the first page of this form also covered a waste transfer station (WTS) or some other type of waste treatment / materials recovery facility (MRF) in 2008, please answer Question 1. Otherwise go straight to Table Q2.

Q1 Which of the following statements applied to your site in 2008? Please circle the appropriate answer (or delete the others) in all three rows.
A Was the landfill accepting CDEW (either as waste, or for engineering and/or restoration purposes) in 2008?
B Did some, all or none of the materials that came out of the WTS / MRF then go off-site for use or disposal elsewhere?
C Did some, all or none of the materials that came out of the WTS / MRF then go into the landfill identified on page 1 of this form?

If you answered 'No' to Question 1A, please ignore the remaining questions, and return the form to the FreePost address on the back page of this form. Thank you.

When completing Table Q2, please note the following:

- You should not record any materials that you recycled/reclaimed and then sent off-site.
- There should be no overlap between the cells in the Tables: any materials which went into the landfill for any purpose should only be recorded once.
- The total tonnage of CDEW (as illustrated opposite) which entered the landfill in 2008 will be the total of all cells in Table Q2.
- 'Hazardous' means any EWC Code marked with an asterisk (e.g. 17 09 03*).

Table Q2: Tonnages of unprocessed (or residual) CDEW that entered the landfill in 2008, and what happened to them.

	Used in landfill engineering (roads, bunding, drainage, daily cover etc)	Used in capping or restoration	Disposed of as waste
Clean hard C&D waste			
Hazardous hard C&D waste			
Clean excavation waste			
Hazardous excavation waste			
Clean 'mixed' CDEW			
Hazardous 'mixed' CDEW			
Other CDEW (or category unknown)			

Q3 Is the landfill a former quarry which is being backfilled and restored exclusively with materials which are exempt from landfill tax?

Mailings

The initial mailing was sent on 8 October 2009. Unfortunately a series of regional and national postal strikes were called soon thereafter. A follow-up mailing was sent to all non-respondents on 16 November 2009.

Results

The level of survey returns was very disappointing. On previous national CDEW surveys organised for Government departments, landfill operators have provided a great deal of information. In 2005, the overall response rate was close to 40%, and higher than that for the more important sub-groups of large facilities. On this occasion by 5 January 2010 the response rate was 14.1% for inert / mixed landfills and 11.9% for other landfills (and 12.9% overall).

Several operators rang to say that they felt that the survey should not be necessary, given the information that they already report to the Environment Agency and others, and that they would not be responding.

Given this low response rate, it would be unwise to over-interpret the data that were received, particularly in view of the finding that the data from HMRC appear to provide a good estimate of the level of beneficially used CDEW. However, some findings and trends could be seen.

- Although some operators provided a clear break-down of a total tonnage that was either exactly the same as, or very close to, the tonnage reported to the Environment Agency for inert (and similar) CDEW, in several other instances there were clear discrepancies between the tonnages reported in response to this survey and the tonnages reported by operators to the Environment Agency.
- To the extent that it is wise to do so, when the returns are grossed up, they are consistent with a reduced level of both use and disposal of inert CDEW since 2005. The fall appears to be greatest as concerns clean excavation waste, and smallest as regards the use of hard inert CDEW for site engineering purposes.

This would be consistent with two quite separate factors, both of which were observable during 2008:

- a reduced level of construction activity, resulting in less CDEW seeking landfill space; and
- less municipal waste going to landfill, and therefore a reduced demand for engineering and capping materials.

Appendix 8: Individual site reports from larger treatment and transfer facilities

This Appendix provides reports from the larger CDEW treatment and transfer facilities that were visited as part of this project. Comparable reports on selected smaller facilities are provided as Appendix 9.

Introduction

It was agreed that facilities would not be named or otherwise identified, to make it easier for operators to express themselves clearly without fear of unwanted come-back. The site numbers used in this Appendix are the same as are used in Appendix 4. The sites are from three clusters: numbers 1-7 are in a northern industrial city, 8-21 are in one segment of the M25 corridor, and 22-29 are in a coastal area and its largely rural hinterland. Not all sites are reported on individually, and wherever possible common themes and findings are identified.

All visits took place between November 2009 and early February 2010.

Site 4 (northern industrial cluster)

Site 4 is a long, thin site located on an industrial estate very close to the city centre. It handles in excess of 200,000 tonnes of mixed waste per annum. The operator's roots were in hiring skips to builders, but the business now extends to an active fleet of more than 90 vehicles, including skip lorries, 'Ro-Ro' containers, front-end loader (FEL) collection vehicles, kerbside collection vehicles and articulated bulkers. It is a high profile operation in the city, and promotes itself via a range of approaches, from advertising and sponsorship to school presentations.

Office, vehicle maintenance and waste recycling have dedicated modern buildings. However the site has little space for storing recyclates, and the operator works on the basis of a fast turnaround for all waste streams.

