4sight

ROCKS TO RUBBLE

BUILDING A SUSTAINABLE REGION

Biffaward

Programme on Sustainable Resource Use

BIFFAWARD PROGRAMME ON SUSTAINABLE RESOURCE USE

Objectives

This report forms part of the Biffaward Programme on Sustainable Resource Use. The aim of this Programme is to provide accessible, well-researched information about the flows of different resources through the UK economy, based either singly, or on a combination of regions, material streams or industry sectors.

Background

Information about material resource flows through the UK economy is of fundamental importance to the cost-effective management of the flows, especially at the stage when the resources become "waste". However, at present:

Information is not adequate in terms of quality and quantity

The UK Government is finding it very difficult to meet even relatively unchallenging targets of waste reduction and resource recycling

Businesses are faced with increasing costs of waste disposal.

In order to maximise the projects' full potential, data will be generated and classified in ways that are consistent both with each other, and with the methodologies of other generators of resource flow/waste management data, e.g.:

The Environment Agency

The Department of Environment, Transport and the Regions

The Office for National Statistics.

This entails:

Careful co-ordination of the projects

Information sharing and mutual awareness between the projects.

In addition to the projects having their own means of dissemination to their own constituencies, their data and information will be gathered together in a common format to facilitate policy making at corporate, regional and national levels.

4sight

PROJECT FUNDERS & STEERING GROUP

Project Funders

Biffaward
www.biffaward.org
www.biffa.co.uk
Biffa is one of the UK's major waste management companies and one of the principle campaigners in raising awareness of the issues of resource efficiency in the UK. In December 1997 Biffa Waste Services agreed to donate landfill tax credits to the Royal Society for Nature Conservation (RSNC) to administer under the fund name Biffaward. The fund is currently worth more than £15 million a year and supports many worthwhile environmental projects involving local communities, education, biodiversity, heritage and research into sustainable waste management.

The Co-operative Bank
www.co-operativebank.co.uk
The strategy of The Co-operative Bank is simple - to be a modern bank that goes about its business in a profitable and ethical manner. It aims to develop its business taking into account the impact its activities have on the environment and society at large.

NWRA
www.nwra.gov.uk/afs/
The North West Regional Assembly's commitment to sustainable development in the Northwest.

GONW
www.go-nw.gov.uk
Represents Central Government in the Northwest region and feeds back the region's views to Whitehall.

Steering Group

CURE
www.art.man.ac.uk/planning/cure
CURE (The centre for Urban and Regional Ecology is part of the Department of Planning and Landscape at the University of Manchester.

The National Centre for Business and Sustainability
www.thencbs.co.uk
The National Centre for Business and Sustainability was set up in 1995 to provide applied environmental advice and services to business, to develop and influence environmental best practice and to promote and assist the implementation of sustainable development. The Centre is a partnership between The Co-operative Bank and the four Greater Manchester Universities; Manchester, UMIST, Manchester Metropolitan and Salford. The Centre is informed and motivated by the Bank's ethical policies and its commitment to environmental improvement. The resources to deliver the Centre's mandate come from an expert staff, the wealth of knowledge within the academic sector and a large number of associates who share the Centre's objectives.

Sustainability Northwest
www.snw.org.uk
Sustainability Northwest is a partnership organisation, providing leadership and focus for sustainable development issues in the Northwest.

The Environment Agency
www.environment-agency.gov.uk
The Environment Agency is the regulatory body for the environment in England and Wales.

Tarmac Central Ltd
www.tarmac.co.uk
Tarmac is the leading producer of construction aggregates in the north west. The company is not only involved in all the source extraction areas which feed this important market but is also actively engaged in processing recycled materials for construction. The organisation has provided input to the project through participation in the present steering group and provision of data.

Balfour Beatty
www.balfourbeatty.com
Balfour Beatty is a construction and engineering services company committed to improving its environmental and social performance. The organisation has provided input to the project through participation in the project steering group and provision of data and case study material.

Northwest Regional Aggregates Working Party
Cheshire County Council acts as the secretary and Chair for the Northwest RAWP, which provides advice to government departments in relation to the supply of, and demand for, aggregate minerals.

ABOUT 4SIGHT

4sight is a new initiative aimed at developing a new way of business thinking for the 21st century.

Led by The National Centre for Business and Sustainability, **4sight** aims to investigate and identify a practical framework to help businesses and institutions learn to think beyond the traditional cycle of consumption and disposal. With producer responsibility and resource efficiency high on national and international agendas, no sector of industry or government can afford to ignore the implications of an efficiency revolution that is developing into a world trend.

4sight will provide the information and decision-making tools necessary to promote a more sustainable region.

4sight has so far concentrated on a regional mass balance of construction minerals, which is the subject of this report. However, the findings and principles have relevance to other regions, sectors and resource flows.

4sight is based on the principles of Factor Four, a concept which postulates that how efficiently we use our resources, can and should grow four fold in order to achieve sustainable development, i.e. we need to make twice as much out of half the initial ingredients. The novel element to this environmentally driven idea is that it can be income generating; the efficiency revolution can and should be delivered at negative cost.

As with any new trend, pioneers can reap the benefits. Examples already exist and show that using Factor Four principles can both save expense and generate income, as well as reducing and in some cases completely removing elements of environmental impact.

The NCBS are piloting **4sight** in Northwest England in order to create best practice models and an important source of data and reference for the future.

The 4sight website

Visit **www.4sight.org.uk** to find out more about 4sight and how you can become more resource efficient. The site will be regularly updated to incorporate information and case studies on resource efficiency. It also has a 'discussion forum' where you can share your opinions and experience in this area.

CONTENTS

Page	Part	Title
2	1	Summary
4	2	Introduction: Hindsight + Vision = 4sight
6	2.1	Policies and laws push for change
8	2.2	The 4sight project
8	2.2.1	What are the key objectives of the 4sight project?
8	2.2.2	Why minerals?
9	2.2.3	What minerals?
9	2.2.4	Where are the minerals?
10	2.2.5	From rocks to rubble
10	2.2.6	Why the NW?
12	3	Mass Balance - Tracking Mineral Resources Through the Region
14	3.1	Tracking mineral resource production in the NW
14	3.2	Tracking imports to the NW
14	3.3	Tracking what's available
16	3.4	Tracking the use of mineral resources
18	4	The Impacts Caused by the Extraction, Production, Use and Disposal of Minerals
18	4.1	Tracking impacts
20	4.2	Land use and landscape
21	4.3	Ecological impacts
22	4.4	Energy impacts
23	4.5	Transport
24	4.6	Waste
25	4.7	The fate of construction and demolition waste in the NW
25	4.7.1	Recycling
25	4.7.2	Waste disposal in landfill sites
26	5	The 4sight Challenge - Building a Sustainable Region
26	5.1	Key issues for construction minerals
28	5.2	Lessons beyond the quarry
28	5.3	Achieving sustainable use of resources
29	5.4	Challenge 1: Use Less - Reduce resource inputs
30	5.5	Challenge 2: Close material loops
31	5.6	Challenge 3: Promote whole-life responsibility
32	5.7	Challenge 4: Promote integrated materials management
34	6	Notes
35	6.1	Data availability
36	6.2	Glossary of Terms
37	6.3	Bibliography

Part 1. SUMMARY

The North West region (NW) has the second largest economy in the UK, outperforming the economies of several European Member States. The demand for mineral resources in the region is considerable, particularly in construction and road building and current projections suggest that this is likely to continue for many years to come.

With few exceptions, our roads, schools, hospitals, factories, shops and houses are all dependent on mineral resources. In an expanding NW economy, we should now be questioning whether the structural materials we use to underpin that development are produced, processed and used in a sustainable way.

Rocks to Rubble provides an overview of the **4sight** project which has grappled with these very issues. It takes us on a fascinating journey through the life cycle of mineral resources in the NW. The journey takes in all the sites, from the quarries of the Lake District and the Pennines, through the region's industrial hinterlands and into the heartland of our towns and cities. At the many different stages in the life cycle the 4sight project has considered the impacts on society from the construction minerals sector. Tracking resources in this way provides a valuable insight into the key issues that affect the sector's impact on regional sustainable development.

The life cycle of construction minerals is complex and involves many players: quarries, industrial processors, manufacturers, transporters, construction companies and waste disposal operators. The 4sight project has used mass balance and other modelling tools to identify and assess the impacts associated with the various processes and operations in the life cycle of construction minerals. It has shown that there are inefficiencies and waste at every stage. The excessive exploitation of resources, the inefficient use of energy, an over-congested road transport system and poor management of waste all have a negative effect on the region's economy and the environment. As pollution and waste build up in the system there are wider implications for human health and social wellbeing which could further undermine the region's commitment to sustainable development.

In terms of environmental impacts, there are the usual suspects. For example, we know that blasting rocks out of the landscape leaves scars. But the 4sight project also has found that the NW as a whole has only five years available landfill capacity left - Greater Manchester has only four years. There are also some

surprises. For example, the NW has around 60 active quarries, yet the region is the biggest importer of aggregates (49 per cent) in England.

The over-riding concerns identified in the study are inefficiency, pollution and waste generation. It is estimated that for every tonne of construction mineral used in the NW, around 115 kg of CO_2 is released. This adds significantly to the region's burden of CO_2 and undermines regional efforts to cut global warming gases. Similarly, about 13 million tonnes of building materials are being thrown away unused from building sites in the NW. Such excesses increase unit costs of production and put unnecessary pressures on landfill capacity. It is astonishing to think that the holes created by taking rocks and sand out of the ground might one day be filled by demolition materials made from the very same minerals.

By highlighting some of the key impacts associated with minerals resource management, the 4sight project also identified sustainable solutions. Cutting the amount of over-specified and over-ordered materials would be prime candidates. There are opportunities too for closing the material loop by reusing or recycling mineral resources within the system. Using materials more efficiently reduces the demand for quarried minerals, minimises traffic flows and saves energy at every stage in the minerals life cycle.

The challenge for the NW, as well as other regions, is to promote the conversion of waste streams into resources. This is something that is beginning to happen. For example the market share of recycled aggregate was 10 per cent in 1989 and by 1999 it had increased to 18 per cent. Such activities have economic value and should be actively encouraged. From a regional economic perspective, all industries in the minerals supply chain need to consider ways of improving resource management to ensure that inefficiencies and waste do not make future development prohibitively expensive.

However, bringing about real improvements in resource efficiency may require a radical change in the way we deal with wastes and resources. Putting the whole material life cycle into the hands of "Resource Management Enterprises" (RMEs) could be a way to break down the barriers that prevent wastes being recycled back into the resource stock. RMEs could lease resources to users who would pay for the service they provide. The RME would be responsible for recovering the material and recycling it when it has ceased to fulfil its purpose. These are ideas that are already becoming a reality within sectors as diverse as carpet manufacturing and utilities.

Real improvements can and should be made in the way we process and use resources and manage waste. The 4sight project puts mineral resources and related industries in context with the region's commitment to sustainable development. But the findings of this report have implications that go beyond the construction minerals sector. There are examples of inefficient resource use in every sector of our society and we no longer have the capacity to deal with the waste created by this level of inefficiency. This report aims to persuade people that there are more effective ways of doing things. By adopting a sustainable approach to resource management we have an opportunity to slow down and possibly reverse the current rate of environmental destruction and safeguard the environment for future generations.

Part 2. INTRODUCTION: HINDSIGHT + VISION = 4SIGHT

We learn from experience. Our past mistakes are a useful guide for doing things better - next time. That's the benefit of hindsight.

Clean air, water and land are essential for sustaining life on earth. Yet throughout history we have plundered the earth's resources, polluted the air we breath and the water we drink and degraded the land on which we rely for food and shelter.

At the start of the twenty first century, society's unrestrained use of energy and materials is exerting unsustainable pressure on the natural environment. Global warming, climate change, air and water pollution, flooding, are all happening now and are having a significant effect on our lives, our health and the natural environment.

