



July 2007

Study to fill the evidence gaps for construction, demolition and excavation waste streams in the North West region of England

Clients

North West Regional Technical Advisory Body for Waste and the North West Minerals and Waste Planning Authorities

Client contact

Andrew Farrow

Project manager

Dr Jason Beedell
Smiths Gore
Stuart House
City Road
Peterborough PE1 1QF

Telephone

01733 866562

Fax

01733 866561

E-mail

Jason.beedell@smithsgore.co.uk

Executive summary

1. This report was commissioned to address the evidence gap in sub-regional construction, demolition and excavation waste (CDEW) data, whilst also providing a regional assessment of waste generation.
2. A wide range of types of operator / operation was surveyed to generate as complete picture of waste arisings, processing and disposal as possible. Previous CDEW surveys, carried out for DCLG / ODPM, have surveyed crusher and screen operators, landfill sites and Registered Exempt Sites only.
3. The estimates of CDEW arisings, processing and disposal are presented for each type of operator / operation surveyed unless there was an insufficient response. Due to the lack of data from some types of operator, an overall regional estimate of CDEW is not presented as it would be misleading. Estimates are presented by type of operator (see table below).

Regional estimates of CDEW generated, processed or handled and disposed of in 2006

Operators that generate arisings	Regional estimate ¹	Operators that process / handle / transport arisings	Regional estimate ¹	Operators that dispose of arisings	Regional estimate ¹
Demolition contractors	No data	Crushers and screens	5,168,157	Landfill sites	4,113,878
House builders	183,245	Composters	44,500	Registered Exempt Sites ³	3,438,940
Highways works	27,500	MRFs and WTSs	3,357,349	Quarries	1,499,436
Land regeneration firms	No data	Registered Exempt Sites ³	3,438,940		
Land remediation firms	No data	Rail ballast recyclers	436,000		
Ports and harbours	<25,000	Skip hire operators	No data		
Power stations ²	>5,000,000	Quarries	1,499,436		
Pre-cast concrete manufacture	3,957,360				
Quarries	1,499,436				

All figures are in tonnes

No data means that due to the low response rate received from this operator group, data is not presented for them

Some operators (e.g., quarries) generate, process and dispose of CDEW and so appear in all three sections

¹ Regional estimate is the mean regional estimate of CDEW arisings or waste handled for all types of waste

² Only one power station reported producing and handling relevant waste, so data is not presented

³ Data presented for all types of RES surveyed. There was 1,510,788 tonnes of waste received at Paragraph 9 and 19 RESs

4. A comprehensive waste survey down to sub-regional level has not previously been attempted. The methodology used allowed sub-regional waste movements to be estimated, which are presented in the report. They show the flow of CDEW within sub-regions, between sub-regions and outside the region. District level data can also be generated but it will be subject to large confidence intervals.
5. Capacity projections for the region and sub-regions / counties have been generated for 2006 to 2025. They are based on the survey results for crusher and screens operators, landfill sites and Registered Exempt Sites (paragraphs 9.1 and 19.2 only¹) to allow comparison to previous capacity projections.
6. There is a complicated web or network of operators that produce, handle and dispose of CDEW in North West England (and nationally). Many of them are involved in generating arisings, handling them and then disposing of them. This raises significant difficulties in generating a reliable regional estimate of CDEW.

¹ Table 13 describes paragraph 9 and 19 exemptions in further detail

7. There are also vastly different amounts and quality of waste management data recorded by the different types of operator / operation. Some are used to recording detailed data while others do not appear to collect (or be willing to divulge) data as there is less of a regulatory requirement for them to do so and there may also be differences in organisational culture as well. Higher response rates tended to be achieved from operators involved in waste processing or disposal.
8. The approach of surveying a wider range of waste operator is recommended for future surveys as it appears to produce a fuller picture of CDEW despite drawbacks with double counting (see above).
9. The study grouped waste by European Waste Catalogue Codes. This allowed more detailed information to be collected than previous studies.
10. The use of a methodology that allows spatial tracking of waste was successful in identifying sub-regional (i.e., inter-county) flows of waste. This approach allowed the waste flows to (i) be identified and (ii) be built into capacity projections for the region, something that has not been possible previously.
11. The survey results are compared to the findings of the DCLG survey for 2005. Although the total estimate of arisings of CDEW is broadly similar for the two years (and surveys), this masks large differences in the estimates for the amount of waste handled by crushers and screens (2005 is 1.5 million tonnes higher) and by landfill sites (2005 is 1.4 million tonnes lower).
12. Although high response rates were obtained from some types of operator / operation, there was such a low response from some groups that data is not presented as it would be unreliable. Confidence intervals around the estimates are also significantly affected by the vast range of amounts of waste handled on sites. Responses to this survey from individual sites varied from less than 50 tonnes of waste to over 5 million tonnes. Such variation leads to large standard deviations in the data, which produces large confidence intervals.
13. The simplest way to increase the reliability of estimates, and to reduce the size of confidence intervals, is to increase response rates, which is most likely to be achieved through making provision of data mandatory. This will impose extra regulation / burden on all operators, which has to be balanced against the increased reliability of the data.
14. It is therefore concluded that the methodology used, of telephone and postal surveys, can provide a greater understanding of CDEW management but by no means a complete picture.
15. It is the research team's strong opinion that data that is considered reliable by the local planning authorities and waste management industry can only be generated by making provision of data mandatory.

