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PUBLISHED PROJECT REPORT PPR058

HAMPSHIRE COUNTY COUNCIL: MATERIAL RESOURCES STRATEGY – CONSTRUCTION WASTE AND SOIL

Version: 02

by C R Sowerby and J M Reid

Prepared for: Project Record:	**Hampshire County Council: Material Resources Strategy**
Client:	**Environment Department Waste Management Section**

	Approvals
Project Manager	**J M Reid**
Quality Reviewed	**R A Smith**

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Executive summary

This report is the Technical Report for Construction Waste and Soil produced for the Material Resources Strategy of Hampshire County Council. Construction waste and soil derive from the construction demolition and excavation waste (CD&EW) stream. In Hampshire, it is estimated that the total inert CD&EW stream is about 1.54 Mt per year. A number of materials can potentially be recycled from this waste stream, including: recycled aggregates; CD&EW fines (material < 6mm); wood; plastic; metals; and paper and card. All these materials are considered in this report. A summary of the total arisings of each material, the amount currently recycled (2004) and estimates of amounts that could be recycled under 'stretching best practice' and 'business as usual' scenarios for 2010 and 2020 are given in Summary Tables 1 and 2.

Summary Table 1. Estimated Arisings of Materials in the Construction Waste and Soil Stream

Material	Estimated Volume of Arisings in 2004 (tonnes per year)	Estimated Volume of Arisings in 2010 (tonnes per year)	Estimated Volume of Arisings in 2020 (tonnes per year)
Inert CD&EW Suitable for Recycling as Aggregate	750,000	769,000	788,000
Inert CD&EW Fines (< 6mm)	108,000	110,700	113,500
Wood	66,900	68,575	70,290
Plastic	33,800	34,645	35,511
Metal	13,300	13,630	13,973
Paper and Card	5,000	5,125	5,253

Summary Table 2. Estimates of Current Recycling and Scenarios for 2010 and 2020

Material	Estimated Amount Recycled in 2004 (tonnes per year)	Scenario	Estimated Amount Recycled in 2010 (tonnes per year)	Estimated Amount Recycled in 2020 (tonnes per year)
Recycled Aggregates (from Inert CD&EW)	500,000	Stretching Best Practice	654,00	750,000
		Business as Usual	525,000	550,000
Manufactured Soil (from Inert CD&EW Fines)	5,000	Stretching Best Practice	50,000	75,000
		Business as Usual	5,250	5,500
Wood	1,000	Stretching Best Practice	10,000	20,000
		Business as Usual	1,050	1,100
Plastic	1,000	Stretching Best Practice	5,000	10,000
		Business as Usual	1,050	1,100
Metal	4,000	Stretching Best Practice	7,000	10,000
		Business as Usual	4,200	4,400
Paper and Card	0	Stretching Best Practice	1,000	2,000
		Business as Usual	0	0

The figures contain a lot of uncertainty and should be regarded as 'ball park' estimates. Only those for recycled aggregates are based on direct estimates of the amounts in Hampshire; the other figures are based on indirect estimates of the proportion of the various components in the overall CD&EW stream, based on national figures.

The main recyclable component is recycled aggregates. The potential recyclable amounts for manufactured soil, wood, plastic, metals, paper and card are thought to be much smaller, and these materials should be dealt with by the appropriate working groups.

A number of issues were identified that require action if the 'stretching best practice' targets are to be met. These include:

- A need for more sites to produce recycled aggregate from CD&EW. These should be located close to the source of the material, mainly older urban areas, and to potential markets. Excessive transport distances make recycled aggregates uneconomic compared with primary aggregates.
- A need for higher quality processing of CD&EW to produce recycled aggregates suitable for high value applications such as asphalt and concrete. This will require investment in the necessary infrastructure to separate contaminants and produce more closely graded aggregates.
- A need for producers to adopt quality control procedures that give clients assurance about the consistency and performance of the recycled aggregates.
- A need for market development for greater use of recycled aggregates, particularly in high value applications. Public sector clients such as Hampshire County Council can give a lead by encouraging use of recycled aggregates, as in the existing PSA scheme.
- Education of the public and industry, especially SMEs, of the benefits of using recycled aggregates and assurance about their safety and quality. Demonstration projects can be particularly helpful in this regard.
- A need to promote new specifications and protocols that encourage the use of recycled aggregates. This is also a national issue and liaison with SEEDA, WRAP, ODPM and DTI may be required for this and the education/market development issues.
- A need to encourage greater segregation at source of wood, plastic, metal, paper, card and other materials in demolition and construction works. This will reduce the processing requirements for the production of recycled aggregates and soils from CD&EW and will enable the wood, plastic and other materials to be obtained in a 'clean' form, which will then be easier to recycle.
- A need to develop markets for the wood, plastic, metal, paper, card and other minor components of CD&EW.
- A need to develop methods of producing manufactured soil using the soil component of CD&EW and compost from green waste or other sources, and associated market development.

While all these issues require action, there is no doubt that there is significant potential to increase both the quantity and quality of recycled aggregates in Hampshire, and to develop significant markets for manufactured soil and the minor components of the CD&EW stream.

It should also be noted that there are other recycled and secondary aggregates potentially available in Hampshire; these include railway ballast, incinerator bottom ash, glass and material recycled on-site in highway maintenance and new works. It is estimated that the total recycled and secondary aggregate use in Hampshire in 2004 is 686,200 tonnes, or 13.4% of the total aggregate use. Under the stretching best practice scenario this could rise to 19.6% by 2010 and to 21.6% by 2020.

1 Introduction

Hampshire County Council is developing a Material Resources Strategy (MRS) to deal with arisings of a range of waste streams over the period to 2020. The MRS aims to develop strategies for maximising reuse, recycling and recovery of materials and minimise the amount going to landfill. The philosophy is to regard the arisings of these materials as a resource rather than a waste, and also to minimise the arisings wherever possible.

The MRS will split the traditional waste streams (commercial, industrial, domestic) into individual material resource streams. By analysing how much of each resource stream can be reused, recycled and recovered a strategy will be developed for diverting material away from the unavoidable waste stream. The MRS is based on the principle that recovery/recycling relates to material streams that are either separated at source or mechanically separated from the waste stream. The recovery of mixed waste will be dealt with under the strategy for dealing with unavoidable waste.

One of the waste streams that have been identified is construction waste and soil. This is basically material that is derived from construction, demolition and excavation waste (CD&EW). This is one of the largest and most diverse waste streams in the UK, and offers many opportunities for recovery, reuse and recycling of materials. Construction waste and soil was one of the waste streams discussed at MRS Workshop 3 in March 2004.

The next stage of the MRS is to prepare technical reports on each of the waste streams, identifying the potential for recycling. The papers are to cover two scenarios:

- A '**business as usual**' scenario that has regard to essential change, e.g. the requirements of existing and new legislation, regulations and statutory targets.
- A '**stretching best practice**' scenario that sets out the best that could reasonably be achieved with a concerted effort, having regard to 'state of the art' approaches overseas and in the UK.

Predictions were requested for 2010 and 2020. In addition, the working groups charged with producing these papers were issued with further guidance by Hampshire County Council on a number of aspects that were to be considered for all the waste streams. In addition to a detailed paper, a two page summary of the sector strategy was required.

This report is the Technical Paper for the Construction Waste and Soil stream, and the Executive Summary is the Summary Sector Strategy. The report has been prepared by TRL Limited for Hampshire County Council through Viridis, its resource efficiency arm. Viridis has been carrying out a separate project to optimise the use of recycled and secondary aggregates in Hampshire, funded by the Department of Trade and Industry via the Partners in Innovation scheme, and hence is familiar with the background to the MRS and the CD&EW stream. Viridis supplied an expert on construction waste and soil, Dr J M Reid, for the MRS Workshop 3, and they have been working closely with Hampshire County Council and other stakeholders on the PII project since November 2003, hence they are well placed to understand the issues and prepare the technical report.

The report was issued as a draft for comment to the offline working group at the beginning of June and was reviewed by the group at a meeting in Hampshire County Council Offices, Winchester, on 1 July 2004. The report has been revised, taking account of all comments received, and the final version was issued in advance of MRS Workshop 4, which was held on 14th July 2004.

2 Construction Waste and Soil

Construction waste and soil derive from the construction demolition and excavation waste (CD&EW) stream. This is a major waste stream, accounting for approximately 94 million tonnes (Mt) per year in England and Wales according to a survey carried out for the Office of the Deputy Prime Minister (ODPM) for 2001. The main components that can be recovered from the waste stream are recycled aggregates and fines (material < 6mm). Smaller amounts of ancillary materials such as wood, glass,

plastic, metals, paper and card can also potentially be recovered from CD&EW and recycled or reused. This report will assess the volume and potential markets for the following six materials:

- Recycled aggregates
- CD&EW fines
- Wood
- Plastic
- Metal
- Paper and Card

It should be noted that much of the data used to obtain the figures shown in this report is incomplete, some of it is contradictory, some refers to different time periods and all of it comes with a number of caveats and large, generally unknown error margins. The conclusions and recommendations drawn from the data have to reflect these limitations. Particular factors affecting the data are indicated in the text.

