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Green Balance

# Aggregate resource alternatives: Options for future aggregate minerals supply in England

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# Aggregate resource alternatives: Options for future aggregate minerals supply in England

## *Key words*

England, aggregates,  
environmental designations,  
supply

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## *Front cover*

Sand and gravel workings.  
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# 1 Executive Summary

This report is one of two outputs from a project entitled 'Aggregate resource alternatives: Options for future aggregate minerals supply in England'. It accompanies eight aggregate mineral resource maps at 1:250 000 scale, one for each region in England (the South East and London have been combined on one map).

This study is one of five projects undertaken in 2007 to examine many different aspects of the current system for the supply of aggregates in England. The other four projects are entitled:

- The Verney report – Beyond the way ahead;
- Exploring the reasons for the decline in aggregate reserves in England;
- The need for non-energy indigenous mineral production in England;
- Managing aggregates supply in England - A review of the current system and future options.

The aims of this particular project were:

- To produce maps at 1:250 000 scale for each region in England which depict those aggregate mineral resources that lie outside selected environmental designations as well as showing the location of active aggregates operations (quarries, wharves and rail depots). Designations to be assessed were National Parks, Areas of Outstanding Natural Beauty (AONBs) and Natura 2000 sites (Special Protection Areas (SPAs) and Special Areas of Conservation (SACs)). (As part of this work, analysis was subsequently extended to include Sites of Special Scientific Interest).
- To describe the impacts of policy and regulations on the working of aggregates in designated areas.
- To identify current aggregate production from, available reserves within and current interaction between active aggregates quarries and selected environmental designations.
- To summarise, at the strategic level, the extent to which possible alternative supply options for aggregates would be able to sustain into the future a steady and adequate supply of aggregates should additional resources located within National Parks and AONBs become unavailable. An in depth assessment (of, for example, every possible environmental impacts) and comparison of all potential alternative supply scenarios and possible outcomes did not form part of this study on account of the diversity of such scenarios that might be considered.

Just under a third (32%) of all the active aggregates quarries in England lie within a National Park or Area of Outstanding Natural Beauty, or are associated with (within 500 metres of) a Special Area of Conservation / Special Protection Area / Site of Special Scientific Interest. Between them, these sites extract 47 Mt/y of aggregates, a third of the total yearly supply of primary land-won aggregates in England. They 'contain' 41% (1 700 Mt) of the total permitted reserves in England.

Within England, 27% of the sand and gravel resource is covered by at least one of the above national / international environmental designations and or urban areas. For the crushed rock resources, this rises to 52%. For the Carboniferous limestone and igneous rock resources, the most important sources of crushed rock aggregates in England, the proportions covered are 65% and 84% respectively. The proportions for each resource type on a regional basis have also been calculated and are presented.

All of the alternative supply options considered in this study have the ability to supply more aggregates in the future should the market demand it.

- *Existing quarries outside designated areas.* Many of the quarries producing the highest quantities of aggregates have some, albeit limited, capacity to increase their supplies in the short term with only the need for minimal investment. Indications are that on a national basis this potentially could be in the order of 10 to 12 Mt/y. However, increasing the rate of extraction would also increase the depletion rates of the permitted reserves for these quarries. This is likely to result in an increase in applications for planning permission to release extra reserves in order that the individual companies could ensure long term viability. The capacity of smaller quarries to further increase supply has not been evaluated.
- *Secondary and recycled aggregates.* These make an important contribution to the supply of aggregates and help reduce the rate at which primary aggregate resources are depleted. Comparing 1990 with 2005, the quantity of recycled and secondary aggregates produced within Great Britain has increased by 107%. Within England, the total for 2005 was 56 Mt. The amount of potentially available secondary and recycled aggregates being utilised is, however, felt to be reaching its maximum. Additional secondary and recycled aggregates that could be supplied in the future is estimated to be around 7 Mt/y (based on 2005 sales rates).
- *Marine dredged sand and gravel.* The marine aggregates industry is currently felt to be working at capacity. They contribute 9% (13.7 Mt) of total primary aggregates supply in England. There is potential to increase this contribution in the short term by diverting current exports. However, this will only occur if the market is likely to be sustained long enough to justify losing (probably permanently) markets in Belgium and the Netherlands. In the longer term, investment in the dredging fleet is needed to sustain higher levels of supply. This would occur if the indications were that the market share for the marine aggregates industry could increase and be sustained.
- *Importing aggregates.* England currently imports 4% of its primary aggregates needs (10.7 Mt). The principal source of these imports is Wales with more modest amounts coming from Scotland and Norway. There is no presumption against increasing imports of aggregates from Wales or Scotland should the market demand it. It is, however, constrained by the capacity to supply within limits stated in policy. However, applications for extensions and new permissions primarily aimed at meeting the English market where home demand is already being met may lead to sensitivities. Possibilities for increasing imports that are delivered by ship from other countries are limited. This is primarily due to limitations on ability (capacity) to stockpile and subsequently distribute material through the existing wharves.
- *Underground mining of aggregates.* Currently not utilised as a source for aggregates in England, the underground mining of aggregates need not be discounted as a potential supply option. Given the restricted outcrop extent for certain strategically located quarries in England (if both economic and geological conditions were favourable) their extension / conversion to underground methods of extraction may become a realistic supply option in order to meet a proportion of future demand requirements. This does, however, have implications on the costs of aggregates. Underground mining will be realistic if higher costs can be sustained through higher prices in a situation (for example) of increasing scarcity.

All the supply options considered provide broad indications of the strategic overarching capacity to supply. The potential from all options to increase their share of the supply of aggregates ultimately relies on market conditions and the certainty of the industry in order that they can justify the long term investments required.

## 2 Introduction

The town and country planning system aims to make the best use of land for society as a whole, taking into account a wide range of issues which have a land use dimension (such as housing, shops, recreational opportunities, people's amenities, and the needs of society for a range of infrastructure such as transport, energy, materials and waste management); by sustaining the natural environment in which those activities take place; and by managing the resources on which they depend. As mineral resources, and particularly construction mineral resources (principally aggregates), are used to create the 'goods' that society 'needs' (e.g, housing and infrastructure development), the working of mineral resources is necessary. However, planning for and the working of aggregate minerals can be a contentious issue with regulators, industry and society, particularly where mineral extraction is undertaken or proposed in areas of high landscape / ecological value. Such areas include (but are not limited to) National Parks, Areas of Outstanding Natural Beauty (AONBs), Sites of Special Scientific Interest and Natura 2000 sites (Special Protection Areas (SPAs) and Special Areas of Conservation (SACs)). Applications for the working of minerals (including aggregate minerals) in such areas come under particularly close scrutiny.

*Minerals Policy Statement 1 (MPS1): Planning and Minerals* (Department for Communities and Local Government, 2006), sets out the Government's objectives and national planning policies for minerals. These are further supplemented for aggregates by provision of an annexe. One of the national policies stated in MPS1 is to 'protect internationally and nationally designated areas of landscape value and nature conservation importance from minerals development other than in exceptional circumstances'. This includes proposed major mineral developments in National Parks and AONBs where consideration of applications for mineral working require an assessment of:

- the need for the development, including in terms of national considerations of minerals supply and the impact of permitting it, or refusing it, upon the local economy;
- the cost of, and scope for making available an alternative supply from outside the designated area, or meeting the need for it in some other way;
- any detrimental effect on the environment, the landscape and recreational opportunities and the extent to which that could be moderated.

Further, where minerals development is proposed within, adjacent to, or where it is likely to significantly affect a European site (SPA/SAC) advice contained in *Planning Policy Statement 9 (PPS9): Biodiversity and Geological Conservation* (Office of the Deputy Prime Minister, 2005), should be taken into account. Finally, permission should not normally be granted on land within or outside an SSSI if it is likely to have an adverse effect on the SSSI.

This report, and the accompanying A0 maps, presents and analyses data on the current distribution, sales and reserves of primary, land-won aggregates in England in respect of the contribution made from quarries located within, or close to, the above selected national and international environmental designations. In addition to the spatial assessment of resource availability the report describe the policy background affecting the extraction of aggregates from such designations. It then summarises the future potential, and issues surrounding, possible alternative supply options for meeting the quantity of aggregates currently supplied from (specifically) National Parks and AONBs.

## 3 Policy Background

### 3.1 ENVIRONMENTAL DESIGNATIONS INCLUDED IN THE STUDY

A significant amount of the land area of England has been designated for its environmental or cultural heritage. These environmental designations range from international designations, through national designations to (non-statutory) designations of local importance. Table 1 and Figure 1 summarise the distribution and number of environmental designations in England that have been included in this study, all of which have statutory protection. Around 27% (35 521 km<sup>2</sup>) of England is covered by at least one of the environmental designations listed with the area covered gradually increasing over time. For example, between 1985 and 2005 there has been a 61% increase in the area of land designated as SSSIs.

**Table 1.** Selected national and international environmental designations in England.

Designation	Number of sites <sup>a</sup> (June 2005)	Area (km <sup>2</sup> ) <sup>a</sup>	Percent of total England area <sup>b</sup>	Exclusive area (km <sup>2</sup> ) <sup>a</sup>	Exclusive percent of total England area
National Parks <sup>c</sup>	9	10 523	8	7 645	<b>6</b>
AONBs	36	20 345	16	17 728	<b>14</b>
SSSIs <sup>d</sup>	4 101	10 146	8	1 146	<b>1</b>
SPAs/SACs <sup>d</sup>	240	8 131	6	3 507	<b>3</b>
NP/SSSI/SPA/SAC <sup>a</sup>				2 877	<b>2</b>
AONB/SSSI/SPA/SAC <sup>a</sup>				2 618	<b>2</b>
<b>Total</b>	<b>4 386</b>	<b>49 145</b>	<b>-</b>	<b>35 521</b>	<b>27</b>

a) It is important to note that certain designations are not mutually exclusive, such that all SPAs and SACs are also SSSIs. Further, both SSSIs, SPAs and SACs can fall within National Parks and AONBs. National Parks and AONBs are, however, exclusive from each other. For a diagrammatic explanation see Appendix 1.

b) Total area of England, 130 281 km<sup>2</sup>.

c) Includes the Norfolk Broads which has equivalent status.

d) Onshore (above mean low water mark) extent only. SPAs/SACs, and to a lesser extent SSSIs, have significant offshore extents (Figure 1). These have been discounted from the analysis.

The surface area of land given over to mineral working is small by comparison to that of many other land uses, including environmental designations. Of the 270 km<sup>2</sup> of sand and gravel permissions in England, 12 km<sup>2</sup> (4.4%) are located within National Parks and AONBs. For crushed rock the total permitted area of surface mineral workings is 183 km<sup>2</sup> of which 43 km<sup>2</sup> (23.5%) are located within National Parks and AONBs.

Table 2 summarises the total permitted area of surface mineral workings. National Parks and AONBs cover 30 868 km<sup>2</sup> of England. Of this, 12 km<sup>2</sup> (0.04%) is permitted for sand and gravel extraction and 43 km<sup>2</sup> (0.14%) for crushed rock.

**Table 2.** Area of surface mineral working in England, 2000 and that contained within National Parks and AONBs<sup>a</sup>.

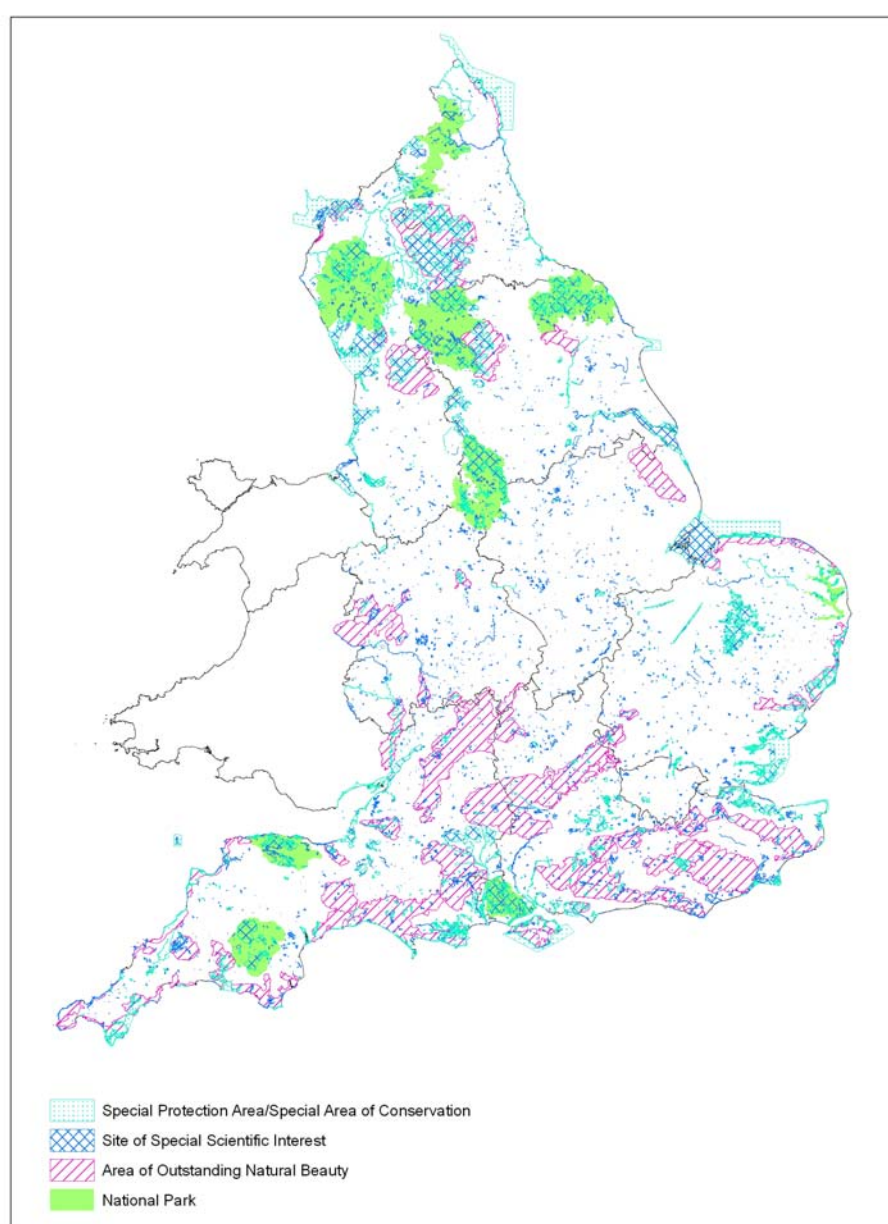
Mineral	In England		In National Parks and AONBs	
	km <sup>2</sup>	% <sup>b</sup>	km <sup>2</sup>	% <sup>c</sup>
All surface mineral working	1 136	0.87	68	0.22
Sand and gravel	270	0.21	12	0.04
Crushed Rock	183	0.14	43	0.14

a) Therefore, represents only a subset of the statutory environmental countryside/landscape designations investigated. Excludes SSSIs, SPAs and SACs.

b) As a percent of the total area of England (130 281 km<sup>2</sup>).

c) As a percent of the total area of National Parks and AONBs (30 868 km<sup>2</sup>).

Source: Survey of Land for Mineral Working, 2000.



**Figure 1.** Distribution of environmental designations in England.

### 3.1.1 National Parks

The National Parks and Access to the Countryside Act 1949 provided for the designation and protection of National Parks. The Act has had a great deal of amendment since then, with the latest in 1995 in the Environment Act. The Act of 1995 established independent national park authorities. It rephrased the two basic purposes of National Parks as: '*conserving and enhancing the natural beauty, wildlife and cultural heritage of the areas*' and '*promoting opportunities for the understanding and enjoyment of the special qualities of those areas by the public*'. National Parks are afforded the highest level of protection for their landscape quality. Development is controlled in national parks through the town and country planning system, with the national park authorities having control over all planning functions. There are eight National Parks within England. The New Forest (AONB) obtained its status as a National Park in 2006. The Norfolk and Suffolk Broads are also administered by their own independent authority and have protection equivalent to that of a National Park. Therefore, the total area of England with National Park (or equivalent status) is 10 523 km<sup>2</sup> (Table 1).

### 3.1.2 Areas of Outstanding Natural Beauty (AONB)

The National Parks and Access to the Countryside Act 1949 provided for the designation and protection of Areas of Outstanding Natural Beauty (AONBs). Their purpose is to conserve the natural beauty of the landscape, though not to provide means for public access and enjoyment. Protection may be limited as many of the powers available are optional rather than statutory. However, under the Countryside and Rights of Way Act (2000), many of the provisions relating to National Parks have been extended to AONBs. The 36 AONBs in England cover an area of 20 345 km<sup>2</sup> (Table 1). Currently, the South Downs AONB is a candidate National Park.

### 3.1.3 Sites of Special Scientific Interest (SSSI)

Sites of Special Scientific Interest (SSSI) were introduced under the National Parks and Access to the Countryside Act 1949. SSSIs may be designated for their special wildlife or geological interest. Management agreements were added under the Countryside Acts of 1967 and 1968. Management plans and a list of potentially damaging operations are used to prevent damage to sites and ensure that operations take conservation into account. In 1981 much of this was changed and strengthened under the Wildlife and Countryside Act, Part 2. Sites are designated purely on scientific grounds and they are intended to represent sample British habitats. Sites can be designated for their biology, geology or both. Most SSSIs are privately owned or occupied and there are 4 101 SSSIs in England covering 10 146 km<sup>2</sup> (Table 1). SSSI status does not change the use of the land but owners and occupiers have a duty to notify Natural England of any change or development they wish to undertake. If a proposed development is within 2 km of an SSSI this is considered important due to the possible remote impacts on the SSSI itself. However, this distance is only indicative and therefore development further away may still need to be considered for its possible impact on the SSSI.

### 3.1.4 Special Protection Areas and Special Areas of Conservation (SPA/SAC)

Special Protection Areas (SPAs) designated in accordance with European Directive 79/409/EEC, adopted 2nd April 1979, provide measures to conserve wild birds, their eggs and their habitats. This directive is commonly known as the 'Birds Directive.' Special Areas of Conservation (SACs) designated in accordance with European Directive 92/43/EEC, adopted 21st May 1992, provide measures to conserve natural habitats and associated wild fauna and flora. The directive is commonly known as the 'Habitats Directive'.

SACs together with SPAs form 'Natura 2000', a European wide network of areas of special nature conservation interest. The legislation to give effect to these Directives in the UK was subsequently introduced and then suitable sites were proposed for designation and subsequently

confirmed. As a result, the Natura 2000 network, which is now largely complete, has only had an impact in recent years. However, as all Natura 2000 sites are also Sites of Special Scientific Interest under UK legislation, there has in most cases been a lengthy recognition of the wildlife value of these sites. As for SSSIs, if a proposed development area is within 2 km of a SPA/SAC this is considered important due to the possible remote impacts on the SPA/SAC itself. However, this distance is only indicative and therefore development further away that may still have an impact on the site are considered. Therefore, whilst Natura 2000 sites may be limited in spatial extent they have a much larger potential sphere of influence.

Within England there are 240 sites designated as either SPAs, SACs or both. Collectively these cover 8 131 km<sup>2</sup> (Table 1).

### **3.1.5 Other Environmental Issues**

In addition to the above national and international environmental designations there are many other environmental designations that may also have an impact on the location of future aggregate quarries. These include (but are not limited to): Ramsar sites (which the Government has volunteered to treat the same as Natura 2000 sites); Scheduled Ancient Monuments; Local Nature Reserves; Sites of Importance for Nature Conservation; Community Forests; Community Woodlands and Ancient Woodlands; Historic Parks and Gardens; Regionally Important Geological/ Geomorphological Sites. In planning, local designations have less weight than statutory national ones which in turn have less weight than international designations (UK treaty obligations). However, it is important to recognise that once designated, an area of land is afforded some degree of protection. Constraints relating to other factors (groundwater, archaeology, noise, dust, traffic, proximity to airfields (bird strike risk) etc.) further reduce the number of potential locations available for the extraction of aggregates. The existence of a designation or constraint relating to other factors will have varying significance site by site in relation to any proposed mineral working. Analysing the impact of these other environmental issues fell outside the scope of the project.

## **3.2 IMPACTS OF REGULATIONS ON THE WORKING OF AGGREGATES IN DESIGNATED AREAS.**

Regulation of the working of aggregates and other minerals in nationally designated areas differs between the landscape and wildlife designations. There are differences in both the powers to regulate workings in the types of area and the relationship of these powers to planning control. These differences are amplified by the passage of time between the introduction of controls over impacts on national landscapes in 1949 and European wildlife sites in 1994. The two sets of designations are therefore addressed separately.

### **3.2.1 Aggregates working before the designation of National Parks and AONBs**

Prior to the passage of the National Parks and Access to the Countryside Act 1949 and prior to the designation of the first seven National Parks in England by 1957, mineral extraction (including for aggregates) was taking place from quarries located within many of the areas which came to be designated. The same experience applied to workings where AONBs were designated from 1956 onwards. Designation had no impact on those operations. However, the introduction of the modern land use planning system at about the same time, through the Town and Country Planning Act 1947, did have an impact. This required the regularisation of pre-existing mineral working (including 'Interim Development Order' [IDO] sites granted since 1943 under wartime emergency powers), though this process too had little impact on pre-existing activities or over the areas where these were planned to continue. The planning legislation did, though, signal the beginning of a continuous process of regulation of newly proposed development.