The recycling hall has a large area for incoming waste served by multiple doors. The incoming waste is segregated into light, bulky C&I waste and denser CDEW. Each delivery is discharged onto the floor for an initial 'hand-pick'. Items such as mattresses, doors, PVC profiles and long metal trims are extracted and placed in dedicated containers. Bulky waste is shredded and added to the stockpile of heavier wastes. (If the incoming waste is identified as uncontaminated inert excavation waste, then it is re-directed to a satellite site (which is operated by another company) for screening and crushing. This is done for two reasons, partly because storage space at Site 4 is at a premium, and partly to avoid 'contaminating' the main recycling plant with clay, which characterises much local excavation waste.)

After hand picking, the two waste streams are combined and loaded into the recycling plant. This densifies the waste to enable the plant to run more efficiently. A vibrating plate feeder transfers to a trommel screen that splits the waste at 40mm. The 0-40mm fraction is then further split (by screening) into 0-12mm and 12-40mm fractions. The 12-40mm fraction is passed through an air separator to separate out the light residues from the inert fraction. This inert material is transported off site to be blended into recycled aggregate, which is typically used for site restoration purposes. The operator has found little interest in alternative uses (such as pipe bedding): the utility companies are still not convinced that their specifications can be achieved.

The > 40mm material is subjected to extensive hand sorting to take out the wood, hard plastics, non-ferrous metals and cardboard. The residual waste stream then passes to air technology which sucks out the paper and plastic foils. The residual clean inert materials then fall into a collection bay. From there, most of the inerts go off site for crushing and blending. A certain percentage can also go out direct for restoration works. Clean wood from the picking station goes to a panel manufacturer, and residual wood goes to a specialist re-processor, but the market for recovered wood is difficult.

The operator would like to use the light residues to make an RDF material: currently it is landfilled. The company claims a 95% recycling rate, though it appears that this very high rate can only be achieved when a market for

the light residues has been developed. The recovery rate for some mixed waste stream is certainly lower than 95%.

Figure A8.Site4.1: Mixed incoming CDEW in the recycling hall.

Figure A8.Site4.2: The picking station.

Figure A8.Site4.3: The residual inert fraction, albeit with some 'contraries'.

Site 8 (M25 cluster)

Site 8 was one of the most impressive of those visited. It is not the largest, having a throughput of about 55,000 tonnes a year, but it achieves a very high recovery rate from the waste received, some of which comes from other facilities which have already 'plucked the low-hanging fruit'. One of the key features that distinguish it from most others is that all operations take place inside buildings, giving much more control over material quality than most of its competitors.

Site 8 is the company's only treatment and transfer facility, and the bulk of their business is as a demolition contractor. They have recently signed WRAP's 'halving waste to landfill' commitment. Their overall recycling rates

were 73% in 2007/08 and 83% in 2008/09. So far, the level achieved during 2009/10 has been approximately 90%.

The majority of demolition waste from their own demolition business is brought to this site. Site 8 also accepts waste from other construction / demolition contractors and receives residual waste from other treatment and transfer facilities.

The site operates by extracting a series of waste streams from incoming mixed waste. These streams are: timber, plasterboard, tyres, batteries, cables, fines, aggregate, metals and UPVC window frames. Concrete is crushed, tyres are shredded, and residual waste is turned into refuse derived fuel (RDF) for use in an energy from waste plant.

Incoming wastes containing larger items are tipped out onto the floor of the main hall and large items are removed with a grab. Operatives then hand pick timber, plasterboard, metals, batteries and cable.

The residual material is fed into an older processing line, where oversize items are removed before fines are removed by a trommel. Fines go to landfill for use as daily cover or for restoration. Material then moves on through a picking station, where more timber, batteries, plasterboard, metals and cable are removed, leaving a stream that is largely hardcore suitable for recycling into aggregate. This hardcore is screened, and oversized elements are passed through an on-site mobile crusher.

The mixed residual waste from the older line is then fed into a second (and much newer) processing line, together with residual waste from other treatment and transfer facilities. Metals are removed by a magnet, heavier materials (e.g. soil and hardcore) are removed, and the resultant material is shredded to between 20 and 40mm to form RDF for use in an energy from waste plant.

If the shredded material contains too much soil or fines to allow it to be used satisfactorily as RDF, then it is fed back through the screen, and back onto the older processing line to remove the fines.

Figure A8.Site8.1: Heavily mixed incoming wastes waiting to be hand-picked. Includes green waste, wood and bagged waste.

Figure A8.Site8.2: Hand picking of cable, wood and plasterboard. Grab removing large items before screening.

Figure A8.Site8.3: Very different incoming waste. Soil with contaminants, including lots of soft plastics.

Figure A8.Site8.4: Waste ready to go through the older processing line and picking station.

Figure A8.Site8.5: Intermediate stage waste. More soil will be screened out before the residue becomes RDF.