2.1 Arisings (Volumes) of Inert CD&EW

The total volume of inert CD&EW in Hampshire is estimated to be **1.54 Mt per year**, based on Environment Agency figures. These are figures based on returns made by sites operating under a waste management license; the operators of these sites are required by legislation to provide data to the Environment Agency on the amount and nature of material accepted at their sites. This represents the only comprehensive data on CD&EW arisings in Hampshire, but it has a number of limitations and has to be interpreted with caution.

The data held by the EA was collected using two coding systems: the new European Waste Catalogue (EWC) coding system; and the old UK coding system. Of the European coding system the classes 17 and 20 are the most relevant in respect of construction and demolition waste. Of the old UK coding system the categories which were thought to be inert C&DW were chosen and agreed with the EA that they were similar classifications as the European inert C&DW. These were assigned to Class 21.

The data supplied by the Environment Agency was analysed by first selecting the waste streams defined as inert waste in EA Regulatory Guidance Note 2 (November 2002). These classes have since been confirmed in Appendix C of the WRAP document 'The Quality Protocol for the production of aggregates from inert waste' (WRAP, June 2004). The wastes were then split into those that were marked as 'final disposal' and those that were marked as 'not final disposal'. The materials marked 'final disposal' were generally accepted at landfill sites, whereas those marked 'not final disposal' were accepted at waste transfer stations, physical treatment facilities and landfill sites. The results are shown in Table 1. The 'final disposal' material accepted at landfill sites will either be disposed of in the landfill or used for daily cover or landfill engineering. The 'not final disposal' material is either recycled or may be stored pending disposal to a landfill site. The total in this column thus gives an upper bound figure for the material that potentially could be recycled as aggregate from sites with a Waste Management Licence.

The figures indicate roughly similar amounts of inert material going to landfill and potentially available for recycling, about 650,000 tonnes each giving a total arising of about 1,300,000 tonnes. The data was provided in aggregated format so that individual sites were not identified. The main categories of material potentially available for recycling were 'soil and stones' (170504) and 'inert natural rocks and subsoil' (210100) rather than any of the categories where brick, concrete, tiles or ceramics were identified as the primary constituents. This suggests that much of the material may be excavation waste. It may thus contain silt, clay or weak rock fragments and may have high moisture content, and thus be less suitable for recycling than demolition or construction waste. It could also be that material is categorised into one or two categories that are known to be acceptable and that the full range of possible codes is not used because it is too complex.

Table 1: Material monitored by the EA as going to landfill and waste recycling/ treatment facilities

Waste Class	Description	Total (tonnes)		
		Final Disposal: Accepted at Landfill Sites	**Not Final Disposal: Accepted at Waste Transfer Stations/ Treatment Facilities and Landfill Sites**	**Total**
170102	Bricks	262	0	262
170107	Mixtures of concrete, tiles and ceramics other than those mentioned in 170106	11,357	13,106	24,463
170504	Soil and stones other than those mentioned in 170503.	259,852	399,210	659,062
200102	Glass	516	4,302	4,819
200202	Soil and stones.	80	9,682	9,762
210000	Inert unspecified	250,410	27,073	277,073
210100	Inert-natural rocks and sub-soil.	68,537	209,743	278,280
210101	Inert rocks and stone	5,944	2,440	8,384
210102	Inert sub-soils	31,179	2,022	33,201
210200	Inert- ceramic and/or cemented	5,173	216	5,389
210201	Inert glass	913	5,713	6,626
210203	Inert concrete and or mortar		4,342	4,342
210300	Inert – processed mineral materials	1,996	2,215	4,210
Totals		**636,222**	**680,068**	**1,316,286**

The figures in Table 1 underestimate the total for Hampshire because they relate to the part of Hampshire in the Environment Agency's Southern Region. This follows river catchment boundaries, and excludes part of north and north east Hampshire, where the rivers flow north to the River Thames. This includes the heavily populated areas around Basingstoke, Aldershot, Farnborough and Fleet. Given the uncertainties associated with the figures, however, we have not attempted to apply a correction factor to the figures.

The following limitations with the figures were highlighted during a meeting with the Environment Agency (EA):

- Forms are filled in by either the drivers or the weigh bridge operators. The weigh bridge operators are not always consistent in their coding of the waste type.
- There is potential for under reporting of figures to keep the site licence fees at a minimum.
- If there is any doubt as to which code to describe a waste, the more expensive option is likely to be chosen.
- The terms used to describe the waste are for the purposes of classification under the Waste Management Licensing Regulations and do not indicate the potential for recycling of the material.
- Waste described as 'not final disposal' option does not mean that the waste is recycled but that it is not going to landfill directly. It could be going to a waste transfer station for bulking and then on to a landfill site for final disposal.

- Glass is rarely collected separately; the real quantities of glass arising in the county are likely to be a lot higher than shown in the EA figures because it is mixed within a number of other waste streams.
- The Environment Agency data does not cover the north of the county, because their area boundaries follow river catchments.
- Material accepted at a landfill site may not be disposed of in the landfill, but may be used as daily cover or for landfill engineering purposes.

The figures in Table 1 only relate to sites operating under a waste management license. This includes a number of sites where CD&EW is recycled as aggregate in Hampshire, as a number of them are located at landfill sites. However, the production of aggregate from CD&EW can also be carried out under an exemption from the Waste Management Licensing Regulations, and there are a number of sites operating in this way in Hampshire. The owners of these sites are not required to send details of the amount and nature of the material they handle to the EA, so the amount of material processed at these sites has to be estimated by other methods. The category of exempt sites also includes sites where materials are deposited for the purposes of reclamation or redevelopment.

The amount of CD&EW recycled as aggregate at sites operating under an exemption from the Waste Management Licensing Regulations can be estimated from the total amount of recycled aggregate produced in Hampshire minus that produced at sites operating under a Waste Management Licence. Figures for recycled aggregate production are not available directly and were estimated from a number of sources, including discussions with operators, planners, consultants, trade directories and registers. Much of the information is commercially confidential, and it was only possible to gain a general indication of the amounts of recycled aggregate produced. The general consensus was that about 500,000 tonnes per year of recycled aggregate is produced in Hampshire, of which about 275,000 tonnes is at sites operating under a Waste Management License and 225,000 tonnes from sites operating under an exemption. Adding this figure of 225,000 tonnes to the 1,316,000 tonnes in Table 1 gives a total of **1,540,000 tonnes** of inert CD&EW per year. This excludes material deposited at exempt sites and also material recycled on site during redevelopment.

It should be noted that the figures relate only to inert CD&EW. Non-inert materials, such as contaminated soils or organic materials are not included.

2.2 Inert CD&EW Potentially Suitable as Recycled Aggregate

The total volume of inert CD&EW is less important than the amounts that are potentially suitable for recycling in various forms: an important differentiation needs to be made between the waste stream and the products that can be recovered from it. In bulk terms, the most important product is recycled aggregate. This arises principally from the demolition sector of the waste stream, with smaller amounts from the construction and excavation streams. Hence the amount of inert CD&EW that is potentially recyclable as aggregate will be considerably less than the total figure of 1.54 Mta for the whole waste stream.

Discussions with relevant stakeholders and examination of relevant literature gave an estimate of about **500,000 tonnes per year** of inert CD&EW currently being recycled as aggregate in Hampshire (see 2.1 above). Several operators felt that this was close to the maximum that could easily be recovered from the waste stream. It is estimated that about 275,000 tones was produced at sites operating under a Waste Management License. Comparing this figure with the ‘not final disposal’ figure of 680,000 tonnes for sites operating under a Waste Management License in Table 1 leaves about 400,000 tonnes. Some of this material may be suitable for recycled aggregate production. However, some will be excavation waste, as suggested by the classifications used in Table 1, and will consist of material unsuitable for aggregates, such as clay, silt and Chalk. Some of this material can be rendered suitable for use in construction by treatment with cement, lime, pulverized-fuel ash or other binders; however this is not considered as aggregate for the purposes of this report, as it involves chemical treatment rather than mechanical separation. However, a significant amount will consist of

granular material, either natural or construction and demolition material, that can be recycled as aggregate.