In addition to the pre-1947 Act workings, planning permissions were given for mineral workings after the introduction of the new planning system but before the designation of National Parks or AONBs. Such quarries comprise old operations which are lawfully able to provide mineral, principally aggregates, from areas which were subsequently designated for their national landscape importance.

By virtue of the geology of the areas designated, about four fifths of the land affected by aggregates workings in National Parks was for rock quarrying and the remainder for sand and gravel.

Until the passage of the Countryside and Rights of Way Act 2000, AONBs were not afforded the same degree of protection in policy as were National Parks. Correspondingly, mineral working proposals in AONBs were initially not required to meet such exacting tests of a national need for the material and no identification of alternative sites. Policy nonetheless aimed to regulate and limit the impact of mineral working on AONBs, with a greater emphasis on whether they could be accommodated without significant damage to the quality and character of the landscape. In 1994, policy on aggregates development in AONBs was changed, requiring them to satisfy the same tests as proposals in National Parks. *Mineral Planning Guidance 6 (MPG6): Guidelines for Aggregates Provision in England* (Department of the Environment, 1994) thereby introduced a policy change which would only affect most other types of development six years later. As with National Parks, various major aggregates workings were present prior to the designation of AONBs covering their locations, and are still in operation today.

### **3.2.2 Aggregates working in National Parks and AONBs after designation**

In practice, the designation of National Park boundaries was used so far as practicable to exclude land affected by significant mineral working. It was by this mechanism and by limiting new workings, rather than by resisting pre-existing workings within National Parks, that limitations on operations were achieved inside designated areas. The intention to use designation to exclude quarrying so far as practicable from National Parks is best illustrated by the boundary of the Peak District National Park which took a circuitous course notably to avoid a group of quarries in the Buxton area (enclave). The boundary of the Yorkshire Dales National Parks also reflected pre-existing quarries in the Leyburn area. The result has been that, at a number of points, National Parks are fringed by mineral workings.

Major aggregates workings (whether new sites or extensions to existing ones) may find it difficult to meet the criteria for being acceptable in National Parks. Despite the granting of a major permission for the extension of Swinden Quarry in the Yorkshire Dales in 1996 by the National Park Authority, the principle was reaffirmed by the Secretary of State when he refused a major extension to Spaunton Quarry in the North York Moors in 1998. There are nonetheless two main possibilities for new aggregates workings being permitted in National Parks: at 'non-major' sites and as a by-product of the working of industrial mineral sites which have been able to satisfy the tests.

Extensions have, however, been permitted at a large number of aggregates workings in National Parks. These have usually been modest at least in relation to the scale of operations already permitted or involved a modest amount of excavation not previously permitted (for example time-extensions have been granted at Dry Rigg and Ingleton Quarries in the Yorkshire Dales), and usually involved a compensatory benefit provided by the operator. The procedures for the Review of Old Mineral Permissions under the Planning and Compensation Act 1990 (for IDOs) and the Environment Act 1995 (for old planning permissions) have afforded opportunities for the regularisation of operations, sometimes in association with new permissions to consolidate a series of earlier permissions or to afford modest extensions. For example, the Peak District National Park Authority negotiated a small extension to Ivonbrook Quarry in 1996 in exchange notably for the cessation of permissions at the much larger adjacent Hartshead Quarry. New



greenfield ‘non-major’ quarries within National Parks have been rare. Much the same experiences have applied to AONBs.

Industrial mineral operations are more likely than aggregates to be able to satisfy the tests for being permissible in National Parks. Some of these operations, such as dolomite and industrial limestone, china clay, silica sand and slate may produce lower grade material as a by-product – unsuited to industrial use but satisfactory for aggregates. If this material is not required for later restoration of a quarry, it may be acceptable to sell it for aggregates. Permissions have been granted at a selection of sites in National Parks, after designation, where aggregates have been sold as a by-product, notably limestone quarries at Tunstead/Old Moor and Ballidon in the Peak District.

### **3.2.3 Aggregates working before the designation of Natura 2000 sites**

The EEC Directive on the Conservation of Wild Birds (79/409/EEC) was passed in 1979 and inter alia required the identification and protection of Special Protection Areas (SPAs) valuable for wild birds. The EEC Directive on the Conservation of Natural Habitats and of Wild Flora and Fauna (92/43/EEC) was passed in 1992 and inter alia required the identification and protection of Special Areas of Conservation (SACs) for scarce species of flora and fauna and their habitats. SPAs and SACs together comprise the Natura 2000 network. The legislation to give effect to these Directives in the UK was subsequently introduced and then suitable sites were proposed for designation and subsequently confirmed. As a result, the Natura 2000 network, which is now largely complete, has only had an impact in recent years. The majority of aggregates workings therefore predate the coming into effect of Natura 2000 sites. However, as all Natura 2000 sites are also Sites of Special Scientific Interest under UK legislation, there has in most cases been a lengthy recognition of the wildlife value of these sites.

The relatively recent designation of Natura 2000 means that aggregates workings which interact with those designations are for the most part better controlled through the modern planning system than were aggregates workings at the time National Parks were designated. The likelihood is that more recent permissions, and the consolidation of old permissions in new ones to modern standards, will have resulted in better attention having been paid to the wildlife interest in such sites because of their SSSI notation. Many aggregates permissions will have been drawn up to exclude and protect the SSSIs in question in any event.

The terms of the Habitats Directive impose a far more onerous responsibility on the regulatory system in respect of habitats than did the National Parks and Access to the Countryside Act in respect of National Parks (or AONBs). Instead of putting a line under inherited mineral workings which happened to be affected by the new wildlife designations, and instituting a tighter regime to control fresh proposals, the Directive had compulsory retrospective effect on pre-existing mineral workings. The legislation requires all pre-existing permissions which might have a significant adverse effect on a Natura 2000 site to be reviewed, and requires a strongly precautionary approach to be taken in this process in order to protect designated sites. Furthermore, where such a review shows that there is a significant risk to the integrity of the site, then steps must be taken to remove that risk. Whilst negotiation is preferred, the ultimate responsibility is on the regulatory body (Mineral Planning Authority (MPA)) to amend or even revoke the planning permission so that damage is avoided (though there are numerous intervening steps to consider first).

Experience of the interaction between the European legislation and pre-existing aggregates workings is limited. There are two reasons for this. First, the obligation in law on MPAs to review relevant mineral permissions is not subject to a time limit. In view of the financial risks faced by MPAs (which arise if they undertake a review and discover a significant risk which can only be overcome by the serving of a modification, revocation or discontinuance order and paying the accompanying compensation to the parties affected), this is a major disincentive to action. Second, the law only requires reviews when there is a reasonably imminent threat to a

European site, and the working of many permissions has not yet reached this point. As MPAs do not have the money to pay the associated compensation, and Government support for reimbursing any costs has not been established to the satisfaction of MPAs, MPAs have little incentive to commence the review process. These provisions have so far enabled many MPAs to avoid the need to embark on the review process. However, this position cannot be held indefinitely. With the passage of time, more mineral workings will have a potential effect on Natura 2000 sites, and appropriate assessments will become obligatory.

A number of MPAs have completed reviews in accordance with the Habitats Directive. Some of these have progressed smoothly but others not. Difficulties centre on (a) weaknesses in the legislation surrounding compulsion on mineral companies to provide the information the MPA needs to complete the review; and (b) the difficulty the MPA faces in demonstrating that harm to a Natura 2000 site will be avoided, as this requires judgements about acceptable levels of risk and levels of doubt. The main aggregates-related review to have been taken to conclusion and involving compensation arose at Blackhill Quarry, near Exeter in Devon. The mineral planning permission here had about twenty years to run, but the impact of mineral working on the newly designated SPA was judged to put at risk the integrity of the wildlife interest in the site. The mineral permission was therefore reviewed, with cessation of working required in one area and a limitation on the depth of working in another. This prevented extraction of much of the mineral in the site, and compensation was therefore payable to the landowner and the operator (Aggregates Industries). The amount involved, paid by the Government, was agreed by negotiation at about £8 million, though the compensation was reduced to £5 million by the provision of a replacement source for some of the mineral reserves through a permission at the nearby Thorntree plantation.

Full implementation of the review procedures under the Habitats Regulations lies ahead. There is considerable pressure on MPAs to provide alternative working opportunities for mineral companies, to avoid paying compensation for the revocation of existing permissions which would significantly damage Natura 2000 sites, so there is currently doubt about the degree to which the legislation will have a net impact on the capacity of the industry to supply aggregates. Nonetheless, the prospect is for less extraction of aggregates in locations which would be in or affect Natura 2000 designated sites.

### **3.2.4 Aggregates working in Natura 2000 sites after designation**

Planning applications for aggregates working and associated activity which could have a significant effect on the integrity of Natura 2000 sites must be accompanied by an ‘appropriate assessment’ of that impact. Permission cannot be granted if such an effect is likely. The assessment process is the same as the review applied to pre-existing planning permissions for mineral working, outlined in section 3.2.3 above. The procedures therefore provide a remarkably strong restriction on aggregates working proposals which might adversely affect designated sites.

## **3.3 INDUSTRY VIEWS ON AGGREGATES WORKING IN DESIGNATED AREAS**

Aggregates working in National Parks has received considerable attention as a policy issue by the aggregates industry. The industry recognises the strong policy constraints on excavation in these designations, and has taken positive steps to work with the national park authorities to achieve environmental benefits associated with its remaining activities in these areas. The collective formal opinion of the industry is expressed through the Quarry Products Association (QPA) for companies providing the large majority of output (including all the major companies) and through the British Aggregates Association (BAA) a group of the smaller companies.

In 1998, prior to the publication of MPS1, the QPA proposed the Four Point Plan for National Parks. This formed part of a major review by industry into how it could enhance and protect the environment.

In the Four Point Plan QPA members pledged to:

- “i. Work with the Government and National Park authorities to identify dormant planning permissions in National Parks which will not be reactivated and respond positively to initiatives by appropriate authorities to seek Prohibition Orders. This goes further than the present statutory position that they should not be reopened without the imposition of modern planning conditions. (The QPA also committed member companies not to enter into new agreements to operate dormant sites owned by third parties).
- ii. Work with National Park authorities to identify and clarify current permissions which are uncertain in scope or extent. Every effort will be made to resolve any areas of uncertainty without recourse to the courts;
- iii. Not submit any planning application for new workings in a National Park unless there is a national need in terms of mineral supply or where the proposal has benefits for the National Park in question;
- iv. Only propose the extension of existing quarries in National Parks where:
  - there is a national need in terms of mineral supply;
  - or the proposal has benefits for the environment, landscape and economic well-being of the National Park in question.”

Prominent QPA members worked with the Council for National Parks to develop the Four Point Plan, and particular progress has been made with tackling dormant sites. Initially seven significant old permissions were relinquished at dormant sites. Mineral companies have also co-operated over the last ten years in removing the possibility of future working at a selection of other dormant sites, usually by negotiation in conjunction with the granting of other permissions or by assisting the procedures for Prohibition Orders (which prevent resumption of mineral working). A survey in 2003 (CNP, 2004) showed that dormant permissions had been relinquished at 14 sites in National Parks, although 33 sites still had dormant permissions. Progress therefore continues to be made to limit the damage to National Parks which would undoubtedly arise if old permissions were reactivated, and industry involvement has achieved more than could have been done by MPAs using only the powers available to them in law.

Other aspects of the Four Point Plan continue to be applied by QPA members. A number of environmental improvements have been secured at quarry operations in National Parks, though this has almost always been in association with permissions to excavate additional land. However, no new quarry or major extension has been proposed by a QPA member in a National Park purely for aggregates working since the Four Point Plan was issued.

The weight which the QPA attaches to its approach to National Parks is illustrated by the status afforded to the Four Point Plan. This was originally part of an offer put before the Government as an alternative to the Aggregates Levy, (which had first been proposed by the Treasury in 1997), as a different means of securing environmental improvements. The QPA clarified that, even though all the other parts of the offer fell when the Aggregates Levy was introduced in law in 2000, the Four Point Plan for National Parks would still be honoured. There is no other policy statement from the industry comparable to its commitments to National Parks.

### **3.4 CREATION OF DESIGNATED LAND AT AGGREGATES SITES**

Aggregates working can be associated with the creation of valuable new habitats and the exposure of geological faces which may then warrant SSSI status. Studies (Entec, 1999; RSPB, 2006) have reported that over 600 SSIs have been designated in former mineral workings (of all types), both for wildlife and geology. Natural regeneration (/re-vegetation) will have been a major factor in the creation of wildlife interest, but the skills are now available to focus effort more directly on the creation of priority habitats. In the last two decades there has been a

significant shift in practice towards the restoration of completed aggregates workings in part or wholly to nature conservation end uses. This has increased the potential for aggregates working to create habitats which are scarce or of special value for wildlife, which may warrant designation.

Research by the Royal Society for the Protection of Birds (RSPB, 2006) has shown that mineral working (of which aggregates is likely to be the predominant type of working) has the potential to create very large areas of valuable new habitats. This would be sufficient to more than achieve the UK Biodiversity Action Plan targets for the creation of nine priority habitat types (and significant contributions to two others). Practice, however, is currently short of the potential, for a variety of reasons explored in the report. The four main reasons cited were 1) lack of support from the landowner; 2) inadequate financial return from a conservation end-use; 3) difficulty in securing long-term conservation management of the site and 4) proximity to airfields (threat of bird strike).

Government policy supports both the restoration of mineral workings for wildlife and geological benefits, and the operation of workings in ways which are sympathetic to biodiversity and geological conservation. Planning Policy Statement 9 *Biodiversity and Geological Conservation* (Office of the Deputy Prime Minister, 2005) advocates that planning authorities should prepare Local Development Frameworks which “identify any areas or sites for the restoration or creation of new priority habitats which contribute to regional targets, and support this restoration or creation through appropriate policies”. This principle is developed further in the accompanying *Planning for Biodiversity and Geological Conservation: A Guide to Good Practice* (ODPM, 2006), with specific encouragement for contributions from minerals development.

### 3.5 POLICY SUMMARY

Aggregates were being worked extensively in areas which subsequently were designated as National Parks or Areas of Outstanding Natural Beauty for their landscape quality or under European law for their wildlife interest. National Park and AONB boundaries were designated so far as practicable to omit major quarrying operations, whereas Natura 2000 sites were designated for their conservation interest regardless of the presence or absence of mineral workings.

Pre-existing aggregates workings in the areas designated for their landscape value have been allowed to continue, subject to legislative controls which apply everywhere. However, pre-existing operations which threaten the integrity of newly designated Natura 2000 sites must be amended to avoid such effects.

Taken together, the powers of the Habitats Directive in relation to Natura 2000 wildlife sites are much stronger than those of the National Parks and Access to the Countryside Act in relation to National Park landscapes. The interests of aggregate workings are overridden by the Directive if such working would have a significant adverse impact on designated wildlife areas. This applies to aggregates workings which predate any designation, to the process of designating new areas (whether or not aggregates workings are present), and to new proposals for aggregates workings unless it can be shown that the integrity of a Natura 2000 site will not be adversely affected. The effect of this legislation will be progressively to remove most aggregate workings from within and close to Natura 2000 sites, and to prevent new ones from being permitted there unless the aggregates workings will not adversely affect the reasons for the designation. In National Parks and AONBs, the volume of aggregates working can be expected to decline progressively when quarries (whether IDO sites or permissions dating from the early years of the planning system) become worked out.

## 4 Extraction of aggregate minerals from environmental designations

Resources of material suitable for use as primary aggregates in England comprise land-won sand and gravel, and crushed rock (limestone, sandstone, igneous and metamorphic rock). England is fortunate in having large resources of primary aggregates, all of which make an important contribution to supply. However, unlike human resources, capital knowledge and manufacturing facilities, mineral resources are non-transferable and can only be worked where they occur. The location of quarries fundamentally reflects geology and this distinguishes the extractive industries from other sectors of the economy. Primary aggregate resources are not evenly distributed throughout the country. In particular, there is very little hard rock suitable for crushed rock aggregate in southern and eastern England, where demand is highest, continuously exceeding that of the other regions.

A wide range of aggregates contribute to overall supply. Crushed rock and sand and gravel are the most important sources of aggregates. These are supplemented by substantial quantities of alternative materials (recycled aggregates and materials from secondary sources). The supply of aggregates in England is summarised in Table 3. Primary aggregates comprise 74% of the total supply with 67% being land won. In general, data for 2005 has been used throughout this report due to it being the most available and complete. However, where it is the best available, data for other years has been utilised to illustrate specific points/issues.

**Table 3.** England summary of aggregate sales, 2005.

	England		
	Thousand tonnes	% supply	% Total aggregates supply
<b>Primary (natural) aggregates</b>			
Sand & gravel ( <i>of which</i> )	70 453	46	34
( <i>Land-won sand &amp; gravel</i> )	56 743	37	27
( <i>Marine-dredged sand &amp; gravel</i> )	13 710	9	7
Crushed rock ( <i>of which</i> )	83 535	54	40
( <i>Limestone/dolomite</i> )	55 595	36	27
( <i>Igneous rock</i> )	20 018	13	10
( <i>Sandstone</i> )	7 250	5	3
( <i>Chalk</i> )	494	0.3	0.2
( <i>Ironstone</i> )	179	0.1	0.1
<b>Total primary aggregate</b>	<b>153 986</b>	<b>100</b>	<b>74</b>
<b>Alternative aggregates</b>			
Recycled aggregates	48 870	88	23
Secondary aggregates	6 920	11	3
<b>Total alternative aggregates</b>	<b>55 790</b>	<b>100</b>	<b>26</b>
<b>Total for England</b>	<b>209 776</b>		<b>100</b>

Source: Aggregate Minerals Survey, 2005. Survey of Arisings and Use of Alternatives to Primary Aggregates in England, 2005. Annual Minerals Raised Inquiry, 2005.

#### 4.1 INTERACTION BETWEEN AGGREGATE MINERAL RESOURCES, ACTIVE QUARRIES AND ENVIRONMENTAL DESIGNATIONS

Utilising mineral resource information from the BGS Minerals GIS a series of eight regional Aggregate Mineral Resource Maps at a scale of 1:250 000 have been produced. Digital PDF versions of these maps are available for download from the ALSF Sustainable Aggregates Website (<http://www.sustainableaggregates.com/>) and from the BGS MineralsUK website ([www.mineralsUK.com](http://www.mineralsUK.com)). These maps depict the spatial extent of those geological units potentially suitable as sources of aggregate that are not covered by National Parks, AONBs, SPAs/SACs and SSSIs. They also show the location of active quarries that produce aggregates either as the principal product, or (where known) as a by-product from other quarrying (for example, of building stone). The location of active rail depots and wharves that handle aggregates are also shown.

Generally, an aggregate resource is known to exist within the boundaries outlined by geological mapping. This may have been supplemented in some areas by more detailed geological mapping. It is important to note that the majority of data depicted on the maps are inferred resources for aggregates; they have been delineated on the basis of existing geological information (see Appendix 2). The resources defined show the areas within which potentially workable mineral may occur. No analysis of the full depth or quality of each mineral resource has been undertaken. For example, superficial sand and gravel resources tend to have thicknesses ranging from 1 to 10 metres, which will limit the depth of working; hard rock resources tend to be significantly thicker which generally allows for the extraction of more aggregates from a smaller area. Therefore, whilst Carboniferous limestone and igneous rock resources outside of the designations is limited in extent (Figures 2 and 3) the potential depth of resource means that a large volume of aggregate may still potentially be available.

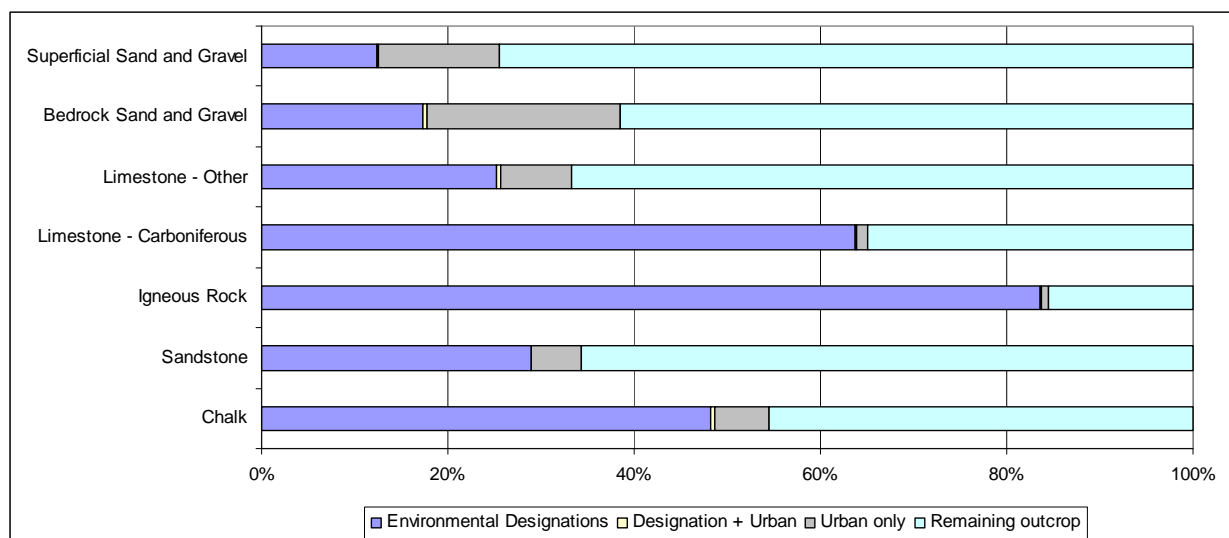
A statistical summary of the spatial extent of each resource category covered by National Parks, AONBs, SACs/SPAs, SSSIs and urban areas along with the extent of resources remaining is also shown on the maps in the form of two bar charts (also included in Appendix 3). Data has also been compiled for the whole of England (Figures 2 and 3). These charts provide an indication of the degree of resource availability. Data has also been shown for urban areas. The urban areas included in this study represent 3 000 towns and cities which range in size from 0.25 to 220 km<sup>2</sup>. (Therefore, not every built up area is included). No buffer has been applied to any of the designations or urban areas. Other land-use factors such as roads, small settlements, agricultural land designations, local environmental designations and groundwater protection zones in addition to any operational constraints and physical constraints (such as fragmented outcrop) will further reduce the area of available resource.