The current rate of environmental deterioration is unprecedented. The global statistics are alarming:

Atmospheric emissions of greenhouse gases have risen by 50 per cent in less than two hundred years. Experts now agree that the major source of greenhouse gas emissions is from the combustion of fossil fuels and that "the balance of evidence suggests a discernible human influence on climate".[1]

At present rates of extinction, as much as 20 per cent of the world's species could be gone within the next 20 years.[2]

45 per cent of the Earth's original forest cover has been lost, mostly during the last century.[3]

At present levels of water consumption and existing standards of mis-management, two-thirds of the world's population could experience water shortages by 2025.[4]

About 1,200 million people still lack access to clean drinking water and some 2,400 million to sanitation services. The consequences include the deaths of 3-5 million people annually from water-related diseases.[5] In cities of the developing world, one out of every four households lives in poverty and 5.8 per cent of children die before reaching the age of five years.[6]

Although the effects of environmental degradation have reached global proportions, the consequences are no less severe at home and there is growing concern that we are not doing enough to protect our own environment. In the UK:

Every household creates six tonnes of carbon dioxide every year - enough to fill six hot air balloons.[7]

The 1990s was the warmest decade in central England since records began in the 1660s.[8]

If current world level emissions of ozone depleting substances continue, the UK could expect 30,000 extra cases of skin cancer each year by 2050.[9]

England and Wales currently generates 400 million tonnes of waste per annum, most of which is landfilled.[10]

[1] Intergovernmental Panel on Climate Change, 1996

[2] World Wildlife Fund website - http://www.worldwildlife.org/

[3] The Convention on Biological Diversity website - http://www.biodiv.org/

[4] World Wildlife Fund UK - http://www.wwf.org.uk/

[5] GEO: Global Environment Outlook 3 - Past, present and future perspectives. http://www.unep.org/GEO/geo3/

[6] GEO: Global Environment Outlook 3 - Past, present and future perspectives. http://www.unep.org/GEO/geo3/

[7] Energy Saving Trust - http://www.est.co.uk/

[8] The UK Climate Impacts Programme (UKCIP) website - http://www.ukcip.org.uk/

[9] Department of Health, Health Effects of Climate Change in the UK, http://www.doh.gov.uk/

[10] DEFRA, Waste Strategy 2000 for England and Wales Part 1 & 2, 2000. http://www.defra.gov.uk/

We have the science to define the problems and the technologies to provide the solutions. Yet we continue to exploit, to pollute, to waste, as if there was no tomorrow.

Previous generations were generally unaware of the full range of impacts their activities were having on human health or the environment. This generation has no excuse. We have the science to define the problems and the technologies to provide the solutions. Yet we continue to exploit, to pollute, to waste, as if there were no tomorrow. The grim reality is that there will be no tomorrow if we continue to live the way we do now.

Advanced countries, such as ours, consume vast quantities of natural resources in a ceaseless drive to improve our standard of living. We depend on the continual supply of energy and raw materials, a viable industrial base to convert materials into goods and an efficient transport network to deliver products and services to the customer. As these products become redundant, out of date or out of fashion we simply throw them away.

At every stage in the life cycle of materials and products there are inefficiencies and waste. The exploitation of finite resources, the inefficient use of energy, an over congested road transport system and poor management of waste are generating intolerable levels of pollution and putting unsustainable pressure on the natural environment.

We need to find a different way of operating - of becoming more efficient - by doing more with less. Our survival depends on it. Doing nothing is no longer an option. We need to find a more sustainable way of living, within the constraints of planet earth.

2.1 Policies and laws push for change

In 1987 the World Commission on Environment and Development looked at various ways in which the international community could deal more effectively with environmental concerns. The Commission's findings were published in *Our Common Future*, which defines Sustainable Development as; *'that which meets the needs of the present generation without compromising the ability of future generations to meet their own needs'*.

The message was clear: our children and their children shouldn't have to pay for our profligate misuse of resources.

By adopting a sustainable approach to development we have the opportunity to slow down and possibly reverse the current rate of environmental destruction.

In Europe this has meant extending the laws on environmental protection to ensure that economic development takes full account of the environmental costs involved. For example, the EU's 6th Environmental Action Programme had key objectives on decoupling resource use from economic growth. Resource efficiency will be achieved through greater legislation, taxation and tradable permits. New and proposed European Directives will change the way we live.

Legislation in the UK and Europe will have an impact on the way we use resources:

Landfill Directive
- which has led to a tax on all wastes sent to landfill

Climate Change Levy
- taxes energy use

Aggregates Levy
- taxes virgin quarried materials

Integrated Pollution Prevention and Control (IPPC) Directive
- which controls emissions from a wide range of industrial processes

Packaging waste directive - requires producers to recover and recycle packaging waste

Waste from Electric and Electronic Equipment (WEEE) directive
- requires producers to recover and recycle electrical and electronic waste

End of Life Vehicles Directive

Sustainable development means believing in the future.

It's a paradox. Our quality of life is being undermined by the very things that improve our standard of living: industrial activity and employment, consumer products and economic growth.

The Vision for Sustainability in the NW - To be a region which uses its resources wisely, makes full use of renewable alternatives, produces minimal waste and conserves its historic environment.

Action for Sustainability (AFS) - North West Regional Assembly

The UK continues to introduce its own measures to promote sustainability. In 1994 the government published; *The UK Strategy for Sustainable Development*, which sets a number of priorities and headline indicators for sustainable development in the UK. These include climate change, resource efficiency and waste reduction as well as specific actions to reduce the use of construction minerals (virgin aggregates). Progress towards sustainability will be plotted against these indicators.

The move to an increasingly knowledge based economy will create much greater opportunities for whole systems of production and consumption to be transformed rather than changed incrementally. This will enable businesses to give consumers much greater choice while radically improving resource productivity.

"Improving resource productivity is an overriding priority"
Dti - sustainable development strategy

At a regional level, the NW is taking the lead on sustainable development. *Action for Sustainability* sets out a vision for sustainable development in the NW, together with a regional framework detailing the actions required to improve the lives of individuals and communities in the region.

Whilst every effort is being made to protect the environment at a political level, very little can be achieved without the support of the business community. Aware of the limitations of 'end of pipe' technologies, more and more companies are adopting measures to improve environmental performance overall. Waste minimisation programmes and environmental management systems (EMS), such as ISO 14001, are on the increase. Other companies are looking at whole life cycles of products and processes and working with suppliers and customers to identify areas for improvement.

There are tangible benefits in taking this approach. Improving energy efficiency or reducing waste brings down unit costs of production and increases overall business performance. As environmental regulations become ever more stringent, tracking impacts across operational activities helps identify polluting activities and where there may be weaknesses in legal compliance.

Environmental impacts are generated throughout the whole life cycle of production and use, from the extraction of raw materials, manufacture and use, through to ultimate disposal of obsolete products and materials.

The environmental benefits are many and various. Conserving energy, for example, cuts down sulphur dioxide and other pollutants from power stations, reducing waste takes some of the pressure off landfill sites, while improving transport logistics takes the pressure off the roads.

Stakeholder confidence also gets a boost. Banks and insurance companies are more likely to invest in companies with a proven environmental track record and customers in the supply chain often insist on 'green' credentials in procurement contracts. All recent surveys also indicate that consumers too are voting with their feet by buying environment-friendly products and services if the quality and price is right.

There is also added value for the region as a whole, both in terms of protecting the local environment and increasing the viability of the regional economy. Arguably those organisations that do not engage in resource efficiency, pollution control and waste reduction are hindering sustainable economic growth and missing out on potential new business opportunities.

In the transition to a more sustainable society good and bad practice is becoming more transparent. There are examples to follow and lessons to be learned. The construction industry, for example, is one of the biggest producers of waste materials, both from the construction process itself and from demolition. Many of the materials thrown away by one contractor could potentially be the raw materials for another, but there are currently few opportunities for putting the two together.

We tend to think of a life cycle in relation to living creatures, but every product - from a doughnut to a luxury sports car - uses resources and energy, and inevitably produces waste.
Duane Tolle of Battelle

Humans are currently running a huge deficit with the Earth - using over 20 per cent more natural resources each year than can be regenerated - and this figure is growing each year.

While the Ecological Footprint of the average African or Asian consumer was less than 1.4 hectares per person in 1999, the average Western European's footprint was about 5.0 hectares, and the average North American's was about 9.6 hectares.
WWF Living Planet report 2002, http://www.panda.org/livingplanet/lpr02/

Inefficiency is the crime: pollution and waste are the culprits.

2.2 The 4sight project

This is where the 4sight project comes in. The overall aim of the 4sight project is to provide the information and decision making tools necessary to establish and promote a more sustainable approach to development. More specifically it aims to persuade people that there are more effective ways of doing things better. Real improvements can and should be made in the way we process and use resources and manage waste.

By measuring industrial activities and assessing their impacts on the environment, the 4sight project is able to identify inefficiencies in the system and how these might be improved. By tracking the flow of products and materials through their life cycle, 4sight aims to provide reliable predictions of the threats and opportunities to future sustainability.

This information is vital to decision-makers who have the difficult task of developing policies and programmes that stimulate the local economy whilst ensuring that current and future development is sustainable.

2.2.1 What are the key objectives of the 4sight project?

As a starting point, the 4sight project concentrates on the flow of mineral resources throughout the NW including Cumbria, Lancashire, Cheshire, Greater Manchester and Merseyside.

The study considers all phases in the life cycle of minerals from mining and extraction, processing minerals into viable materials, the use of these materials in construction and related industries, through to the disposal of waste materials.

There's a familiar and highly appropriate mantra in business circles - if you can't measure it you can't manage it. Effective communication and co-operation between decision makers, planners, extraction companies, industry and waste managers is better served by reliable data on mineral resources. The 4sight project has defined the following objectives to support the decision-making process:

- Estimate the bulk mineral flows for the NW
- Show where and how minerals are produced and used across the region
- Develop standardised tools, methods and indicators to assess the potential impacts through the life cycle
- Identify opportunities for improving efficiencies in the life cycle of minerals
- Provide decision-makers with an overview of relevant and appropriate information that will promote a more sustainable region

The acquisition of information has been a vital component in the project, helping to create an accounting framework which can highlight ways to reduce the environmental impact of the minerals industry whilst at the same time improving cost effectiveness and mineral resource efficiencies.

Much of the resource accounting data used in this report has been published by various national and local government departments, the Regional Aggregates Working Party (RAWP), trade associations and individual businesses. Some data were not available for business confidentiality reasons, there was also anomalies in some data sets due to different accounting methods. Assumptions and conclusions take full account of these points.

2.2.2 Why minerals?

Rocks and sand are the basic minerals that provide the structural materials for the built environment in which we all live and work. With few exceptions, our roads, schools, hospitals, factories, shops and houses are made of bricks, mortar, concrete and glass, which are derived in part from rocks and sand.

The choice of minerals as the focus for the 4sight project is an interesting one. On the one hand there is an abundance of mineral resources in the UK and reserves are virtually unlimited. It's also reasonable to say that quarrying itself creates relatively few environmental impacts and generates less pollution than many of our larger industrial processes.

But there are many other impacts. For example, quarrying leaves a permanent scar on the landscape and wildlife sites are damaged. Quarries are noisy, dusty and use a lot of energy. Then there's the constant flow of haulage trucks generating pollution and disrupting rural roads as they transport their heavy loads from country to city.

More importantly, quarrying is just the first stage in a very long journey that turns rocks into motorways and sand into glass. The flow of minerals through their life cycle from quarrying through processing, product manufacture, end use and final disposal,

In the NW some 200 million tonnes of material is moved and processed every year, much of it at less than 5 per cent efficiency.

If unchecked, the impact of our actions now will make life on planet earth unsustainable for future generations.

We can learn from past mistakes but we must also understand the long term consequence of our current actions.

generates a wide range of additional environmental impacts.

What's more, the effects can be cumulative and far-reaching if not properly controlled. As pollution and waste build up in the system there are wider implications for human health and social wellbeing.

Social and environmental considerations might be reason enough to examine the minerals industry, but the economic costs of urban renewal and industrial expansion are also important. Arguably the biggest threat to the mineral resources and construction industries in the NW is the recently introduced aggregates tax. The tax is set at £1.60 a tonne which, according to the Quarry Products Association, will add £36 million to the cost of construction projects in the NW.

The government introduced the tax in an effort to encourage the reuse of redundant materials such as using demolition waste in construction projects by making virgin materials more expensive. Reducing the demand would take some of the pressure off sensitive quarry sites. The aggregates tax is just one of a number of fiscal measures now in place to encourage businesses to improve their environmental performance, reduce impacts and minimise waste.

There are over 60 quarries in the region, producing over nine million tonnes of aggregate every year and employing around 2000 people. Improvements in performance are essential if the unit cost of production is to remain competitive. Waste is produced at each stage of the lifecycle from quarrying, through to processing and construction. By conserving resources, it should be possible for this sector to dramatically improve environmental performance and at the same time to reduce costs and improve competitiveness.

2.2.3 What minerals?

Minerals in all forms, shapes and sizes are used by a variety of industries to build roads, construct houses and factories and produce a wide range of other products that make up the material infrastructure of the NW. The 4sight minerals study covers those in common use such as aggregates, building stone, clay, sand and slate.

The project traces these minerals from extraction through materials processing and end use in the construction industry through to their ultimate disposal. Waste is generated at every stage in the life cycle of minerals and can be categorised as quarry waste and dredged spoils, construction and demolition waste.

2.2.4 Where are the minerals?

The geology of the NW is as fascinating as it is varied. From the mountains of the Lake District to the plains of Cheshire and Merseyside and the coasts of Cumbria and Lancashire, there's a wide range of rocks, clays and sands that can be used for a variety of industrial and construction processes.