Material that is suitable for recycling as aggregate will also currently be disposed of at exempt sites for the purposes of land reclamation. This will become a less easy route in the future, as revisions to the exemption system to be introduced by the EA in 2005 will require more detailed information on the nature, use and quantities of material. Charges will also be introduced for registering exempt sites and renewing the registration on an annual basis. More of this material will therefore become available for recycling.

Taking all aspects into consideration, it has been estimated that a further **250,000 tonnes** of inert CD&EW suitable for recycling as aggregate is available in Hampshire, giving a total of **750,000 tonnes per year**.

2.3 Inert CD&EW Fines (< 6mm)

Another major product stream from inert CD&EW is the fine fraction (< 6mm), which is sometimes referred to as 'recycled soil'. This material consists of excess fine material from processing of CD&EW to produce aggregates and subsoil from excavation waste. Processing of 'hard' construction and demolition material, such as brick and concrete, by crushing and screening leads to small amounts of fine material; this will be only a few percent in modern, efficient plants. If excavation material is being processed, or the plant is inefficient, the proportion of fines produced will be higher, but is still likely to be less than 10%. However, significant quantities of subsoil may be available from excavation waste, including sand, silt, clay and some gravel.

A mixture of fines from CD&EW processing and subsoil from excavation waste is often sold as 'recycled soil', although this is not an accurate description. The material may have the appearance of a soil, but it will be very low in organic matter and nutrients and will not support vegetation without the addition of compost and fertilisers. However, it is suitable as landscaping fill and subsoil, rather than topsoil, and is probably used largely for these purposes. The term 'CD&EW Fines' will be used in this report, to avoid confusion with soil in which things grow, such as topsoil or manufactured soil. The CD&EW Fines can be used to create manufactured soil with the addition of compost. However, the term 'recycled soil' is widely used in the literature and is one of the categories used by the ODPM in their survey of CD&EW in England and Wales for 2001 (ODPM, 2002).

There are no direct figures available for CD&EW Fines in Hampshire, but an estimate can be made from the relative proportions of recycled aggregate and recycled soil in the ODPM survey (ODPM, 2002). The ODPM survey figures are broken down by region, and include categories such as material used as recycled soil. Taking the total of 1.54 Mt CD&EW for Hampshire and distributing it with the percentages shown for the South East gives an estimate of **108,000 tonnes** of recycled soil in Hampshire. The breakdown is shown in Table 2.

Table 2: Estimate of Breakdown of CD&EW in Hampshire from Comparison with ODPM Survey

Material route	South East (Data from ODPM Survey for 2001)		Arisings in Hampshire Assuming Same % as for the South East
	Tonnes	%	Tonnes
Recycled as aggregate	4,898,000	36.43	561,062
Recycled as soil	945,000	7.03	108,249
Landfill engineering	1,792,000	13.33	205,272
Backfill quarry voids	2,202,000	16.38	252,237
Registered exempt sites	2,828,000	21.04	323,945
Disposed of at landfills	779,000	5.79	89,234
Total	**13,444,000**	**100**	**1,540,000**

The indirect figure for recycled aggregate in Table 2, 561,062 tonnes, agrees well with the direct estimate of 500,000 tonnes.

2.4 Minor Components

Direct figures are not available for the other materials, such as wood, metal, glass, plastic, paper and card in the CD&EW stream, so indirect methods have been employed to estimate the proportion of these additional CD&EW materials using estimates from data by the Building Research Establishment (BRE) relating to CD&EW composition.

Hurley and McGrath (2001) of BRE reviewed the available information on CD&EW and estimated the amount annually arising in the UK. The review lists the composition of construction and demolition waste separately and describes excavation waste to be soil/clay waste. Tables 3 and 4 use the composition estimates to apportion the total volume of CD&EW in Hampshire.

Table 3: UK Breakdown of CD&EW by Origin Applied to Hampshire

	BRE %	*Hampshire (tonnes)*
Construction waste	14.4	221,760
Excavation waste	42.8	659,120
Demolition waste	42.8	659,120
CD&EW total	**100.0**	**1,540,000**

Table 4: UK Material Composition of Construction and Demolition Waste Applied to Hampshire

Construction waste composition:	*BRE %*	*Hampshire (tonnes)*
Timber	19	42,134
Concrete	6	13,306
Inert	11	24,394
Ceramic	3	6,653
Insulation	3	6,653
Plastic	13	28,829
Packaging	25	55,440
Metal	3	6,653
Plaster & cement	3	6,653
Miscellaneous	14	31,046
Total	**100**	**221,760**
Demolition waste composition:	*BRE %*	*Hampshire (tonnes)*
Concrete	4	263,648
Masonry	24	158,189
Paper, cardboard, plastic and other	17	112,050
Asphalt	15	98,868
Wood based	3	19,774
Other	1	6,591
Total	**100**	**659,120**

This provides an estimated volume of other materials in the CD&EW stream. Table 5 totals the estimated volume for each material. The totals for wood, plastic, metal, paper and card include a nominal 5,000 tonnes from the 112,050 tonnes estimated for the Paper, cardboard, plastic and other in demolition waste.

Table 5: Estimates of Components of CD&EW in Hampshire Based on UK Figures

Material	*Tonnes*
Inert (suitable for aggregate)	565,057
Wood*	66,908
Plastic*	33,829
Metal	6,653
Paper and card*	5,000

* Total includes 5,000 tonnes from the Paper, cardboard, plastic and other total in Table 1.3

It was felt by the offline working group that the figure for metal was too low. The figures in Tables 4 and 5 relate to loose metal in the waste stream, and do not include steel reinforcement in concrete. It was felt that this would about double the amount of metal available, as the reinforcement is recovered when the concrete is crushed to make recycled aggregate. The figure for arisings of metal was therefore increased to **13,300 tonnes per year**. The figures for wood, plastic, paper and card in Table 5 were felt to be reasonable and have been used in the report.

The figure for inert material, suitable for recycled aggregate, again agrees well with the direct estimate of 500,000 tonnes.

2.5 Other Recycled and Secondary Aggregates

It should also be noted that there are other recycled and secondary aggregates potentially available in Hampshire that are not included in this analysis because they do not arise from the CD&EW stream; these include railway ballast, incinerator bottom ash aggregate, glass and material recycled on-site in highway maintenance and new works. These are considered in the separate PII project carried out by Viridis on optimisation of recycled and secondary aggregate use in Hampshire. A summary of the estimated current arisings and potential arisings in 2010 and 2020 under different scenarios is given in Table 6.

The total level of aggregate use is assumed to be essentially constant over the period in accordance with guidelines for aggregate provision in England issued by ODPM (ODPM, 2003).

Table 6. Estimates of Recycled and Secondary Materials Recycled as Aggregates

Material	Estimated Amount Recycled in 2004 (tonnes per year)	Scenario	Estimated Amount Recycled in 2010 (tonnes per year)	Estimated Amount Recycled in 2020 (tonnes per year)
Recycled Aggregates (from Inert CD&EW)	500,000	Stretching Best Practice	654,00	750,000
		Business as Usual	525,000	550,000
Highway New Works and Maintenance	45,000	Stretching Best Practice	100,000	102,000
		Business as Usual	47,500	50,000
Railway Ballast	140,000	Stretching Best Practice	140,000	140,000
		Business as Usual	140,000	140,000
Incinerator Bottom Ash Aggregate	1,000	Stretching Best Practice	90,000	90,000
		Business as Usual	2,000	5,000
Recycled Glass	0	Stretching Best Practice	15,000	15,400
		Business as Usual	0	0
Recycled Plastic	0	Stretching Best Practice	1,000	2,000
		Business as Usual	0	0
Recycled Tyres	0	Stretching Best Practice	5,000	5,130
		Business as Usual	0	0
Totals	**686,000**	**Stretching Best Practice**	**1,005,000**	**1,104,530**
		Business as Usual	**714,500**	**745,000**
Total Aggregate Use in Hampshire	**5,119,500**	**Zero growth in total aggregate use assumed**	**5,119,500**	**5,119,500**
Proportion of Recycled and Secondary Aggregates	**13.4%**	**Stretching Best Practice**	**19.6%**	**21.6%**
		Business as Usual	**14.0%**	**14.6%**

3 Information Required for Material Resources Strategy

The actual and potential recycling of each of the six materials within the overall CD&EW stream is discussed in the Chapters 4 to 9, one for each material. The chapters are structured to a common format, based on a list of questions to be answered for each material stream. For each material, the chapter will have the following headings:

- Volumes: Volumes of arisings for 2004, 2010 & 2020. Note that these figures are for arisings that are potentially suitable for recycling, not the total volume of arisings for the material stream. Mixed and contaminated CD&EW has been excluded.
- Targets: Targets for 2010 & 2020. These are 'stretching best practice' targets rather than 'maximum achievable' targets. With current technologies, reaching the 'maximum achievable' targets for recycling as aggregates would be prohibitively expensive, and may not be the most environmentally friendly option.
- Business as usual estimates: The 'business as usual' figures are generally based on a small increase but no substantial change. Generally an increase of 5% for 2010 and 10% for 2020 was used.
- Collection: What changes/additions to collection systems are needed to achieve the targets?
- Infrastructure: What new handling/processing infrastructure is needed to achieve the targets and a broad indication of spatial needs. Infrastructure must be able to produce material that can meet specification and quality control requirements.
- Market Development: Is achieving the targets dependent on market development? If so, what?
- Education: What needs to happen in terms of information, education and other societal changes to meet the targets?
- Financial Issues: What are the key financial/affordability issues?
- Risks: What are the main risks in the targets not being achieved?
- Wider Issues: Are there any issues where we need EU, UK Government, regional action, help?