Figure A8.Site8.6: Older processing line and picking station.

Site 14 (M25 cluster)

Site 14 occupies a large area (of about 3.2 ha), and has its own fleet of four 'Ro-Ro' lorries and four skip lorries. It takes waste from an oval shaped catchment area roughly 20 miles across. The operator will accept wastes from further away if an existing client requests it. There are few other WTSs nearby, and Site 14 is nearly always busy. However, it is currently only taking about 70% of the volume of waste compared to the pre-recession situation.

Site 14 also accepts a large amount of waste from other operators, including trade waste from national waste management contractors and skip waste from local skip hire companies. At times the operator also bulks up various local councils' household waste collections, and transports it to landfill in bulk. This was an obvious feature at the time of the site visit, which took place in the aftermath of the extended disruption caused by snow in January 2010. Trade and domestic waste for landfill is tipped separately and then bulked up into large containers on articulated lorries.

One quirk of the location is the number of hotels nearby. Periodically Site 14 receives multiple skips full of mattresses, carpets etc when a hotel buys new ones. In the absence of any alternative use, such materials are sent to landfill.

Mixed CDEW (which at Site 14 means all skip waste) is tipped into the building, with large items, and plasterboard, being removed by grab. The waste is then loaded into a hopper, which feeds a trommel screen. This is used to remove soil and small stones. Residual mixed waste is then carried by conveyor to a picking line where paper and card, wood and residual wastes are removed. A magnet then removes ferrous metals, and the remaining waste (consisting of larger hardcore) is tipped into a storage bay. Soil and small stones from the trommel are carried outside the building by conveyor, where they are screened.

Loads containing only plasterboard, only soil and stones, only green waste or only timber are tipped directly into the relevant bays. Plasterboard is not supposed to be delivered in mixed skips, but some still is, and this is removed by the grab and picking line. Green waste is chipped and goes to another (reasonably local) waste treatment and transfer facility.

Residual waste is sent to one of three relatively local landfills.

Currently Site 14 achieves an 85% recycling rate for CDEW (trade and domestic waste is not processed and is kept separately). The operator has tried providing wheelie bins to construction sites for canteen-type waste in an effort to improve the quality of CDEW. Although this has helped, it has not completely solved the problem, as some site workers still put their food waste into the skips. Site 14 has observed a drop in the amount of packaging waste coming from construction in recent years, reflecting the fact that it is separately collected and coded as packaging waste rather than CDEW.

The operator also pointed out that commonly available picking stations have a limited number of chutes, meaning that the number of different materials that can be separated on any one pass is limited. Additionally, the site is generally extremely busy, and certainly during our site visit there was a constant stream of vehicles in and out, and a queue to tip. To include additional operations the site would need expanding.

Hard plastics can be separated by hand, but there is limited demand for it and those companies that will take it one week may decide not to the next. This has meant that the effort required to achieve a decent separation of plastics is seldom worthwhile. Site 14 has a contract under which they are required to accept hard plastics from a group of local authorities and their HWRCs, under which the other party is supposed to find an outlet and Site 14 is simply required to store and bulk up the plastics. However, the other party has failed to find an outlet. There are established reprocessors further north, but transport costs outweigh the benefits, so the plastic is sent to landfill.

Figure A8.Site14.1: Heavily mixed incoming wastes being sorted by grab, with the residual fraction being loaded into the trommel screen's feed hopper.

Figure A8.Site14.2: Trommel screen and conveyors. One conveyor carries the fines outside; the other takes the residual waste to the picking station.

Figure A8.Site14.3: Paper and card from the picking station.

Figure A8.Site14.4: Plastics from the picking station. The material is slightly dirty, but no more than would be expected in winter.

Figure A8.Site14.5: Timber from the picking station. There is a real range of timber from very clean to very dirty.

Figure A8.Site14.6: Residual waste from the picking station. Much of this is very dirty timber, card and soft plastics.

Figure A8.Site14.7: Metals removed by the magnet (after the picking station).

Figure A8.Site14.8: The plasterboard pile, which is kept clean and dry inside the main building.

Site 19 (M25 cluster)

Site 19 has been in business for many years. It is a large open air site which processes a significant tonnage of recycled aggregate. Its annual throughput is approximately 115,000 tonnes (between 2,000 and 3,000 tonnes a week), all of which comes in as mixed CDEW, with hardcore and soil being the dominant fractions.

Although 95% of the incoming waste is recovered for use or further processing, Site 19 is finding that demand for recycled materials is currently lagging behind supply.

Incoming waste is tipped into bays, and grabs remove the largest items. There are two identical processing lines each based on a trommel screen and picking line, which carry out the following processes:

- Lightweight wastes (e.g. soft plastics) are blown out.
- The resultant waste stream is screened to remove fines.
- A magnet removes metals before operatives in the picking station remove timber, plastics, batteries, cable and asphalt.