Cheshire
- construction sand, sand and gravel, sandstone and gritstone

Cumbria
- gypsum, limestone, sand and gravel, clay/shale/mudstone, sandstone and slate

Lancashire
- limestone, sandstone and gritstone, clay/shale/mudstone, sand and gravel

Greater Manchester and Merseyside
- sandstone and gritstone, clay/shale/mudstone, sand and gravel

The aggregates tax is 'equivalent to adding nine per cent to the cost of schools and hospitals and other improvements to public services, or 32 per cent to the cost of social housing.'
Quarry Products Association (2001)
www.qpa.org/news/21dfeb01.htm

The purpose of the landfill tax is to encourage reuse and recycling of materials by making disposal at landfill sites more expensive.

The abundance and variety of minerals in the NW played a vital role in establishing the region as the world's first successful industrial zones in the 19th century. Its coal and iron ore resources sparked the industrial revolution and built the region's economic foundation. At the start of the 21st century the region is dependent on limestone, sand, gypsum and clay to provide the basic infrastructure materials for urban growth and regeneration. The region also relies on imports of crushed rock and other mineral from the Pennines, the Peak District, Wales and Scotland.

2.2.5 From rocks to rubble

At the other end of the minerals life cycle is the disposal of demolition and other waste materials. The landfill tax, introduced in 1996 was heralded as the first environmental tax. The aim of the tax is to encourage the reuse and recycling of redundant materials by taxing waste going to landfill sites. Currently the tax on inert materials such as construction waste is £2 per tonne and adds substantially to the overall cost of building projects.

Landfilling is the government's least preferred option for disposing waste and the lowest on the waste management hierarchy. A wide range of regulations has been implemented to control and manage the volume and types of waste going to landfill.

But for the NW there is another important factor. According to estimates from the Environment Agency the NW may run out of landfill sites altogether in five years time. This means that new sites will have to be found or wastes will have to be transported out of the region for disposal. The cost of both these options is likely to inhibit future economic growth and prosperity in the region.

Mineral resources make a valuable contribution to employment and economic prosperity. Managing those resources in an efficient and cost effective way throughout the life cycle is the only way of ensuring sustainability in the long term.

2.2.6 Why the NW?

There are good reasons for considering minerals on a regional basis and, in particular, the NW.

The region has the second largest economy in the UK outperforming the economies of several European Member States. What's more, it's a growth economy. A major urban regeneration programme is underway with projections for more house building and an expansion in industrial development. This means that the demand for mineral resources is considerable, particularly in construction and road building. The NW is the biggest net importer of aggregates in the UK and current projections suggest that this is likely to continue for many years to come.

By contrast, the NW also boasts some the UK's most magnificent landscapes and pristine wildlife habitats. The Lake District National Park, parts of the Yorkshire Dales National Park and the north-west fringe of the Peak District National Park are within the region's boundaries, amounting to almost 2,600km^2, over 18 per cent of the land area. A further 1,583km^2 (11.2 per cent) of the NW is designated as Areas of Outstanding Natural Beauty (AONB).

The NW region contains nationally and internationally important nature conservation sites:

4 Areas of outstanding natural beauty (AONB)

15 internationally protected RAMSAR sites

431 Sites of Special Scientific Interest (SSSI)

1 Heritage Coast

32 National Nature Reserves (NNR)

It is indicative of poor minerals management that most of the rock we take out of the ground ends up as rubble in a landfill site 60 years later.

Two-thirds of the region is considered rural yet most of the population lives in a few large conurbations. The potential conflicts of interest require long-term policies to ensure that future development is sustainable. For example, quarrying is undertaken in the region's two national parks and other areas of natural beauty that puts the industry in conflict with the tourism industry and wildlife conservation.

Regional policies must take full account of the range of interests that make the NW special. In terms of future development policies it is generally acknowledged that:

There is a high demand for minerals in the NW, particularly from the construction industry

The NW is a major producer of minerals and aggregates and the biggest net importer of aggregates (crushed rock) in the UK

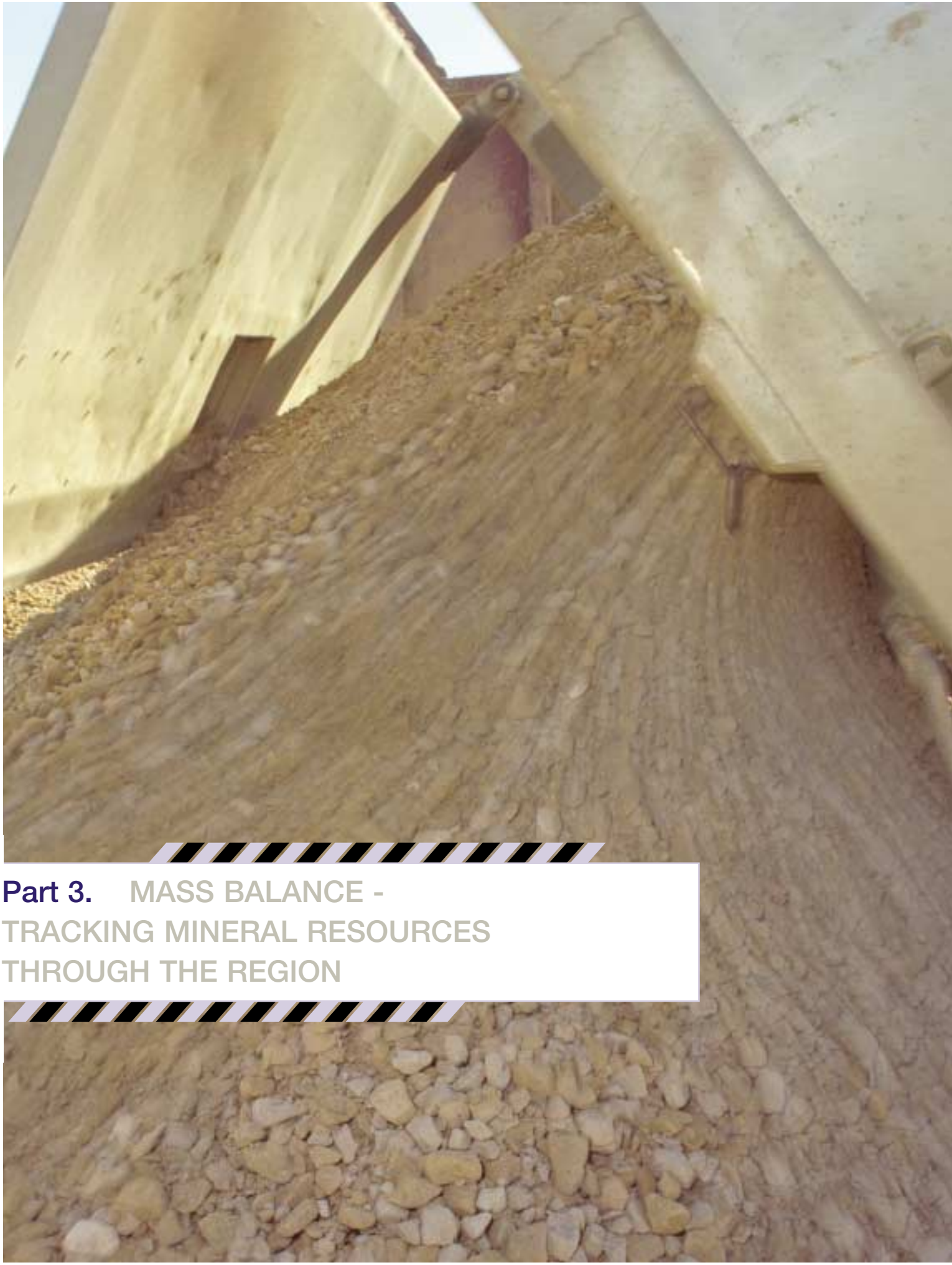
Very little is known of the full environmental costs of minerals flows

The recently introduced Aggregate Tax is likely to raise the cost of aggregates which in turn will increase building costs

Similarly, the combination of landfill taxes, rising amounts of waste and fewer landfill sites in the longer term will result in higher waste disposal costs

The combination of these and other factors means that the flow of minerals, the production of building products and the disposal of waste are likely to have a significant effect on future development in the NW.

Increased regional autonomy allows for greater local accountability and transparency in regional decision making. It also means that the region's policy-makers have greater autonomy in deciding how these issues are addressed. Sustainable development is being incorporated into regional policies, for example the regional economic strategy and regional planning guidance both contain commitments to sustainable development. 4sight provides the necessary information to help policy-makers deliver on those commitments.



Part 3. MASS BALANCE - TRACKING MINERAL RESOURCES THROUGH THE REGION

Tracking minerals from exploitation through to end use and final disposal provides vital information about the levels of efficiency in the system and opportunities for improving the management of the region's natural resources.

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The mass of minerals or raw materials inputs into a system is balanced by the mass of products and waste outputs leaving the system. 'Mass balance' is the term used to define this process.

In the NW, mineral resources are extracted, manufactured into products, used and disposed of. Waste materials are generated at each stage in the process and some obsolete materials are either reused or recycled in some way.

The 4sight project uses the mass balance model to track and measure mineral resources through their life cycle, including waste materials. The model provides valuable information about the management of resources in the NW. It identifies inefficiencies in the processing and movement of those resources and where performance can be improved.

31.4 million tonnes of resources

31.4 million tonnes of waste and products

Mass balance -
What goes in must come out.

Mass is neither created nor destroyed.

3.1 Tracking mineral resource production in the NW

The total tonnage of all construction minerals excavated in the NW in 1999 was 21.35 million tonnes. This figure includes aggregates and other construction minerals as well as limestone and sand used in industrial processes.

The breakdown is as follows:

	(000)tonnes
Limestone (used as aggregate)	6,000
Limestone (non-aggregate use)	2,900
Sandstone/gritstone igneous	5,220
High Specification Aggregate[3] (HSA)	500
Slate[4]	80
Clay/shale/mudstone	700
Gypsum[4]	300
Sand & Gravel[5]	4,340
Industrial sand	1,310
Total	**21,350**
Imports	10,600

NW production and import of construction mineral

3.2 Tracking imports to the NW

The NW is the biggest net importer of aggregates (49 per cent) of any region in England. The next biggest importer is the South East with just 20 per cent imports. Other regions import less than 10 per cent or are net exporters of aggregates[11].

Material, including sand and gravel, crushed rock and marine sands, is imported from North Wales,Yorkshire Dales and the Peak District. Crushed rock makes up the largest portion of imports to the NW region and is the principal material used in construction.

The NW is highly dependent on supplies of construction minerals from the Peak District, the Yorkshire Dales and the Lake District National Parks. Care must be taken to balance the need for quarrying against the amenity value of these areas.

3.3 Tracking what's available

Landbanks are there to ensure that adequate reserves are available to meet future demand for minerals.

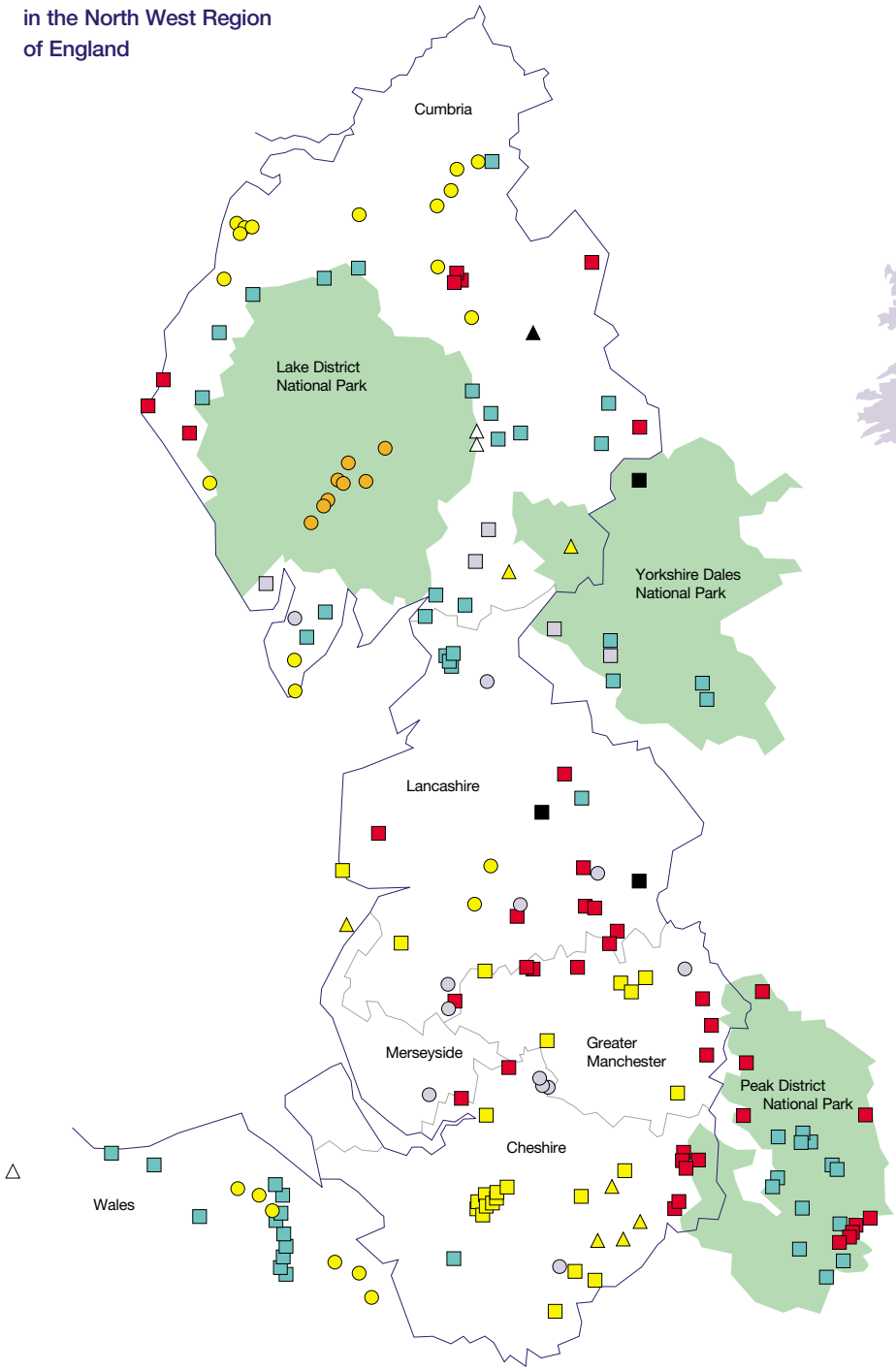
Mineral Local Plans are run for a ten year period but must provide for a constant ten year supply of material. In other words, there must still be a 10 year landbank remaining at the end of the ten years covered by the plan.