An overall summary is given in Chapter 10 and in the Executive Summary.

The arisings are assumed to increase at a slow rate over the period to 2010 and 2020 in line with population estimates for Hampshire, Portsmouth and Southampton (ONS, 2003). An average increase of 2.5% was chosen for both the periods 2004 – 2010 and 2010 to 2020.

4 Recycled Aggregate

	Year		
	2004	2010	2020
Volume of suitable aggregate material (tonnes)	**750,000**	**769,000**	**788,000**
'Stretching Best Practice' Targets (tonnes)	**500,000 (66% of potential) all unbound applications**	**654,000 (85% of potential) of which 65,400 tonnes in bound applications and 588,600 tonnes in unbound applications**	**750,000 (95% of potential) of which 150,000 tonnes in bound applications and 600,000 tonnes in unbound applications**
'Business as Usual' Estimates (tonnes)	**500,000**	**525,000 All unbound**	**550,000 All unbound**
Collection	• Better segregation on site to minimise contamination.		
Infrastructure	• Provide new recycling sites and increase capacity of some existing sites. Need to meet stringent environmental standards. • Processing will depend upon the intended final use and the specification. • Additional processing required to remove contaminants such as wood, metal, paper and plastic. • Encourage and increase the number of ventures such as that of Recycled Rock and Aggregate Ltd which sort builders waste and inert materials.		
Market Development	• Higher value markets, such as concrete and asphalt, require significant development in Hampshire. • Research and development of market for surplus fines required to increase the efficiency of CD&EW processing.		
Education	• Remove the perception that Waste Management Licensing Regulations and specifications restrict the use of CD&EW as aggregate. Promote their use as a positive benefit. • Promote the new WRAP/EA protocol for recycled aggregates and specifications that permit the use of recycled aggregates.		
Financial Issues	• Processing materials to a higher standard would attract higher prices. Help with purchase of capital equipment for recycling is available from WRAP (see www.wrap.org.uk).		
Risks	• Without the assurance of a guaranteed supply or market, companies opening and operating infrastructure for recycled and secondary aggregates are entirely at the mercy of market forces.		
Wider Issues	• Planning system needs to encourage an adequate number of well controlled high quality recycling sites to serve local needs across the county. • Utilise demolition protocols and indices as part of the planning process for redevelopment of sites.		

4.1 Volumes

The main source of material recycled as aggregate is assumed to be demolition material with smaller amounts of construction and excavation waste. The type and amount of material available is liable to vary rapidly in quality and quantity because the source material changes.

Derivation of the figures for arisings is described in Chapter 2. Taking account of all the available evidence, we consider that it is likely that about **500,000 tonnes** of recycled aggregate are being produced and used in Hampshire per year at present, probably mostly from construction and demolition waste rather than excavation waste. This figure does not include material recycled on site during redevelopment projects, which might add considerably to the total of recycled material. The recycled aggregate mostly appears to be used as relatively low value general fill, with some being used for slightly higher value applications such as capping and unbound sub-base in roads. These are all applications as unbound granular materials.

Examination of the figures suggests that there are potentially significant amounts of material that could be recycled. There are some questions about the quality of this material, but we have assumed that a further 250,000 tonnes could be recycled as aggregate, giving a potential total volume of some **750,000 tonnes per year**. This includes the processing of some excavation waste to obtain recycled aggregate. In Hampshire, much of the excavation waste will consist of Chalk, clay and silt rather than sand and gravel, and in urban areas some of it may be contaminated. The amount of excavation waste that can potentially be recycled as aggregate is thus considerably less than the total arisings of the material.

As the CD&EW arises mainly from urban areas, the potential supply will be related to population density. The correlation is not exact, as the amount of CD&EW will be related to the amount of redevelopment going on in the area, which is heavily affected by economic and political factors. Also, there is likely to be more material available in older urban areas, such as Southampton, Portsmouth, Aldershot and Farnborough than in areas of recent urban growth such as Basingstoke and Andover. However, the distribution of population will give a good general indication of the likely supply of CD&EW.

It is assumed that the volume of CD&EW suitable for use as recycled aggregate will rise in proportion to population to give **769,000 tonnes per year for 2010** and **788,000 tonnes per year for 2020**.

4.2 'Stretching Best Practice' Targets

Examination of the figures suggests that there are potentially significant amounts of material that could be recycled. There are some questions about the quality of this material, but we have provisionally assumed that a further 250,000 tonnes could be recycled as aggregate, giving a potential total of some 750,000 tonnes in 2004. At present it is believed that 500,000 tonnes is recycled or 66% of the potential 750,000 tonnes. The targets for 2010 and 2020 will increase the volume of material recycled to 95% of the potential available by 2020.

All of the recycled aggregate is currently used in unbound (low value) applications. The targets set for 2010 and 2020 not only aim to increase the total volume of material recycled, but also to increase the volume used in high value bound applications. WRAP estimate that over 30% of recycled and secondary aggregates have the potential to be used in bound applications (Barritt, 2004). A significant proportion of this is made up of secondary aggregates such as slags, china clay sand and slate that are not available in Hampshire. A lower figure of 20% of recycled aggregates having the potential to be used in bound applications has therefore been assumed for Hampshire, and the aim is to reach this level by 2020. The 'stretching best practice' target for 2010 is **654,000 tonnes per year** (85% of potential) of which 65,400 tonnes (10%) will be in bound applications and 588,600 tonnes in unbound applications. The target for 2020 is **750,000 tonnes per year** (95% of potential) of which 150,000 tonnes (20%) will be in bound applications and 600,000 tonnes in unbound applications.

From 2004 to 2020, it is assumed that greater efficiency in isolating and processing 'hard' CD&EW and easily processed excavated material will result in an increase from current levels of about 500,000 tonnes of recycled aggregate to about 750,000 tonnes. This is much less than the total volume of CD&EW, but represents the maximum that is 'hard' CD&EW that can be readily recycled as aggregate. Processing of the remaining excavated material to yield recycled aggregate is likely to be expensive, and would only yield material suitable for low value applications, so is unlikely to be economic. However, industry sources may consider that most of the material that can be recycled is already being recycled. This may mean that further processing of the additional material may be required to render it suitable as recycled aggregate, compared to that undertaken at present. We have assumed that more excavation material will be processed to obtain the target of 750,000 tonnes per year.

4.3 'Business as Usual' Estimates

Discussions with industry suggest that almost all the material that can easily be recycled as aggregate is already being recycled. With the introduction of the WRAP protocol (WRAP, 2004) removing the problem of waste management licensing or exemptions, and greater ability to use recycled aggregates under new specifications, it is likely that some growth in use is likely, though it will be constrained by the availability of easily recyclable material. Growth of 5% by 2010 and 10% by 2020 has been assumed, giving totals of **525,000 tonnes by 2010** and **550,000 tonnes by 2020**. It is likely that the use of the recycled aggregate will continue to be in unbound applications under this scenario.

4.4 Collection

All CD&EW is collected at present but not all is destined for recycling. The manner in which the material is collected may need to be adapted to better suit recycling. In some cases merely changing the destination of the material from landfill to the nearest recycling site will achieve the required volumes. However, better segregation on site to minimise contamination would greatly improve the efficiency of processing CD&EW. To recover the maximum amount of usable material is important to remove the internal furnishings and fittings before demolition takes place. This type of activity must be promoted by the demolition companies to encourage customers to take the extra time and recover the materials from the site for recycling. On construction sites, it is important to keep inert and non-inert waste separate, so that they can more easily be recycled. It is anticipated that the overall volume of construction waste will decrease as a result of the adoption of waste minimisation procedures and the increasing cost of sending material to landfill, but that this will be compensated by an increase in demolition and excavation waste diverted from exempt sites and landfill.