This leaves mixed hardcore, which is taken to another part of the site for crushing and screening. Hardcore received from household waste recycling centres is also crushed and screened. All aggregate produced on Site 19 is recycled in accordance with the WRAP Quality Protocol. As of late 2009 this appears to be causing problems with selling the resultant aggregate, because Site 19 cannot compete on price with non-Protocol producers, and since the economy has been in recession, clients have increasingly bought on price rather than quality.

Green waste is separated and sent for composting, although currently Site 19 is struggling to find suitable outlets due to high gate fees and quality issues. Timber is chipped on site and sent for reprocessing, whilst poorer quality timber boards are chipped and turned into RDF for use elsewhere. Tyres and UPVC window frames are also separated and sent for recycling.

Residual waste (about 60 tonnes a day) is sent to various landfills. This includes some bagged and office waste which has been collected by a waste management contractor, but which has a very low recyclable content. This waste is simply bulked up and transported to landfill.

The operator of Site 19 would like to have an energy from waste plant to burn the residual waste.

Figure A8.Site19.1: Incoming waste with a high inert content, waiting to be screened.

Figure A8.Site19.2: Heavily mixed incoming waste.

Figure A8.Site19.3: Incoming waste with a significant content of plastics from construction sites.

Figure A8.Site19.4: Residual waste removed by the picking line. Mostly plastics, but with some dirtier waste towards the back.

Figure A8.Site19.5: Residual waste waiting to be sent to landfill.

Figure A8.Site19.6: Separated wood board ready for chipping. This will be burned as RDF.

Site 22 (coastal cluster)

A formal site visit to Site 22 was not conducted: despite several telephone calls and emails, a date could not be agreed. The following brief information draws on the company's website, satellite images and a 'windshield survey'. This is one of the biggest waste transfer stations in the coastal cluster: their website states they have the largest fleet of waste vehicles in the county, and in 2008 they received about 40,000 tonnes of CDEW, over 75% of it mixed. Their skips can be widely seen around the local area and it is evident that they receive a significant amount of construction waste from domestic building projects. Their website states that they recycle more than 70% of the 'general waste' that they take in. They crush and sell aggregate both in bulk and as a bagged product.

Site 22 operates a general skip hire business as well as providing other specialist waste collection and reprocessing / recycling services for local businesses covering glass, cardboard, hardcore, soil, steel, aluminium, copper and WEEE. Much of the mixed skip waste received is largely CDEW.

Most operations are fully enclosed in a modern building with multiple entry doors. Waste is pre-sorted using front end loaders, and fed to a trommel screen and picking station. Soils and hardcore are handled outside, and the large yard is used for skip and vehicle storage.

Figure A8.Site22.1: One of Site 22's skips adjacent to a small construction site, showing basically clean inert waste 'spoiled' by the presence of other wastes, both CDEW and other.

Site 23 (coastal cluster)

Site 23 is operated by a skip hire company. It also accepts roll-on / roll-off skips and trade waste with a low level of recyclables from a major waste management contractor. Despite this, the site has an 84% recycling rate. Its annual throughput of CDEW is about 55,000 tonnes.

The site was busy at the time of the visit, with a queue of four or five skip lorries at any given time waiting to unload. The first impression of Site 23 is that, although it has large areas of open yard, its operational areas

(which are in open sided sheds) are quite cramped. This is a reflection of the shape of the site, which requires these yards to be kept clear to facilitate vehicle movements.

Incoming waste is tipped onto the ground, and wood, plasterboard and UPVC windows are picked by hand. Once these larger items have been removed, the denser residual fraction is passed over a trommel screen, and metals are removed with a magnet. The remaining waste stream then goes through a picking station, leaving a final fraction which is largely hardcore.

By these means, plasterboard, wood (both good and poorer quality), UPVC windows and doors, card, metal, soils and hardcore are separated.

- Card and poorer quality wood (such as MDF and chipboard) goes to another local treatment and transfer facility (Site 26) to be burned in their energy from waste plant.
- Good quality timber is shredded on site and goes for reprocessing. Site 23 would like to expand into grading chipped wood to sell it directly into various markets.
- Residual waste goes to landfill.

Figure A8.Site23.1: The picking station, and some stockpiles, are under cover, but in open-fronted sheds.

Site 26 (coastal cluster)

Site 26 is operated by a skip hire company. It has two processing lines operating alongside each other, one for mixed wastes, and the other for soil and hardcore. These processing lines, and much of the rest of the site, are located within enclosed buildings, with some storage bays outside. It has an annual throughput of about 55,000 tonnes of CDEW a year, some of which comes from other waste management facilities.

Plastics are removed (by hand and by a grab) before the waste is fed onto the mixed wastes line. Plastics used to be sold, but now go to landfill due to a lack of sites prepared to accept them.