Table 4 summarises the area for sand and gravel and crushed rock resources. In total 27% of sand and gravel resource and 52% of crushed rock resource is covered by at least one of the designations considered in this study.

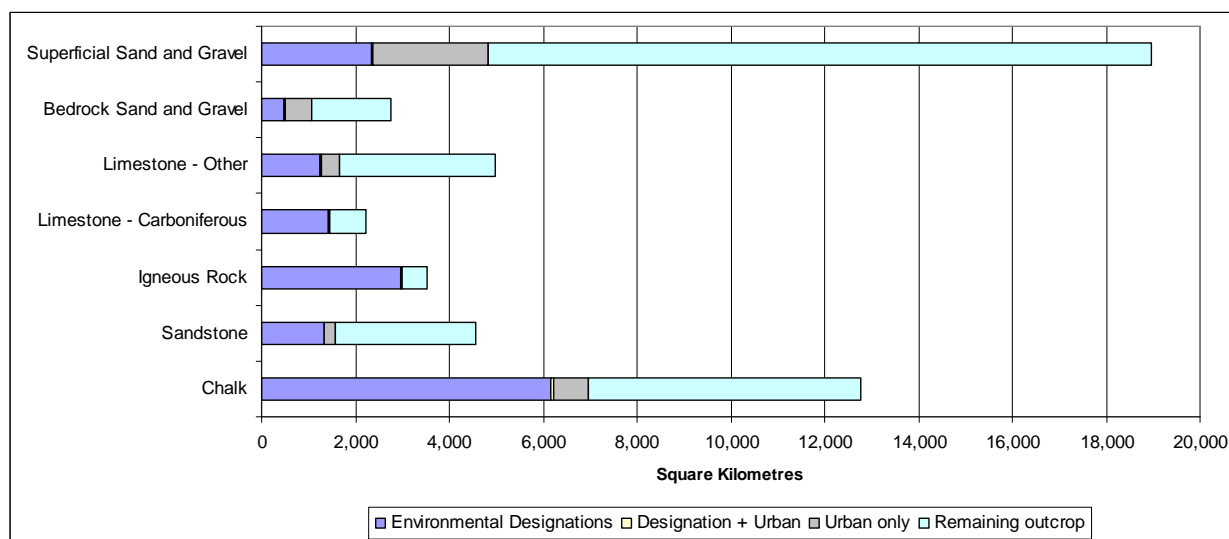
**Table 4.** Summary of the spatial extent of primary aggregate resources in England.

Mineral	Total area (km <sup>2</sup> )	Area covered by designation /urban (km <sup>2</sup> )	% covered	Area remain (km <sup>2</sup> )	% remain
Sand and gravel	21 731	5 910	27	15 821	73
Crushed rock	28 074	14 628	52	13 446	48
<b>Total aggregates resource</b>	<b>49 805</b>	<b>20 538</b>	<b>41</b>	<b>29 267</b>	<b>59</b>

In addition to assessing the area of aggregate resources that lie within the environmental designations the number of active quarries selling aggregate that are located in National Parks, AONBs, (or within 500 metres of) SPAs/SACs and SSSIs has been analysed. The results are shown on Figures 4 to 8.



**Figure 2.** Percentage areas of land-use in each aggregate resource, England.



**Figure 3.** Absolute area of land-use in each aggregate resource, England.

#### 4.1.1 Aggregate resources depicted on the maps

The aggregate mineral resources depicted on the regional maps and summary Figures 4 to 8 are sand and gravel, limestone (including dolomite and chalk), igneous rock and sandstone.

##### 4.1.1.1 SAND AND GRAVEL

Sand and gravel deposits are accumulations of the more durable rock fragments and mineral grains, which have been derived from the weathering and erosion of hard rocks mainly by glacial and river action, but also by wind. The properties of gravel, and to a lesser extent sand, largely depend on the properties of the rocks from which they were derived. However, water action is an effective mechanism for wearing away weaker particles, as well as separating different size

fractions. Most sand and gravel is composed of particles that are durable and rich in silica (quartz, quartzite and flint).

Land-won Sand and gravel resources can be conveniently classified into two major categories depending on their age and geology:

- superficial, or ‘drift’ deposits, and
- bedrock, or ‘solid’ deposits.

#### *Superficial sand and gravel*

Superficial deposits comprise all those sediments laid down during the last two million years. They mainly comprise river sands and gravels which take the form of extensive spreads that occur along the floors of major river valleys, generally beneath alluvium, and as river terraces flanking the valley sides. River terraces are the dissected, or eroded, remnants of earlier abandoned river floodplains.

The other major group of resources are glaciofluvial sands and gravels. These deposits were associated with glacial action and laid down by the glacial meltwaters issuing from, or flowing on top, within and beneath, ice sheets and glaciers. As Britain has been subjected to several periods of glaciation, their distribution is complex. Resources may occur in all parts of the country except southern and southwest England which were not glaciated.

#### *Bedrock sand and gravel*

Bedrock deposits of sand and/or gravel are important sources of supply in some areas. They occur as bedded formations, of a young age, and are relatively unconsolidated and easily worked. Some deposits such as the Folkestone Formation of the Weald and the Permian Yellow Sands of Durham, consist entirely of sand.

Sand and gravel was the principal source of primary aggregate until 1979, when crushed rock output exceeded it for the first time. Its relative importance has declined since then, however, in 2005 land won sand and gravel still accounted for 37% (57 Mt) of total primary aggregate supply (Table 3). Sand and gravel resources in England cover 21 731 km<sup>2</sup>, of which 5 910 km<sup>2</sup> (27%) is covered by National Parks, AONBs, SSSIs, SPAs/SACs or urban areas (Figures 2 and 3). There are 468 active sand and gravel quarries extracting aggregate of which 118 (25%) are associated with at least one environmental designation (Figure 4 and Table 5).

#### 4.1.1.2 LIMESTONE (INCLUDING DOLOMITE AND CHALK)

Most limestones and dolomites are hard and durable and useful for aggregate. They are common rock types and consequently widely extracted for aggregate materials. Limestone is also widely used for non-aggregate uses such as cement manufacture and both limestone and dolomite are valued for a range of industrial uses which, like cement manufacture, utilise their chemical properties.

Limestone (including dolomite) is the principal source of crushed rock aggregate within England. The 55.6 Mt sold in 2005 accounted for 67% of total crushed rock aggregate and 36% of all primary aggregates (Table 3). Limestones of Carboniferous age (360 to 285 million years) are the major source of limestone aggregate and it represents one of the largest resources of good-quality aggregate within England. They are commonly thickly bedded and consistent which enable them to be quarried extensively and economically. They typically produce strong and durable aggregates suitable for roadstone (sub-base and lower layers) and concreting aggregate. The quality of the limestone resources and their ease and economy of working may be affected by a number of geological factors (such as waste content, alteration by dolomitisation,



degree of faulting and folding etc.). There are 2 231 km<sup>2</sup> of Carboniferous limestone resource of which 1 454 km<sup>2</sup> (65%) are covered by at least one of the designations analysed (Figures 2 and 3).

‘Other’ limestones being worked for aggregates include the Devonian limestones of south Devon, the Permian Magnesian Limestone of north-eastern England and to a lesser extent Silurian limestones of the Welsh Borders (Figure 5). Such limestones cover a total area in England of 4 970 km<sup>2</sup>. Of this, 1 651 km<sup>2</sup> (33%) of the resource is covered at least one of the designations analysed (Figures 2 and 3).

There are 165 active quarries in England extracting limestone for aggregate use, of these 85 (52%) are associated with at least one of the environmental designations included in this study (Figure 5 and Table 5).

Chalk is a form of fine-grained limestone but is soft and porous and generally unsuitable for use as aggregate. Chalk resource has only been shown on the maps for those regions (East Midlands, Yorkshire and the Humber) where it is older and harder and therefore, although unlikely, is a potential source for aggregate. Younger chalk resource does exist in the East of England, South West and South East England regions. However, it is much softer and is not really a source for construction aggregates (apart from small amounts used for constructional fill). Therefore, it has not been depicted on the maps. Apart from the extraction of very minor amounts of chalk for roadstone in Yorkshire and the Humber, nearly all of the 0.5 Mt of chalk sold for aggregate use in 2005 (Table 3) was used as constructional fill. There are also 25 active chalk quarries that extract rock for use as aggregate in England of which 10 (40%) are associated with an environmental designation (Figure 6 and Table 5).

#### 4.1.1.3 IGNEOUS (AND METAMORPHIC ROCK)

Igneous rocks tend to produce strong aggregates with a degree of skid resistance and are hence suitable for many road surfacing applications, as well as for use in the lower parts of the road pavement. Aggregates for the most demanding road surfacing applications are, however, usually produced from sandstones. The high strength and attrition resistance of certain igneous rocks results in their use as railway ballast. In England resources are localised and only occur in the North, Midlands and South West (Figure 7).

In 2005 igneous rock production accounted for 13% of total primary aggregates supply (24% of total crushed rock supply) in England (Table 3). Quarrying of igneous rocks is centred on the outcrops that are best placed to serve the main markets. The small outcrops of igneous rock in Leicestershire provide a source of hard rock in the Midlands, which are also well placed to serve markets in the South East. The deposits are of economic importance out of proportion to their relatively small size and account for over 70% of total igneous rock production in England. The area of total igneous rock resource (3 540 km<sup>2</sup>) covered by National Parks, AONBs, SPAs/SACs, SSSIs and urban areas is high 2 991 km<sup>2</sup> (84%) (Figures 2 and 3). Of the 34 active igneous rock quarries 23 (68%) are associated with at least one of the environmental designations (Figure 7 and Table 5).

#### 4.1.1.4 SANDSTONE

Sandstones are sedimentary rocks consisting of sand-sized particles composed predominantly of quartz but with variable amounts of feldspar and rock fragments set in a fine-grained matrix or cement. Compositional differences, both of the sand grains and the matrix, give rise to different rock names under the general heading of ‘sandstone’, such as quartzites, greywackes, gritstones, and arkoses.

Sandstones of various geological ages occur in England. They differ widely in their thickness and physical properties, and thus resource potential.

Many types of sandstone are too porous and weak to be used other than as sources of constructional fill. In general, older more indurated sandstones (subjected to tectonic compression) exhibit higher strengths and are suitable for more demanding aggregate uses. Some sandstones (greywackes) also have a high polishing (Polished Stone Value, PSV) and abrasion resistance and are particularly valued for road surfacing (roadstone) where they provide resistance to skidding. They are the premium products of the crushed rock quarrying industry.

In 2005 sandstone contributed 5% to total primary aggregate supply (13% of total crushed rock) (Table 3) and of the total 4 563 km<sup>2</sup> of sandstone resource 1 556 km<sup>2</sup> (34%) are covered by at least one of the designations included in this study (Figures 2 and 3). Of the 75 active sandstone quarries that extract material for aggregate uses, 13 (17%) are associated with at least one environmental designation (Figure 8 and Table 5).

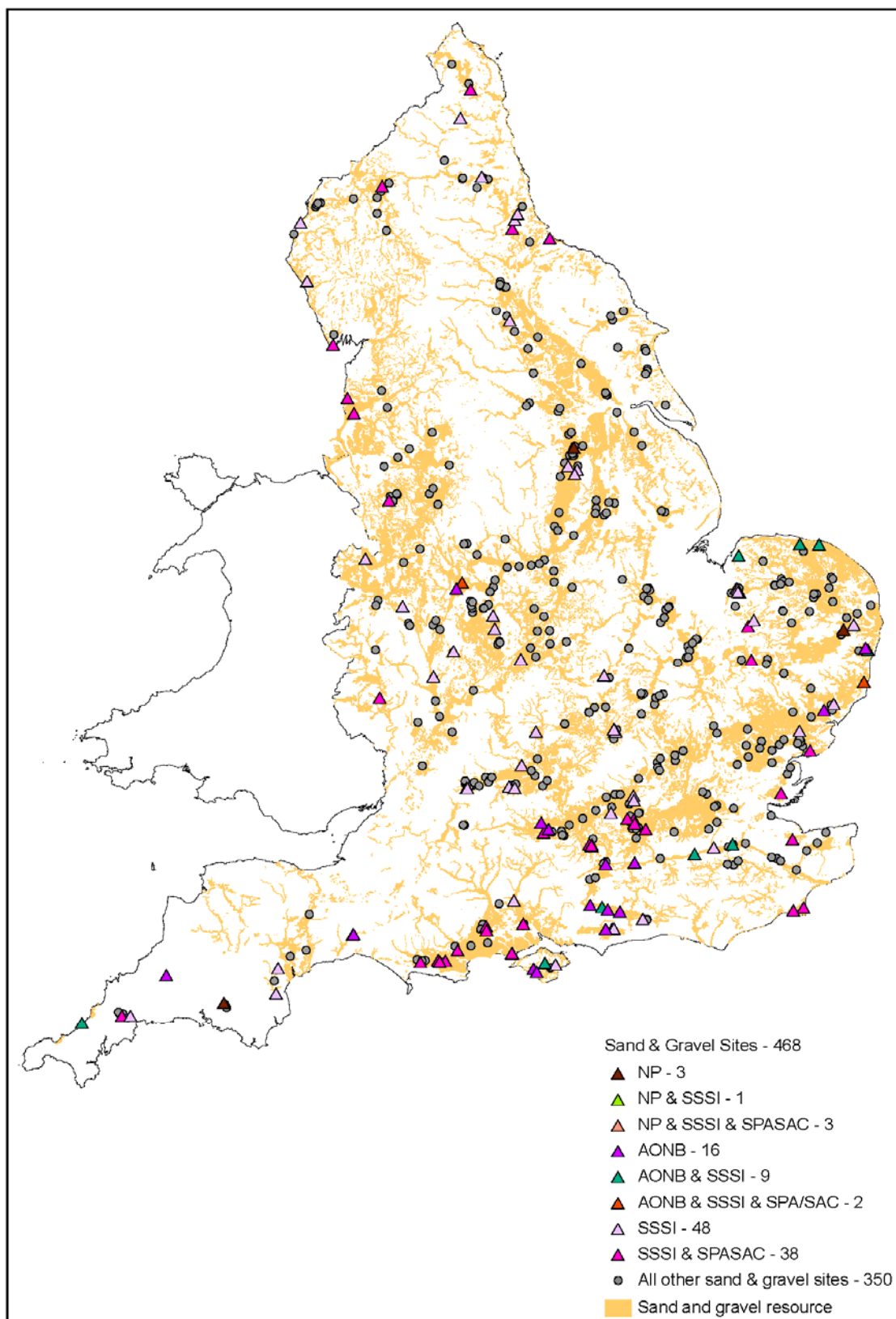
In total, almost third of all active aggregate quarries in England are currently associated with at least one environmental designation (Table 5).

**Table 5.** Active aggregates quarries in England associated with selected environmental designations.

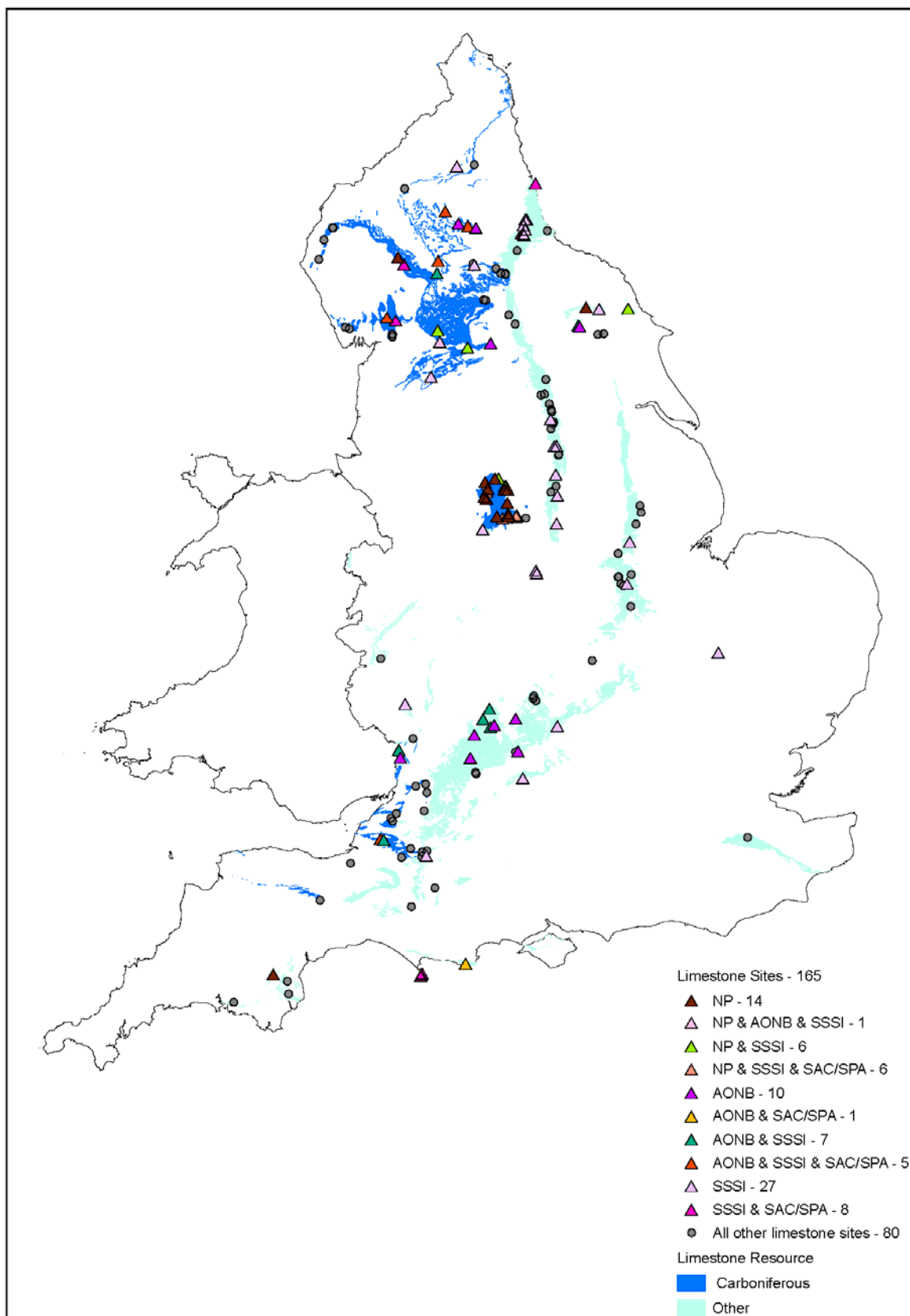
Mineral	Active quarries (extracting aggregate)	Active quarries associated with at least one env. desig. <sup>a</sup>	% of total
Sand and gravel	468	118	25
Limestone (excluding chalk)	165	85	52
Igneous rock	34	23	68
Sandstone	75	13	17
Chalk	25	10	40
<b>Total aggregates</b>	<b>767</b>	<b>249<sup>b</sup></b>	<b>32</b>

a) National Park, AONB, SAC/SPA, SSSI.