4.5 Infrastructure

Processing of CD&EW is similar to primary aggregates and involves the stages of crushing and screening to produce a usable product. It is important for recyclers to stockpile concrete, brick and asphalt separately as far as possible, in order to obtain the maximum value from the materials. The amount of crushing and screening will depend upon the intended final use and the specification. In addition to these processes there will be a need to separate the aggregates from contaminants such as wood, metal, paper and plastic. There are several methods for doing this such as screening with trommels, washing, air blowing, flotation and skip separation. Most sites have permanent screeners but use a mobile crusher, which is only on site for short periods to process stockpiled material. Many sites have little or no facilities for removing contaminants, and considerable upgrading of facilities will be required if the materials are to meet specification requirements for high value end uses.

Recycled Rock and Aggregate Ltd is a joint venture owned by Raymond Brown Ltd and Foster Yeoman Ltd. Their site at Warren Farm has a skip recycling operation which receives 35/40 4.6 m^3 skips per day of builders waste and inert materials. The material is processed through a picking station and trommel where all the hardcore, soil and metals are recovered. Any residual material is then sent

to landfill. The current recovery rate for waste is 63% (Recycled Rock and Aggregate Ltd). This type of venture is encouraged to increase the volume of recycled aggregate use in Hampshire.

The companies that undertake the processing are a mixture of large aggregate producers and smaller companies. The smaller companies which only hold an exemption under the Waste management Licensing regulations will only be able to store to crush grind or screen 20,000 tonnes of waste at any time (ref. Waste Management Licensing Regulations 1994). Companies that operate under a Waste Management License may be able to store and handle greater amounts; these will be specified in the Waste Management License for the site.

It is likely that a number of new sites for processing CD&EW into recycled aggregates will be required between now and 2020, both to accommodate the expected increase in material and as a result of some existing sites closing and new ones opening. The main concerns relating to the processing of CD&EW are traffic, noise, dust and visual intrusion, and measures have to be put in place to mitigate the impacts. For noise and dust, one option is to enclose the whole operation. This is initially expensive, but then gives the operator much greater freedom to run the plant according to his requirements. It would also encourage production of aggregates for higher value applications, to justify the expense. Enclosed facilities might be acceptable at a much wider range of sites than open ones.

The location of sites which have planning permission to produce recycled aggregates in Hampshire at present is shown in Figure 1. Not all of these sites are active, and the total capacity is not known; it will be in excess of the current production of 500,000 tonnes per year, but is likely to be less than the stretching best practice target of 750,000 tonnes per year by 2020. Further sites are likely to be necessary to meet this target, especially as it may be anticipated that some of the sites may close as a result of commercial pressures between now and 2020.

Figure 1. Location of Sites with Planning Permission for the Production of Recycled Aggregates

There appears to be a shortage of sites in the central part of the county, around Winchester, Basingstoke and Andover. It is known, however, that there are a number of waste transfer stations in these areas that take CD&EW and bulk it up before sending it on to one of the recycling sites shown on Figure 1.

Planning guidance has moved on from the Hampshire Minerals and Waste Local Plan of 1998. The problem in the past has been that in urban areas recycling sites were restricted to high value industrial land, for which they could not compete. A wider range of sites is now available to operators of recycling plant. The proximity principle – that materials should be processed near to where they arise and where they will be used – appears to be generally accepted; however, with an increase in the number of sites likely in the next 5 years, problems may be encountered in some areas. An alternative may be to increase the capacity of some existing sites, where this is possible. However many sites, particularly those in the centre of urban areas, are restricted in size, and hence in the amount of material they can process.

4.6 Market Development

At present all recycled aggregate in Hampshire is used in low value unbound applications. This reflects experience elsewhere that recycled aggregates are not widely used for high value applications such as aggregate in concrete and asphalt (Barritt, 2003), although specifications are in place that enable them to be used for these applications. Meeting the targets for higher value markets, such as concrete and asphalt, will require significant market development in Hampshire.

After crushing and screening there may be problems in finding markets for, or disposing of surplus fine materials. If an effective market can be established for the fine material, the efficiency of CD&EW processing will be greatly improved. There is also a need to find markets for the materials removed during processing such as wood, plastic, metals, paper and card or they may end up being disposed of to landfill. These materials are discussed in Chapters 5 to 9.

4.7 Education

The regulatory position has become much more supportive to recycling and the use of recycled and secondary aggregates in recent years. Specifications are available which allow materials to be used, and quality control protocols are available to ensure materials are consistent and fit for purpose. The new WRAP quality protocol for the production of aggregates from inert waste (WRAP, 2004) will remove the barrier presented by the Waste Management Licensing Regulations when using recycled aggregates. If inert CD&EW is processed in line with the new protocol then it will generally no longer be classified as a waste. This means contractors can use recycled aggregate with out having to obtain a Waste Management Licence or register an exemption. The perception that the Waste Management Licensing Regulations and specifications still restrict the use of recycled aggregate may linger and this perception must be removed. Education is required for all sectors of construction in this area; perhaps particularly for small to medium enterprises (SMEs) who may be much less aware of recent specifications and quality control requirements than larger companies. Education of construction clients, particularly in sectors such as house building, is essential to enable wider use of recycled aggregates and meet the targets.

4.8 Financial Issues

The fact that most recycled aggregates are sold for low prices, for low value applications, means that there is little money available to invest in plant for processing the materials to a higher standard that would attract higher prices. Help with purchase of capital equipment for recycling is available from WRAP (see www.wrap.org.uk). Production of high value aggregates for use in bound applications will enable higher prices to be charged, justifying the investment in the necessary infrastructure. It is envisaged that this investment will be made by individual companies rather than Local Authorities. However, it may be advantageous for the operators to enter into agreement with Local Authorities or other suppliers to ensure both a reliable source of material and a market for the resulting recycled aggregates.

4.9 Risks

Without the assurance of a guaranteed supply or market, companies opening and operating infrastructure for recycled and secondary aggregates are entirely at the mercy of market forces. As a result, many of the smaller companies may be unwilling or unable to invest in up-to-date machinery and may be stuck in a 'vicious circle' of producing low cost, low quality materials. This is less likely to be a problem with the larger national mineral or waste companies. They are likely to have the resources to invest in the appropriate infrastructure, and to be anxious to safeguard their reputation by producing high quality products and operating in a responsible manner. Without the incentive of a partnership or similar arrangement to provide some security of supply and demand, however, they may be reluctant to invest in infrastructure to produce recycled aggregates suitable for high value applications.

4.10 Wider Issues

Hampshire's planning system needs to encourage an adequate number of well controlled high quality recycling sites to serve local needs across the county. The demolition protocols and indices produced by Envirocentre should be utilised as part of the planning process for redevelopment of sites.

5 CD&EW Fines (< 6mm)

	Year		
	2004	2010	2020
Volume (tonnes)	**108,000**	**110,700**	**113,500**
'Stretching Best Practice' Targets (tonnes)	**5,000**	**50,000**	**75,000**
'Business as Usual' Estimates (tonnes)	**5,000**	**5,250**	**5,500**
Collection	• Fine material will arise from the processing of CD&EW and will be located at the recycling sites. This can be mixed with subsoil from excavation waste.		
Infrastructure	• The same infrastructure used to produce aggregates will produce the fine material and subsoil. This can be used as landscaping fill. • Additional infrastructure may be required to manufacture products for particular markets, for example manufactured soils, where the fine material from CD&EW will be mixed with compost from green waste or other sources.		
Market Development	• Manufactured soils from a mix of the fine material and subsoil with organic waste could be a significant resource stream in Hampshire but significant market development will be required. This should be done in conjunction with the appropriate working group.		
Education	• Education needed to establish the idea of manufactures soils as a good thing in the public mind.		
Financial Issues	• Establishing a market for the fine fraction of CD&EW would make the processing of CD&EW for higher value aggregates more cost effective.		
Risks	• Significant research and development is required to establish a market for the fine material		
Wider Issues	• Manufactured soil needs to be developed in conjunction with the appropriate working group		

5.1 Volumes

It is assumed that the volume of CD&EW fines is related to the volume of CD&EW processed for aggregates. This is the volume of material that is suitable for recycling, and excludes contaminated or mixed material. It includes fines from processing concrete, brick and asphalt and subsoil, stones and ash from excavation waste. Applying the OPDM's estimate for the volume of soil recycled in the South East to total CD&EW in Hampshire provides an estimate of **108,000 tonnes** per year of fine material (see Chapter 2.3 for more detail). The arisings are assumed to increase in line with population to give **110,700 tonnes** per year by 2010 and **113,500 tonnes** per year by 2020.