Regional estimates of CDEW recycled by crushers and/or screens, used/disposed of at landfills, and spread on Paragraph 9 and 19 Registered Exempt Sites in 2005 and 2006

Tonnes	2006	2005
Crushers and / or screens		
Adjusted estimate of population of recycling crushers ¹	92	117
Estimated production of recycled graded aggregate		3,758,097
Estimated production of recycled ungraded aggregate		2,259,397
Estimated production of recycled soil (excl top soil)		703,320
Estimated amount of C&D waste received	2,264,861	
Estimated amount of excavation waste received	345,600	
Estimated amount of mixed waste received	2,474,496	
Estimated amount of other waste received	83,200	
Total	5,168,157	6,720,814
Estimated tonnage of unprocessed CDEW entering licensed landfills, and its use / fate		
	Total	Total
Clean hard C&D waste ²	453,645	174,817
Contaminated hard C&D waste ²	inc above	6,231
Clean excavation waste ²	1,586,525	2,123,367
Contaminated excavation waste ²	inc above	88,259
Clean mixed CDEW ²	0	133,004
Contaminated mixed waste ²	inc above	31,659
Other	2,071,076	108,923
Total	4,113,878	2,666,260
Estimated weight of waste materials used on Paragraph 9 and 19 RESs	1,510,788	1,958,148
Total estimated arisings of CDEW	10,792,823	11,345,222

1 2006 estimate of population based on assumption of 1.33 machines per operators for 69 operators

2 2006 data was not collected by clean or contaminated categories so data is presented for clean and contaminated combined

Contents

Executive summary	3
Report preparation and limitations	7
Authors	7
Steering Group	7
Duty of care, liability and responsibility	7
Views expressed	7
Information relied on	7
Information confidentiality	7
Acknowledgements	7
Chapter 1	
Introduction	7
Purpose of project	7
Detailed Project Objectives	7
Chapter 2	
Methodology	7
Choice of datasets	7
Survey questions and waste groupings	7
Businesses contacted	7
County boundaries	7
Data entry	7
Survey dates	7
Statistical methodology	7
Availability of CDEW generation data for the North West	7
Reliability of the available data	7
Chapter 3	
Results	7
Number of operators and response rate	7
Data quality and reliability	7
Interpretation of the data	7
Presentation of the results and data	7
Results for crusher and screen operators	7
Number of operators and response rate	7
Estimates per site, per active site and regional estimates	7
Regional waste movements	7
Results for landfill sites	7
Number of landfill sites and response rate	7
Estimates per site, per active site and regional estimates	7
Regional waste movements	7
Results for Registered Exempt Sites	7
Number of Registered Exempt Sites and response rate (All exemptions)	7
Estimates per site, per active site and regional estimates (All exemptions)	7
Regional waste movements (All exemptions)	7
Results for composters	7
Number of composters and response rate	7

Estimates per site, per active site and regional estimates	7
Results for construction companies	7
Results for demolition contractors	7
Number of demolition contractors and response rate	7
Estimates per site, per active site and regional estimates	7
Results for highways contractors	7
Number of highways contracts and response rate	7
Estimates per site, per active site and regional estimates	7
Results for house builders	7
Number of house builders and response rate	7
Regional estimates	7
Building works to existing houses	7
Results for land regeneration firms	7
Results for land remediation	7
Results for Materials Recycling Facilities (MRFs) and Waste Transfer Stations (WTSs)	7
Number of MRFs and WTSs and response rate	7
Estimates per site, per active site and regional estimates	7
Results for ports and harbours	7
Number of port and harbours and response rate	7
Results for power stations	7
Number of power stations and response rate	7
Results for pre-cast concrete product manufacturers	7
Number of pre-cast concrete product manufacturers and response rate	7
Results for quarries	7
Number of quarry operators and response rate	7
Estimates per site, per active site and regional estimates	7
Results for rail ballast recycling	7
Number of rail ballast recyclers and response rate	7
Regional estimates	7
Results for skip hire firms	7
Number of skip hire operators and response rate	7
Results for utilities	7
Chapter 4	
Capacity projections for the treatment of CDEW in the North West	7
Methodology for calculating capacity projections	7
Expected and target capacity projections for North West England	7
Expected and target capacity projections for sub-regions in North West England	7
Chapter 5	
Comparison to DCLG data for 2005 for the North West	7
Results for crusher and screen operators, landfill sites and Paragraph 9 and 19 Registered Exempt Sites combined	7
Paragraph 9.1 and 19.2 Registered Exempt Sites	7
Estimates per site, per active site and regional estimates	7