Both processing lines comprise a shredder, a trommel screen, a magnet and a wind sifter. The soil and hardcore line also has a small picking station, after which aggregates are screened to <10mm, 10-20mm and 20-40mm. Lightweight wastes that have been removed from the soil and hardcore line are carried by conveyor onto the mixed wastes line, and hardcore removed from the mixed wastes line is transferred to the soil and hardcore line.

Residual waste is shredded, (along with some residual waste from other local treatment and transfer facilities) burned as RDF in Site 26's on-site energy from waste plant.

The operator of Site 26 also operates Site 28, some 20km along the coast, where some wastes are stored and some incoming wastes are roughly separated. There is quite a high level of movement of waste between the two sites. The operator would like to equip Site 28 with the same equipment as they have at Site 26.

Figure A8.Site26.1: Heavily mixed incoming waste.

Figure A8.Site26.2: Largely inert incoming CDEW.

Figure A8.Site26.3: The indoor processing line for soil and aggregate. To the left are bays for the larger fractions. The picking line is in the centre.

Appendix 9: Individual site reports from small treatment and transfer facilities

This Appendix provides reports from the smaller CDEW treatment and transfer facilities that were visited as part of this project (i.e. those with a throughput of less than 40,000 tonnes of CDEW). Comparable reports on selected larger facilities are provided as Appendix 8.

Introduction

It was agreed that facilities would not be named or otherwise identified, to make it easier for operators to express themselves clearly without fear of unwanted come-back. The site numbers used in this Appendix are the same as are used in Appendix 4. The sites are from three clusters: numbers 1-7 are in a northern industrial city, 8-21 are in one segment of the M25 corridor, and 22-29 are in a coastal area and its largely rural hinterland. Not all sites are reported on individually, and wherever possible common themes and findings are identified.

All visits took place between November 2009 and early February 2010.

Sites 1 and 2 (northern industrial cluster)

The operator of Site 1 is a civil engineering contractor, and Site 1 is their yard, which is located in the urban fringe adjacent to a concrete plant. They only bring a small proportion of the waste generated by their demolition works (e.g. concrete, brick and some soil) back to their yard, where it is crushed and blended. There was minimal evidence of mixing with non-inert fractions (wood, plastics etc), though the site's 2008 site return to the Environment Agency did report small tonnages of such materials.

Site 2 was also visited. It is a busy skip hire business based in a small yard with little scope for processing beyond the most basic sorting.

Site 3 (northern industrial cluster)

Site 3 is located on the same industrial estate as the much larger Site 4 (see Appendix 8 for details), and the two businesses are in direct competition. The operator of Site 3 is predominantly a skip hire business bringing in mixed CDEW and some commercial waste. The site is long and thin, with a reasonably large open-fronted building along one of the long sides.

The company installed a recycling plant some 2 years ago, which has subsequently had to be modified to make it work better. A recycling rate of 80% is achieved on CDEW.

In an unusual configuration, incoming mixed CDEW is passed through a picking station (in a cabin) prior to trommel screening. An air separator then removes light residues and the heavy fraction passes a quality control picking station to achieve a clean inert fraction. The inert fraction then goes out for low value restoration work. The operator does not see a market for a premium grade of recycled aggregate at this stage[14].

Incoming C&I waste is shredded before it reaches the initial picking station.

Trommel fines (0-40mm) currently go to landfill for use as daily cover. However, the operator has concluded that a fines clean-up system is required. This should allow the 0-40mm fraction to be split into 0-5mm inert fines (30%), 5-20mm inert waste (30%) and 20-40 inert waste (30%), with about 6% metals and 4% residual light contaminants. Fines screening in the area served by Site 3 can be complicated by the presence of clay.

[14] *A nearby site had a very large stockpile of apparently clean crushed concrete and brick, supporting the operator's view that the local market for recycled aggregate is currently over-supplied.*

The operator has seen the markets for separated cardboard and hard plastics becoming increasingly unrewarding. These materials now go for reduced revenues to other re-processors. The operator is also interested in the possibility of converting residual wastes into RDF. However, this will require a very substantial investment, and is not being actively pursued.

Figure A9.Site3.1: Incoming waste prior to shredding.

Figure A9.Site3.2: Recovered hardcore.

Sites 5 and 6 (northern industrial cluster)

This owner of Site 5 recently sold his waste handling business to a local skip hire company. The company has restructured into civil engineering activities and does organise some demolition. The transfer station buildings have been redeveloped into units.

The incoming skip hire business is located on a semi-rural site with little investment in recycling equipment. It is typical of the low tech approach (of tipping onto the ground for a simple manual pick, and transferring the waste on to others). No recycling rates were established.

The operator of Site 6 also runs a skip-hire business, and a fleet of 8 wheelers that can optimise excavation waste in and recycled aggregate out, from a busy site on the outskirts of the city. There were several different waste streams on site when the visit was made, though the CDEW is largely inert, with minimal wood and light residues.

CDEW is processed through a trommel screen and large picking station to achieve a recycled inert fraction. The company has a crushing and screening operation on site, and markets a range of restoration products.