5.2 'Stretching Best Practice' Targets

Available evidence suggests that little of this material is currently recycled. A nominal amount of **5,000 tonnes** has been estimated for 2004. It is assumed that this is used mostly as landscaping fill or subsoil. It is desired to increase the productive use of this material, both as manufactured soil and for other purposes. 'Stretching best practice' targets of **50,000 tonnes for 2010** and **75,000 tonnes for 2020** have been set to allow time for the necessary infrastructure to be established and for market development. These targets are dependent on the market development in manufactured soils detailed below.

5.3 'Business as Usual' Estimates

Without stimulus for markets for manufactured soil, it is assumed that growth will parallel that for recycled aggregates, i.e. 5% by 2010 and 10% by 2020, giving figures of **5,250 tonnes by 2010** and **5,500 tonnes by 2020**.

5.4 Collection

No additional collection facilities would be required. The material would arise as the residue for present and proposed CD&EW recycling centres. A good example of a source of this material is Recycled Rock and Aggregate Ltd joint venture. This is a joint venture owned by Raymond Brown Ltd and Foster Yeoman Ltd. Their site at Warren Farm has a skip recycling operation which receives 35/40 4.6 m^3 skips per day of builders waste and inert materials. The material is processed through a picking station and trommel where all the hardcore, soil and metals are recovered. The current recovery rate for waste is 63% (Recycled Rock and Aggregate Ltd). The residual material is currently sent to landfill, but the development of markets for materials such as the soils fraction would divert more of this material to productive uses.

5.5 Infrastructure

Some additional infrastructure could be required depending upon the market for the soils material. For example additional plant will be required for mixing of organic material with the fines to produce manufactured soil.

5.6 Market Development

Organic matter is one of the most important components of soil. It is essential for the development of soil structure, it helps to regulate the movement of pollutants and contaminants in the soil and it also plays an important role in the cycling and storage of nutrients and water.

Replacement soil could be manufactured with the inclusion of properly processed organic waste, e.g. processed to PAS100 standards (British Standards Institution, 2002). Previous work undertaken on manufactured soils by Harper Adams College suggests that a mix of approximately 70% mineral to 30% organic waste is appropriate for most applications (Keeling AA and Marchant L, 2001).

Projected Integra figures from Hampshire Country Council indicate that 59,360 tonnes of green waste will be collected in the region in 2004/5, rising to 62,366 in 2006/7. Currently much of this green waste is recycled as compost. The diversion of the green waste is expected to be required by HCC if it is to achieve mandatory recycling targets and increased collection of biodegradable waste resulting from the landfill directive. The manufacture of soils could contribute to this diversion. Meeting the stretching best practise targets with manufactured soil would require 20,000 tonnes of green waste in 2010 and 32,000 tonnes in 2020.

The production of manufactured soil would not only divert material from landfill for both material streams but produce value added product. Significant market development will be required to

establish outlets for the manufactured soil. Protocols and standards will need to be introduced and developed to give clients assurance as to the quality of the material. Areas where the material can be used must be identified and clients in the public and private sectors convinced that the use of the manufactured soil is safe, economic and will be aesthetically acceptable.

5.7 Education

Education will be required for client and public acceptance of the material, to overcome any objections to the aesthetic appearance of the material and deal with concerns about safety/toxicity. This should be part of a general public campaign to raise awareness and acceptability of recycling of a whole range of materials.

5.8 Financial Issues

Establishing a market for the fine fraction of CD&EW would make the processing of CD&EW for higher value aggregates more cost effective. There will be costs associated with infrastructure for mixing the material with compost to produce manufactured soils.

5.9 Risks

The targets are dependent on significant market development.

5.10 Wider Issues

Manufactured soil crosses over between this material stream and the appropriate working group. The development of this product requires liaison between the two groups to ensure the most effective use of the materials.

6 Wood

	Year		
	2004	2010	2020
Volume (tonnes)	**66,900**	**68,575**	**70,290**
'Stretching Best Practice' Targets (tonnes)	**1,000**	**10,000**	**20,000**
'Business as Usual' Estimates (tonnes)	**1,000**	**1,050**	**1,100**
Collection	• Wood material will arise from the processing of CD&EW and will be located at the recycling sites. • The wood would require collection and storing for further processing		
Infrastructure	• The same infrastructure used to produce aggregates will produce the wood material. • Additional infrastructure may be required to manufacture products for particular markets.		
Market Development	• There are a range of possible markets for waste wood. However, contamination may be an issue. Contamination of the wood may restrict its recycling potential.		
Education	• Need to establish the acceptability of recycled wood in the public mind		
Financial Issues	• Establishing a market for the wood fraction of CD&EW would make the processing of CD&EW for higher value aggregates more cost effective.		
Risks	• Significant research and development is required to establish a market for the wood material		
Wider Issues	• Utilisation of the wood arising from the CD&EW stream should be considered by the Wood working group		

6.1 Volumes

It is assumed that the volume of wood available for recycling is related to the volume of CD&EW processed for aggregates. Applying the Hurley and McGrath's estimate for the composition of construction and demolition waste to the total volume in Hampshire provides an estimate of **66,900 tonnes** of wood. It is assumed the arisings will rise in line with population to give figures of **68,575 tonnes** per year by 2010 and **70,290 tonnes** per year by 2020.

6.2 'Stretching Best Practice' Targets

Available evidence suggests that none of this material is currently recycled. A nominal amount of **1,000 tonnes** has been assumed for 2004. 'Stretching best practice' targets of **10,000 tonnes for 2010** and **20,000 tonnes for 2020** have been set, but there is little objective evidence to justify these or any other targets.

6.3 'Business as Usual' Estimates

These are assumed to follow the figures for recycled aggregates, with growth of 5% by 2010 and 10% by 2020, giving totals of **1,050 tonnes for 2010** and **1,100 tonnes by 2020**.

6.4 Collection

Wood material will arise from the processing of CD&EW and will be located at the recycling sites. Additional collection facilities would be required to separate the wood from other lightweight contaminants, e.g. plastic and paper, take the wood for storage/bulking and further processing e.g. chipping.

On demolition sites, facilities should be provided to strip out the wood and 'soft' materials before demolition. This material will then need to be processed to separate wood from plastic, glass, plasterboard and other materials.

On construction sites, recycling facilities should be provided for surplus or damaged wood to avoid mixing with other materials.

6.5 Infrastructure

Additional sorting plant will be required to separate the wood from other lightweight contaminants, e.g. plastics from the residue after processing. Additional plant may be required to manufacture products for particular markets, for example wood chipping machines.

6.6 Market Development

There are no cross industry standard specifications for wood recycling. Timber recyclers generally will accept nearly all soft and hardwood materials including pallets. Plywood is also accepted. Restrictions are imposed with regard to contaminants. Metals are divided into two categories: ferrous and non-ferrous. Ferrous contamination such as nails and screws is usually acceptable and can be readily removed by magnetic extraction. Non-ferrous materials are not so easily removed and recyclers often ask for these to be removed in advance. Such items would include aluminium window catches and other fittings.

Other materials that are excluded include: MDF (medium density fibreboard), paper and card, laminated material and railway sleepers. Some restrictions may also be imposed on chipboard.

High quality timber can be recovered prior to demolition and reused as timber in new construction. It is assumed that this will continue and probably increase with time. However, most of the wood recovered from the CD&EW stream will not be in a form that can be readily reused as timber. Wood from CD&EW may be contaminated and this would restrict its potential to be recycled. However, the recycled wood can be used in many established applications and markets for recycled wood products, these include:

- Panel products - medium density fibreboard (MDF) and particleboard
- Mulches and soil conditioners
- Wood chip products
- Animal bedding

6.6.1 Panel products

The UK panelboard industry consists of six organisations operating at eleven sites: two Medium Density Fibreboard (MDF) mills, eight particleboard mills and one oriented strand board (OSB) mill. Particleboard and MDF panel types are produced in a wide range of sizes and thickness for the

construction, furniture and packing industries, with extruded MDF mouldings also produced for the joinery and construction industry. This industry represents the biggest single market for recycled wood waste in the UK, consuming 692,000 tonnes in 2001 and an estimated 777,000 tonnes in 2002 (TRADA, 2003). However, research by WRAP and TRADA suggests that recycled wood cannot currently be used to make MDF, and there are currently no chipboard manufacturers within economic distance of Hampshire.

6.6.2 Mulches and soil conditioners

The UK market for mulches and soil conditioners in 2002 was estimated at 700,000 tonnes and valued at £16 million wholesale or £28 million retail. There are 90 operators in the UK with 197 sites between them, ten processing more than 10,000 tonnes per year. Mulches and soil conditioners are derived mainly from composted bark and green waste as well as some recycled wood content. Some bark and bark/wood chip mixes are also supplied as a surface mulch rather than as a composted growing medium (TRADA, 2003).