Chapter 6

Summary and conclusion	7
Comparison with 2005 data from DCLG survey	7

Chapter 7

Recommendations for future studies	7
Reliability of estimates	7
General comment on response rates	7
Appendix 1 Survey covering and follow up letters	7
Covering letter	7
Follow up letter	7
Appendix 2 Sample survey form	7
Appendix 3 Glossary of terms	7
Appendix 4 Additional results tables for crusher and screen operators	7
Regional waste movement for crusher and screen operators (actual waste movements reported by respondents)	7
Appendix 5 Additional results tables for landfill sites	7
Regional waste movement for landfill sites (actual waste movements reported by respondents)	7
Appendix 6 Additional results tables for Registered Exempt Sites	7
Regional waste movement for Registered Exempt Sites (actual waste movements reported by respondents)	7
Appendix 7 Additional results tables for Materials Recycling Facilities (MRFs) and Waste Transfer Stations (WTSS)	7
Appendix 8 Additional results tables for quarries	7
Appendix 9 Expected and target capacity projections for sub-regions in North West England	7

Table of charts, maps and tables

Executive summary		3
Report preparation and limitations		7
Chapter 1		
Introduction		7
Chapter 2		
Methodology		7
Table 1	Source of datasets	7
Table 2	Groupings of waste materials used	7
Availability of CDEW generation data for the North West		7
Table 3	Number of crusher and screen operators, landfill sites and Registered Exempt Sites (paragraphs 9.1 and 19.2 only) in 2005 and 2006 surveys	7
Chapter 3		
Results		7
Table 4	Number of operators and response rate	7
Results for crusher and screen operators		7
Table 5	Estimates per site, per active site and regional estimates for crusher and screen operators for C&D, excavation and mixed materials	7
Table 6	Estimates per site, per active site and regional estimates for crusher and screen operators for C&D, excavation and mixed materials excluding the response which recorded a large amount of mixed material	7
Table 7	Estimates per site, per active site and regional estimates for crusher and screen operators for all types of waste	7
Table 8	Waste movements of waste processed by crushers and screens (grossed-up movements for the region)	7
Table 9	Waste movements of waste exported by crushers and screens (grossed-up movements for the region)	7
Results for landfill sites		7
Table 10	Estimates per site, per active site and regional estimates for landfill sites for all types of waste	7
Table 11	Waste movements of waste imported onto landfill sites (grossed-up movements for the region)	7
Table 12	Waste movements of waste exported from landfill sites (grossed-up movements for the region)	7
Results for Registered Exempt Sites		7
Table 13	Paragraph number and description of exemptions included in the survey	7
Table 14	Estimates per site, per active site and regional estimates for Registered Exempt Sites for all types of waste (All exemptions)	7
Table 15	Waste movements of waste imported onto Registered Exempt Sites (grossed-up returns for the region)	7
Table 16	Waste movements of waste exported from Registered Exempt Sites (grossed-up returns for the region)	7

Results for composters		7
Table 17	Estimates per site, per active site and regional estimates for composters for all types of waste	7
Results for construction companies		7
Results for demolition contractors		7
Table 18	National Federation of Demolition Contractors North West region members annual returns 2006	7
Results for highways contractors		7
Table 19	Estimates per site, per active site and regional estimates for highways contacts for all types of waste	7
Results for house builders		7
Table 20	Total number of new dwellings built in the North West	7
Results for land regeneration firms		7
Results for land remediation		7
Results for Materials Recycling Facilities (MRFs) and Waste Transfer Stations (WTSs)		7
Table 21	Licence type and description of MRFs and WTSs included in the survey	7
Table 22	Estimates per site, per active site and regional estimates for MRFs and WTSs for all types of waste	7
Results for ports and harbours		7
Results for power stations		7
Results for pre-cast concrete product manufacturers		7
Table 23	Estimates per site, per active site and regional estimates for pre-cast concrete product manufacturers for all types of waste	7
Results for quarries		7
Table 24	Estimates per site, per active site and regional estimates for quarries for all types of waste	7
Results for rail ballast recycling		7
Table 25	Amount of sleepers and rail ballast removed from Network Rail's rail infrastructure in 2004/05 (Britain)	7
	Regional estimate for rail ballast recycling	7
Results for skip hire firms		7
Results for utilities		7
Chapter 4		
Capacity projections for the treatment of CDEW in the North West		7
Table 26	Waste management method for North West England for 1999, 2005 and 2006	7
	Low, medium and high CDEW growth rates for North West England sub-regions / counties	7
Table 27	Management method targets for 2010 to 2025	7
Table 28	Expected and target capacity projections for North West England, 2006 to 2025	7
Chapter 5		
Comparison to DCLG data for 2005 for the North West		7
Table 29	Regional estimates of CDEW recycled by crushers and/or screens, used/disposed of at landfills, and spread on	