Site 6 reckons to achieve an 80-85% recovery rate for CDEW, but (as stated above) with little by way of wood and light residues.

The site is operating at full capacity, and has to divert some waste streams to other waste treatment and transfer facilities.

Site 7 (northern industrial cluster)

Site 7 provides an excellent example of an increasingly important trend in urban waste management. Having been bought by another waste management company, it is now operated as the first link in a network of complementary treatment sites.

Prior to the change of ownership the previous operator had been developing Site 7 as a recycling centre to serve the regenerating city centre. The site itself is fairly restricted, and is now surrounded by a mixture of new residential and commercial developments that form the backbone of the area's urban regeneration process. The previous owner invested in a new plant, but soon after installation problems were encountered that resulted in the company being bought by a competitor. Now, as part of a larger organisation, the site is busy.

Incoming waste is divided into 'heavy mixed' waste and other, lighter wastes. Lighter (and bulkier) wastes, typically C&I waste and some waste from HWRCs is transferred to one of the operator's other processing sites. The recycling plant at Site 7 then only handles the heavier wastes, most of which are CDEW.

Incoming heavy waste is tipped under cover. After an initial hand-pick on the floor, the waste passes under a magnet and into a heavy-duty trommel screen. The 0-40mm fraction is collected in a bay below the screen, and this fraction is not subjected to any further processing. The >40mm fraction passes through a manual picking station, where wood, card, non-ferrous metals and hard plastics are removed. The heavy fraction then passes a simple blower to remove small light residues and some small pieces of wood. This produces a reasonably clean hardcore fraction, and a very dirty residue that goes to landfill.

The operator of Site 7 also has an open-air site with space for storing and crushing inert CDEW, and a (separate) former quarry which can take some restoration materials.

At yet another of the operator's sites (which is located in an old established industrial area on the edge of the urban area with a large number of skip yards and scrap metal companies), and to which some of the lighter mixed CDEW might be diverted, incoming waste is predominantly hand sorted on the ground. Items such as plastic profiles, steel and non-ferrous metals, large sheets of plastic, wood and residues that can easily be handled are removed. If there is sufficient inert material in the remaining pile, then it is then processed through a simple trommel screen and blower system to recover the 0-40mm fines and heavy inerts.

Finally, they have an urban site where there has been considerable investment in a turnkey recycling plant that incorporates primary shredding, trommel screening, magnetic belts, air separation technology, sorting cabins and an eddy current separator for non-ferrous metals. This site processes a mixture of heavy CDEW blended with C&I / HWRC waste. The operator has found that the plant runs better when fed with a mixture of wastes, rather than processing a 'light' waste run followed by a separate 'heavy' waste run. Nevertheless, reflecting the heavily mixed wastes that are handled, this site sends 40-45% of incoming waste (by weight) to landfill as post-processing residues.

The operator is actively looking at possible recovery methods for fines, and at further investment in another centralised treatment centre.

Figure A9.Site7.1: Indoor recycling hall.

Figure A9.Site7a.2: Waste receiving yard and recyclate storage at operator's other premises.

Site 13 (M25 cluster)

Site 13 is a small facility with relatively basic separation activities based on hand picking, and a mobile screen that is used to recover soil. The operator recently started separating wood and plasterboard and now hires in a chipper to chip wood on site. Residual waste is sent to a larger treatment and transfer facility about 40km away for further processing. Until recently it went to a landfill about 15km away. This change was stimulated by other local WTSs recycling more, and therefore offering lower gate fees. The throughput tonnage is currently lower than the historic norm.

The operator has applied for planning permission for a building, but cannot get planning permission for permanent plant.

Following the recent switch (from landfill to further off-site processing), approximately 50-60% of material arriving at Site 13 is recycled (including the separation and recycling carried out on residual waste by the remote treatment and transfer facility). This outgoing residual waste contains a high proportion of large items such as chunks of expanded polystyrene, card, polythene, carpet, ferrous metals and hard plastics.

Figure A9.Site13.1: To the left is a pile of incoming waste being hand picked. The main pile is residual waste which is dispatched to another waste treatment facility for further processing.

Figure A9.Site13.2: Incoming waste being hand sorted. There are three distinct loads: the pile at the back is mostly soil and hardcore, the pile in front of that is mostly wood, and the pile to the right contains a lot of green waste.

Figure A9.Site13.3: Soil / hardcore processing. To the left is a pile of screened soil, next to the excavator is a pile of incoming mixed waste containing a high proportion of inert CDEW, and to the right is general incoming mixed waste.

Figure A9.Site13.4: Residual waste going for further sorting by another waste treatment facility. The large white lumps are polystyrene.

Figure A9.Site13.5: More residual waste for further sorting by another waste treatment facility.