6.6.3 Wood chip products

Wood chip products are used as surfacing products, primarily for visual impact and erosion control. Mulch products are distinct from these products and used by the horticultural industry for moisture retention and weed control. Wood chip products will have similar beneficial characteristics to mulches.

Opportunities exist for the development of the market in areas such as bridleways, golf courses, other heavy public access areas, roadway roundabout coverage, and motorway embankment cover.

6.6.4 Animal bedding

Animal bedding covers bedding for horse and cattle, poultry, and domestic pets. Traditionally, this market has been dominated by the wood shavings suppliers. The bedding requires a moisture content of less than 15% with zero contaminants and is generally sourced from a sawmill or secondary processing by-product (TRADA, 2003).

6.7 Education

Some education of the public may be necessary to achieve acceptance of the recycled wood products.

6.8 Financial Issues

Establishing a market for the wood fraction of CD&EW would make the processing of CD&EW for higher value aggregates more cost effective.

6.9 Risks

Significant research and development is required to establish a market for the wood material.

6.10 Wider Issues

Development of products and markets for wood from CD&EW should be done by the Wood working group.

7 Plastic

	Year		
	2004	2010	2020
Volume (tonnes)	**33,800**	**34,645**	**35,511**
'Stretching Best Practice' Targets (tonnes)	**1,000**	**5,000**	**10,000**
'Business as Usual' Estimates (tonnes)	**1,000**	**1,050**	**1,100**
Collection	• Plastic will arise from the processing of CD&EW and will be located at the recycling sites. • Plastics would require collection and storing for further processing		
Infrastructure	• Additional sorting plant may be require to separate the plastics from the residue • Additional infrastructure may be required to manufacture products for particular markets.		
Market Development	• Appropriate market development should be considered by the MRS Plastics working group. • The plastic waste will be mixed polymer and possibly contaminated.		
Education	• Education needs should be considered by the Plastics working group.		
Financial Issues	• Establishing a market for the plastic from CD&EW would make the processing of CD&EW for higher value aggregates more cost effective.		
Risks	• Success is dependent on establishing a market for the plastic material.		
Wider Issues	• Plastic arising from the CD&EW stream should be considered by the Plastics working group.		

7.1 Volumes

It is assumed that the volume of plastic available for recycling is related to the volume of CD&EW processed for aggregates. Applying Hurley and McGrath's estimate for the composition of construction and demolition waste to the total volume in Hampshire provides an estimate of **33,800 tonnes** of plastic. It is assumed that the arisings will increase in line with population to give **34,645 tonnes** per year by 2010 and **35,511 tonnes** per year by 2020.

7.2 'Stretching Best Practice' Targets

Available evidence suggests that none of this material is currently recycled. A nominal target of **1,000 tonnes** has been set for **2004**, rising to **5,000 tonnes by 2010** and **10,000 tonnes by 2020**. The figures for 2010 and 2020 include 1,000 and 2,000 tonnes respectively for use as aggregate. The bulk of the material, however, will be recycled as plastic.

7.3 'Business as Usual' Estimates

These are assumed to follow the figures for recycled aggregates, with growth of 5% by 2010 and 10% by 2020, giving totals of **1,050 tonnes for 2010** and **1,100 tonnes by 2020**.

7.4 Collection

Plastics will arise from the processing of CD&EW and will be located at the recycling sites. Additional collection facilities would be requited to take the plastic for storage/bulking and further processing e.g. melting and extruding. As far as possible on construction and demolition sites, plastic should be kept separate from other materials such as wood and glass to enable greater recycling of all these materials.

7.5 Infrastructure

Additional sorting plant may be required to separate the plastics from the residue. Additional plant may be required to manufacture products for particular markets, for example extruded plastic products.

7.6 Market Development

The Hampshire Material Resource Strategy (MRS) has a dedicated plastics team. The volumes of plastic identified within this report would be best considered as part of the plastics MRS. CD&EW should be considered as a potential source of mixed plastic waste. The plastic waste will be mixed polymer and possibly contaminated.

Single polymer recycling is now well established in the UK. However, the plastic arising from CD&EW will be a mix of polymers. These do have potential markets such as:

– Plastic fencing, industrial plastic pallets, traffic cones, and playground equipment and garden furniture.

7.6.1 Plastic lumber

Plastic lumber is made from post-consumer or industrial scrap plastic and is a substitute in many wood applications. Plastic lumber has been used in fences, utility and sign posts, pilings, stationary or movable piers, bulkheads (groynes), sea walls, decking for boardwalks and boat docks, pier impact protectors and railings. The two primary manufacturing methods are:

- Continuous extrusion in which the molten plastic is passed through a die and then cooled by water;
- Moulding in which the molten plastic is extruded into a mould and then cooled in the mould.

7.7 Education

This should be dealt with by the Plastics working group.

7.8 Financial Issues

Establishing a market for the plastic from CD&EW would make the processing of CD&EW for higher value aggregates more cost effective.

7.9 Risks

Success is dependent on establishing a market for the plastic material.

7.10 Wider Issues

The plastic arising from the CD&EW stream should be considered by the Plastics working group.

8 Metals

	Year		
	2004	2010	2020
Volume (tonnes)	**13,300**	**13,632**	**13,973**
'Stretching Best Practice' Targets (tonnes)	**4,000**	**7,000**	**10,000**
'Business as Usual' Estimates (tonnes)	**4,000**	**4,200**	**4,400**
Collection	• Metals will arise from the processing of CD&EW and will be located at the recycling sites. • Metals would require collection and storing for further processing		
Infrastructure	• Additional sorting plant may be required to separate the metals from the residue and to sort the different metals from each other.		
Market Development	• Appropriate market development should be considered by the MRS Metals team.		
Education	• Any needs should be identified by the Metals working group		
Financial Issues	• Establishing a market for the metal from CD&EW would make the processing of CD&EW for higher value aggregates more cost effective.		
Risks	• Success is dependent on the viability of the metals for the established recycled metal markets.		
Wider Issues	• Metals from the CD&EW stream should be considered by the Metals working group		

8.1 Volumes

It is assumed that the volume of metal available for recycling is related to the volume of CD&EW processed for aggregates. Applying the Hurley and McGrath estimate for the composition of construction and demolition waste to the total volume in Hampshire provides an estimate of 6,600 tonnes of metal. After consultation with the offline working group this figure was doubled to include reinforcing steel from crushed concrete, giving an estimated total of **13,300 tonnes** per year. It is assumed that the arisings will increase in line with population to give figures of **13,632 tonnes** per year by 2010 and **13,973 tonnes** per year by 2020.

8.2 'Stretching Best Practice' Targets

At present, ferrous metals are separated by magnet after the crushing of concrete. The amounts are unknown, but as metal is valuable a figure of **4,000 tonnes** has been set for **2004**. The metal is probably sold for scrap. Greater processing of CD&EW using gravity based methods has the potential to separate greater amounts of metals. Metals are potentially a high value material stream, so 'stretching best practice' targets have therefore been set of **7,000 tonnes for 2010** and **10,000 tonnes for 2020.**

8.3 'Business as Usual' Estimates

These are assumed to follow the figures for recycled aggregates, with growth of 5% by 2010 and 10% by 2020, giving totals of **4,200 tonnes for 2010** and **4,400 tonnes by 2020**.

8.4 Collection

Metals will arise from the processing of CD&EW and will be located at the recycling sites. Additional collection facilities would be required to take the metal for storage/bulking and further processing.

8.5 Infrastructure

Additional sorting plant may be required to separate the metals from the residue and to separate different metals from each other.

8.6 Market Development

Appropriate market development should be considered by the MRS Metals working group.

8.7 Education

Appropriate education should be considered by the MRS Metals working group.

8.8 Financial Issues

Establishing a market for the metals from CD&EW would make the processing of CD&EW for higher value aggregates more cost effective.

8.9 Risks

Success is dependent on the viability of the metals for the established markets.

8.10 Wider Issues

The metals arising from processing of CD&EW should be considered by the Metals working group.

9 Paper and Card

	Year		
	2004	2010	2020
Volume (tonnes)	**5,000**	**5,125**	**5,253**
'Stretching Best Practice' Targets (tonnes)	**0**	**1,000**	**2,000**
'Business as Usual' Estimates (tonnes)	**0**	**0**	**0**
Collection	• Paper and card will arise from the processing of CD&EW and will be located at the recycling sites. • Paper and card would require collection and storing for further processing		
Infrastructure	• Additional sorting plant may be require to separate the paper and card from the residue		
Market Development	• Appropriate market development should be considered by the MRS Paper and Card working group. • The paper and card waste will be of mixed types and possibly contaminated.		
Education	• Appropriate education should be considered by the MRS Paper and Card working group.		
Financial Issues	• Establishing a market for the paper and card from CD&EW would make the processing of CD&EW for higher value aggregates more cost effective.		
Risks	• Success is dependent on the viability of the paper and card for the established recycled paper and card markets.		
Wider Issues	• The paper and card arising from the CD&EW stream should be considered by the Paper and Card working group		

9.1 Volumes

It is assumed that the volume of paper and card available for recycling is related to the volume of CD&EW processed for aggregates. Applying the Hurley and McGrath estimate for the composition of construction and demolition waste to the total volume in Hampshire gives an estimate of 112,050 tonnes classified as paper, cardboard, plastic and other**.** It is assumed that a nominal figure of **5,000 tonnes** of this is potentially recyclable paper and card. It is assumed that the arisings will increase in line with population to give **5,125 tonnes** per year by 2010 and **5,253 tonnes** per year by 2020.