	Paragraph 9 and 19 Registered Exempt Sites in 2005 and 2006	7
Table 30	Regional estimates for landfill sites for all types of CDEW waste for 2006 and 2005 (from the DCLG survey)	7
Table 31	Analysis of landfill site respondents (2005 and 2006)	7
Table 32	Regional estimates for Registered Exempt Sites for all types of waste for 2006 and 2005 (from the DCLG survey)	7
Table 33	Estimates per site, per active site and regional estimates for paragraph 9.1 and 19.2 Registered Exempt Sites combined for all types of waste	7
Table 34	Estimates per site, per active site and regional estimates for paragraph 9.1 Registered Exempt Sites only for all types of waste	7
Table 35	Estimates per site, per active site and regional estimates for paragraph 19.2 Registered Exempt Sites only for all types of waste	7
Chapter 6		
	Summary and conclusion	7
Table 36	Regional estimates of CDEW generated, processed or handled and disposed of in 2006	7
Table 37	Regional estimates of CDEW recycled by crushers and/or screens, used/disposed of at landfills, and spread on Paragraph 9 and 19 Registered Exempt Sites in 2005 and 2006	7
Chapter 7		
	Recommendations for future studies	7
Appendix 1	Survey covering and follow up letters	7
Appendix 2	Sample survey form	7
Appendix 3	Glossary of terms	7
Appendix 4	Additional results tables for crusher and screen operators	7
Table 38	Estimates per site, per active site and regional estimates for crusher and screen operators for concrete, bricks, tiles, plasterboard and ceramics and waste management sites waste	7
Table 39	Waste movements of waste processed by crushers (actual waste movements reported by respondents)	7
Table 40	Waste movements of waste leaving site after crushing (actual waste movements reported by respondents)	7
Table 41	Waste movements of waste processed by crushers, presented by crushers base of operation (actual waste movements reported by respondents)	7
Table 42	Waste movements of waste leaving site after crushing, presented by crushers base of operation (actual waste movements reported by respondents)	7
Appendix 5	Additional results tables for landfill sites	7
Table 43	Estimates per site, per active site and regional estimates for landfill sites for concrete, bricks, tiles, plasterboard, ceramics & waste management sites waste	7
Table 44	Estimates per site, per active site and regional estimates for landfill sites for soil (including contaminated), stones and dredging spoil	7

Report preparation and limitations

Authors

The main contributors were

Dr Jason Beedell	Project manager (Smiths Gore)
Dr Chris Yates	Statistical analysis (Smiths Gore)
Andrew Teanby	Telephone interviews, survey management (Smiths Gore)
Bob Allcock	Geographic Information System (GIS) analysis (Smiths Gore)
Caroline Kendal	Contact database compilation, telephone interviews (Smiths Gore)
Sue Green	Telephone interviews (Smiths Gore)
Emily Godfrey	Telephone interviews (Smiths Gore)
John Martin	Consultant (Terraconsult)
Will Vaughan	Consultant (Terraconsult)

Steering Group

The steering group assisted the research team by checked the approach taken in the survey and endorsing it on behalf of the sponsors. The project was managed by the following people in the North West Regional Technical Advisory Body for Waste and the North West Minerals and Waste Planning Authorities:

Andrew Farrow	Cheshire County Council
James Cook	Merseyside Environmental Advisory Service
Dave Forster	Environment Agency
Sue Bradburne	Environment Agency
Lynne Rowe	Environment Agency

Duty of care, liability and responsibility

This report has been prepared for the North West Regional Technical Advisory Body for Waste and the North West Minerals and Waste Planning Authorities. No duty of care, liability or responsibility will be accepted to any third party acting or refraining from actions as a result of any material in this report.

Views expressed

The views expressed in this report are those of the report's authors and do not necessarily reflect those of the North West Regional Technical Advisory Body for Waste and the North West Minerals and Waste Planning Authorities except where expressly stated.

Information relied on

The authors relied on information and data extracted from various sources, which have been stated and assumed to be reliable. The information and data has been assumed to be true, correct and complete. It has been audited, tested and checked so far as possible.

Information confidentiality

Data was provided by respondents on the basis that it would be treated as confidential. Therefore where there are four or fewer responses to a question or in a cell of a table, the number of respondents, the amount of material or both have been replaced by an asterisk, '*'.

Acknowledgements

The authors would like to thank those who contributed to this project and in particular all those businesses who took the time to respond to the survey.

The authors would also like to thank the Steering Group who were always helpful, constructive and worked with us to complete the project. They were a pleasure to work for and with.

Cover image reproduced with permission from the Department of Environment and Conservation NSW, Australia.

Chapter 1

Introduction

This report was commissioned by the North West Regional Technical Advisory Board for Waste (NWRTAB) and the North West Minerals and Waste Planning Authorities to provide regional, sub-regional and local information on the amounts of construction, demolition and excavation wastes (CDEW) produced and managed in the North West of England in 2006.

Purpose of project

National estimates of construction, demolition and excavation waste (CDEW) arisings with regional apportionment have been produced in 1999 by the Environment Agency and latterly in 2001 and 2003 by the Office of the Deputy Prime Minister.

Planning Policy Statement 10, issued in July 2005, placed a significantly increased burden on the North West Regional Technical Advisory Body to collect, collate and publish data on the region's waste management. The data should be used to develop strategic plans and local development frameworks, as well as a numerical context to planning applications and appeals.