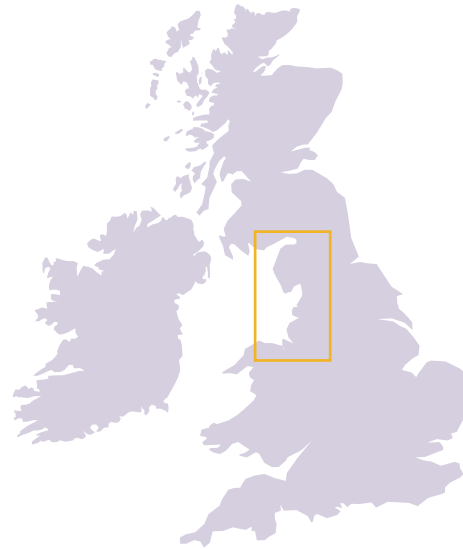
The latest Mineral Planning Guidance document (MPG6) suggests a landbank of at least seven years for sand and gravel, and longer than that for crushed rock (usually at least ten years).

Whilst landbanks do play an important role in ensuring availability of minerals for future demand, there is also a need to ensure that guaranteed reserves do not actively discourage options for conserving and reusing redundant materials or for using alternative materials. The size of the landbank and the existence of a policy to maintain one, makes it extremely difficult to alter existing patterns of supply.

[11] Department of the Environment, Transport and the Regions, 2000a

Location and nature of quarrying activity in the North West Region of England





Minerals

- Limestone
- Sandstone/gritstone
- High spec. aggregate
- Granite
- Building stone
- Gypsum
- Clay/shale/mudstone
- Sand
- Sand & gravel
- Industrial sand
- Slate

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3.4 Tracking the use of mineral resources

The construction industry accounts for over 90 per cent of mineral consumption and, of this, one-third is used in road construction. Other uses include buildings and railways, and manufacturing of cement, lime and plaster, and a variety of other products such as glass and ceramics[12].

Some of the key mineral products used in the NW include:

Limestone

Predominantly used for roadstone or concrete/cement purposes, though high purity limestone is used in the Flue Gas Desulphurisation (FGD) process at coal-fired power stations. It is also used in the steel processing industry.

Sandstone/gritstone

Similar end-uses as limestone (though not used for cement). Some sandstone quarries lay dormant for years and reopen for specific contracts.

High specification aggregates (HSA)

Due to a high polished stone value (psv) this sub-category of mineral tends to have high-grade use in road building (due to useful anti-skid properties). Deposits are currently worked in the Yorkshire Dales and Cumbria.

Granite

There is only one high quality granite site in the NW region. Significant quantities are imported from Scotland and sites in the national parks outside the NW. Igneous rock for railway ballast is imported from North Wales (Penmaenmawr).

Building stone

There is a growing market for natural building stone and flags for urban development and design across the UK. However, the quantity used is relatively small compared to other minerals and was not covered in any great detail in the 4sight project.

Sand and Gravel

Construction sand is used in mortar, and concrete. It is also used in asphalt production and as a fill material. Cheshire and Lancashire are the main sources of sand and gravel for the region.

Slate

Slate is typically used for roofing and flooring. In the NW, it is currently quarried predominantly in the Lake District, and tends to supply a local market (though small amounts of ornamental slate are also exported from the region). Stone slates are durable and reusable and can last hundreds of years. Slate extraction uses low-level technology, is labour intensive and tends to produce substantial amounts of waste material.

Clay and shale and mudstone

This grouping of minerals is predominantly used for tiling or bricks, with the quality/type of product dependent on the characteristics of the raw material used. Mudstone and clay are also used in construction and engineering mainly as constructional fill. Clay has useful containment properties and is, therefore, used as a source of 'engineering' material within landfill sites. Clay pits are themselves used as landfill sites, though this may not always be a desirable option, particularly as there is concern that some clay pits are being excavated for their value as landfill sites rather than for their clay product.

Gypsum

Estimates suggest that 300,000 tonnes of gypsum is used in the production of plasterboard in the UK .

Industrial sand

Industrial sand is used in foundries and glass manufacture. Sites of industrial sand extraction can also contain poorer quality sands that are used for more general aggregate purposes.

Secondary materials

Secondary materials, which are wastes left over from industrial processes such as blast furnace slag, pulverised fuel ash (PFA) and incinerator bottom ash, can also be used as construction material. PFA, for example, is used in road construction and in several construction applications such as lightweight aggregate manufacture, cement replacement, additive in concrete, and brick manufacture.

[12] European Commission, 2000
[13] National Statistics, 2000
[14] British Geological Survey, 2000.

Incinerator bottom ash is used for fill, or as aggregate for asphalt and concrete building blocks. Desulphogypsum is derived from the FGD process and can replace the use of natural gypsum at the British Gypsum plant. Opportunities to exploit this valuable resource are currently being considered at Fiddlers Ferry.

Reusing industrial waste as primary building materials fulfils all the sustainable development criteria: the reuse of wastes saves disposal costs and replaces primary materials, reduces the potential polluting impacts of disposing of these materials and provides opportunities for employment. 4

Key

Houses - minerals used in construction of housing

Roads - minerals used in construction of roads

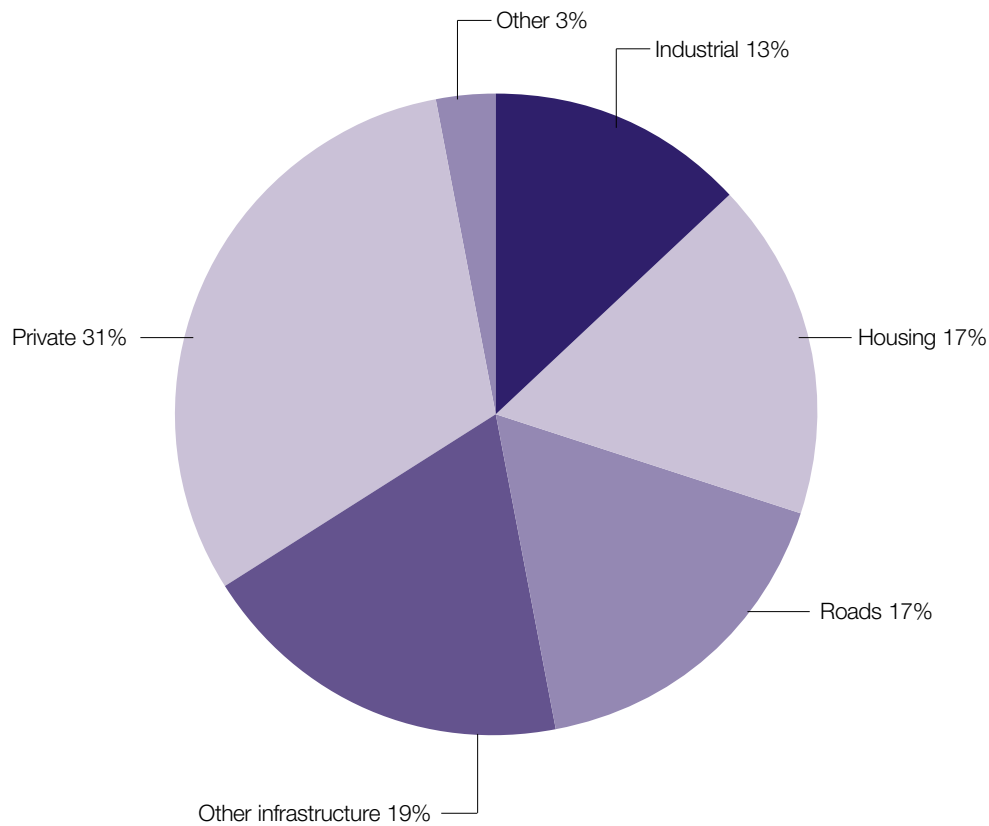
Other infrastructure - minerals used in production of additional infrastructure, for example, sewage treatment works, flood defences, rail, etc

Private - minerals used for commercial and industrial infrastructure

Industrial - used in industrial processes, for example limestone used in cement

Other - not included in above categories

Use of construction minerals in the NW



Part 4. THE IMPACTS CAUSED BY THE EXTRACTION, PRODUCTION, USE AND DISPOSAL OF MINERALS

Sustainable development means taking account not only of society's needs today but recognising the interests of future generations and their economic, social and environmental wellbeing.

4.1 Tracking impacts

There is an abundance of mineral resources in the UK. Current reserves of aggregates, sand and clay are more than sufficient to build the infrastructures that NW communities need now and in the future. In an expanding NW economy, the issue is whether the structural materials we use to underpin that development are produced, processed and used in a sustainable way.

Here we have to consider a wide range of related issues: the use of land, the consumption of energy, heavy traffic congestion, noise and so on. Perhaps more importantly, we need to assess whether the environment can continue to absorb the vast amounts of pollution and waste that are generated when we take a rock out of the ground or put a roof over our heads.

One of the key concerns is the continual rise in carbon dioxide and other greenhouse gases that are causing the Earth to heat up. Industrialised countries provisionally agreed at the Kyoto Summit to cut overall emissions of carbon dioxide by 5.2 per cent by 2012 from 1990 levels. The revised agreement reached at Bonn in 2001 by around 180 countries will actually cut overall levels by only 2 per cent due largely to the failure of the US government to take part. The UK Government has promised a cut of 20 per cent.

Tracking minerals from a hole in the ground to a construction site or a motorway is a long and often complex process involving many players: quarries, industrial processors, manufacturers, transporters and construction companies - not forgetting the waste management companies that deal with redundant materials and demolition waste when materials reach the end of their useful life.

This section reports on the 4sight assessment of the range of environmental impacts at each stage in the life cycle of minerals from initial excavation through the various production processes to end use and final disposal. The project considered the conflicts of interest from different land users, the impacts on wildlife habitats and the implications of global warming and the wider environment. It examined the planning process and other regulatory regimes that are addressing sustainability issues in the minerals and construction industries.

Sustainable development means taking account not only of society's needs today but recognising the interests of future generations and their economic, social and environmental wellbeing. The following impacts are discussed:

Land use and landscape

Mines and quarries disfigure the natural landscape. This is a particular problem in national parks and other areas of natural beauty that support the tourism industry. The dust, noise, vibration and traffic associated with quarrying are also a constant problem for local residents.

Ecological impacts

Wildlife habitats are frequently damaged and often destroyed resulting in a loss of flora and fauna. Noise, dust and general site operations can also inhibit wildlife activities. When redundant mineral workings are abandoned, nature reclaims its own, so that longer term impacts may be small. Some sites are landscaped for that purpose.

Energy

Most of our energy is produced by burning fossil fuels that release carbon dioxide (CO_2) into the atmosphere. The build up of CO_2 contributes to global 'climate change'. An estimated 7 per cent of the total NW energy use is attributable to the production of building materials including cement, bricks, blocks and plasterboard.