Site 17 (M25 cluster)

Site 17 is operated by a skip hire company which also runs a fleet of grab lorries and 'RoRo' containers. A site visit was not carried out, but a telephone discussion was held, and the company has a website. The information below was assembled from those two sources.

The main focus of the business is on the production of recycled aggregate (crusher run, Type 1 and road planings) and recovered soil compost, so as well as demolition and excavation waste, other materials including wood, green waste, metals and mixed wastes are handled. They have a composting operation on site.

The main separation operation is based on a trommel screen. Waste wood is directed to an energy from waste facility wherever possible, and scrap metal is separated and passed to specialist recyclers.

Site 24 (coastal cluster)

Site 24 is operated by a skip hire company. Roughly 30% of skips bring waste from domestic sources, and 70% from construction. The site has a throughput of CDEW of about 35,000 tonnes a year. Its facilities are more typical of larger sites, and much of the processing is carried out under cover. There is a large open area where recovered soils and aggregates can be stored. There is also an asbestos skip in case asbestos is brought in within a mixed load. This is sent for specialist disposal.

Incoming waste is tipped into bays in the building, and hand sorted to remove larger recyclable items. Plasterboard, timber, wood boards, aggregate, soil, UPVC window frames and wheelie bins, metals and items such as cable and batteries are all separated. The mixed fraction is then passed over a trommel screen to remove fines. The remaining waste then goes through a picking station to remove the smaller fractions of recyclables and other unwanted materials, so that at the end of the conveyor only hardcore remains. This hardcore is carried out into the yard behind the building on a conveyor.

Some whole bricks are recovered and sold for re-use, as are some pallets.

Site 24 sends plasterboard for reprocessing to a specialist site in Lincolnshire (which is a considerable distance away). They also receive plasterboard from several other sites in the coastal cluster. Since April 2009, when plasterboard segregation became obligatory, Site 24 has recovered approximately 590 tonnes, and made cost savings.

Site 24 has trialled use of a wood chipper, but the noise was inappropriate for the locality, and there was not really enough space for this alongside their existing operations. Chipping also would have put them in more direct competition with Site 27, which is one of the local sites that sends plasterboard to them.

Glass can be separated on site, but there is a shortage of local sites which accept it, so transport costs can end up outweighing the financial benefits of recycling.

Site 24 has a large baling machine which is used for plastics. This allows them to accept plastics from other sites in the coastal cluster, which they bale, thereby making onward transport more economical (for either recovery or disposal). They already separate UPVC window frames and send them for recycling, but have had problems finding reliable users for other plastics. They have had instructions from reprocessors on what to separate, but have then had loads refused because of poor quality. The site operatives and even the reprocessors cannot reliably identify the majority of plastics coming through the CDEW stream, because manufacturers do not label them. Given the opportunity, Site 24 would like to set up a mixed plastics separation plant nearby, once the technology catches up with the opportunity.

There are sites at the other end of the country that will accept baled mixed plastics, but the transport and gate fees make this uneconomical. Site 24 is also looking at sheet plastic recycling, but finds cleanliness to be the biggest barrier.

Site 24 has been supplying aggregate and soil to a number of local farmers for development works, though the overall demand for recycled aggregate has dropped since the onset of the recession. Their farming customers would also like Site 24 to take away their silage wrap (plastics). This is being considered, despite the relatively small volumes involved.

Residual waste from Site 24 is sent to Sites 26 (some of it via Site 28) to be further sorted, shredded and used as feedstock for the energy from waste plant at Site 26. Before this arrangement was initiated, Site 24 had problems finding a recipient for chip board, ply board, MDF etc.

Figure A9.Site24.1: Incoming CDEW after hand picking. This waste will be screened next.

Figure A9.Site24.2: Timber extracted by the picking line.

Figure A9.Site24.3: A bale of mixed plastics, including some removed from mixed CDEW.

Figure A9.Site24.4: Good quality bricks and pallets extracted from CDEW, which will be sold to local companies for re-use.

Site 25 (coastal cluster)

Site 25 is a small site cut into a steep hillside and operated by a skip hire company. Most of the incoming waste is from small building projects and domestic skip hire, with a small amount coming from larger construction sites. Waste is also brought in from landscaping projects. The site has recently had problems with thefts of copper and other metals.

Waste recovery operations (which are fairly low-tech in nature) are constrained by this lack of space. Heavy and light wastes are processed separately. They separate PVC window frames for recycling but not other types of plastics. Plasterboard is a problem: because clients still put it into mixed skips it has to be separated by hand. Soils and hardcore / recycled aggregate are used in landscaping where possible, but otherwise go to landfill. Light wastes and the residual fraction from heavy waste processing goes to Site 26 for incineration. The residual waste consists mainly of timber, plastic, green waste, paper, wood board and glass.

Mechanical separation of the heavier waste is based on a trommel screen and magnet, which is used to remove hardcore and ferrous and non-ferrous metals. Light fractions are separated using a blower, following which the waste goes through a picking station. There is no very formal system for managing fines from the screening process.