A gap in sub-regional construction, demolition and excavation waste data was identified during the preparation of NWRTAB Waste Management Monitoring Report for 2004. This should be addressed when DEFRA's three year Waste Data Strategy begins reporting in 2008. Prior to this the counties of the North West require an evidence base to support the development of their Waste Development Plan Documents.

Previous studies have omitted / not segregated components of the construction demolition and excavation waste stream, collecting only information about the quantity of excavation waste, hard construction and demolition waste and a mixture of the two. Segregation of waste types will be addressed with this project.

This report was commissioned to address the evidence gap in sub-regional construction, demolition and excavation waste, whilst also providing a regional assessment of waste generation.

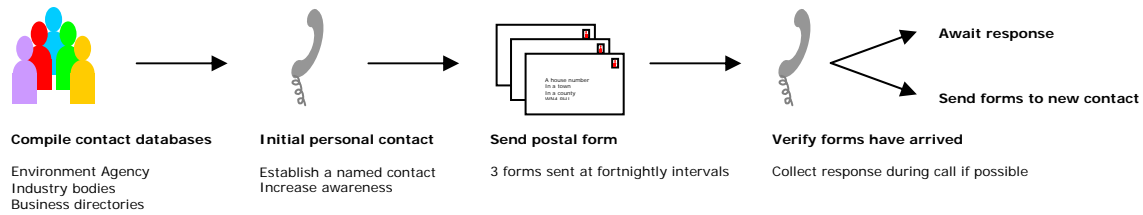
Detailed Project Objectives

- Review the availability of CDEW generation data for the North West.
- Ensure that the project's methodology is compatible with previous national waste survey work.
- Develop an agreed methodology that will provide estimates of CDEW arisings in the North West region.
- Prepare estimates of waste arisings at regional, sub-regional and district levels.
- Prepare future predictions to 2020 on a 5 yearly basis.
- Collect data on imports and exports of CDEW between the North West and surrounding regions, its sub regions and districts.
- Assemble an evidence base to inform the Development Plan Documents including spatial planning considerations and the need to better understand the link

between aggregate extraction, re-use and recycling and the export of CDEW from sites of production.

- Evaluate capacity projections for the treatment of CDEW in the North West and update the capacity projections contained in the Initial Needs Assessment Reports for each of the sub-regions.

Businesses contacted



Telephone calls were made to all businesses identified within the survey databases. Contacting businesses at this stage increased awareness of the study and encouraged businesses to respond as they would have discussed the study and the reasons for conducting it before they received the form.

A very important aspect of the call was to identify the most suitable person at the company to complete the survey form, so that it could be targeted at the individual, as in the majority of cases contact names at the company were not known. Where possible contact was made with the individual, however the nature of the industry is such that in some cases these individuals work on site for long periods and are difficult to reach.

Contacts were established for 74% of operators and operations.

The calls also served to eliminate operators from the database who were not relevant as the facility had closed or did not handle CDEW. For example, 73 Materials Recycling Facilities and Waste Transfer Stations were removed following initial telephone contact.

Once contact names had been established, survey forms were emailed or posted to the businesses. All forms were accompanied by a personalised letter explaining the reasons for the survey and the potential benefits to the regions operators (see Appendix 1 for the covering letter). Forms were issued with a reply-paid envelope. Some businesses requested the form to be emailed to them.

A further two survey forms were distributed to all the non respondents two and four weeks after the previous survey form. The final survey form was accompanied by a follow-up survey letter which emphasised the importance of the project (see Appendix 1). All contacts who had previously received email forms were included in the final mail shot.

The organisations were then contacted by telephone to verify that the form had reached the correct individual and to see if they would be able to help. If necessary additional forms were dispatched to the individual, or in some cases sent to a new contact whom they suggested would be better suited. The calls also presented an opportunity for the information to be gathered over the telephone as the respondent was familiar with the information we were collecting; businesses producing no waste were also identified at this stage.

Forty six forms were returned undelivered by the Royal Mail. These firms are most likely to no longer be in business or have closed that particular facility. In the majority of cases no prior contact via the telephone had been possible. These businesses were removed from their respective operator groups. A further 132 facilities were identified as not relevant as they had closed or were not handling waste relevant to the study; similarly they were removed from the database.

County boundaries

County boundaries used in this report are based on the County and Unitary Authority boundaries in 1998 (source: Office for National Statistics, 2007²). To simplify presentation and due to small numbers of respondents in the unitary authorities, Blackburn with Darwen and Blackpool are included in the Lancashire sub-region, and Halton and Warrington within Merseyside.

Data entry

The survey data was stored in a Microsoft Excel spreadsheet and analysed using SPSS and bespoke statistical software written for the project.

Survey dates

The survey commenced on 4 January 2007, survey forms were issued between 25 January and 16 March 2007. The Survey was closed on 30 March 2007 after which no more data was collected.

Statistical methodology

The key factors in the analyses are full sampling procedure (except in the case of some operator groups, such as house builders) and the convolution of a binomial and normal distribution. That is a site may or may not record data for a given waste product with a probability determined by a binomial distribution, if the site has recorded data for a given product then this is distributed normally.