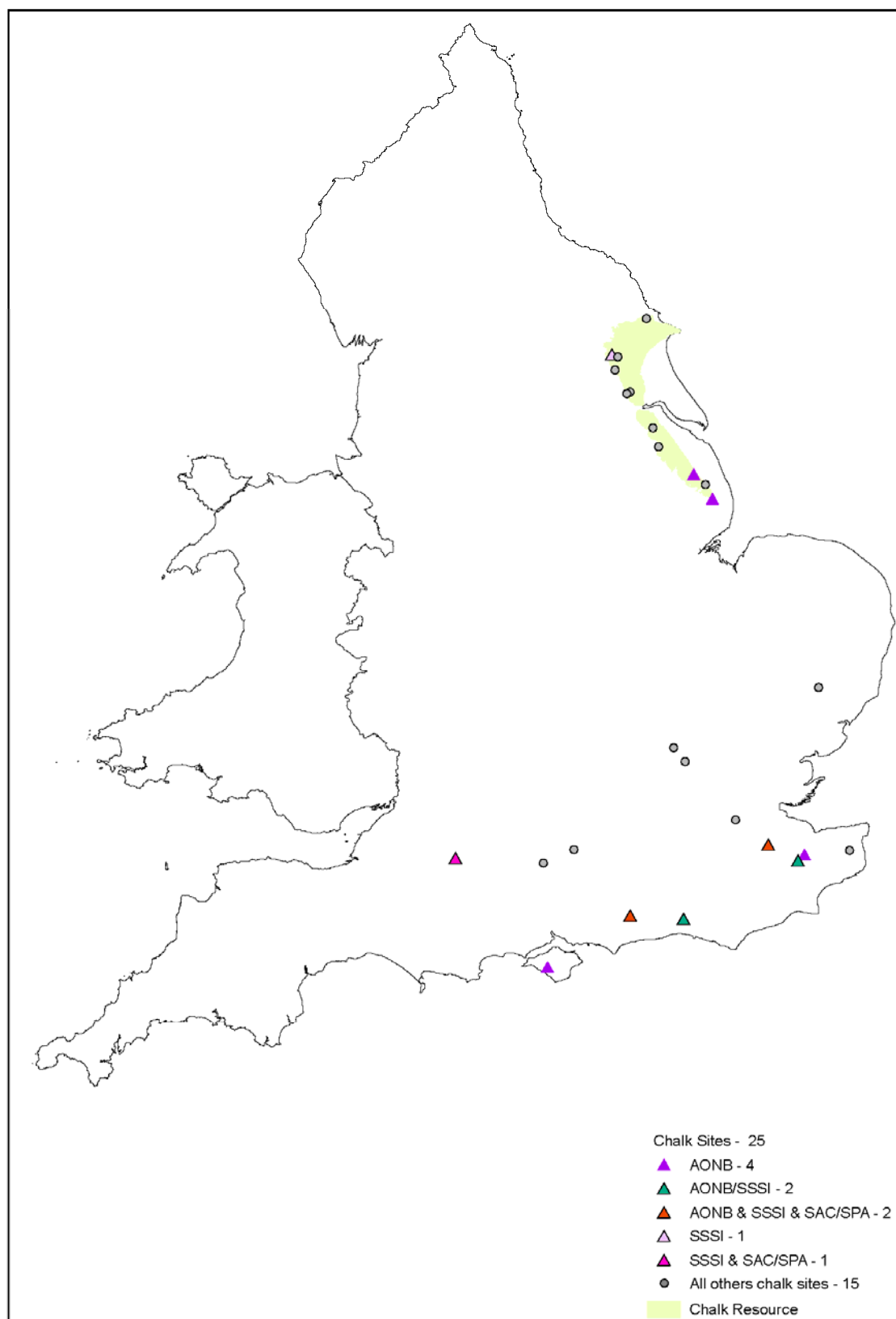
b) Of this total, 76 quarries are between 0 to 500 metres of an SAC/SPA.



**Figure 4.** Distribution of active sand and gravel aggregate quarries.

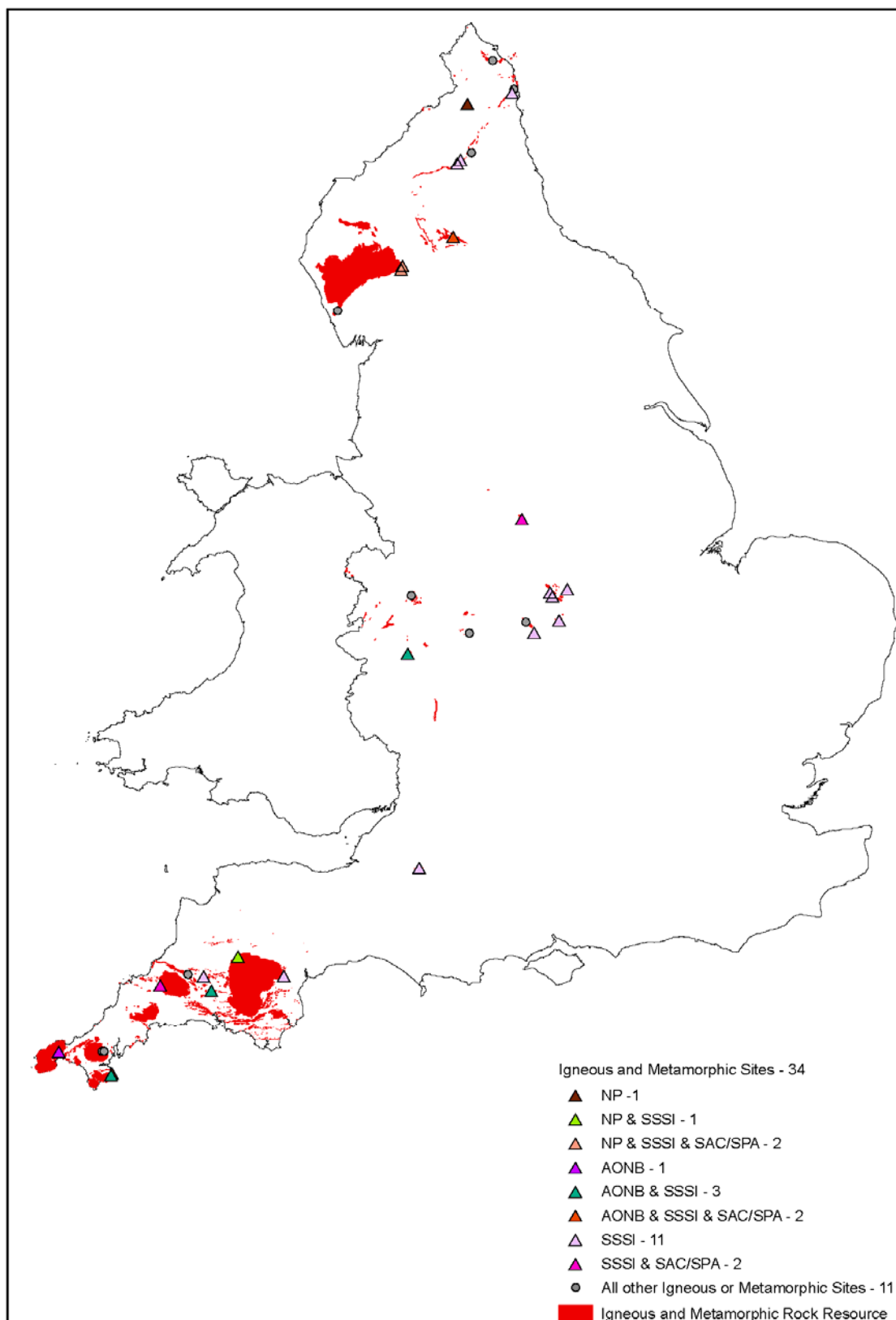


**Figure 5.** Distribution of active limestone aggregate quarries.

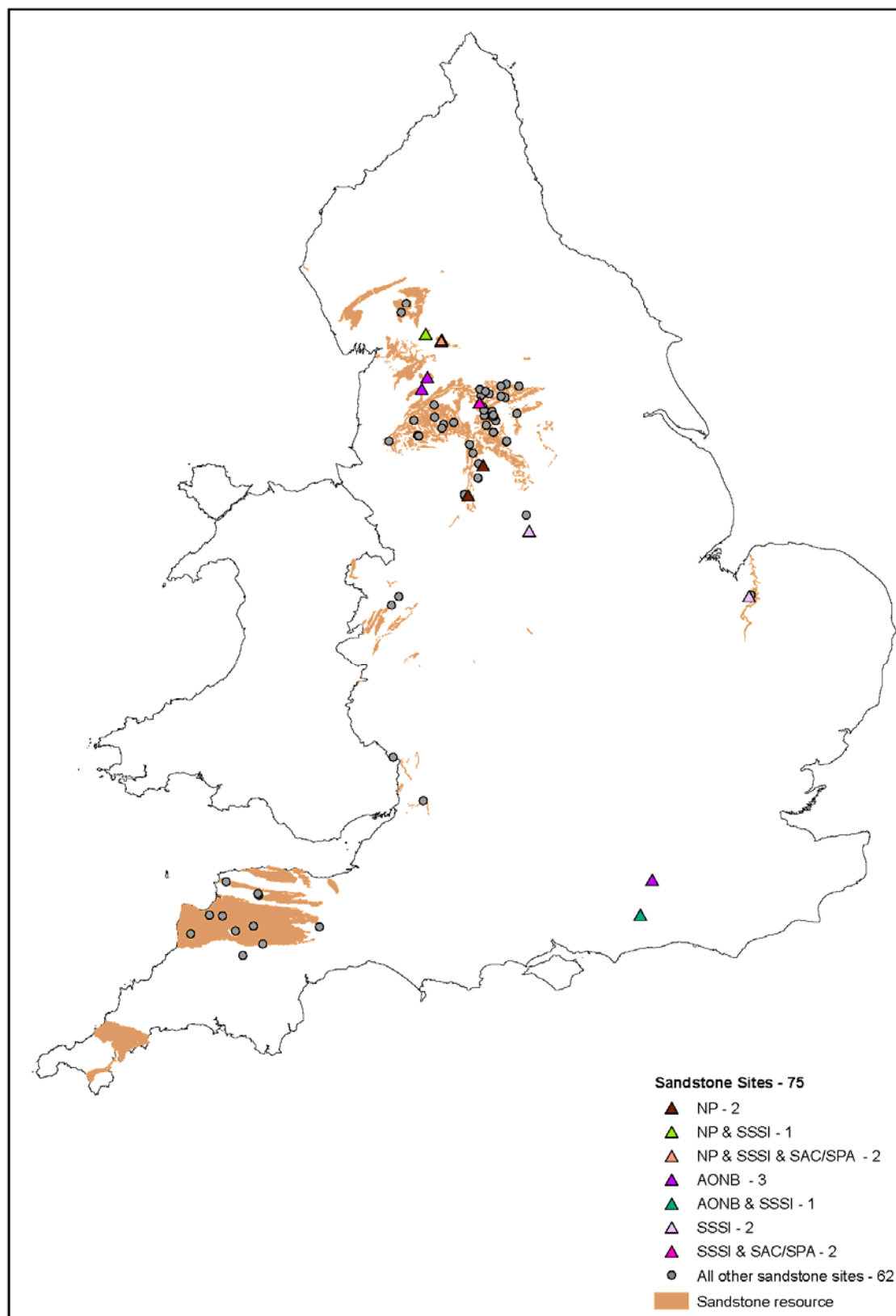


**Figure 6.** Distribution of active chalk aggregate quarries.

(Chalk is generally unsuitable for use as aggregate. Younger chalk resource does exist in the East of England, South West and South East England regions. However, it is much softer and is not really a source for aggregates. Therefore it is not shown).



**Figure 7.** Distribution of active igneous and metamorphic rock aggregate quarries.



**Figure 8.** Distribution of active sandstone aggregate quarries.

(The two aggregates quarries in the South East of England produce aggregates as a by product of extraction from a building stone resource).

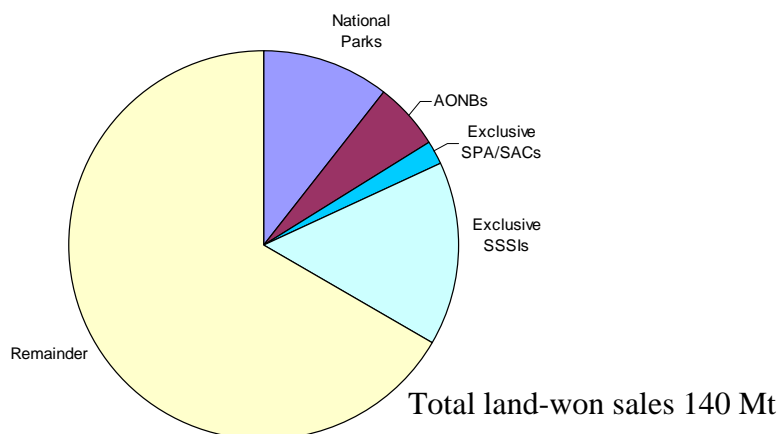
## 4.2 SALES AND RESERVES FROM ENVIRONMENTAL DESIGNATIONS.

There are approximately 250 active quarries that extract aggregates within, or are associated with National Parks, AONBs, SPAs/SACs and SSSIs (Table 5). The four yearly, Aggregate Minerals Survey collects information on sales and reserves from selected environmental designations. However, data for SPAs/SACs and SSSIs are not mutually exclusive from that for National Parks and AONBs (many SPAs/SACs and SSSIs are contained within National Parks and AONBs). In order to attempt to distinguish the proportion of aggregate associated with those SPAs/SACs and SSSIs outside of National Parks and AONBs separate MPA level (collated) data for those quarries associated with SPAs/SACs and SSSIs but which are outside of National Parks and AONBs was obtained. The resulting sales and reserves data are presented in Table 6 and 7.

It is important to note that some designations, notably SSSIs (and consequently SPAs/SACs where relevant), may only coincide with a small part of an extant mineral permission, which may, or may not, be active. The degree of overlap, and the actual or potential impacts of mineral extraction on the conservation interest, whether geological or biological, will vary and cannot be calculated or assumed from the figures presented. For example, where a quarry site overlaps to a small extent onto an SSSI or SPA/SAC (see Appendix 4) the whole sales and reserve figures are presented. For some SSSIs, the whole quarry site is affected. However, where this is the case the SSSI is itself likely to have been formed by quarrying. In addition, legal agreements may already exist which protect these designations from quarrying. The information, in particular for SSSIs and SPAs/SACs therefore, needs to be treated with caution.

### 4.2.1 Sales

In 2005 total sales of primary aggregates from quarries located in or associated with the selected environmental designations was 46.8 Mt (Table 6). This represents a third (33.4%) of total land-won primary aggregate sales. Sales from National Parks contributed 14.8 Mt (10.5%) and 7.8 Mt (5.6%) came from quarries within AONBs. Certain environmental designations dominate supply. The Peak District National Park alone accounts for 18% of total aggregate sales associated with environmental designations and 58% of aggregate sales from National Parks. This is followed by the Yorkshire Dales and North York Moors National Parks contributing 9% of all aggregate sales from quarries associated with the selected designations and 28% of National Park sales (the majority of which is from the Yorkshire Dales). Sales associated with SSSIs are dominated by igneous rock with the greatest contribution being made by quarries situated in Leicestershire (the majority of which have been designated as geological SSSIs). Figure 9 summarises the relative proportions of total primary land-won aggregate sales by selected environmental designation.



**Figure 9.** Primary aggregate sales in England by selected environmental designation, 2005.

*Source: Mineral Planning Authorities; Aggregate Minerals Survey, 2005.*



**Table 6.** Proportion of total land won primary aggregate sales from selected environmental designations.

Mineral (for aggregate use only)	National Park (total)		AONB (total)		SPA/SAC (exclusive of NP and AONBs) <sup>a</sup>		SSSI (exclusive of NP, AONBs and SPA/SAC) <sup>b</sup>		Total	
	Thousand tonnes	% of total sales <sup>c</sup>	Thousand tonnes	% of total sales <sup>c</sup>	Thousand tonnes	% of total sales <sup>c</sup>	Thousand tonnes	% of total sales <sup>c</sup>	Thousand tonnes	% of total sales <sup>c</sup>
Land won sand and gravel	160	0.1 (0.3)	1 907	1.4 (3.4)	1 676	1.2 (2.9)	2 103	1.5 (3.7)	5 846	4.2 (10.3)
Limestone	12 592	9.0 (22.6)	5 040	3.6 (9.1)	885	0.6 (1.6)	5 125	3.7 (9.2)	23 642	16.9 (42.5)
Igneous rock	949	0.7 (4.7)	624	0.4 (3.1)	-	- -	14 409	10.3 (72.0)	15 982	11.4 (79.8)
Sandstone	1 059	0.8 (14.6)	204	0.1 (2.8)	-	- -	18	0.0 (0.2)	1 281	0.9 (17.7)
Chalk	-	- -	50	0.0 (10.1)	-	- -	-	- -	50	0.0 (10.1)
Total crushed rock aggregate	14 600	10.4 (17.5)	5 918	4.2 (7.0)	885	0.6 (1.1)	19 552	13.9 (23.4)	40 955	29.2 (49.0)
<b>Total aggregate</b>	<b>14 760</b>	<b>10.5 -</b>	<b>7 825</b>	<b>5.6 -</b>	<b>2 561</b>	<b>1.8 -</b>	<b>21 655</b>	<b>15.4 -</b>	<b>46 801</b>	<b>33.4 -</b>

a) Total England sales for SPA/SAC inclusive of National Parks and AONBs in 2005 were 1.9 Mt sand and gravel and 2.7 Mt crushed rock.

b) Total England sales for SSSIs inclusive of National Parks, AONBs and SPA/SAC in 2005 were 3.6 Mt sand and gravel and 27.7 Mt crushed rock.

c) Percent of total England sales. Figures not in brackets represent percent of total land won primary aggregate sales (thus excluding marine) in 2005 (140 Mt). Figures in brackets represent percent of total sales for each individual rock type in 2005.

Source: Mineral Planning Authorities; Aggregate Minerals Survey, 2005.

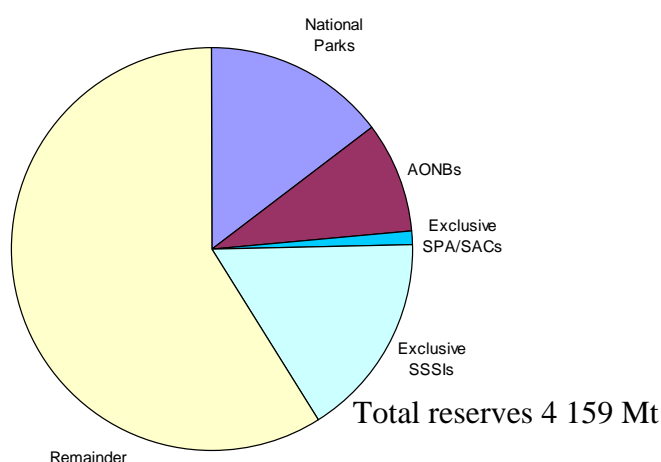
### 4.2.2 Reserves

A significant amount of permitted reserves for primary aggregates are at quarries within, or associated with, environmental designations. Table 7 provides the breakdown of reserves as at 2005. Of the 4 159 Mt total permitted reserves in England, 987.6 Mt (24%) are in National Parks and AONBs. National Parks account for 614 Mt, (15% of total reserves) and AONBs 374 Mt (9% of total reserves). Figure 10 summarises the relative proportions of total primary aggregate reserves by selected environmental designation.

Around 42% of all limestone aggregate reserves in England (1,060 Mt) are in quarries associated with an environmental designation with the bulk (523 Mt, 20.6%) being in National Parks. Whilst lower in terms of tonnes permitted (529 Mt) a higher proportion of igneous rock reserves (68.7%) are in quarries associated with environmental designations (principally SSSIs).

As with sales, crushed rock reserves in the Peak District National Park dominate (22% of total reserves for all designations and 61% of National Park reserves). This is followed by the Yorkshire Dales and North York Moors National Parks, contributing 8% of reserves associated with all designations and 21.5% of National Park reserves (the majority of which are within the Yorkshire Dales).

Assuming a base market price for extracted aggregate of £10 per tonne the value of aggregates reserves in National Parks and AONBs is in excess of £10 billion. The actual price of material sold as aggregate will depend on the quality of material extracted and the end use to which it is put.



**Figure 10.** Primary aggregate reserves in England by selected environmental designation, 2005.

*Source: Mineral Planning Authorities; Aggregate Minerals Survey, 2005.*

**Table 7.** Proportion of total primary aggregate reserves from selected environmental designations.  
(active and inactive quarries).

Mineral (for aggregate use only)	National Park (total)		AONB (total)		SPA/SAC (exclusive of NP and AONBs) <sup>a</sup>		SSSI (exclusive of NP, AONBs and SPA/SAC) <sup>b</sup>		Total (within designation)	
	Thousand tonnes	% of total reserves <sup>c</sup>	Thousand tonnes	% of total reserves <sup>c</sup>	Thousand tonnes	% of total reserves <sup>c</sup>	Thousand tonnes	% of total reserves <sup>c</sup>	Thousand tonnes	% of total reserves <sup>c</sup>
Land won sand and gravel	1 729	0.0 (0.3)	39 608	1.0 (6.6)	21 522	0.5 (3.6)	11 935	0.3 (2.0)	74 794	1.8 (12.4)
Limestone	522 954	12.6 (20.6)	225 904	5.4 (8.9)	23 055	0.6 (0.9)	288,060	6.9 (11.3)	1 059 973	25.5 (41.7)
Igneous rock	76 215	1.8 (9.9)	83 685	2.0 (10.9)	-	- -	368 921	8.9 (47.9)	528 821	12.7 (68.7)
Sandstone	13 231	0.3 (6.1)	7 050	0.2 (3.3)	-	- -	2 458	0.1 (1.1)	22 739	0.5 (10.5)
Chalk	-	- -	17 228	0.4 (66.3)	-	- -	679	0.0 (2.6)	17 907	0.4 (68.9)
Total crushed rock aggregate	612 400	14.7 (17.2)	333 867	8.0 (9.4)	23 055	0.6 (0.6)	660 118	15.9 (18.6)	1 629 440	39.2 (45.8)
<b>Total aggregate</b>	<b>614 129</b>	<b>14.8 -</b>	<b>373 475</b>	<b>9.0 -</b>	<b>44 577</b>	<b>1.1 -</b>	<b>672 053</b>	<b>16.2 -</b>	<b>1 704 234</b>	<b>41.0 -</b>

a) Total reserves for SPA/SAC inclusive of National Parks and AONBs in 2005 were 22.6 Mt sand and gravel and 152.6 Mt crushed rock.

b) Total reserves for SSSIs inclusive of National Parks, AONBs and SPA/SAC in 2005 were 36.1 Mt sand and gravel and 1 080 Mt crushed rock.

c) Percent of total reserves. Figures not in brackets represent percent of total primary aggregate reserves in 2005 (4 159.2 Mt). Figures in brackets represent percent of total reserves for each individual rock type in 2005.