Transport

Even where distances travelled are relatively short the haulage of construction materials causes congestion, damages roads and generates significant environmental impacts.

Waste

Waste is generated at every stage in the life cycle of minerals.

Planning regulations control the location, scale and active life of quarries. The regulations aim to strike a balance between the various interests that help protect a region's natural assets whilst ensuring adequate provision for minerals extraction.

4.2 Land use and landscape

The NW is valued at local, national and international levels for its magnificent landscapes and diverse ecology. The Lake District National Park and parts of the Peak District and Yorkshire Dales National Parks are within its boundaries.

The regional economy benefits from this national asset. Farming and other agri-businesses, together with a range of service industries, are net contributors to the economy that help to maintain a viable network of local communities.

Not surprisingly, tourism is one of the region's biggest and most successful industries. The tourism industry makes a vital contribution to the regional economy by supporting local business and contributing to the cultural heritage of the region. Tourists spend around £5.5 billion in the NW every year, which supports around 250,000 jobs. A large proportion of the money and the jobs help to maintain rural areas.

By contrast, quarrying permanently disfigures the natural landscape and damages wildlife habitats. The intrusive impacts of quarrying and the indelible scars in the landscape are a disincentive to tourists. Noise, dust, vibration and large volumes of heavy traffic also present problems for tourists and those local communities living close to active quarry sites.

Planning regulations control the location, scale and active life of quarries. The regulations aim to strike a balance between the various interests that help protect natural assets whilst ensuring adequate provision for minerals extraction. Local economic interests are not the only concern of planners or national policy makers. For example, Government policy advises that planning decisions should favour conservation of the natural beauty of the landscape in National Parks and important wildlife areas.

Yet future structural development in the NW depends on the availability of mineral resources from our national parks and other areas of natural beauty. The region is highly dependent upon imports of construction minerals from surrounding National Parks.

Importing material from other regions or other countries

involves trade-offs between transport, materials handling and environmental constraints. Similar problems are created elsewhere and may not be an option in the long term. For example, in an intervention by the Secretary of State in the application to extend Spaunton Quarry in the North Yorkshire Moors[15], it was decided that local economic interests were not sufficient grounds to justify degradation of the natural assets of the Park. The judgement came down in favour of protecting the Moors in the national interest[16].

In response to growing pressure to protect sensitive sites, the three largest quarry operators in the UK have renounced long-held rights at several National Park sites, concentrating their efforts instead in less vulnerable areas.

Given the range of regulatory controls now in place, the conflicting interests of other land users and the growing concerns to protect the natural environment, quarry companies are beginning to consider ways of reducing their environmental impacts and to take account of the wider issues of national interest and sustainability.

[15] Yorkshire Dales NPA (1998)

[16] Weston et al, 1999

Approximately 10% of all UK crushed rock aggregates are provided by the National Parks, of which the Peak District provides 42% and the Yorkshire Dales 34%.

The North West is highly dependent on aggregates and other mineral from the Peak District, the Yorkshire Dales and the Lake District National Parks.

4.3 Ecological impacts

Minerals occur naturally in the environment and shape the region's distinct topographical features. Our mountains, rivers, lakes, valleys and even the coastline owe everything to the underlying rocks and sand that have shaped the familiar NW landscape over millions of years. The natural weathering of these minerals form the soils and muds that support the wide range of plants and trees and other vegetation and provide habitats for wildlife.

The diversity of the region's natural ecology is a national asset and many areas are protected in law from unwarranted exploitation and damage. The ecological value of these sites is irreplaceable which is why they are protected.

For the most part, sandstone, slate, limestone, sand and gravel and other minerals used in construction are quarried outside these protected areas. The minerals are inert which means that exploitation itself presents few risks to the natural environment. Most of the impacts associated with minerals are related to the transportation, processing and end use of products and the disposal of waste materials.

Yet wildlife and natural landscapes are important to us, not just for the aesthetic pleasure of seeing birds, plants and animals in the wild but also for the sense of wellbeing we derive from the totality of the natural world. By digging holes in the ground and laying acres of concrete and miles of tarmac we lose some of that.

Ecological impacts occur at various stages in the construction mineral life cycle:

In quarrying -
contamination is most likely to occur during quarry operations when dust and other emissions are dispersed on the land, which can change soil chemistry and affect the growth and spread of natural vegetation. Similarly, site run-off will contain high levels of dust and other suspended materials that can have a detrimental effect on aquatic life in local rivers and streams. Quarrying can also affect the hydrology of local lakes and rivers and alter the water table which further affects local aquatic life.

When redundant mineral workings are abandoned sites are recolonised by vegetation and marine life returns to rivers and streams. Some sites are actually reclaimed for the purpose of improving local wildlife habitats. However, given that quarrying has been and will continue to be a major landuse activity it could be argued that nature's balance sheet is always in deficit.

During processing and production of minerals -
minerals processing plants and construction sites generate their own ecological impacts, depending on the type of minerals, the processes involved and end use.
The most obvious impacts are those relating to land use, for example, when construction sites take over wildlife habitats. As with quarry sites, planning regulations are in place to protect the most vulnerable habitats from intrusive development.

Other ecological impacts generated by industrial and construction processes include dust, noise and discharges of polluting substances that can have a detrimental impact on human health and the natural environment.

During secondary and recycling activity -
some construction materials are reused or recycled when buildings are demolished. Secondary processing plays a valuable role in helping to minimise the need for primary resources and reduces the amount of demolition waste going to landfill sites. Storing and processing secondary materials generates similar impacts as those relating to quarrying and primary production as outlined above, although to a much less extent.

Energy accounts for 92% of UK CO_2 emissions, and is the most significant man-made greenhouse gas emission, accounting for 80% of global warming potential.

4.4 Energy impacts

Most of our energy is produced by burning fossil fuels such as coal, oil and gas, that release carbon dioxide (CO_2) and other polluting gases. The build up of these gases in the atmosphere creates a 'greenhouse effect' and the resulting increase in global temperatures has contributed to climate change effects, including melting polar ice caps, rising sea levels and significant changes in climate patterns both locally and globally.

According to recent studies, the NW has witnessed significant changes in climate with temperatures rising on average by 0.4°C between 1988 and 1997. Winter rainfall is predicted to increase by between 6 per cent and 14 per cent over the next 50 years, whilst summer rainfall may be reduced by up to 10 per cent over the same period.

Carbon dioxide is not the most potent of the greenhouse gases but, because of the huge quantities we generate, it is the most harmful. The 4sight project therefore assessed energy and CO_2 emissions (expresses in tonnes), throughout the life cycle of minerals from primary production through to end use and disposal.

Energy (for heating, lighting, power and for transport) is used at every stage in the minerals extraction and production cycle, either directly in the form of fossil fuels such as gas and oil or indirectly as electricity, of which a high proportion is also derived from fossil-fuelled power stations.

In quarrying - quarrying is an energy-intensive industry, although the amount of energy used is dependent on the minerals being extracted and processed at each quarry site.

It has been estimated that energy used in recycling would be 75 per cent that used at a limestone quarry .

In construction - most mineral resources are either processed or used directly in building construction, road building and other infrastructure development.

The amount of energy used in construction is considerably larger than for the other stages of the construction minerals life-cycle.

In processing and products - minerals processing and the production of construction materials rely heavily on energy either directly by burning oil, coal and gas to generate heat or indirectly by using electricity to generate heat and power.

Cement and glass, two of the most common materials used in construction, consume the most energy during their manufacture.

Carbon dioxide is produced as a by-product during cement manufacture. At the Castle Cement works at Ribblesdale, 1.9 million tonnes of limestone is used to produce 1.4 million tonnes of cement, and around 0.5 million tonnes of CO_2 is driven off. This is in addition to the CO_2 emitted from the energy used in the production process.

	Total energy used	Total CO_2 generated (000 t)
Quarrying the construction minerals used in the NW	361.7	140.3
Construction activities in the NW	3,370	1,043
Transport		162.3

Estimated energy input and CO_2 emissions in quarrying, construction and transport of construction minerals in the NW.

For the NW, the predicted impacts of global warming and climate change are more floods in winter and more droughts in summer.

About 10 per cent of UK energy is consumed in the production and transport of construction materials.

Moving a tonne of freight by rail produces 80 per cent less carbon dioxide than moving it by road.[18]

4.5 Transport

Economic growth and social wellbeing in the NW is dependent on an effective and well-maintained transport infrastructure of roads, railways, waterways and air routes.

We depend on lorries to carry around 65 per cent of all freight transported (in tonne-kilometres), compared with only 7 per cent by rail. In the last ten years heavy goods vehicle (HGV) traffic has increased by 38 per cent (DETR).

The continuing growth of traffic on our roads has increased the number of accidents, raised levels of pollution and noise and led to unacceptable levels of congestion. A glance at the key indicators of sustainability - economic, social and environmental - suggests that the current traffic levels are unacceptable and projected rates of growth unsustainable:

From an economic perspective: The Confederation of British Industry estimates that current congestion levels, mainly on roads, cost the UK economy around £20 billion a year. European research suggests that the total external costs of transport (accidents, pollution, climate change, congestion and noise) amount to nearly 10 per cent of GDP. The health impacts of traffic pollution alone cost £11.1bn each year, according to the Environmental Transport Association.

From a social perspective: Exhaust gases from burning diesel oil can have a serious impact on human health and the environment. For example, carbon monoxide (CO), smoke and small particulates, often referred to as PM10, are harmful to the respiratory and cardiovascular systems. Nitrogen oxides are also toxic and can damage the respiratory system. Children and old people are most at risk.

From an environmental perspective: Transport is responsible for over 30 per cent of UK energy consumption. Exhaust emissions are particularly harmful to the environment. Sulphur dioxide and nitrous oxides are highly corrosive and are responsible for acid rain that damages buildings, crops and wildlife habitats. Transport's share of UK greenhouse gas emissions is expected to continue to rise over 26 per cent by 2010. The Royal Commission on Environmental Pollution argues that we need to cut greenhouse gas emissions globally by 60 per cent by 2050 if we are to avoid catastrophic climate change.

The minerals industry relies heavily on lorries to transport minerals from quarries to industrial processing plants or construction sites, and to dispose of demolition and redundant materials in landfill sites.

On-site quarry traffic such as diggers and dumper trucks present few problems other than those relating to local pollution, noise and dust. Transporting aggregates and other minerals from quarry sites is a different matter. Air pollution, noise, vibration, congestion and the physical damage to road networks all contribute to the general deterioration of the environment and affect our quality of life.

Heavy lorries on minor roads in country areas, which is where most quarry sites are located, is a particular problem for rural communities. According to the Council for the Protection of Rural England (CPRE), the physical size of some lorries inhibits other road users and pedestrians and damages country lanes. The situation is exacerbated in national parks and other tourist attractions where seasonal traffic levels are much higher.

Of all the impacts currently generated by heavy traffic, one of the most worrying is the continual rise in CO_2 emissions and the effect on global warming. The amount of CO_2 emitted while transporting minerals in the NW is estimated to be over 160,000 tonnes. This is significantly higher than the 140,800 tonnes of CO_2 emitted from all quarry operations in the NW.

A quarry with an annual output of 1 Mt will generate around 220 daily lorry loads.[19]

Estimated figures for daily HGV movements (1996)[20]:
1600 - Yorkshire Dales;
1400 - Peak District

Recent research indicates that heavy goods vehicles only pay for 59-69 per cent of the costs they impose upon society.[21]

[18] Railfuture - http://www.railfuture.org.uk/why2.shtml

[19] Weston et al, 1999

[20] Weston et al, 1999

[21] English Welsh and Scottish Railways, 1999

The NW has only 5 years available landfill capacity left - Greater Manchester could run out of landfill sites in 4 years.

4.6 Waste

For every tonne of useful products made in the UK, an estimated 10 tonnes of raw materials and energy are consumed. A high proportion of materials used, including most of the products themselves, ultimately end up as waste. Waste means inefficiency and we all pay for it several times over.

We pay for materials we don't need or use, and pay again when we dispose of them. Then there are the hidden social and environmental costs - pollution, wasted energy, wasted journeys, wasted time, effort and money.

Waste is generated at every stage in the life cycle of minerals, from extraction through to processing, construction and end use. Waste can take many forms: unused minerals or spoils, bi-products of a production process, surplus products and demolition waste.

A significant proportion of the 72 million tonnes of construction and demolition waste generated each year in the UK ends up in landfill sites. But landfill sites are becoming a scarce resource. The Environment Agency's strategic waste management assessment indicates that the NW has only five years available landfill capacity left - Greater Manchester has only four years capacity left.

The shortage of landfill space has forced the UK Government to introduce a landfill tax that adds substantially to overall disposal costs and is designed to discourage people from generating unnecessary waste. The diminishing amount of available landfill space means that waste disposal costs will continue to rise in the coming years.