For all types of operator surveyed, means and confidence intervals are presented. Thus:

N	total number of sites surveyed (whole populations except for construction industry firms)
n_{ret}	number of returns
n_{act}	number of sites with non-zero data (or set of sites with non-zero data)
x_i	data recorded for the i^{th} active site
S	sum of data across all active sites
f	Proportion of sites with non-zero data
\bar{x}	mean across all sites
\bar{x}_{act}	mean across active sites
T	regional/sub-regional estimate
V_{act}	variance of active sites

Thus

$$S = \sum_{i \in n_{act}} x_i$$

$$f = n_{act} / n_{ret}$$

$$\bar{x} = S / n_{ret}$$

² http://www.statistics.gov.uk/geography/downloads/UK_LADUACty.pdf

$$\bar{x}_{act} = S / n_{act}$$

$$T = N.S / n_{ret}$$

In the case of types of operator where whole population sampling is not used:

$$T = N_{Total} S / n_{ret}$$

where N_{Total} is the estimated number of individual firms in the region.

$$V_{act} = \sum_{i \in n_{act}} (x_i - \bar{x}_{act})^2 / (n_{act} - 1)$$

The variance and standard deviations for all sites (that is both active and non-active) are omitted from the report as their interpretation is not as straight forward as the variance or standard deviation of a normally distributed variable. Instead 90% confidence intervals have been used to demonstrate the degree of certainty of the means and national totals.

The confidence intervals will be generated using Monte-Carlo simulation techniques, as this is an established and robust method for deriving statistics based on complex distributions.

Although previous reports on CDEW have used analytically derived methods, there is concern that these methods do not give realistic results. For instance many confidence intervals reported previously contained negative lower bounds. This is incorrect: the lowest possible bound should be the recorded level of activity before grossing up. The use of a Monte-Carlo simulation allows the calculation of the confidence intervals for the sites that did not return the survey forms, which are then increased by the actual level of activity recorded. This is especially important when the response rate is high. Also, it is of paramount importance to ensure that the active sites are distributed normally otherwise serious errors will result, in this case a suitable power transformation must be taken.

Availability of CDEW generation data for the North West

The main data sources for CDEW are the two-yearly surveys carried out for the Department for Communities and Local Government (DCLG), and formerly the Office of the Deputy Prime Minister (ODPM)³. These surveys collect data on waste arisings and use in England and regional estimates are also provided. Surveys have been carried out for 2005, 2003, 2001 and 1999.

The surveys collect data on the following waste categories:

- i) Hard C&D waste: either segregated or mixed unprocessed/uncrushed materials (particularly concrete, masonry, bricks, tiles, 'blacktop' etc.).
- ii) Excavation waste: naturally occurring soil, stone, rock and similar materials (whether clean or contaminated) which have been excavated as a result of site preparation activities.
- iii) Mixed hard C&D and excavation waste: a physical mixture of the above.

Data is collected from crusher and screen operators, landfill sites operators and from the operators of Registered Exempt Sites (paragraph 9.1 and 19.2 exemptions only⁴).

Reliability of the available data

The reliability of the data generated by the DCLG / ODPM surveys has been questioned; this is one of the reasons this survey is being carried out. This is a result of (i) uncertainties about the total number of active and inactive operators or sites, (ii) survey response rate and (iii) the waste streams included in the survey.

Waste streams included in the surveys

The DCLG / ODPM surveys have been criticised, notably by SLR, as they exclude the other waste streams from construction and demolition activity that do not fall under the category of 'hard' or 'excavation' wastes. These could be termed 'soft' C&D wastes and include a wide range of wastes such as timber, plastics, metals, other packaging, plaster and certain forms of hazardous wastes (excluding soils classified as 'contaminated' which are included under 'excavation' wastes).

'While the 2003 baseline tonnage of C&D arisings may lie within the 1.95-2.44 million tonnes range, the level of confidence is likely to be significantly lower than the 90% reported by Symonds [which carried out the DCLG surveys for 2001, 2003 and 2005] for the North-West data – due to the 'missing' waste and the pro-rating estimate at the sub-regional level.'

Source: Waste Planning: Initial Needs Assessment for Waste Management Facilities in the Merseyside Area, SLR CONSULTING LIMITED, August 2005, page 32

³ The latest report is the Survey of Arisings and Use of Alternatives to Primary Aggregates in England, 2005. Construction, Demolition and Excavation Waste. February 2007.

⁴ 'Paragraph 9 sites' are registered exempt sites where exemption holders are permitted to spread up to 20,000m³/ha of soil, rock, ash, sludge, dredgings, or C&D waste for land reclamation purposes or agricultural improvement. 'Paragraph 19 sites' are registered exempt sites where exemption holders are permitted to store or use C&D waste, excavation waste, ash, clinker, rock, wood or gypsum in connection with recreational or infrastructure projects, excluding land reclamation.

This survey has collected data from a wider range of operators that generate construction, demolition and excavation waste and has collected data based on nine groupings of waste materials (see Table 2) which include soft wastes to try to address this issue. Although relatively high response rates were obtained for some types of operator, there were low ones for others and reliable data could not be presented for them.