9.2 'Stretching Best Practice' Targets

At present it is not thought that any of the paper and card arising from CD&EW is recycled. Nominal targets of **1,000 tonnes for 2010** and **2,000 tonnes for 2020** have been set.

9.3 'Business as Usual' Estimates

CD&EW is not a prime source for recycled paper and card because of the contamination with other materials, so without intervention it is assumed that no material from this waste stream will be recovered. **Zero figures** have therefore been entered for 2010 and 2020.

9.4 Collection

Paper and card will arise from the processing of CD&EW and will be located at the recycling sites. Additional collection facilities would be requited to take the paper and card for storage/bulking and further processing.

9.5 Infrastructure

Additional sorting plant may be required to separate the paper and card from the residue.

9.6 Market Development

Appropriate market development should be considered by the MRS paper and card team.

The paper and card waste will be of mixed types and possibly contaminated.

9.7 Education

Appropriate education should be considered by the MRS paper and card team.

9.8 Financial Issues

Establishing a market for the paper and card from CD&EW would make the processing of CD&EW for higher value aggregates more cost effective

9.9 Risks

Success is dependent on the viability of the paper and card for the established recycled paper and card markets.

9.10 Wider Issues

The paper and card arising from the CD&EW stream should be considered by the Paper and Card working group.

10 Summary

The anticipated total volumes, stretching best practice' and 'business as usual' estimates for the recyclable components of the inert CD&EW waste stream are summarised in the following tables.

Summary Table 1. Estimated Arisings of Materials in the Construction Waste and Soil Stream

Material	Estimated Volume of Arisings in 2004 (tonnes per year)	Estimated Volume of Arisings in 2010 (tonnes per year)	Estimated Volume of Arisings in 2020 (tonnes per year)
Inert CD&EW Suitable for Recycling as Aggregate	750,000	769,000	788,000
Inert CD&EW Fines (< 6mm)	108,000	110,700	113,500
Wood	66,900	68,575	70,290
Plastic	33,800	34,645	35,511
Metal	13,300	13,630	13,973
Paper and Card	5,000	5,125	5,253

Summary Table 2. Estimates of Current Recycling and Scenarios for 2010 and 2020

Material	Estimated Amount Recycled in 2004 (tonnes per year)	Scenario	Estimated Amount Recycled in 2010 (tonnes per year)	Estimated Amount Recycled in 2020 (tonnes per year)
Recycled Aggregates (from Inert CD&EW)	500,000	Stretching Best Practice	654,00	750,000
		Business as Usual	525,000	550,000
Manufactured Soil (from Inert CD&EW Fines)	5,000	Stretching Best Practice	50,000	75,000
		Business as Usual	5,250	5,500
Wood	1,000	Stretching Best Practice	10,000	20,000
		Business as Usual	1,050	1,100
Plastic	1,000	Stretching Best Practice	5,000	10,000
		Business as Usual	1,050	1,100
Metal	4,000	Stretching Best Practice	7,000	10,000
		Business as Usual	4,200	4,400
Paper and Card	0	Stretching Best Practice	1,000	2,000
		Business as Usual	0	0

The figures contain a lot of uncertainty and should be regarded as 'ball park' estimates. Only those for recycled aggregates are based on direct estimates of the amounts in Hampshire; the other figures are based on indirect estimates of the proportion of the various components in the overall CD&EW stream, based on national figures.

The main recyclable component is recycled aggregate. The potential recyclable amounts for manufactured soil, wood, plastic, metals, paper and card are thought to be much smaller, and these materials should be dealt with by the appropriate working groups. Manufactured soil needs to be tackled in conjunction with the Green Waste working group to assess its potential more accurately.

A number of issues were identified that require action if the 'stretching best practice' targets are to be met. These include:

- A need for more sites to produce recycled aggregate from CD&EW. These should be located close to the source of the material, mainly older urban areas, and to potential markets. Excessive transport distances make recycled aggregates uneconomic compared with primary aggregates.
- A need for higher quality processing of CD&EW to produce recycled aggregates suitable for high value applications such as asphalt and concrete. This will require investment in the necessary infrastructure to separate contaminants and produce more closely graded aggregates.
- A need for producers to adopt quality control procedures that give clients assurance about the consistency and performance of the recycled aggregates.
- A need for market development for greater use of recycled aggregates, particularly in high value applications. Public sector clients such as Hampshire County Council can give a lead by encouraging use of recycled aggregates, as in the existing PSA scheme.
- Education of the public and industry, especially SMEs, of the benefits of using recycled aggregates and assurance about their safety and quality. Demonstration projects can be particularly helpful in this regard.
- A need to promote new specifications and protocols that encourage the use of recycled aggregates. This is also a national issue and liaison with SEEDA, WRAP, ODPM and DTI may be required for this and the education/market development issues.
- A need to encourage greater segregation at source of wood, plastic, metal, paper, card and other materials in demolition and construction works. This will reduce the processing requirements for the production of recycled aggregates from CD&EW and will enable the wood, metal, plastic and other materials to be obtained in a 'clean' form, which will then be easier to recycle.
- A need to develop markets for the wood, plastic, metal, paper, card and other minor components of CD&EW.
- A need to develop methods of producing manufactured soil using the soil component of CD&EW and compost from green waste or other sources, and associated market development.

While all these issues require action, there is no doubt that there is significant potential to increase both the quantity and quality of recycled aggregates in Hampshire, and to develop significant markets for manufactures soil and the other minor components of the CD&EW stream.

It should also be noted that there are other recycled and secondary aggregates potentially available in Hampshire; these include railway ballast, incinerator bottom ash, glass and material recycled on-site in highway maintenance and new works. It is estimated that the total recycled and secondary aggregate use in Hampshire in 2004 is 686,200 tonnes, 13.4% of the total aggregate use. Under the stretching best practice scenario this could rise to 19.6% by 2010 and 21.6% by 2020. Further details are given in the Final Report for Stage 1 of the PII project 'Demonstration project to optimise resource usage in a defined geographic area'.

Acknowledgements

The work described in this report was carried out in the Resource Management Group of TRL Limited, otherwise known as Viridis. The authors would like to thank a number of people and organisations for assistance in the production of this report, and for the reports produced for the PII project. Particular thanks are extended to:

- Clare Saunders and Isabel Cochrane of Hampshire County Council, Environment Department
- Terry Lomas, Hampshire County Council Technical Advisers Group
- Peter Kelly and Dawn Theaker, Environment Agency, Colden Common
- Martin Dudley, Foster Yeoman
- Richard Read, Trevor Badley and Adrian Lynham, Hampshire County Council Planning Department
- The MRS offline working group for construction waste and soil for their interest and helpful comments.

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Appendix A. Members of the MRS Offline Working Group for Construction Waste and Soil

Isabel Cochrane	Hampshire County Council, Waste Management Section
Trevor Badley	Hampshire County Council, Minerals and Waste Planning
Terry Lomas	Hampshire County Council, Technical Advisers Group
Mike Fitch	Hampshire County Council, Property, Business and Regulatory Services
George Fordyce	National House Building Council
Peter Cross	Dean & Dyball Construction Ltd.
Martin Dudley	Foster Yeoman Ltd.
Liz Dowling	Foster Yeoman Ltd.
Ray Dixon	Sherfield English Environmental Society
John Stokes	Harbridge Protection Society
Gordon Hughes	GH Consultancy Ltd.
Jonathan West	The Whitelands Project
Graham May	VS Plant Hire Ltd.
Peter Kelly	Environment Agency
Adrian Richardson	Southampton City Council, Waste Management Section
Richard King	Geoffrey Osborne Limited
David Doling	Independent Consultant
Kevin Bell	K & R Demolition Limited
Richard Comley	Comley & Sons Ltd.
Jonathan Fovargue	Construction Resources
Craig Liddell	Construction Resources
Elspeth Wray	Entec
Clare Brown	Entec
Murray Reid	Viridis
Julia Lovell	Viridis