Construction mineral waste is produced in a number of ways, including:

Quarry waste

Exploiting good quality minerals generates a significant amount of poor quality waste material or 'spoil'. Estimates suggest that as much as 27 per cent of quarried material remains on site as debris or spoil. There is little incentive for quarry operators to reduce the amount of waste they generate.

Waste in processes and products

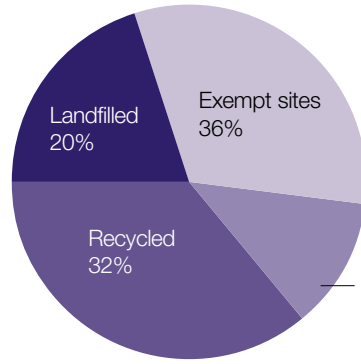
Most minerals are inert and their structural properties remain largely unaltered in the production of construction materials. As such they can usually be fed back directly into the production process. Mis-shaped bricks, for example, can be re-incorporated into the blending process to make new bricks: very little is wasted. Basic raw materials such as clay can also be blended with other secondary materials such as power station fly ash and coke breeze, to make breeze blocks. Industrial sand used in foundries and glass manufacture can also be reused with poorer quality sands used for general aggregate purposes. Similarly, crushed rocks and other aggregates generate little waste during production.

Waste in construction and demolition (C&D)

Most construction waste arises on construction sites or during demolition. The Environment Agency estimates that construction and demolition waste accounts for 17 per cent of the 420 million tonnes of waste arisings in the UK. About one-third of all C&D waste, 24 million tonnes, is brick and concrete waste. Government statistics also indicate that 13 Mt of material is being thrown away from construction projects unused, largely as a result of inefficiencies and poor site practice. Applying this pro-rata to the NW, the region would be accountable for about 1.3 Mt of unused building materials being wasted.

Waste arisings from C&D amounts to over 10 million tonnes per year in the NW, or around 14 per cent of the national figure. In the NW about 3.24 million tonnes (or 32 per cent of total C&D waste arisings) are recycled. This compares poorly with other European countries. For example, the German national recycling rate in 1996 was 70 per cent, with 58 million tonnes being recycled from 83 million tonnes construction and demolition waste .

Reusing old bricks is 400 times more efficient than crushing bricks for use as aggregate. Yet over 2 billion reclaimable bricks are landfilled in the UK every year.



The fate of construction and demolition waste in the NW

4.7 The fate of construction and demolition waste

4.7.1 Recycling

Most construction and demolition waste is inert and suitable for a variety of uses. Some materials, such as reclaimed bricks can be reused. Soil, removed during site excavation can be used for landscaping. Demolition waste can be reprocessed for use as aggregate in new construction or road-building projects. Secondary materials left over from other industrial processes such as blast furnace slag can also be used as primary construction materials.

In the UK, Minerals Planning Guidance (MPG 6) sets a target of 55 Mt for use of recycled and secondary material by 2006, an increase of 15 Mt from levels set in 1989. The UK will need to increase the current rates of recycling and secondary aggregate use considerably over the next few years in order to meet these targets.

A good example of reuse involves road planings. These are bituminous materials removed from roads, car park surfaces, footpaths and other hard standings under repair. It is highly cost effective and common practice to reuse road planing.

4.7.2 Waste disposal in landfill sites

The UK currently disposes more than 80 per cent of all municipal waste in landfill sites. According to research carried out by the Environment Agency, the NW is likely to run out of landfill sites, or voids, in about five years and there are similar shortages elsewhere in the UK. Our dependency on landfill is unsustainable and the scarcity of available void space poses serious problem for waste management in the future.

Landfilling waste from construction and demolition sites is the least efficient and least sustainable waste management practice. The introduction of the landfill tax and the rising cost of landfilling also makes disposal an increasingly expensive option.

Over 260,000 tonnes of clean soil and rock and 6,000 tonnes of uncontaminated C&D waste, all of which could be put to beneficial use, end up in landfill sites. A further 1 million tonnes of mixed C&D waste and soil are also landfilled, suggesting that segregating these materials on site is not common practice, despite the increasing costs of disposal. A further 600,000 tonnes of soil and C&D waste is mixed with contaminated materials which leaves no alternative but to landfill these materials.

The largest category is mixed waste, highlighting the common practice of disposing of mixed building wastes and soil from the construction industry. Using these and other C&D wastes as cheap fill material denies the opportunity of reusing or recycling these materials.

The introduction of the landfill tax and changes in the waste management licensing regulations has had a significant impact on C&D waste management practices. In the NW, C&D and other inactive waste material disposed to landfill in 1999 amounted to 1.2 million tonnes, less than half the amount disposed the previous year. Some of this is accounted for by improved materials segregation on site, although a high proportion of demolition waste ends up in tax-exempt sites.

Some landfill sites are exempt from tax if there is a perceived benefit from filling in the void space either for agricultural, environmental or for recreational purposes. Soils used for lining or landscaping purposes at landfill sites are also exempt from landfill tax in some circumstances.

The Environment Agency estimates that there are around 5,800 sites that are exempt from landfill tax in the UK. The NW has the highest percentage of waste going to tax-exempt sites (18 per cent) of any region. These sites can act as a disincentive to recycling and reuse of redundant materials because construction companies and waste disposal operators do not have to pay the levy.

The high levels of mixed material going to exempt and landfill sites would suggest that opportunities exist for increased segregation and more beneficial use of construction and demolition wastes.

Clean, unmixed C&D waste	6000t
Mixed and/or contaminated C&D waste	218,000t
Clean soil and/or rock	263,000t
Mixed and/or contaminated soil	390,000t
Mixed C&D waste/soil	1,078,000t
Unspecified	94,000t

Regional estimates of C&D waste and soil landfilled as waste - 2.049 Mt

Part 5. THE 4SIGHT CHALLENGE - BUILDING A SUSTAINABLE REGION

It is estimated that for every tonne of construction mineral used in the NW, around 115 kg of CO_2 is released

5.1 Key issues for construction minerals

The NW region uses significant quantities of construction minerals each year. In 1999 this amounted to over 31 million tonnes of material, corresponding to well over 4.5 tonnes (about the weight of the average adult elephant) per head of population. In addition:

A large amount of this material is quarried in the National Parks, where impacts on amenity and on the tourism economy are much greater than if the material were quarried elsewhere.

An extra 13 million tonnes of material was disturbed by quarrying activity but remained on site unused.

Recycled materials make up only 12 per cent of the total construction minerals used by the NW.

One-third (10 million tonnes) of the material used ends up as waste - enough material for over 40,000 new houses.

An estimated 1.3 million tonnes of construction materials are thrown away unused on construction sites in the NW.

Only 32 per cent of waste construction minerals are recycled, which compares poorly with other parts of Europe where recycling rates as high as 70 per cent have been achieved.

[24] Ecological Footprint - To get the resources we need (wood, rocks, water) we need the land that contains them. In the same way, we need land to deal with our wastes - landfill for solid waste and trees to absorb carbon dioxide. For every activity we can map out how much land we need to fulfil that activity. This is expressed as an 'ecological footprint'.

But the most significant issues are those associated with transport, energy and land use. The scale of these impacts can be represented by the 'ecological footprint', the overall land area needed to provide the resources and absorb the pollution from a particular activity. The total 'ecological footprint'[24] arising from the use of construction minerals in the NW region amounts to 340 km^2, which is 2.5 per cent of the total area of the NW region.

Carbon dioxide emissions result from fossil fuels used to provide energy and transport. It is estimated that for every tonne of construction mineral used in the NW, around 115 kg of CO_2 is released. Of this, one-quarter is from transport, two-thirds from processing of cement, bricks and blocks, and the remainder from minerals extraction. There are also indirect impacts of transport, including air emissions, dust, noise, vibration and the ecological impacts of road infrastructure.

Unfortunately we do not consider the 'whole life impacts' of the choices we make on resource use. This may need changes to taxation systems to ensure that the cost of resources are closer to the true life-time costs.

Some of the impacts of resource use may only be seen if we take a longer-term view. The product of construction mineral use is an increasing urban infrastructure. 100-year scenario projections show a wide range of possibilities. One of the more frightening possibilities is under a high economic growth and low environmental constraint scenario, where floor space and infrastructure rises as a proportion of economic growth. If this were to occur, then cumulative build-up in the urban system could amount to over 3 billion tonnes, enough to cover the entire region with hardstanding material to a depth of 250 mm.

Construction minerals and land use

In the NW we use over 30 million tonnes of construction minerals per year and generate just over 10 million tonnes of waste. The remaining 20 million tonnes accumulates in our society as buildings and other infrastructure - it has been estimated that the rate at which we convert nature to an urban environment for human society is some 390 hectares per year (0.03 per cent of the region).

What is waste?

"... superfluous, left over, no longer serving a purpose."

5.2 Lessons beyond the quarry

Improving the sustainability of the region will rely on finding solutions to the significant issues associated with the use of construction minerals. However, many of these issues apply to the use of other resources. The 4sight project looks at how the region can start to reduce the amount of resources it uses in order to reduce the resulting impacts on sustainability.

This may require the use of new technologies for processing materials as well as changes to policies, regulations and specifications relating to how materials are used. But the biggest change will have to be in the way we think about resources and waste. It will mean no longer treating resources and wastes as separate issues but regarding them both as potential resources. The definition of 'waste' is currently an ongoing debate within the EU Community[25]. It is a matter of concern that there is no satisfactory definition to determine when a material becomes waste, and then when waste again becomes an economic item.

5.3 Achieving sustainable use of resources

The 4sight project poses a number of challenges for the NW region in order for it to achieve more sustainable resource use. These challenges apply to all resource use, not just construction minerals.

In the move towards sustainability, the region will need to:

1. Use less - reduce resource inputs (for example, cutting the 13 million tonnes of materials delivered each year to construction sites and thrown away unused)

2. Close material loops (by moving away from using resources to make waste and looking at ways to reuse and recycle resources within the system)

3. Promote whole-life responsibility to minimise environmental impacts (for example, impacts of energy use, pollution and biodiversity)

4. Promote integrated materials management to facilitate the reuse of wastes

The following sections describe these challenges in more detail and provide examples where they are starting to happen.

Dictionary definition of waste
"... materials and products that are obsolete should be termed residues rather than wastes, and it should be recognized that wastes are merely residues that our economy has not yet learned to use efficiently."
Graedel and Allenby, 1994

Recycling is only a partial answer and ultimately recycling and reduced raw material inputs will need to be operated in tandem.

5.4 Challenge 1: Use Less - Reduce resource inputs

Mass balance analysis shows that the conversion of raw materials into products leads to large amounts of waste. By reducing the amount of resources we use, we can reduce the amount of waste we create. In addition, using less will also reduce the impacts arising from energy, transport and land use.

Data suggests that there is a large scope for reducing resource inputs. For example, in the UK an incredible 13 million tonnes of material is delivered to construction sites and thrown away unused.

Some companies are already looking at ways to reduce the amount of resources they use and are reaping the additional benefits of cost savings.

For example, Wessex Water's new offices near Bath have been built using sustainable principles. Waste minimisation was given a high priority during construction and resulted in 20 per cent savings on the project as a whole, with a 25 per cent saving on waste disposal alone. Initiatives included a detailed review of the supply chain, an assessment of the impacts of materials used and waste recycling. Material movements on and off site were minimised by establishing a materials balance for the site[26].

A further example comes from the partnership between Carillion and LaFarge during the construction of a new hospital in Swindon. The companies worked together to develop a more sustainable plasterboard panel. This product was a single board, comprising of just one 15mm skin instead of the twin 12mm panels in the original design. Raw material inputs into the board were decreased by almost a half, and the boards themselves are recyclable at the end of their useful life. The resulting economic savings amounted to £285,000[27].

[25] ENDS, 2000a.

[26] http://www.wessexwater.co.uk/pages/environment/fullbuild.html#building

[27] Everard, M. and Dhami, J. (2001).

The Environment Agency used over 800,000 m^3 of construction materials in 1998/9, of which 38 per cent was secondary or recycled construction aggregates.[29]

5.5 Challenge 2: Close material loops

Reducing resource inputs will help to reduce waste, but to eliminate it completely will require reuse and recycling of the materials that would previously have entered the waste stream at the end of their life. Only 32 per cent of construction materials are recycled currently, whereas case study examples such as the construction of Wessex Water's new offices near Bath show that recycling rates exceeding 70 per cent are achievable.

However, 'closing the Loop' isn't just about recycling wastes, it's also about using recycled materials. Large construction projects used to involve excavation and removal of large amounts of material, mostly into landfill. More modern projects minimise the materials removed from site, storing them for landscaping and infill. This has many benefits including reducing the costs for diposal of material removed and for importing new materials for landscaping and infill.

Markets for recycled aggregates are increasing, albeit very slowly. The market share of recycled aggregate was 10 per cent in 1989 and by 1999 the rate had crept up to 18 per cent. There needs to be a substantial increase in this rate to reduce the quantity of construction and demolition waste going to landfill.