Source: Mineral Planning Authorities; Aggregate Minerals Survey, 2005.

### 4.3 THE SCOPE FOR FUTURE AGGREGATES WORKING IN DESIGNATED AREAS

The policies applied to proposals for aggregates working in National Parks and AONBs are reasonably clear, as are the legal obligations when considering proposals which would affect Natura 2000 sites. These constraints are demanding but not absolute: aggregates working may still be permissible in these areas without breaching the formal requirements.

Predicting the likelihood of development proposals coming forward which meet the requirements is difficult. One indicator may be recent experience. Information collected in the four-yearly Aggregate Minerals Surveys now includes data on the number of quarries and their tonnages permitted in each of the designated areas subject to this study. This covers the four year period since the previous survey. Data published in the most recent survey, AM2005, therefore provide figures for permissions in the four years 2002-2005 and data published in AM2001 provides figures for permissions in the four years 1998-2001.

Table 8 summarises the total reserves and the number of sites granted planning permission to supply wholly, or in part, aggregate minerals between 1998-2005. Also summarised in this table is the relative proportion of those planning permissions granted that are in, or are associated with, National Parks, AONBs, SACs/SPAs, SSSIs. The total number of sites granted permission in England was 505. Of these 51 are in, or associated with, the selected environmental designations.

**Table 8.** Reserves and planning permissions granted in England for the period 1998 – 2005.

Mineral	All sites		Designations <sup>a</sup>			
	Reserves (thousand tonnes)	Number of sites	Reserves (thousand tonnes)	Number of sites	% of total reserves <sup>b</sup>	
Land won sand and gravel	310 918	376	34 730	28	5	(11)
Limestone	365 651	70	15 557	14	2	(4)
Igneous rock	16 578	10	-	-	-	-
Sandstone	52 290	41	3 920	7	1	(7)
Chalk	3 367	8	345	2	0	(10)
Total crushed rock aggregate	437 886	129	19 822	23	3	(5)
<b>Total aggregate</b>	<b>748 804</b>	<b>505</b>	<b>54 552</b>	<b>51</b>	<b>7</b>	<b>-</b>

a) Figures are mutually exclusive (i.e., where a site is associated with more than one designation it has only been counted once).

b) Percent of total reserves (749 Mt). Figures not in brackets represent percent of total primary aggregate reserves granted permission. Figures in brackets represent percent of total reserves for each individual rock type.

*Source: Aggregate Minerals Survey, 2001 and 2005.*

Total reserves granted planning permission in England between 1998 to 2005 were 749 Mt. This was split between 445 Mt for 1998-2001 and 303 Mt for 2002-2005, a 32% decrease in the amount of reserves granted between the two time periods. For the same periods, the amount of reserves granted in sites, in or associated with, the selected environmental designations decreased by 2% (from 27.6 Mt, 1998-2001, compared with 27.0 Mt, 2002-2005).

Of the 51 sites granted permission in, or associated with, the selected environmental designations only three were new sites totalling 1.3 Mt (all sand and gravel), two were borrow pits and the remaining 46 were extensions.

Further investigations were made for those permissions granted in designations for the period 2002-2005. As all the case data are published, the individual sites involved have been traced and details obtained from local Mineral Planning Authority staff familiar with them. The handling of these cases may give an insight into the issues which are arising in designated areas. Only those sites with significant permitted reserves have been studied as smaller ones would have little bearing on the overall output of aggregates from designated areas.

### 4.3.1 National Parks and AONBs

Sites given permission with large reserves of aggregates, and therefore capable of having an impact on the overall output of designated areas, may well also be 'major' developments which should meet stricter tests than are applied to 'not-major' developments before permission can be granted. However, there is no official explanation of the distinction between the two types of proposal, and there is no simple dividing line between them in terms of tonnages. The only point for assessment in the present context is whether policy is being applied correctly before permission is given, though this will necessarily be difficult to judge for the above reason. (If policy is not being properly applied, then it would be expected to be applied more effectively in future, and past rates of permission could be no guide at all to future permissions.) The data on the scale of permissions in National Parks and AONBs is set out in Table 9.

**Table 9.** Reserves of aggregates permitted in National Parks & AONBs, 2002-2005.

Region	National Parks				AONBs			
	Crushed rock		Sand and gravel		Crushed rock		Sand and gravel	
	Reserves (thousand tonnes)	Number of sites	Reserves (thousand tonnes)	Number of sites	Reserves (thousand tonnes)	Number of sites	Reserves (thousand tonnes)	Number of sites
South West	-	-	-	-	20	1	2 930	3
South East	-	-	-	-	45	1	1 855	4
East of England	-	-	-	-	-	-	762	2
East Midlands	1 894	5	-	-	-	-	-	-
West Midlands	-	-	-	-	-	-	11 000	1
North West	-	-	-	-	58	1	-	-
Yorkshire & the Humber	1 900	1	-	-	-	-	-	-
North East	-	-	-	-	-	-	-	-
<b>England</b>	<b>3 794</b>	<b>6</b>	<b>-</b>	<b>-</b>	<b>123</b>	<b>3</b>	<b>16 547</b>	<b>10</b>

*Source: Aggregate Minerals Survey, 2005.*

Three particularly large cases have been identified in nationally important landscapes in the period 2002-05.

(1) A permission for 1.5 Mt of crushed rock was granted in the Peak District National Park (East Midlands). Rock for sale as aggregate was the byproduct part of a consolidating permission principally for fluorspar working at a number of sites in the same ownership on Longstone Edge. There was considerable doubt in the National Park Authority's mind on whether the fluorspar proposals satisfied the policy requirements in terms of national need and lack of alternative sites, but permission was granted on the basis that the proposals offered the least damaging landscape impact on the valued characteristics of the National Park. Net environmental benefit would arise from the relinquishing of existing permissions whose working would have been damaging to the Park and because of the improved control obtained over working across the entire area, including a shorter working period.

(2) A permission for 1.9 Mt of crushed rock was granted in the Yorkshire Dales National Park (Yorkshire & the Humber). This was at Arcow Quarry to remove rock behind the quarry face which was in an unstable condition and a risk to public safety. The engineering solution with the minimum impact on volume of mineral was adopted. The question of whether the scheme was ‘major’ or ‘not major’ was not addressed.

(3) A permission for 11 Mt of sand and gravel was granted by Staffordshire County Council in Cannock Chase AONB (West Midlands). The site at Pottal Pool was an extension to an existing working and had been allocated in a Minerals Local Plan which had been adopted, with AONB protection policies, only six months before the decision. The principle of working the site was therefore considered to have been established.

#### 4.3.2 Natura 2000 sites

If there is a risk that working might adversely affect a designated European wildlife site, then an Appropriate Assessment must be carried out first. If this establishes that a risk to the integrity of the wildlife interest in designated sites does exist, then it is a requirement of European law that aggregates working (like other activities) should not be allowed, subject to some closely defined exceptions. The scale of operation proposed is not relevant to this assessment. The data on the scale of permissions in Natura 2000 sites is set out in Table 10.

**Table 10.** Reserves of aggregates permitted in quarries associated with Natura 2000 sites, 2002-2005.

Region	Natura 2000 sites			
	Crushed rock		Sand and gravel	
	Reserves (thousand tonnes)	Number of sites	Reserves (thousand tonnes)	Number of sites
South West	-	-	-	-
South East	-	-	1 995	1
East of England	-	-	277	2
East Midlands	1 500	1	-	-
West Midlands	-	-	-	-
North West	-	-	3 000	1
Yorkshire & the Humber	1 900	1	-	-
North East	-	-	-	-
<b>England</b>	<b>3 400</b>	<b>2</b>	<b>5 272</b>	<b>4</b>

Source: Aggregate Minerals Survey, 2005.

(1) A permission for 1.5 Mt of crushed rock was granted in the Peak District National Park (East Midlands). Rock for sale as aggregate was the byproduct part of a consolidating permission principally for fluorspar working at a number of sites in the same ownership on Longstone Edge (the same case as referred to under *National Parks and AONBs*, above). There was a risk that, without a rigorous dust monitoring and mitigation scheme, dust deposition on the Coombes Dale candidate Special Area of Conservation would damage the integrity of the designated area. The applicant agreed to the necessary measures. Together with evidence that dust deposition could be controlled to well below the threshold level of concern, this obviated the need to carry out an Appropriate Assessment. The integrity of the wildlife site was not at risk.

(2) A permission for 1.9 Mt of crushed rock was granted in the Yorkshire Dales National Park (Yorkshire & the Humber). This was at Arcow Quarry to remove rock behind the quarry face

which was in an unstable condition and a risk to public safety (the same case as referred to under *National Parks and AONBs*, above). English Nature (now Natural England) expressed concern about this proposal, so an Appropriate Assessment was carried out. This concluded that a permission would risk an adverse impact on the Ingleborough Complex SAC. Permission was nevertheless granted, on the grounds of an overriding interest in public safety.

(3) A permission for 1.995 Mt of sand and gravel was permitted by Hampshire County Council in the Thames Basin Heaths SPA (South East). The site at Bramshill was in commercial woodland where mineral working would not conflict with the purpose of protecting heathland habitat of importance for scarce birds. The integrity of the wildlife site was not at risk.

(4) A permission for 3 Mt of sand was granted by the Secretary of State following a public inquiry into an application called-in from Sefton MBC (North West). Horse Bank is a sand deposit in the intertidal zone where the primary reason for extraction was to supply an extremely scarce grade of sand for grinding and polishing to produce polished-wire glass. Aggregates arose as a byproduct. The Inspector concluded that the proposals would not affect the integrity of the Ribble and Alt Estuaries SPA or the Sefton Coast candidate SAC, and the Secretary of State agreed. Although the permission was implemented, excavations have now ceased.

### 4.3.3 Summary

The reported cases indicate that large-output planning permissions continue to be granted in designated areas. In some cases these were simply because the proposals could be permitted without causing conflicts with the purposes of designation, such as the wildlife value in Longstone Edge (Peak District), Bramshill (Hampshire), and Horse Bank (Sefton). In some other cases, conflicts of interest were established but the designation held to be less important than other interests (including other environmental interests), such as the landscape value in Longstone Edge (Peak District) and the wildlife value in Arcow (Yorkshire Dales). The interests of the designated area were considered in all cases studied, though the appropriate tests may not necessarily always have been addressed fully, such as the grounds for deciding major sand and gravel workings in Cannock Chase AONB at Pottal Pool (Staffordshire).

Other sites became apparent where large-output aggregate quarries had been permitted in designated areas. Some of these post-dated 2005 (and will be counted in AM2009). In other cases there was no increase in permitted output, so the cases would not feature in surveys as providing new reserves. This was indicated by permissions extending time for working at the major Dry Rigg and Old Ingleton Quarries in the Yorkshire Dales National Park.

Many of the circumstances described in these cases seem likely to reappear at other sites. Cases where mineral working do not conflict with the purposes of designation may well continue to be found, particularly in Natura 2000 sites where those purposes and threats can be very specific. Sites also remain where MPAs may be persuaded to override established policies for the sake of greater benefits, particularly environmental benefits, though cases are rarely as complex as the consolidation of fluorspar workings on Longstone Edge.

Taken together, the evidence suggests that the rate of aggregates working decline in designated areas will be somewhat slower overall than indicated by current production rates set against current levels of permitted reserves. This is because permissions may quite legitimately continue to be granted to augment those permitted reserves. It is not possible to know whether permissions in the period 2002-2005 were representative (though sand and gravel permissions for 11 Mt in AONBs must surely be rare), nor to predict the scale of future permissions. Nonetheless, in the period 2002-2005, permissions for aggregates working were granted for the following (with annual equivalents):

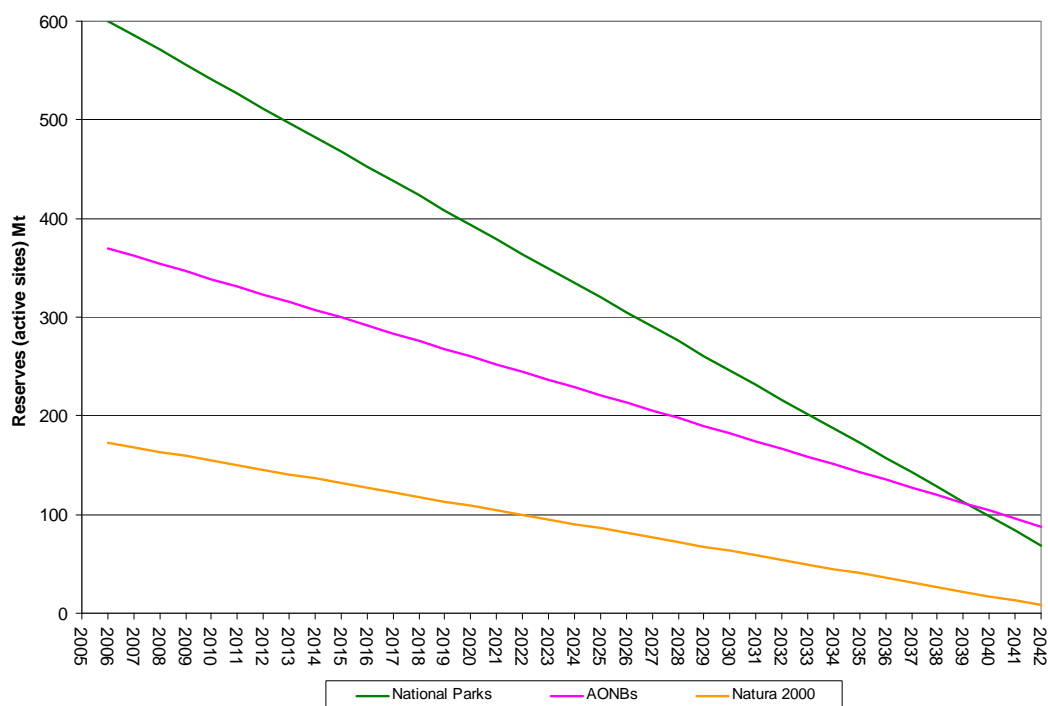
- 3.8 Mt in National Parks (0.95 Mt),
- 16.7 Mt in AONBs (4.2 Mt), and

- 8.7 Mt in Natura 2000 sites (2.2 Mt).

If new permissions continued to be granted in an average year at the rate experienced in 2002-2005, they would top-up permitted reserves in these areas designated annually at the following rates:

- 0.2% (to the 614 Mt of reserves excl. dormant sites) in National Parks,
- 1.1% (to the 373 Mt of reserves excl. dormant sites) in AONBs, and
- 1.3% (to the 175 Mt of reserves excl. dormant sites) in Natura 2000 sites.

Figure 11 shows the predicted decline in reserves for each of these designation types using 2005 sales figures and average annual replenishment rates for the period 2002-2005. [Caution should be exercised in using all these figures, as they are projected from a very limited number of cases over a short period, which may not be representative].



**Figure 11.** Predicted decline in reserves in active sites for National Parks, AONBs and Natura 2000 sites.

*Source: Aggregate Minerals Survey, 2005.*

The rates at which the additional reserves would be worked are unclear, though the annual rates of new permissions are significant in relation to the rates of extraction at least in AONBs and Natura 2000 sites, which in 2005 were:

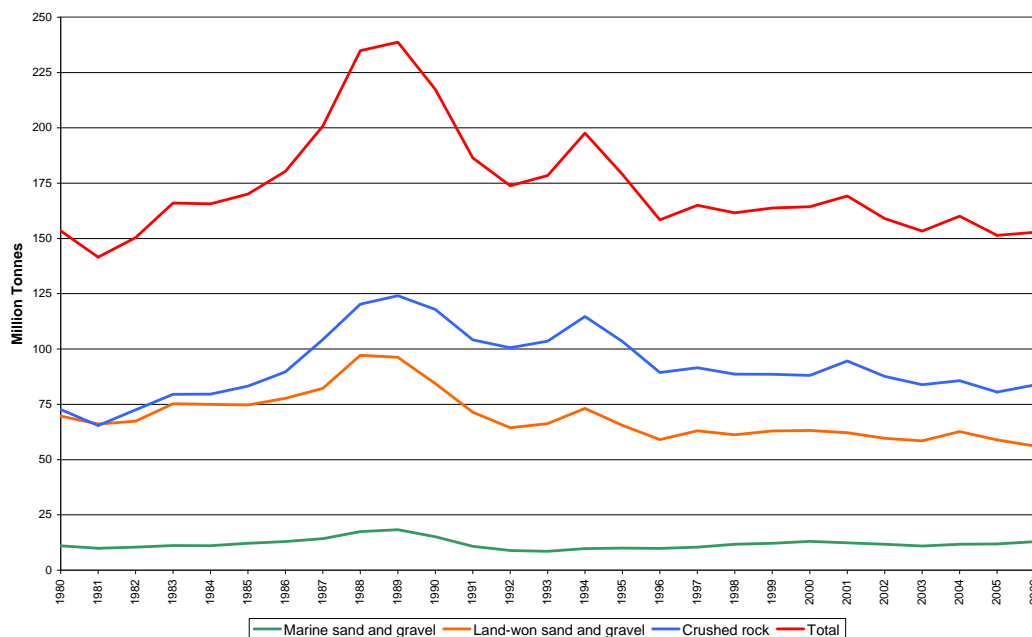
- 14.7 Mt annual sales from National Parks,
- 7.8 Mt annual sales from AONBs, and
- 4.6 Mt annual sales from Natura 2000 sites.

The conclusion may be drawn that, in the event of recent rates of new permissions continuing (which cannot be assured), the lifespan of permitted reserves in designated areas would be extended, substantially so in AONBs and Natura 2000 sites.



## 5 Options for future aggregates supply

The purpose of the managed aggregates supply system is to ensure a steady and adequate supply of aggregates that meets anticipated need. A diverse mix of aggregates sources contribute to overall supply in England. Supply from indigenous primary aggregates sources – crushed rock, land-won sand and gravel and marine sand and gravel has fluctuated with demand (Figure 12). In 2005 these sources accounted for 74% of total supply in England (Table 3). Additional supplies of aggregates are obtained through the increased utilisation of recycled and secondary aggregates and from imports of primary aggregates (from other countries in the UK and elsewhere).



**Figure 12.** England sales of primary aggregates.

*Source: Office for National Statistics (2006 and previous) and British Geological Survey.*

Historically sales of primary aggregates from National Parks and AONBs have contributed to England's supply of aggregates. In 2005 total sales of primary aggregates from National Parks and AONBs were 22.6 Mt (Table 6). This section summarises both the potential and issues surrounding possible alternative sources of aggregates should the traditional supply sources from National Parks and AONBs become curtailed once current permissions expire.

Adequate supply of aggregates is dependent on six fundamental factors:

- The availability of suitable resources – determined by geology (with no aggregate resources there can be no production).
- Demand – a resource will only be developed if there is a readily accessible market.
- Economic viability – can the aggregates be extracted profitably and competitively in the market.
- Investment – are the potential returns in developing a supply option sufficiently acceptable to justify the significant capital investment required.
- Access to resources via a licence to operate – by securing an agreement with the mineral/landowner and through the provision of adequate planning permissions and other necessary consents to sustain production.

- Efficient transport infrastructure to move aggregates to centres of demand.

With these issues in mind the following supply options (in order of relative importance to supply) have been summarised:

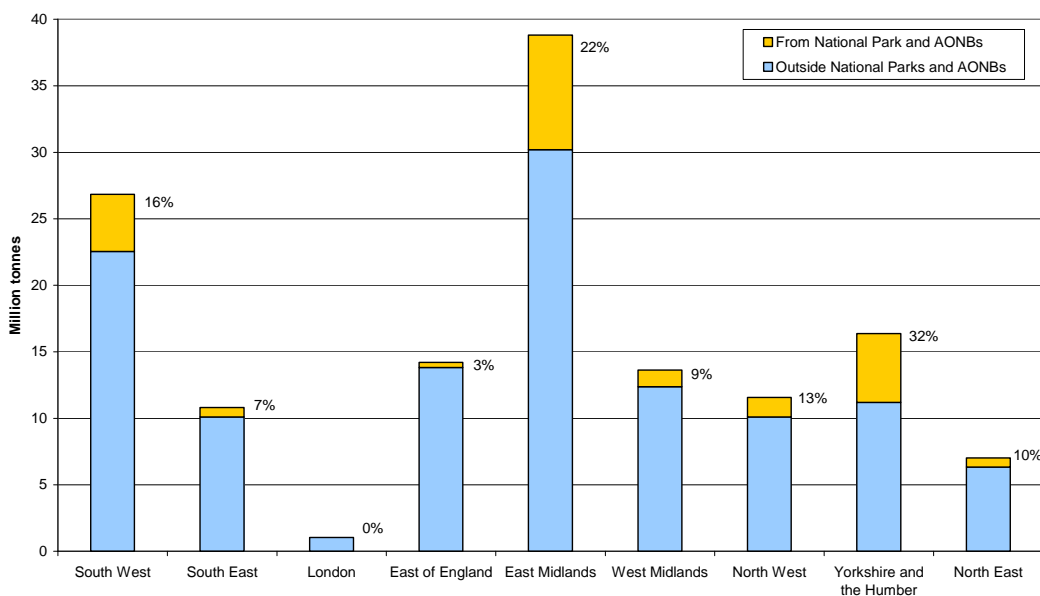
- Land won primary aggregates (supply from outside National Parks and AONBs).
- Recycled / secondary aggregates.
- Marine sand and gravel.
- Increasing imports (from UK and overseas).
- Underground mining of aggregates.