Number of active and inactive operators

To produce accurate data, surveys must be based on accurate numbers of active and inactive operators for each type of operator surveyed as this can greatly affect estimates when data is grossed-up to regional and sub-regional level.

There are considerable differences in the numbers of operators included in the 2005 and 2006 surveys (see Table 3).

Table 3 Number of crusher and screen operators, landfill sites and Registered Exempt Sites (paragraphs 9.1 and 19.2 only) in 2005 and 2006 surveys

Type of operator	2006	2005
Crushers and screens	92 ¹	117
Landfill sites	108	93
Registered Exempt Sites (paras 9.1 and 19.2 only)	72	353 ²

1 2006 estimate of population based on assumption of 1.33 machines per operators for 69 operators

2 2005 estimate of population is based on the Environment Agency' sREGIS database for 12 months ending 21 July 2006

This survey is based on the latest data available from the Environment Agency in the North West, local authorities and industry bodies. It has been assumed that the number of operators used for each operator type is accurate and representative of the actual situation in the region.

Survey response rate

Response rate to surveys largely determine the accuracy of the data they generate.

If high response rates are obtained, less data has to be 'estimated' based on the responses received and so the estimates are likely to be more accurate. If low response rates are obtained, more data has to be 'estimated' and the estimated data will be less accurate than if actual responses were obtained as it is based on best 'guesses' of reality rather than actual data. For example, the DCLG survey for 2005 received responses from 28% of crusher and screen operators. This means that the amount of waste crushed and screened by the remaining 72% had to be estimated based on the data provided by the 28% of respondents.

Considerable effort was made in this survey to obtain high response rates (see Table 4).

Chapter 3

Results

Number of operators and response rate

The total number of operators contacted and the number of which responded are shown in Table 4.

Table 4 Number of operators and response rate

Type of operator / operation	Original number of operators	Final number of operators ¹	Total responses received	Responses from active operators	Responses from inactive operators	Responses from sites producing no waste	Response rate (%)	No data ²
Crusher and screen operators	76	69	21	15	0	6	30%	
Landfill sites	154	108	40	18	22	0	37%	
Registered Exempt Sites	288	273	125	104	21		46%	
Crushers, RES, Landfills	518	450	186	137	43	6	41%	
Composters	21	20	20	5		15	100%	
Demolition contractors	86	84	4	4			5%	No data
House builders	34	34	2	2			0%	
Highways works	18	11	5	4	1		45%	
Land regeneration firms	7	6	0				0%	No data
Land Remediation firms	84	26	2	1		1	8%	No data
Material Recycling Facilities and Waste Transfer Stations	442	401	38	24	14		9%	
Ports and harbours	12	11	5			5	45%	
Power stations	23	4	1	1			25%	
Pre-cast concrete product manufacturers	25	22	9	8		1	41%	
Quarries	133	125	81	27	17	37	65%	
Rail ballast recyclers	1	1	1	1			100%	
Skip hire operators	81	78	3	2	1		4%	No data
Utilities	1	1	1	1			100%	

¹Final number of operators is after not relevant operators and operators who could not be contacted by phone or post were removed

²No data means that due to the low response rate received from this operator group, data is not presented for them

The results are presented for each of the groups surveyed individually, and for crusher and screen operators, landfill sites and RESs combined in the “Comparison with other surveys” section. All data is in tonnes.

Where there are less than four respondents in a group or cell in a table, an asterisk, ‘*’, is shown to reduce the risk of presenting misleading data and also to protect the confidentiality of respondents.

Data quality and reliability

Data quality and reliability is a key issue. The results for all the groups are not aggregated due to the different types of waste involved and as there is highly likely to be an element of double counting, due to the linkages between many of the types of operator / operation.

Where too low a response was received to present reliable estimates, the results for that type of operator / operation are not presented (see rows marked “No data” in Table 4).

The methodology used, which attempted to spatially track waste movements, did not allow double-counting of waste flows between operators to be eliminated. There was clear evidence in the survey responses, as well as through conversations with operators, of flows of materials between operators and sites. Due to vertical integration many firms surveyed carried out more than one type of operation and the degree of “vertical” integration with firms was very variable. This makes estimating where double counting may occur and its extent very difficult.

Although the spatial tracking methodology did not estimate double counting, it did allow a picture of how waste moves sub-regionally to be generated.

These flows are presented in the ‘Regional waste movement’ sections of the report for crushers and screens, landfill sites and Registered Exempt Sites. Data is available for all other types of operator but is not presented in this report.

Interpretation of the data

Data is presented in the results sections for operators separately and also in some combinations.

The results for crushers and screens, landfill sites and Paragraph 9.1 and 19.2 Registered Exempt Sites have been combined to allow direct comparison to the DCLG / ODPM surveys (see “Comparison with other surveys” section and Table 37).

As there are considerable amounts of waste being used on Paragraph 13, 24 and 25 2 Registered Exempt Sites, as well as Paragraph 9 and 19 ones, data is presented for all types of exempt site combined as well (see “Comparison with other surveys” section).