This will be facilitated by:

Changing design specifications to favour recycled materials

Often product design specifications stipulate virgin materials rather than providing a performance target that could be met by either virgin or recycled materials. The European Standards Agency is currently working on a Europe-wide framework for all aggregate applications, with standards being developed to incorporate the promotion of waste materials. It is likely that revised specifications will be based on the performance of the final product, and not its composition[28].

Providing the correct economic incentives

Currently landfilling waste is often the most cost-effective option. This will change as eco-taxes start to affect the costs of materials. Construction aggregates are now subject to the aggegates tax and waste is subject to the landfill tax. This provides greater incentive for recycling and reuse of materials but tougher measures may be required. As an example, certain Danish municipalities responsible for collecting C&D waste have now introduced specific regulations requiring the sorting of waste and have restricted access to landfills, only giving permission once it has been demonstrated that the recycling potential has been fully exploited.

Establishing markets

Recycling can only take place if the market for recycled materials is established. This means encouraging buyers of construction minerals to use recycled materials. 40 per cent of the construction industry's output by value is purchased by the public sector and in 1998/9 Local Authority spending in the NW on construction, conversion and renovation amounted to £504 million. Examples where recycled materials have been used are few, which means that there is a large potential for the public sector to lead by example in this area. In the private sector United Utilities has developed markets for reusing water treatment residues in brick manufacture.

Copenhagen manages to recycle 90 per cent of its C&D waste through a set price for reception of recyclable materials, and a tax on virgin aggregates.

[28] European Commission, 2000.

[29] Department of the Environment, Transport and the Regions, 1999.

Ensuring availability and location

Many of the materials thrown away by one contractor could potentially be the raw materials for another, but there are currently few opportunities for putting the two together. Materials may require storage until they can be used. Although the increased use of alternative material is to be encouraged, the proximity principle is an important factor to be taken into account. There is little environmental benefit in displacing the use of primary materials if recycled materials have to be transported great distances. To facilitate recycling, it will be necessary to establish centres where materials can be sorted, processed and stored for subsequent use. The establishment of Resource Management Enterprises is discussed below.

Setting targets for recycled materials

Setting targets for the amount of recycled materials in construction projects may be one way of promoting their use. Government, as one of the biggest buyers of construction minerals, should lead by example and set targets for alternative materials within public procurement policy.

Case study: United Utilities

The Use of Water Treatment Residues as Alternative Raw Materials for the Brick and Cement Industries

United Utilities supplies water to nearly 3 million customers in the North West of England. Raw water is taken from reservoirs, rivers and boreholes around the region and requires a number of different treatments before it is safe to drink. In one of the treatment processes a coagulant is used to remove fine particles, which are separated as a sludge. This sludge is then processed to remove water and produce a solid cake. Traditionally this cake has been disposed to landfill, but United Utilities have worked with partners to seek alternative uses for the material and have found that the material can be used as a substitute for virgin minerals in the manufacture of cement and bricks.

The project has won a National Green Apple Award for 2002 and demonstrates how reducing waste to landfill can be linked to reducing the demand for virgin resources.

Photo reproduced by kind permission of United Utilities plc

Energy used in quarrying and transport of the NW region's demand for construction aggregates accounts for 303,000 tonnes of carbon dioxide.

5.6 Challenge 3: Promote whole-life responsibility

The 'whole-life' or 'cradle-to-grave' impacts of resource use can be considerable. However, the full impacts of resource use are rarely considered when making choices on purchases. In the future we will need to take a much more holistic approach to looking at resources.

The Private Finance Initiative (PFI) has brought about significant changes and has forced many construction companies to take a more holistic approach to projects. PFI projects usually require construction companies to operate the building upon completion for up to 25 to 30 years. This means that there is greater incentive to look at the lifetime operating costs for the building, rather than the more traditional approach of focusing on the costs of construction. This has led to some innovative solutions too, for example, energy use in buildings. A consortium, led by Carillion, building a new PFI hospital in Swindon has explored energy savings. An early proposal to double the insulation on the roof was ruled out since it would also double the costs. However, the team looked at the savings that would result, through the consequent reduction in the number of radiators required. The savings made here more than outweighed the cost of the extra insulation required and this was before they had calculated ongoing savings in energy use through the lifetime of the building.

Although energy is a major issue for construction mineral use, the 4sight study shows that transport and land use impacts are also significant.

Half the cost of aggregates relates to transport. It is therefore one of the key issues to be addressed. Options might include:

Increased use of rail freight and sea transport (where feasible)

Increased use of temporary sites and stockpiles for recycled materials in urban areas to reduce transport requirements

Economic measures, for example taxes on fuel and road tolls

Transport issues tend to be linked with regional self-sufficiency. It has been argued that the NW region should become more self-sufficient to reduce the impacts its resource use has on other regions. This would mean that more of the resources used would have to come from within the regional boundaries. Regional self-sufficiency was a key factor in the decision to refuse permission for the Isle of Harris super quarry (November 2000) where it was deemed that the demands of one region should not impact detrimentally on another. However, the key issue is not regional self-sufficiency, but ensuring that the impacts associated with resource provision are accounted for within the region and not conveniently exported elsewhere. We need to ensure that we apply sustainability principles wherever we operate - not just in our own region.

For construction minerals the impacts on land use (including amenity and biodiversity) is a significant issue. It has been estimated that the rate at which we convert nature to an urban environment for human society is approximately 390 hectares per year. There is a need to balance the increasing needs of land for housing, roads and other infrastructure and the protection of the natural environment.

5.7 Challenge 4. - Promote integrated materials management

As resources flow through the region, they pass through many hands. From quarry companies, to mineral processing companies, to building materials supply companies, to construction companies, to owners of property, to demolition companies and finally to waste management companies. This creates problems for tracking and managing resources, but also gives rise to the current situation whereby recycled materials compete with virgin materials. An integrated approach to resource management is required, in which virgin materials and recycled materials are supplied side by side.

An alternative scenario would be to establish 'resource management enterprises' (RMEs). The RME would be responsible for managing resources (which may be from virgin materials and/or recycled), which would be leased to users and returned to the RME at the end of their useful life. The RME would monitor and maintain resources to ensure that they continued to meet the specified service requirements of the user. At the 'end of life' the resources are replaced by the RME and are taken for reprocessing at the RME local site. The customer pays for the service that the resources provide. The resources continue to be owned by the RME.

This 'lease sales' scenario for resource management is already occurring in some sectors. For example, photocopiers (most organisations now lease rather than buy) and carpets (Milliken's 'Earth Square' product), however the concept has yet to make an impact in the construction minerals sector. The approach has several advantages including:

De-linking the economic performance from supply of resources as the customer pays for the service and not the materials.

Facilitating the recovery, reuse and recycling of resources at the end of life.

Providing a stimulus for incorporating longevity into products thereby reducing overall materials flows.

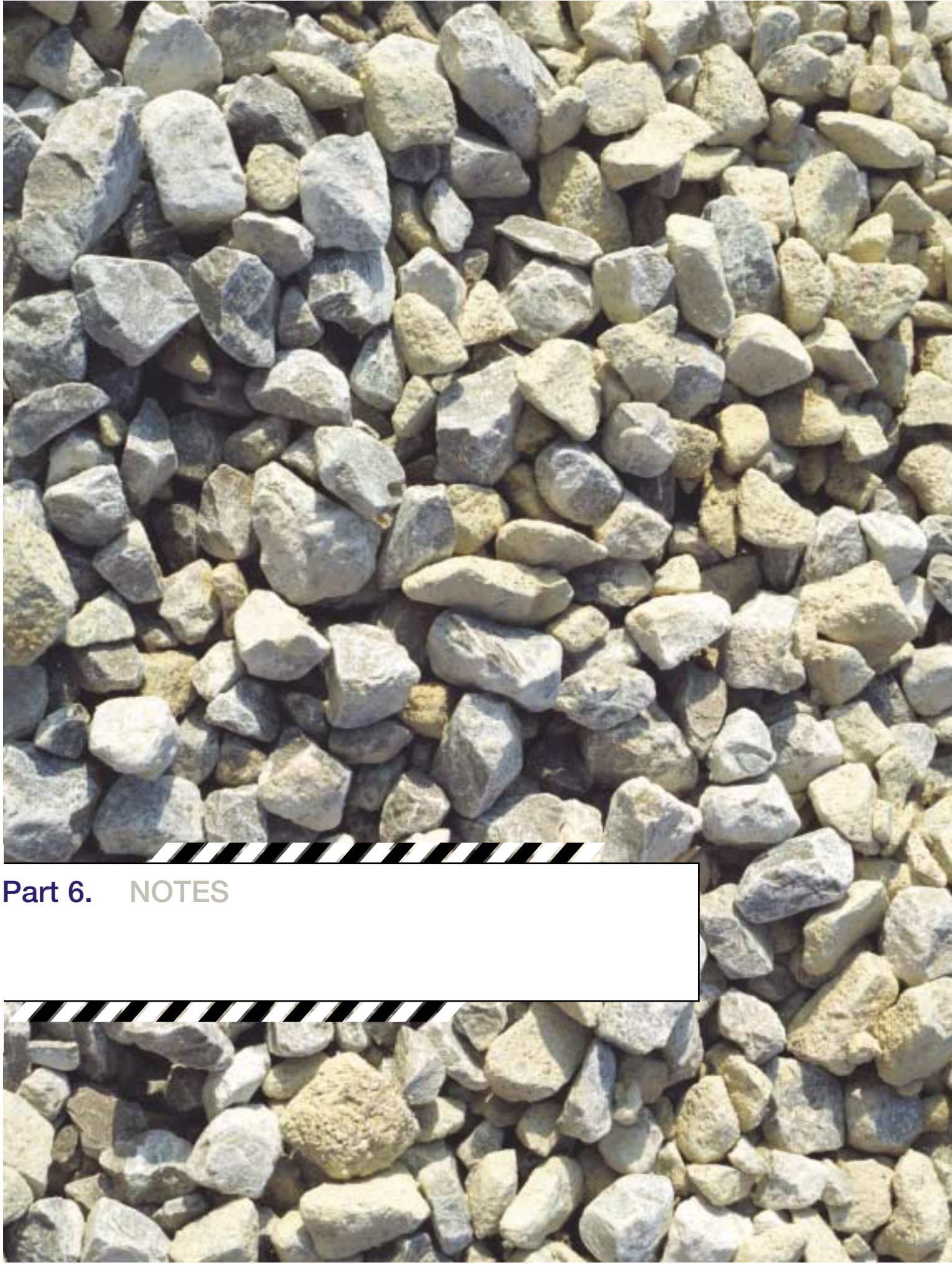
RMEs of the future might be:

Quarry companies

Utility companies

Waste management companies

Sector specific collaborations of companies.



Part 6. NOTES

6.1 Data availability

The 4sight project has involved collating data from a number of sources and has had to grapple with some inconsistencies in data between sources. We have made every attempt to ensure the accuracy of our report in reflecting this data, but are unable to offer assurances as to the validity of the data used.

The project has attempted to put together a mass balance picture for regional flows of construction minerals. However, due to the complexity of flows, the long time period which the material spends in the 'urban system', and the current absence of coherent data, achieving a detailed balance for the flows of construction minerals has been particularly difficult.

Limitations facing this mass balance study have included:

The use of data from different years (national collation data relating to imports/exports only occurs every four years).

Discrepancies for sets of data from different sources. In particular, a 'missing' 0.5 Mt of limestone when comparing NW RAWP (Regional Aggregate Working Party) quarrying figures and National Statistics data for raw materials used for construction products.

Spatial discrepancies between Environment Agency (EA) data and other sources of data.

Confidence limits relating to data accuracy (waste arisings data has an error margin of 35 per cent at a 95 per cent confidence interval).

Wherever possible, data for 1999 has been used. This has enabled the most up-to-date and comprehensive information to be used, whilst enabling problems, such as the inclusion of Cumbria within the NW region in 1998, to be avoided. However, in some cases data from 1999 was unavailable and alternative data has been used. For example, data relating to imports to the region are derived from the National Collation (Aggregate Minerals Survey), which is applicable to 1997.

In certain cases data was unavailable, due to, for example, commercial confidentiality.

Collation of quality data will be necessary if better management of resources is to occur at the regional scale in the future.

6.2 Glossary of Terms

Aggregates
Bulk material suitable for use in construction as concrete, mortar, roadstone, asphalt or drainage courses, or for use as constructional fill or railway ballast.

Cement
Manufactured material, made mainly from limestone and clay, which combines with water to form the binding agent in concrete.

Concrete
A mix of cement, aggregate and water that hardens into a structural material.

Construction and demolition waste
Waste arising from the construction, repair, maintenance, and demolition of buildings and structures.