Each alternative supply option comprises a review of the current situation and a discussion about the ability to supply more aggregate in the future.

## 5.1 LAND-WON PRIMARY AGGREGATES FROM OUTSIDE NATIONAL PARKS AND AONBS

### 5.1.1 Review of current situation

Land won primary aggregates extracted from areas outside of National Parks and AONBs make the largest contribution to the supply of aggregates in England, 118 Mt in total (in 2005). However, historically sales of aggregate from these designations have always made a contribution to the supply of aggregates (see Section 4.2). The significance of supply from National Parks and AONBs within each region can be seen from Figure 13.

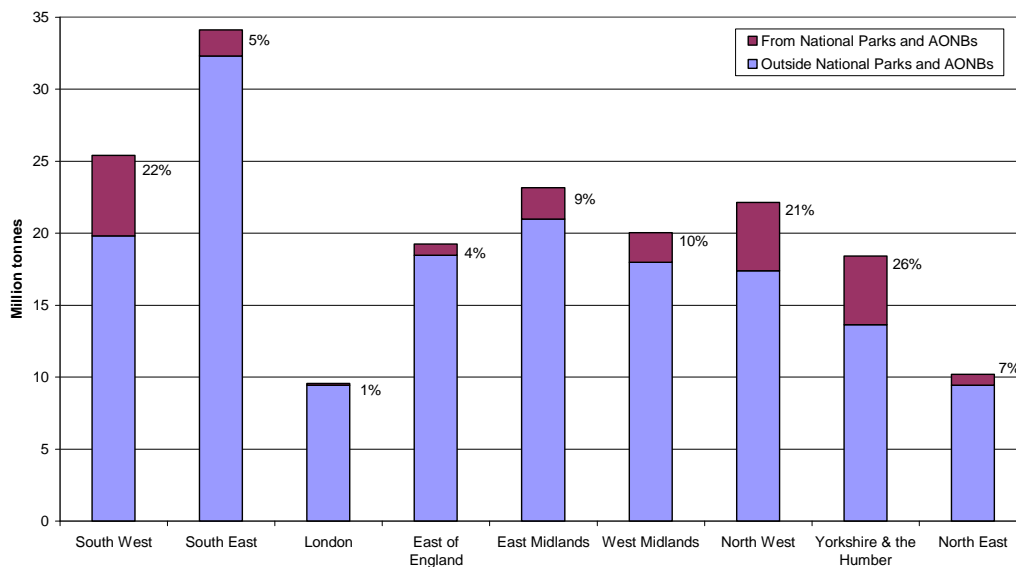


**Figure 13.** Regional sales of land won primary aggregates, 2005.

(Percentages indicate relative contribution from designations for each region).

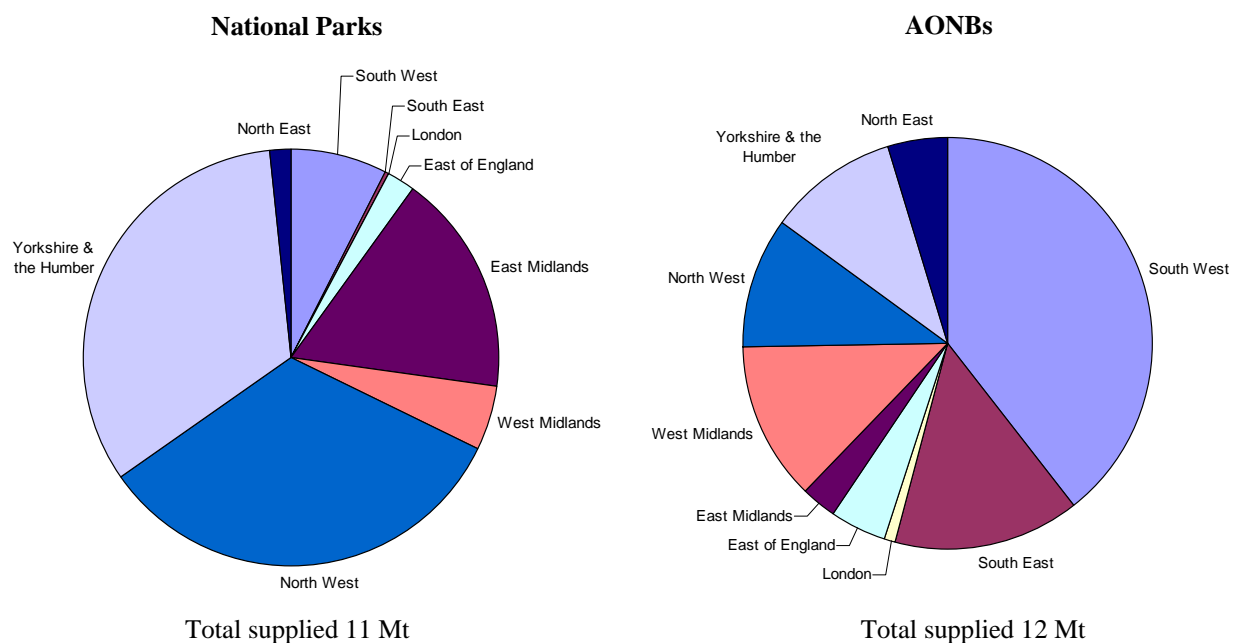
*Source: Aggregate Minerals Survey, 2005.*

Not all of the aggregates extracted from National Parks and AONBs are used within that region. Movement of aggregates between regions ultimately means that some regions consume more aggregates extracted from National Parks and AONBs than others. Figure 14 shows the contribution of National Parks and AONBs to total consumption by region in 2001. (Data relating to both National Parks and AONBs for 2005 does not exist, although consumption patterns are not expected to have significantly changed between 2001 and 2005). Yorkshire and the Humber, the South West and the North West regions are most dependent on utilising aggregates extracted in National Parks and AONBs to meet their regional demand (over 20%). Figure 15 show the regional split of aggregates consumed from National Parks and AONBs respectively. Primary aggregates from National Parks make a significant contribution to meeting regional demand in Yorkshire and the Humber and the North West whilst for the South West consumption of aggregates extracted from designations is principally from AONBs.



**Figure 14.** Regional consumption of land won primary aggregates, 2001.  
(Percentages indicate contribution from designations for each region).

*Source: Aggregate Minerals Survey, 2001.*



**Figure 15.** Regional consumption of aggregates supplied from National Parks and AONBs, 2001.

*Source: Aggregate Minerals Survey, 2001.*

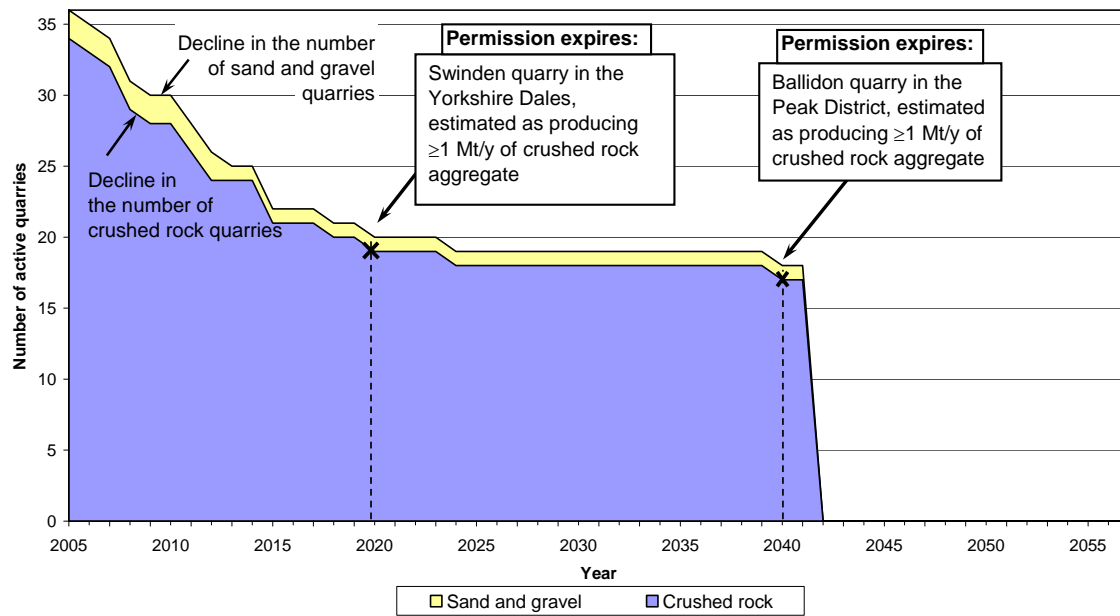
If these traditional supply sources were to be run down, then other sources within the region or further afield would be required to contribute the extra supplies. Any alternative source of aggregates would ultimately need to be able to meet the requirements summarised by the above sales and consumption patterns.

#### 5.1.1.1 WHEN CAN SHORTFALLS IN THE SUPPLY OF AGGREGATES FROM DESIGNATIONS BE EXPECTED?

Since 1997 the four yearly Aggregate Minerals Surveys have included the collection of information on the sales and reserves of aggregates from quarries located in National Parks and AONBs. Data for individual quarries is, however, commercially confidential and therefore not available. If such data were available the expected lifetime of each quarry could be calculated. Depending on reserves and outputs, individual quarries in National Parks and AONBs will become exhausted at different times and the decline in sales from these quarries will have to be met from elsewhere (See Peak District Case Study). This will either mean the quarries themselves receiving planning permission for extensions to increase their reserves and allow continued production, or require a take up of the shortfall by other quarries within or outside the environmental designation thus increasing the rate of depletion on their own permitted reserves.

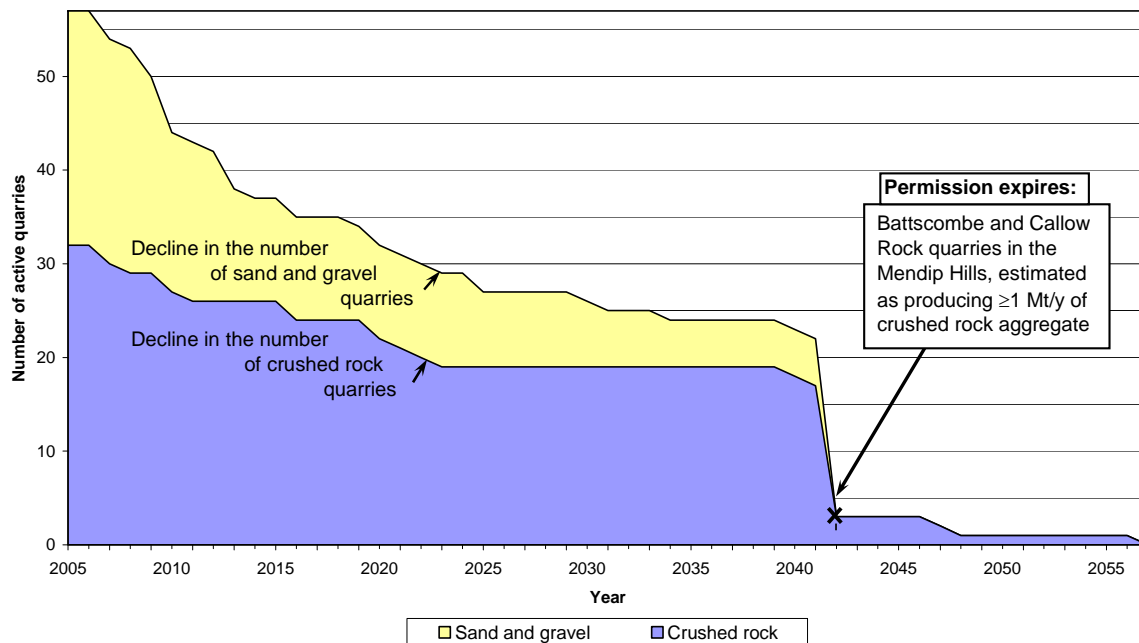
However, in the absence of sales and reserves data for each quarry, the expiry date of current planning permissions for active quarries in National Parks and AONBs has been used as a proxy for the depletion date and thus when shortfalls in the current supply patterns from these designations will have to be from elsewhere (Figures 16 and 17). At best this can only provide a relative indication, as the actual date a quarry ceases to extract aggregates will depend on the actual levels of extraction and these will vary over time. Quarry life will depend on the rate of extraction and some sites may be exhausted prior to the official expiry date of the planning permission. Conversely, the rate of extraction may be low enough that not all the reserves made available in the granting of the planning permission will be exhausted. In this instance the quarry operator may choose to apply for an extension in time to the planning permission to allow them to extract the remaining reserves. Given the high levels of permitted reserves within National Parks and AONBs (Figure 11), any decline in total output will be gradual.

There are currently around 37 quarries in National Parks and 65 quarries in AONBs extracting aggregates in England. If none of these are granted extensions and no new quarries are granted permission, by 2020 only 20 quarries will remain in the National Parks and 33 in AONBs. Eighteen quarries in National Parks and 22 in AONBs have planning permissions that run until 2042. Such quarries generally include those large quarries estimated as capable of producing at least 1 Mt/y of aggregates. One notable exception is Swinden Quarry in the Yorkshire Dales National Park. The current permission on this rail linked quarry is due to expire in 2020. For a summary of the relevance of 2042 see Appendix 5.



**Figure 16.** Relative decline in the number of active quarries – 2005-2057 in National Parks.

*Source: Mineral Planning Authorities (97% of all active quarries obtained).*



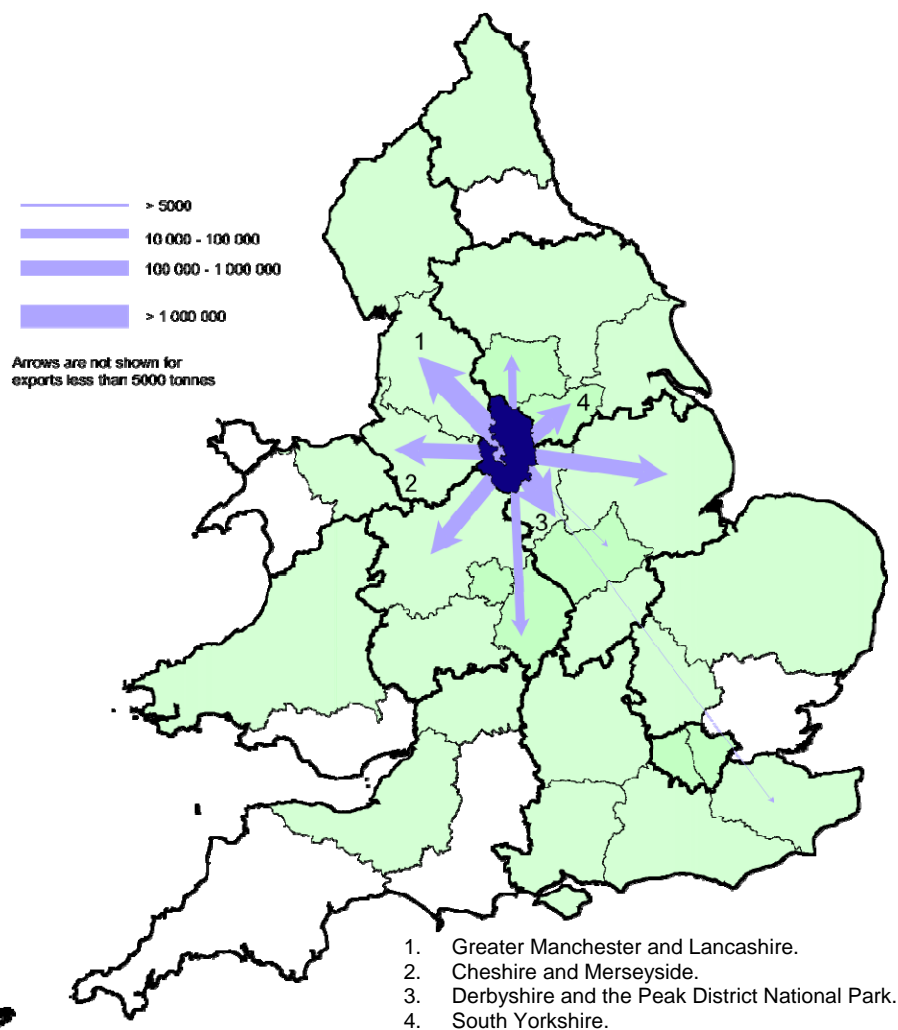
**Figure 17.** Relative decline in the number of active quarries – 2005-2057 in AONBs.

*Source: Mineral Planning Authorities (88% of all active quarries obtained).*

## CASE STUDY - THE SUPPLY OF LIMESTONE AGGREGATES FROM THE PEAK DISTRICT NATIONAL PARK

The Carboniferous limestone is by far the largest source for crushed rock aggregates in England. However, the Carboniferous limestone is also associated with high quality landscapes and as such within England 64% of the resource outcrop lies within at least one environmental designation. The two regions where it is most heavily constrained are the East Midlands (84%) and Yorkshire and the Humber (83%). The homogeneity of Carboniferous limestones across England (and Wales) means that all are suitable for use as crushed rock aggregate, and all are quarried to varying degrees for aggregate. There are minor differences in thickness, mud content, degree of alteration and in folding and faulting of the units but given all of these factors they are usually suitable as an aggregate resource. The main limitation on these rocks for use as an aggregate material is their distance from markets or competition from other supplying quarries. The limestones of the Peak District, in the East Midlands Region, possess good geological qualities for use as crushed rock aggregate, but more importantly they are in a central location that means they help to meet the demand for aggregates from the surrounding regions.

In 2005, sales of aggregates from quarries in the PDNP amounted to 4.8 Mt, 99.9% of which was limestone (the remainder being sandstone). An additional 4.5 Mt was extracted and sold for non-aggregate uses (98% of which was limestone). The limestones in the Peak District are well known for their chemical purity and, although this has little effect on the quality of the aggregate, it can control where aggregate is extracted from. In some cases, where high purity limestone is quarried for industrial end uses, aggregate is a co-product. About 40% of total England sales of limestone for non-aggregate uses arises from quarries in the Peak District National Park (PDNP).

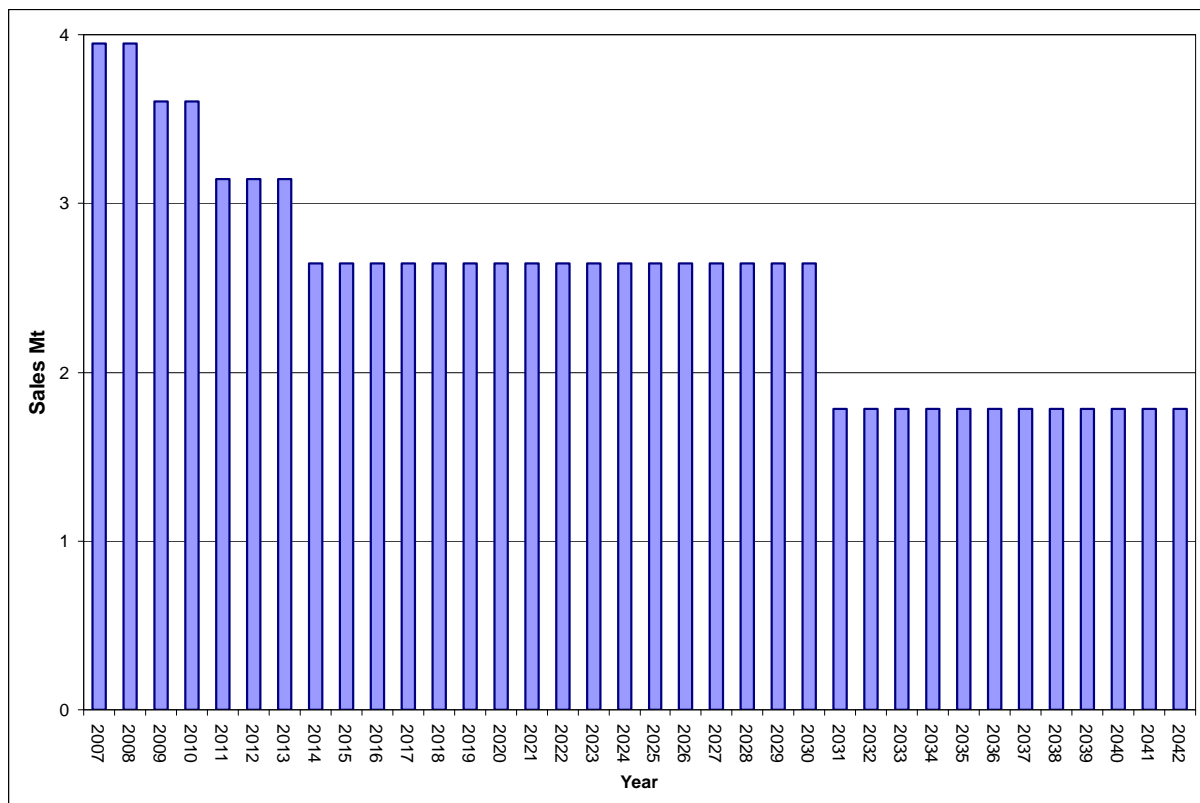


**Map 1.** Limestone aggregate flows from the Peak District National Park, 2005.

Map 1 shows that aggregates extracted in the PDNP are supplied to all regions within England and Wales. However, the majority of output is consumed within the adjacent East Midlands, North West, West Midlands and Yorkshire and the Humber regions.