Site 25 would particularly like to be able to do more with plastics. They receive a lot of relatively clean plastic which would be easy to separate, but they have been unable to identify a reliable end user. They have found that even if they do separate one particular type of plastic, the end users can be difficult to work with and will not commit to accepting regular loads. The operator believes that if there were fewer types of plastics, and if they were better labelled / identified it would increase what could be recovered. As things stand, the market for recyclables needs to be stimulated to make additional sorting worthwhile.

Figure A9.Site25.1: Incoming waste is tipped into one of two bays (the sleeper wall can just be seen in front of the loader, which is transferring light waste into a 'RoRo' container for onward transport). Heavy waste is fed into the trommel screen, to the right.

Figure A9.Site25.2: Closer view of the lighter fraction. Several mattresses are being held back, as Site 26 (where this fraction is sent for further processing) enforces a limit of two mattresses per load.

Figure A9.Site25.3: Concrete awaiting crushing. Wherever possible they crush direct into a lorry or 'RoRo' container to minimise handling costs.

Figure A9.Site25.4: Plasterboard being stored in the open after being hand picked from mixed skips.

Site 27 (coastal cluster)

Site 27 is run by a skip hire company. All activities are carried out in the open. Approximately 20% of the incoming waste is sent on to landfill in the summer, and 25% in the winter. This works out at two 'RoRo' bins per week. At the time of the site visit no 'RoRo' load had gone out for a while, so there was more residual waste on site than usual, and there was a large pile of certified top soil covered by plastic sheeting ready for sale.

Incoming skips are visually assessed. If the load comprises mixed waste, it is taken to the hand picking area. If it contains predominantly green waste, aggregate, soil, timber or plasterboard then the waste is tipped straight into the relevant bay for bulking. Hand-picked UPVC window frames are separated and sent for reprocessing. WEEE goes to a specialist local company. Asbestos is not accepted, but there is a quarantine skip on site to take any asbestos which evades the visual checks. This asbestos is disposed of at a landfill about 30km away.

Timber is accepted from various other local sites (including Sites 23, 24, 26 and 28). Good quality wood is chipped and sent to Belgium for reprocessing. The wood chipper was bought with WRAP funding and is operated under an exemption from permitting. Green waste is chipped twice and supplied to local farmers. Aggregate is crushed and screened on site, and soil is graded.

The main waste stream that Site 27 receives in bulk but cannot economically separate or recycle is plastics. The site operator is proposing to submit a planning application for a gasification plant to be run on a nearby site as a biomass plant. In order to gain double Renewable Obligation Certificates this will burn 90% biomass (predominantly timber and wood boards) and will make up the balance with plastics. The plant will be able to burn 95,000 tonnes per year.

Figure A9.Site27.1: Incoming waste soil with some other wastes mixed in.

Figure A9.Site27.2: Incoming mainly inert CDEW, from builders' skips.

Figure A9.Site27.3: Incoming mixed skip waste.

Figure A9.Site27.4: Residual waste (post sorting), prior to transport to landfill.

Figure A9.Site27.5: Mixed contaminants screened out of soil and hardcore.

Figure A9.Site27.6: Mixed contaminants screened out of soil and hardcore.

Site 28 (coastal cluster)

Site 28 is operated by a skip hire company (the same one as operates Site 26, see Appendix 8). As well as mixed CDEW, Site 28 accepts a wide range of more general waste. At the time of the visit this included site clearance waste, where the site had apparently been a soft toy warehouse. Whereas the site returns to the Environment Agency show that Site 28 handled a bit less than 20,000 tonnes of CDEW in 2008, the overall throughput is typically closer to 50,000 tonnes when all wastes are taken into account.

This site has relatively simple equipment, with more complex waste streams being sent to Site 26 for recovery. All incoming wastes are tipped in the yard, and a grab removes the largest items while operatives do some hand picking. Timber, board and other burnable wastes are separated for use as RDF at an energy from waste plant. Landfilled waste contains mostly composite items such as carpets, furniture and plastics.

As well as initial hand picking of burnable items, there is a processing line on site which alternates between processing soils and aggregates and the more mixed general construction wastes. A 40mm screen is used to remove soils and smaller aggregate followed by a picking line. On that picking line three operatives remove burnable materials and a fourth removes larger lumps of aggregate. There is a blower to remove dust from aggregates when the heavier waste is being processed, which is turned off during processing of mixed waste.

Figure A9.Site28.1: Incoming CDEW – mostly soil, but with significant levels of contaminants mixed in.

Figure A9.Site28.2: Incoming skip waste. Although it contains significant non-CDEW content, it is classified as CDEW for reporting purposes.

Figure A9.Site28.3: Burnable separated waste (mostly wood and wood board). This will be burned as RDF at another location.

Figure A9.Site28.4: Stockpiles of soil and stones.

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