Crushed rock
Essential raw materials required by the construction industry (crushed into a variety of sizes). Used for roads, buildings and other structures.

Gypsum
Mineral used in the production of plaster and plasterboard.

Igneous rock
Important source of high-quality aggregates (in the North West, granite).

Industrial sand (alternatively silica sand)
Sand which contains a high proportion of silica in the form of quartz and is marketed for purposes other than for direct use in the construction industry. Used predominantly in the glass and foundry industries.

Landbank
A stock of planning permissions for the winning and working of minerals.

Limestone
Predominantly used as a construction aggregate but can also be used in a wide range of industries; cement manufacture, steelmaking, chemical industry, water and waste treatment, glass, paper, plastics, animal feeds and agriculture.

Mortar
Sand and cement mix used for binding building materials.

Non-aggregate uses
Use of material suitable for purposes other than construction and normal aggregate applications.

Pulverised fuel ash
Ash produced by coal combustion plants.

Recycled material
Material reused after an initial purpose (predominantly obtained from construction and demolition waste or road planings).

Sand and gravel
Two main types: sharp sand and gravel (larger particles used for concreting) and soft sand (used for mortar).

Secondary material
By-products of quarrying, mining and industrial processes (for example; blast furnace slag, power station ash, etc).

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Yorkshire Dales National Park Authority

USEFUL WEB LINKS

4sight Resource Flow Audit for Sustainability
www.art.man.ac.uk/PLANNING/cure/research_frames.html
Download the Centre for Urban and Regional Ecology's report upon which *Rocks to Rubble* is based.

Mass Balance UK Project web site
www.massbalance.org/
Mass Balance UK is the data co-ordination project for the series of Biffaward-funded mass balance projects. The site provides access to the collated data from these projects plus other national-scale resource flow datasets that give the context to the Biffaward project data.

PIU Report on Resource Productivity
www.cabinet-office.gov.uk/innovation/2001/resource/report/default.htm
A UK Government report on resource productivity from the Performance and Innovation Unit.

The Wuppertahl Institute
www.wupperinst.org
The Wuppertahl Institute for Climate, Environment & Energy in Germany is a major centre for research into sustainable development. The centre published the first edition of the definitive book on Factor 4, the principle on which the 4sight principle is based. They have a site devoted to resource efficiency (www.oekoeffizienz.de/) and have undertaken studies on resource efficiency on behalf of the European Union (Total Material Requirement of the European Union - http://reports.eea.eu.int/Technical_report_No_55/en/tech55.pdf) and and the UK Government (Resource Efficiency of the UK Economy - www.defra.gov.uk/environment/statistics/des/waste/research/mfa/index.htm.

DTi Rethinking Construction
www.dti.gov.uk/construction/index.htm
Promotes sustainable construction practices

M4i - Movement for Innovation
www.m4i.org.uk
This information site gives a number of good case studies showing how 4sight has been applied within the construction industry.

Ecological Footprint News
www.bestfootforward.com/FootprintNews/EFNews230301.htm
Find out the latest in ecological footprinting as a method for measuring resource efficency.

The Rocky Mountain Institute
www.rmi.org
Rocky Mountain institute is a non-profit research and educational foundation with a mission to foster the efficient and sustainable use of resources as a path to global security.

FOE's Fair Share in the Earth
www.foe.co.uk/pubsinfo/infoteam/pressrel/supplementaries/1997/fair-19971128165639.htm

United Nations view on Sustainable Development and resource use
www.un.org/esa/sustdev/conprod.htm

A view on the American Dream and US resource use
www.cn.org/zpg/acpmain.htm

A report on the Ecological footprint of the 52 nations inhabited by 80% of the worlds population
www.ecouncil.ac.cr/rio/focus/report/english/footprint/

WWF Living Planet Report

http://panda.org/livingplanet/lpr00/

The WWF's Living Planet Report 2000 has two main objectives: 1. to quantify changes in the state of the Earth's natural ecosystems over time; and 2. to measure human pressures on the natural environment arising from the consumption of renewable resources and pollution.

Included in the report is an easy-to-understand definition of ecological footprints and a link giving you the opportunity to calculate your own ecological footprint.

Breaking New Ground: Mining, Minerals, and Sustainable Development

www.iied.org/mmsd/finalreport/index.html

World Business Council for Sustainable Development report on a two year study into sustainable Development and the mining and minerals sector.

Quarry Products Association

www.qpa.org

The Quarry Products Association is the trade association for companies involved in supplying crushed rock and sand and gravel from land and marine sources, asphalt and flexible paving, ready-mixed concrete, silica sand, agricultural lime, industrial lime, mortar, slag, recycled materials and construction and quarrying plant. In representing the interests of over 90% of the UK quarrying industry, the QPA is the key national contact on every aspect of the UK quarrying industry.

North West Regional Aggregates Working Party

www.planning.odpm.gov.uk/nwregagg/index.htm

The NW RAWP regularly produces statistics on the production of aggregates in the North West. Similar organisations exist for other regions in England and Wales.

Waste Watch (EEBPP)

www.wastewatch.org.uk

Useful information on dealing with waste responsibly and efficiently.

Climate Change Calculator

www.climcalc.net/

The Climate Change Calculator is an interactive software tool designed to raise people's awareness of the greenhouse gases they produce through their daily activities and lifestyle choices. This Canada-specific tool helps people of all ages learn about their contributions to greenhouse gas emissions and suggest measures that can help reduce emissions.

Environmental Data Services

www.ends.co.uk/

A useful source of information for a wide variety of environmental issues

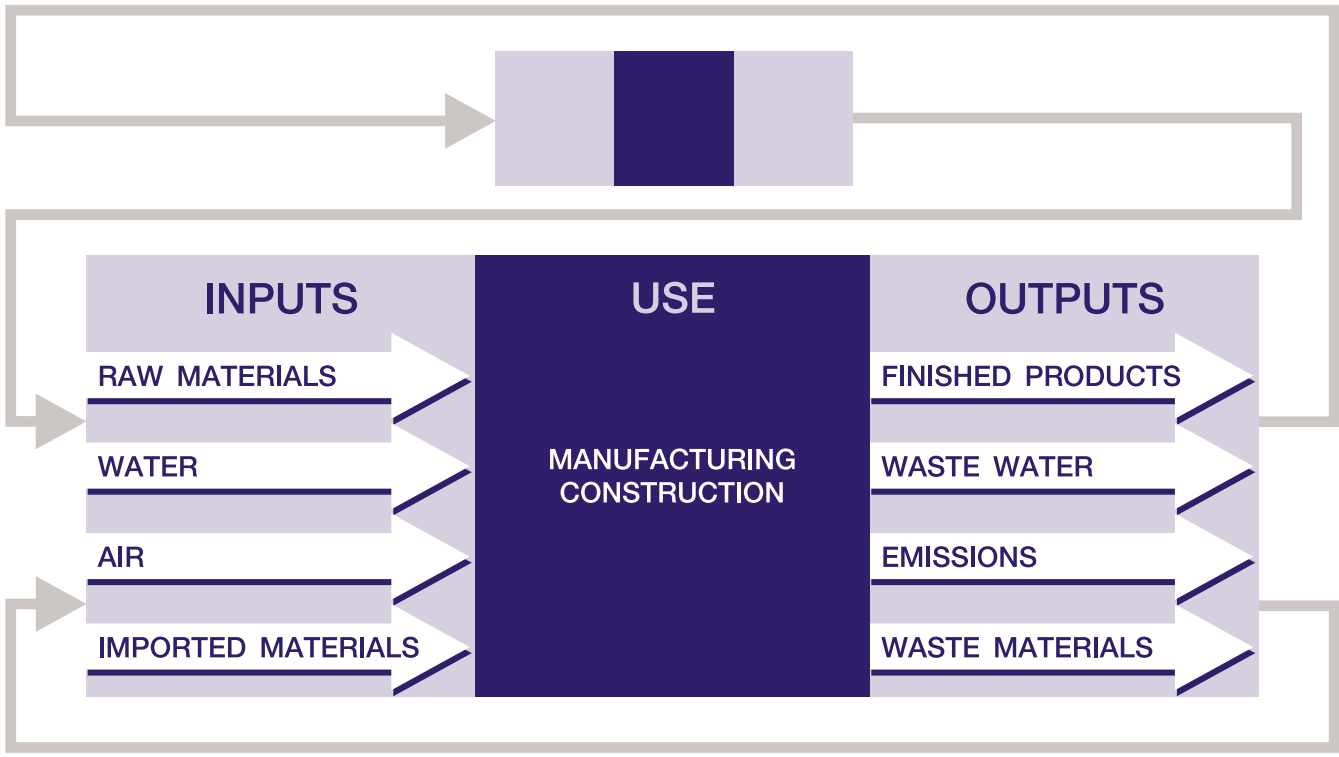
MASS BALANCE

Mass can neither be created nor destroyed.

The mass of inputs to an activity, company or region balances the mass outputs as products, emissions and wastes.

When applied in a systematic manner this simple and straightforward concept of balancing resource use with outputs can provide a robust methodology for analysing resource flow.

Ultimately, the process can provide a framework to analyse, identify and promote a more sustainable system of resource management.



These arrows illustrate a more sustainable system, where materials thrown away by one system could potentially be re-used in the same system or form the raw materials for another.

CONSTRUCTION MINERAL FLOWS IN THE NORTH WEST

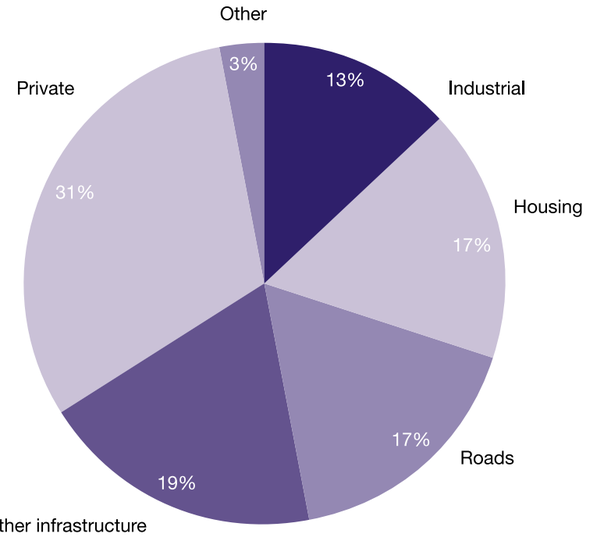
The first stage in identifying what action needs to be taken, is to try and quantify the connections between resources used and waste produced. Only with the collection and analysis of coherent and comprehensive data will it be possible to devise more sustainable resource practices and to stimulate debate and action in the commercial arena and at a local and national government level.

The 4sight project has examined the flow of construction minerals, through the region. Measured by weight, the amount of raw materials used by the construction industry in the Northwest completely dwarfs any other areas of business. The opportunities for sizeable improvements in resource efficiency in this area are significant. However, a particular issue for construction minerals is the build up in society of these materials and the impacts this has on the degradation of the rural landscape.

EXPORT 0.5mt

QUARRIED MATERIALS 21.3mt

IMPORTED MATERIALS 10.6mt
Such as sand, gravel, crushed rock and marine sand



PRODUCT END USE 31.4mt

RE-USE/RECYCLED 3.4mt

ACCUMULATION OF BUILDINGS, ROADS AND OTHER INFRASTRUCTURE 21mt

WASTE 7mt

Many of the materials thrown away by one contractor could potentially be the raw materials for another, but there is currently no means of putting the two together.

The types of raw materials used by the construction industry tend to be non-renewable mineral resources, which because of the high bulk and resultant high costs to transport, tend to be purchased within or not far from the region. With significant increases in urban development and regeneration in the area, there is an increasing demand for this material. Most is obtained from quarries or pits, within the Northwest region. However, around a third is imported from adjacent areas such as Yorkshire and Derbyshire.

The construction industry is also one of the biggest producers of waste materials, both from the construction process itself and from demolition. Many of the materials thrown away by one contractor could potentially be the raw materials for another, but there is currently no means of putting the two together.

4sight Project Funders
Biffaward
The Co-operative Bank
NWRA
GONW

4sight Steering Group Members
The National Centre for Business and Sustainability
CURE, University of Manchester
Sustainability Northwest
The Environment Agency
Tarmac Central Ltd
Balfour Beatty
Cheshire County Council
Northwest Regional Aggregates Working Party
(represented by Cheshire County Council)

4sight project research
The National Centre for Business and Sustainability in partnership with the Centre for Urban and Regional Ecology at the Department of Planning and Landscape, University of Manchester.

Report text
The National Centre for Business and Sustainability and John Barwise (Quality of Life).

Report Design
Hemisphere Design and Marketing Consultants.

Print
Printed by Gyroscope using 100% recycled, 100% post-consumer waste paper and vegetable-based inks.

Photography
Len Grant (front cover and pages 11, 12, 18, 32, 34)

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