Within the above regions, the Greater Manchester and Lancashire (1.5 Mt) and Derbyshire and the PDNP (1.4 Mt) sub-regions consume the largest quantities of aggregates extracted in the PDNP. (Only a small quantity of total consumption within the Derbyshire and the PDNP sub-region was consumed in the PDNP). These are followed by the Cheshire and Merseyside (0.5 Mt) and South Yorkshire (0.26 Mt) sub-regions.

Therefore, it can be seen that the PDNP supplies those areas containing the large urban conurbations of Manchester, Liverpool, Sheffield and Leeds.



**Chart 1.** Predicted decline in limestone aggregate sales for the Peak District National Park. (Assuming sales remain constant at 2006 levels and no additional reserves are released).

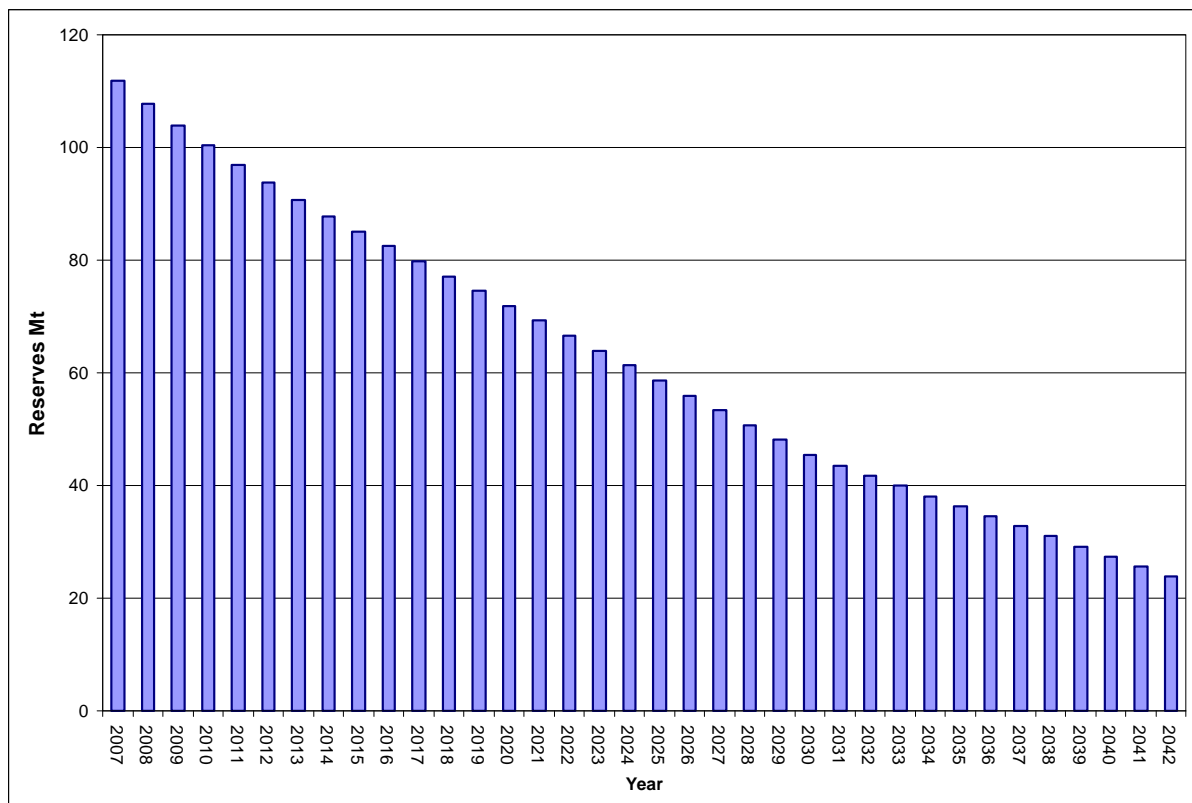
Chart 1 shows the predicted decline in sales (for aggregate uses) from limestone quarries in the PDNP as a result of assumed depletion of reserves. It has been calculated using anonymised data provided by the MPA. The chart is based on sales and reserves data for active sites as they were in 2006. It assumes that sales remain at 2006 levels and that no additional reserves are released. Sales figures in 2007 are less than those for 2005 because the analysis excludes a small number of sites due to other planning considerations or whose planning permission has ended since 2005.

Such an analysis is useful in that it provides indications of the decline in sales of aggregates from the National Park. The analysis indicates that existing sites in the PDNP will continue to make a substantial contribution to the supply of aggregates into the future. As reserves are worked out or permissions expire, sales from the PDNP will gradually decline over the years, beginning in 2009, and these supplies will need to be made up from alternative sources. By 2011 sales from the PDNP are predicted to be around 80% of current levels. This equates to a decline in sales of around 1 Mt. By 2014 the decline increases further and then remains constant until 2030 when the decline in output from 2006 levels will be over 2 Mt (~45% of current sales). It is these sales that need to be met from alternative sources (assuming no further aggregates permissions within



the National Park and that all existing reserves are worked out before permissions expire). These could be:

- Existing quarries within the PDNP itself. If other sites within the Park increase their sales to make up for the decline in sales from those sites that become worked out then their reserves will decline more rapidly and therefore, the predicted decline in sales and reserves would change.
- Other quarries immediately adjacent to the PDNP. This could include, for example, from the Buxton area located in Derbyshire, outside the PDNP boundary.
- Other quarries within the regions currently supplied from the PDNP.
- Other alternative sources outlined in this report.



**Chart 2.** Predicted decline in limestone aggregate permitted reserves for the Peak District National Park. (Assuming sales remain constant at 2006 levels and no additional reserves are released).

Chart 2 depicts the predicted decline in permitted reserves over the same period, should sales remain constant at 2006 levels and with no additional reserves being granted. Analysis indicates that permitted reserves would have declined by around 80% to 22 Mt by the end of 2042.

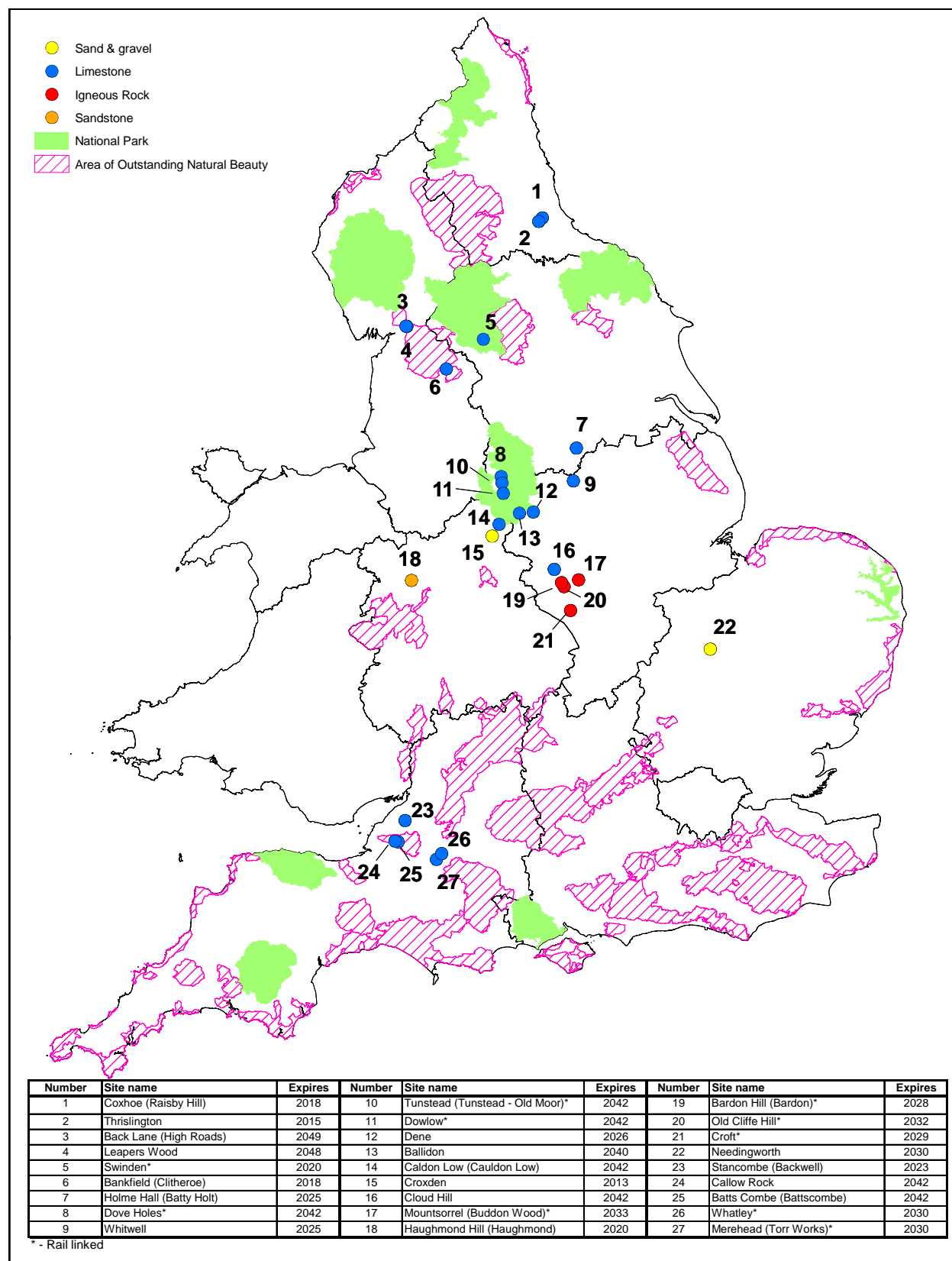
### 5.1.2 Ability to supply more aggregates

A critical question is, therefore, can land-won primary aggregates be supplied at current (or potentially increased) levels without the need for future extraction from quarries located within National Parks and AONBs (as their contribution reduces)?

Quarries work at a rate closely related to market requirements and therefore output will fluctuate with time. Historically total sales of aggregates from within and outside designations have been higher, reaching a peak in 1989 (Figure 12). Thus if quarries located outside designations increased production to previous levels, would it be sufficient to meet any decline in output from National Parks and AONBs? Within England there are 767 quarries producing aggregates. BGS estimate that around 30 of these quarries currently produce (or are capable of producing) around one million tonnes, or greater, every year. Between them it is estimated that they account for around 50 Mt of aggregates. Figure 18 shows the distribution of these quarries along with their current planning permission end dates. A survey of these quarries has indicated that there is generally extra capacity to increase supply. Of those quarries that responded, outputs for individual quarries could be increased by between 10 to 60% without extra investment in additional plant and machinery (but maybe with the requirement to invest in more labour / additional shifts). However, several quarries also indicated that there was no spare capacity to increase output. Using the information obtained for those that responded it would 'appear' that there is potential to provide (from the large quarries located outside of National Parks and AONBs) an additional 10 to 12 Mt/y over current output levels. This increased output may not necessarily be across the full product range and, in particular, additional production of premium products may be constrained. Further, whilst many quarries do not have a limit on the tonnage they can work and distribute in any given year they may be limited in the total amount they can extract in a given time period (for example, every 5 years), or there are restrictions relating to vehicle movements and/or blasting which will in turn limit output.

Whilst the largest quarries may be capable of increasing output in the short term to meet a declining output from the National Parks and AONBs this would correspondingly reduce their permitted reserves and lifetimes. Further, many of these are strategically important rail linked quarries whose reserve lives are already limited and many may be exhausted (Figure 18) before the large one million tonnes, or greater, producing quarries located within the National Parks and AONBs.

If the market justified further investment in plant, machinery and, where appropriate, rail infrastructure then outputs could increase further. However for this to occur, industry requires certainty about the life of such facilities. Any investment in these quarries to raise outputs higher would have to undergo an assessment of the cost and benefits between the additional revenue that would become available from higher output versus the reduced lifetime of the quarry. In the absence of additional reserves, this would affect any decisions to invest.



**Figure 18.** Current planning permission end dates of aggregates quarries estimated as producing, or capable of producing, around 1 Mt/y or greater (including those within designations).

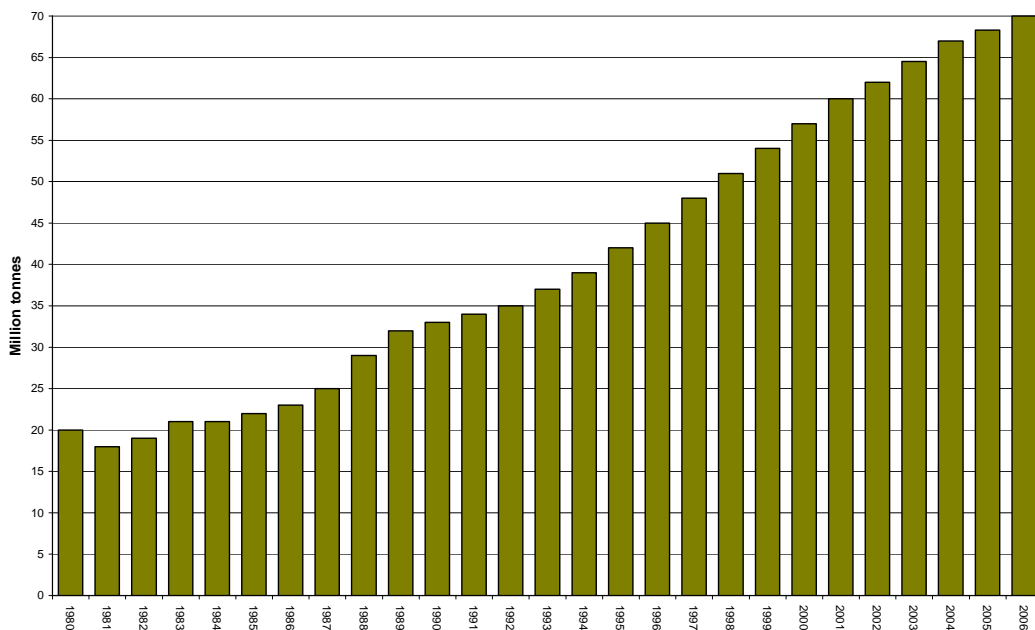
Source: Mineral Planning Authorities.

## 5.2 RECYCLED AND SECONDARY AGGREGATES

### 5.2.1 Review of current situation

Secondary and in particular recycled aggregates are an important source of aggregates in England. Secondary aggregates are obtained as by-products of other quarrying and mining operations, such as china clay waste, slate waste and colliery spoil (minestone), or aggregates obtained as by-products of other industrial processes, such as blastfurnace/steel slag, coal-fired power station ash, incinerator ash, and spent foundry sand. Recycled aggregates arise from various sources including demolition or construction of buildings and structures, or from civil engineering works (Construction, Demolition and Excavation Waste (CDEW)). Other forms of recycled aggregate include asphalt planings (the old road surface) from resurfacing roads, and railway track ballast. Recycled aggregates, once processed, have generally been used for less demanding applications (e.g. fill) where they compete successfully with (principally) crushed rock. The utilisation of recycled and secondary aggregates has helped to meet the demand for aggregates (thus alleviating pressure on finite primary aggregate resources).

With policies of promoting and maximising the use of secondary and recycled aggregates there has been an increase in the total quantities utilised in Great Britain (Figure 19). In England, 48.9 Mt of recycled aggregates and 6.9 Mt of secondary aggregates were utilised in 2005 (Table 11). Totalling 55.3 Mt this is very close to the total sales of land-won sand and gravel (56.7 Mt) but less than the sales of crushed rock (83.5 Mt). Recycled and secondary aggregates contributed 26% of the total aggregates supply in England; the majority of which was recycled aggregates 23% (Table 11).



**Figure 19.** Sales of recycled and secondary aggregates in Great Britain.

*Source Quarry Products Association.*

**Table 11.** England summary of secondary and recycled aggregate sales, 2005.

	Thousand tonnes	England	
		%	%
		Supply of secondary and recycled aggregates	Total aggregates supply
<b>Recycled aggregates (of which)</b>	<b>48 870</b>	<b>88</b>	<b>23</b>
<i>(Construction and demolition waste)</i>	<i>42 070</i>	<i>75</i>	<i>20)</i>
<i>(Spent rail ballast)</i>	<i>1 200</i>	<i>2</i>	<i>1)</i>
<i>(Asphalt planings)</i>	<i>5 600</i>	<i>10</i>	<i>3)</i>
<b>Secondary aggregates (of which)</b>	<b>6 920</b>	<b>12</b>	<b>3</b>
<i>(Power station ash)</i>	<i>1 800</i>	<i>3</i>	<i>1)</i>
<i>(Iron and steelworks slag)</i>	<i>750</i>	<i>1</i>	<i>0.4)</i>
<i>(China clay waste)</i>	<i>2 600</i>	<i>5</i>	<i>1)</i>
<i>(Colliery spoil)</i>	<i>1 000</i>	<i>2</i>	<i>0.5)</i>
<i>(Others)</i>	<i>770</i>	<i>1</i>	<i>0.4)</i>
<b>Total recycled / secondary aggregates</b>	<b>55 790</b>	<b>100</b>	<b>26</b>

Source: Survey of Arisings and Use of Alternatives to Primary Aggregates in England, 2005.

### 5.2.2 Ability to supply more aggregates

Secondary and, in particular, recycled aggregates are subject to the same market forces as primary aggregates. They have to rely on supplying local markets as transport over large distances is generally not economic. However, with the increasing number of recycling facilities the volume of construction and demolition waste is still likely to increase subject to the availability of materials from, for example, demolition projects. The availability of such materials is the main limiting factor in the supply of recycled aggregate. Any increase in the supply of recycled and secondary aggregates will also be dependent on the identification of additional sources of supply, MPAs allocating sites for recycling facilities, and further planning permissions for recycling facilities being granted.

The uses to which alternative aggregates can be put is also generally restricted to low quality applications. Whilst recycled materials are not prohibited in the various specifications (for example BS, CEN and ISO standards), historically overspecification often resulted in the unnecessary exclusion of materials. This is linked to the issue of quality and risk: many operators are not prepared to accept the risk of using secondary materials that come from a variety of sources, with different chemical and physical properties. Therefore, for more demanding applications where high standards of reliability have to be met, primary aggregates are still often the only suitable source. However, a report discussing future trends for the sustainable use of resources (WRAP, 2006) shows that over recent years the range of recycled aggregate products has grown and expanded, from low performance fills to landfill capping and road sub base. Investment by recycled aggregate producers is further increasing this quality product range into materials for concrete and even decorative aggregates.

It is felt that the limit to growth of the sustainable use of recycled and secondary aggregates is being approached (WRAP, 2006). The current market share of around 26% is expected to grow to 30% by 2011. This would represent an additional 7 Mt/y (at 2005 sales rates).

## 5.3 MARINE SAND AND GRAVEL

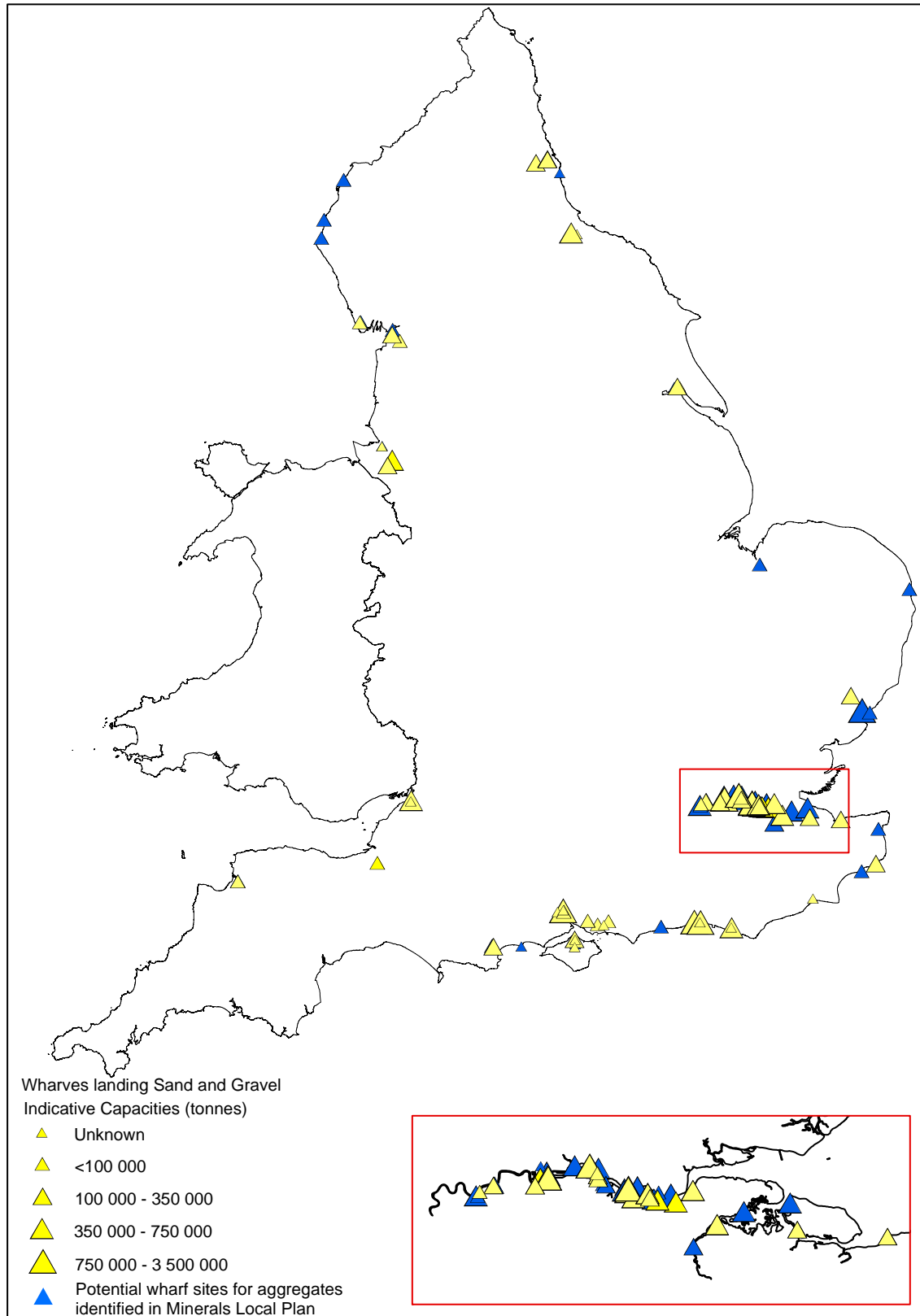
### 5.3.1 Review of current situation

Marine aggregates (sea-dredged sand and gravel) have made an important contribution to aggregates supply in England. In 2005, sales of marine sand and gravel for construction aggregates use in England were 13.7 Mt (Table 3). This equates 9% of total primary aggregates sales and 19% of sales of sand and gravel. In addition to landings at wharves for construction use, marine sand and gravel is landed at numerous coastal locations for beach nourishment and contract fill (1.5 Mt in 2005) and exported to continental Europe (6.5 Mt in 2005). Total landings for the industry in 2005 were 21.2 Mt (Crown Estate).