This survey collected data based on European Waste Catalogue Codes (see Table 2), which is a different approach to the DCLG / ODPM one of collecting data on hard, excavation and mixed categories. Data in this survey therefore includes ‘soft’ CDEW wastes such as timber, plastics, metals, other packaging and plaster. This should be taken into consideration where comparing the results to other surveys.

Presentation of the results and data

Results tables

Tables of results are presented as below:

- “Estimates per site, per active site and regional estimates for [type of operator] for all types of waste” shows the estimates for all types of waste.
- “Estimates per site, per active site and regional estimates for [type of operator] for [waste category]” shows the estimates for main groupings of waste materials received, processed or disposed of.

Estimates from the main waste groupings should sum to approximately the same amount as the regional estimates although the match may not be exact due to incomplete responses, rounding and estimates for ‘minor’ waste groupings not being shown.

- “Regional waste movements” shows the flow of waste between sub-regions (i.e., counties). Flows are shown for source and destination of the waste. These tables are only presented for crushers and screens, landfill sites and Registered Exempt Sites.

Mean per site, mean per active site and regional estimates

Data is presented in three main forms for each type of operator / operation, where there is enough data to present results:

Mean per site is the average across all operators / operations surveyed

Mean per active site is the average across all operators / operations that recorded non-zero results (i.e., were active / generated, processed or disposed of CDEW)

Regional estimate is the grossed-up total for North West England

For each of these statistics, where feasible, confidence intervals were calculated. They represent the degree of certainty of the estimates. A 90% confidence interval gives lower and upper values between which there is a 90% confidence that the true figure lies. This is a key measure of the reliability of the data⁵.

⁵ Variance and standard deviations have been omitted from the report as their interpretation with this type of data is not straightforward.

Results for crusher and screen operators

Number of operators and response rate

See Table 4 for number of operators and response rate.

Estimates per site, per active site and regional estimates

The regional estimate for the quantity of CDEW, mixed and other materials crushed during 2006 is 5.2 million tonnes.

There is a large difference between the regional estimates in Table 5 and Table 7. This is due to some operators only supplying data by broad waste type (i.e., C&D, exaction, mixed) as shown in Table 5 and not by detailed waste type, as in Table 7.

Table 5 Estimates per site, per active site and regional estimates for crusher and screen operators for C&D⁶, excavation and mixed materials

Materials received	Number of active sites	Mean per site			Mean per active site			Regional estimate		
		Mean	Lower 90%	Upper 90%	Mean	Lower 90%	Upper 90%	Mean	Lower 90%	Upper 90%
Construction & demolition waste	14	28,311	20,150	36,787	50,555	41,145	60,089	2,264,861	1,802,054	2,718,387
Excavation waste	4	4,320	n/a	n/a	27,000	n/a	n/a	345,600	n/a	n/a
Mixed materials	5	30,931	12,753	50,162	154,656	19,590	190,442	2,474,496	1,474,710	3,532,209
Other	2	1,040	n/a	n/a	13,000	n/a	n/a	83,200	n/a	n/a
Total		n/a	n/a	n/a	n/a	n/a	n/a	5,168,157	n/a	n/a

NB Confidence intervals have not been calculated for cells where there is data for four or fewer active sites; these are shown as 'n/a'.

This difference illustrates the problem of reliability of data at regional (and below) level. The difference is largely due to a single response, which recorded a large amount of mixed materials (>500,000 tonnes) being crushed but did not record the materials under detailed waste type. If this response is excluded, the regional estimate for mixed materials drops 1.6 million tonnes to 862,400 tonnes and the regional estimate for all materials to 3.6 million tonnes (see Table 6). This illustrates the susceptibility of data based on small numbers of operators (and respondents) to large or abnormal responses. Of course, the certainty of the estimates produced is shown by the confidence intervals around them.

⁶ Operators classified their waste amongst the broad waste categories

Regional waste movements

Waste movements grossed-up for all crushers and screens in the region

For the purpose of grossing up results to show the flows between counties it is necessary to know the sample size per county i.e., the number of crushers per county.

For crushers and screens, the geographic area the crushers mainly worked in was determined from the survey responses. However, this information is not known for the operators who didn't respond to the survey. Therefore, to gross up the results, it is necessary to calculate the number of operators per county based upon the address of the operators' headquarters. This is not ideal as there is evidence that many crushers work outside the county in which they are authorised (see Table 39 and Table 40).

There are at least two ways grossed-up county flows can be calculated:

- 1) Assume each county is different and potentially has different means. Using this approach, the sum of the county flows will not equal the regional total.
- 2) Assume that the missing sites can be represented by the regional means. This loses some of the independence of using county averages but does mean that county flows equal the regional total.

The second approach has been used as it was considered to produce more robust estimates given the small number of flows between counties. This approach has been used for crushers and screens, landfill sites and Registered Exempt Sites, and all three groups combined.

(NB The flow between counties matches, in terms of source and destination, the information provided by respondents. The estimates of the amount of waste flowing have been grossed-up to reflect the number of crusher and screen operators in each county.)