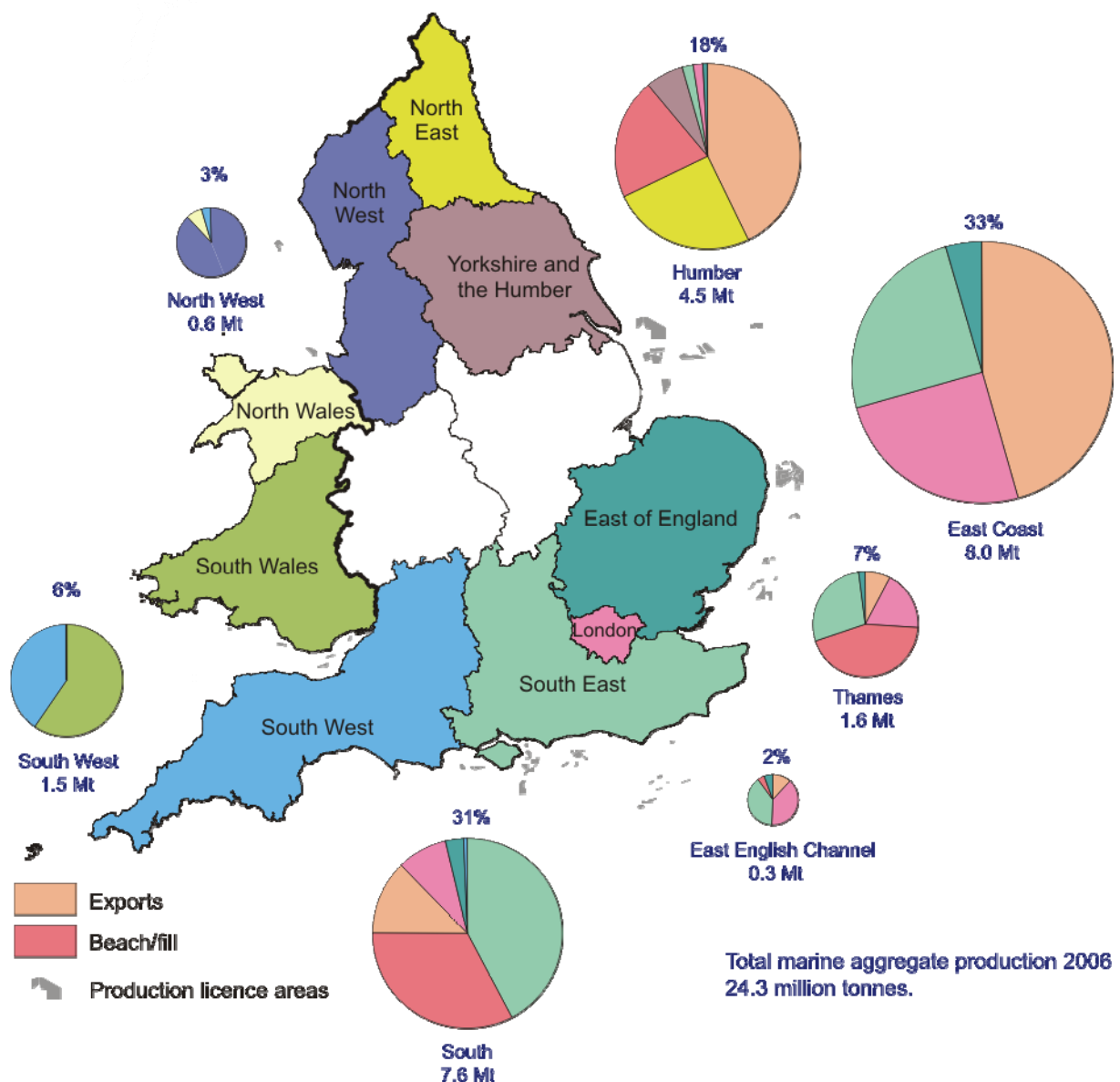
Permitted reserves of coarse marine aggregate in 2005 were 114 Mt (Crown Estate) which was equivalent to only seven years' production thus limiting supply in the medium to long term. However, the award of 11 new dredging permissions during 2006/07 has released additional reserves, increasing total volume to 134.5 Mt.

Marine dredged sand and gravel currently constitutes a particularly sustainable form of aggregate supply in terms of its ability to deliver large volumes of aggregates to wharves that are close to the point of use within urban areas. As such the industry makes a crucial regional contribution to sand and gravel supply in London, South East England and North West England. London (41% of total primary aggregates consumption) and the South East (27% of total primary aggregates consumption) have the highest dependency on marine aggregates and about 70% of total England sales of marine sand and gravel are landed in these two regions. However, marine aggregates are landed at 55 wharves throughout England with the highest concentrations in the principal demand areas (Figure 20). The average amount of sand and gravel landed at the wharves is 245 000 tonnes. However, annual landings vary widely between 20 000 tonnes and 1.7 million tonnes.

There are currently over 70 production licences around the coastline of England and Wales (Figure 21), covering about 0.12% of the UK continental shelf (Crown Estate). The total area under licence in 2005 was 1 179 km<sup>2</sup> of which only 12% was dredged (Crown Estate). Both England and export landings have been relatively uniform over the last 10 years which is a reflection of both market needs and, more recently, the capacity of the dredging fleet. The relative importance of these markets in 2006 is shown in Figure 21. Marine aggregates are principally dredged off the coast of England (with smaller amounts off the South Wales coast). Most recently production started in the East English Channel where large resources have been discovered. This area will become increasingly important as a source of supply in the future (Highley, et al., 2007).



**Figure 20.** Wharves landing marine dredged sand and gravel.



**Figure 21.** Regional production and destination of marine aggregates, 2006.

Source: Highley et al., 2007. (Data presented for 2006 because this is the first year the Eastern English Channel produced aggregates. This area will become an important source of supply into the future as the Thames Estuary area becomes depleted).



### 5.3.2 Ability to supply more aggregates

The UK Government's vision of improving the way in which the marine environment is planned, managed, regulated and protected is demonstrated by the development of a new Marine Bill (DEFRA, 2008). The proposed Bill will introduce a new system of marine spatial planning that is considered essential for sustainable use of the seas and to deliver an effective and coherent approach to the management of the marine environment. Therefore, the policies within which the marine aggregates industry operates will be changing. The consenting of new marine resources is now in the hands of Defra's Marine and Fisheries Agency (MFA). This is due to become part of the new Marine Management Organisation (MMO) to be established under the Marine Bill. Environmental considerations were always dominant in advice supplied by Defra to decisions on the old-style "government view" consents, and were determinative of the recent round of first approvals in the Eastern English Channel area. These were highly precautionary because of uncertainties about the cumulative impact. It remains to be seen whether a less constrained approach will be considered acceptable in the light of monitoring the impact of the first consents.

Notwithstanding this uncertainty marine sand and gravel dredging has the capacity to continue to make a vital contribution to supplies of aggregates in England for the medium term. Wharves have some spare production capacity and providing that the aggregates can be distributed from the wharves quickly enough, are able to increase their throughput by continuous processing and extending working hours. In this respect, the industry considers that wharf capacity will not limit its ability to supply additional marine aggregate in the short to medium term (Highley et al., 2007). One key constraint on the ability of the industry to deliver more aggregates, however, is the dredging fleet (of 28 purpose built dredgers with a total hopper capacity of 112 000 tonnes) which, today, is operating to capacity. In the short term the hiring of vessels (working under contract to dredge aggregates from a third party's licence area) would allow an increase in capacity and thus the volume of aggregates delivered. A further potential source of marine aggregates, if demand increased in particular in the South and South East of England, is by diverting some of the current 6 Mt/y exported to European ports. However, the export market is important to the dredging industry as many of the parent companies have interests in wharves elsewhere in Europe. In an unconstrained European market it is hard to see how diversion could take place other than relative scarcity driving market prices in England above those prevailing in Europe, particularly in Belgium and the Netherlands. Prices would also need to be sufficient to compensate for the potential loss of long-term continental markets.

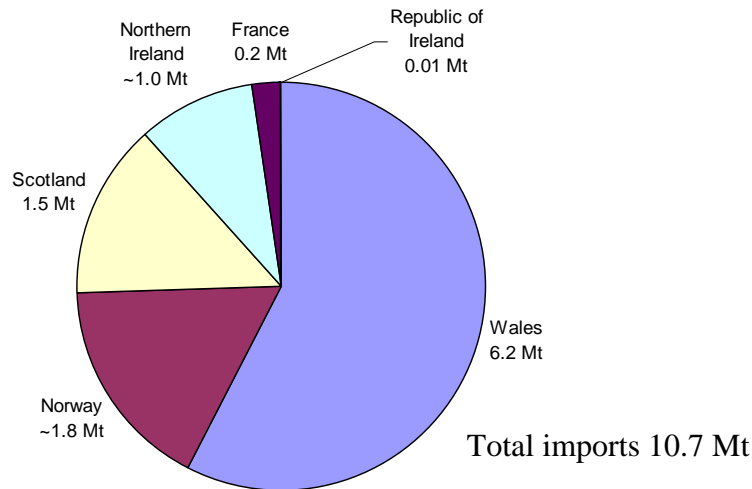
Investment is required to maintain the dredging fleet in the near future. The age profile of the dredging fleet shows that 81% are more than 15 years old, and 26% of vessels are older than the generally accepted working life of 25 years. If indications were that the market share for the marine industry could increase then investment in new (additional) fleet capacity would occur. The cost of building a new vessel is in the range £25 to 40 million. Typically a 5 000 tonne capacity vessel will be able to dredge up to one million tonnes of aggregate a year, more than the largest sand and gravel quarries on land. Confidence will crucially depend on the future regulatory stance of the MFA/MMO.

After landing at the wharf, transport by road is the principal distribution method (93% of total landings). Acting as virtual quarries, distribution of aggregates from wharves therefore, is limited to, on average, 50 km. Therefore, whilst the marine aggregates industry does have the ability to increase their proportion of aggregates supply, if the market demanded, it will broadly be limited to those geographical areas it already supplies.

## 5.4 IMPORTING AGGREGATES

### 5.4.1 Review of current situation

The UK as a whole is self sufficient in primary aggregates and by virtue of marine sand and gravel landings in Europe a small net exporter. England, however, is a small net importer. Total imports in 2005 were 10.7 Mt, of which 95% was crushed rock. The primary source for these imports was Wales. Other sources include Norway and Scotland (Figure 22).



**Figure 22.** Source of primary aggregates imports into England, 2005.

*Source: Aggregate Minerals Survey, 2005; Industry and Norwegian Geological Survey.*

#### 5.4.1.1 WALES

Wales represents the most important source of aggregates imported into England. Imports of primary aggregates from Wales into England in 2005 were 6.2 Mt (5.6 Mt crushed rock and 0.5 Mt sand and gravel). This accounts for 34% of total sales of Welsh aggregate. The majority of the total crushed rock imported from Wales comprises 3.0 Mt (48%) being imported into the North West of England and 1.5 Mt (24%) of crushed rock into the West Midlands. Whilst these two regions rely the most on imports from Wales, aggregates are imported by all regions within England. Conversely England exports 0.5 Mt to Wales.

#### 5.4.1.2 SCOTLAND

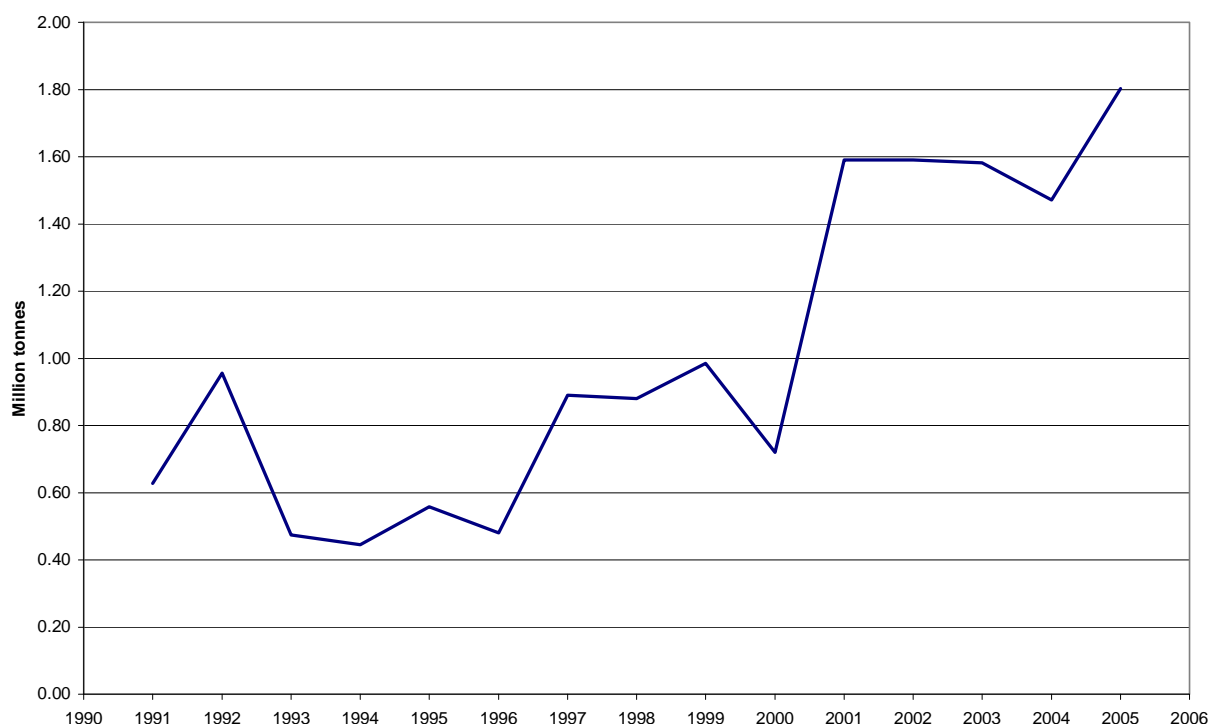
Movement of aggregates from Scotland to England is more or less limited to material from the large Glensanda coastal quarry. The quarry serves the market both in the UK and beyond with crushed rock aggregate being transported via the world's largest self loading ship (up to 97 000 tonne capacity). The majority of the igneous rock exported from Glensanda to England is imported into London and the South East regions. Imports of aggregate from Scotland in 2005 were 1.5 Mt. Aggregate from Glensanda is used primarily for rail ballast and concreting aggregate (80%) with the remaining 20% being utilised for road sub base.

#### 5.4.1.3 NORTHERN IRELAND

A further estimated one million tonnes (specifically of high-specification aggregates used as skid-resistant (high PSV) roadstone) was imported from Northern Ireland principally to the South East and London (but also to East of England) in 2005. In the past high PSV aggregate has also been exported from Northern Ireland to the North West of England.

#### 5.4.1.4 NORWAY

Of the countries outside the UK exporting aggregates to England, Norway is by far the leading supplier. England imported between 1.2 Mt (AM2005), 1.8 Mt (Norwegian Geological Survey (NGU) figure) and 2 Mt (industry figure) of aggregate from Norway in 2005. Approximately 200 000 tonnes was sand and gravel, 300 000 tonnes was amoustone, with the remainder being crushed rock aggregate for railway ballast, concreting aggregate, asphalt aggregate and material for road sub base. There are currently eight principal quarries in Norway exporting crushed rock aggregate to England. Aggregates are generally being transported in ships of between 10 000 to 30 000 tonne capacity. The bulk of aggregates imported from Norway are landed in the South East (50%) and Yorkshire and the Humber (23%). The remainder are landed in London (15%) and, to a lesser extent, East of England (11%). The amount of aggregate imported from Norway into England fluctuates but has increased over the last 15 years (Figure 23).



**Figure 23.** Imports of aggregates from Norway.

(Chart for GB, but nearly all is landed in England).

*Source: Norwegian Geological Survey.*

#### 5.4.1.5 OTHER COUNTRIES

Crushed rock is also imported from France into South East England (225 000 tonnes in 2005) and from Ireland to London (13 000 tonnes in 2005). HM Revenue and Customs record that aggregates are imported from other countries (Table 12). However, there is some uncertainty about the accuracy of the data and some may relate to decorative aggregates and crushed rock imported for non-aggregate uses (Highley, 2005). Total imports of material (some of which may be aggregates) from these countries is less than 600 000 tonnes.

**Table 12.** Other countries exporting material, some likely to be aggregates, to England.

Potential additional imports of aggregates	2005 Thousand Tonnes
<b>Sand &amp; gravel</b>	
Denmark	292
Belgium	6
Germany	3
Italy	1
Elsewhere	19
<b>Total sand and gravel</b>	<b>321</b>
<b>Crushed rock</b>	
Italy	121
The Netherlands	78
Germany	16
Elsewhere	28
<b>Total crushed rock</b>	<b>243</b>
<b>Total primary material</b>	<b>564</b>

*Source: HM Revenue and Customs.*

### 5.4.2 Ability to supply more aggregate

Despite variations in the tonnages reported, what is clear is that imports of aggregates from outside England currently make a minor contribution (5%) to the overall total of all aggregates consumed in England. Where information has been obtained the ability of each country to supply more aggregates is summarised below.

#### 5.4.2.1 WALES

There is no Welsh Assembly Government policy against exporting aggregates to regions in England. The Welsh Mineral Technical Advice Note 1 (MTAN1): Aggregates (Welsh Assembly Government, 2004) notes that the English Guidelines for Aggregates Provision (ODPM, 2003) envisage no change in levels of flows from Wales to England in the period to 2016. However, four policies contained within MTAN1 do have bearing; these are:

- aggregates should be worked in as close a proximity as possible to the market
- rail and water modes are favoured over road transport
- the total level of production in Wales should not exceed 27 Mt/y before 2010 (in 2005 it was 19 Mt)
- and the environment in Wales should not be prejudiced over less sensitive areas elsewhere.

Both the North Wales and South Wales RAWPs have recently published for consultation draft regional technical statements. Both of these envisage no change in the ability to meet the current demand from England. However, if demand for aggregates increases any additional supplies should be provided following the four policies above and within the environmental capacity of the supply sources. The Welsh Assembly Government has policy on 'environmental capacity' in MTAN1 as follows: "The Welsh Assembly Government considers it essential that the role of the

RAWPs be enhanced to include not only assessments of regional changes in demand but also to explore the regional interpretation of the assessment of environmental capacity and environmental capital, and how these principles may be applied to ensure that the provision of aggregates is sustainable."

#### 5.4.2.2 SCOTLAND

In Scotland there is no specific policy for or against exporting aggregates to England. Whilst Scottish Planning Policy 4: Planning for Minerals (Scottish Executive, 2006) does make provision for the identification of the locations of future large coastal exporting quarries, currently Glensanda is the UK's only one.

Output from the Glensanda quarry is around 6 to 7 Mt/y of which 1.5 Mt is exported to England and the bulk of the remainder to other European countries through depots in the Netherlands, Germany, France and Poland. The quarry does, however, have permission to produce a maximum of 15 Mt/y. If the market demand from England and or elsewhere justified the investment Glensanda has capacity to quite substantially increase production.

Other locations in Scotland have been identified as suitable for the location of large quarries exporting aggregates to England (DoE, 1992). However, such developments raise substantial environmental concerns. The protracted attempt to develop a major coastal quarry on Harris in the 1990s was unsuccessful. It is therefore unlikely that any new sites will be developed in the foreseeable future. The potential for developing smaller-scale coastal units may be greater and have less impact though they are still likely to prove contentious. However, the associated use of smaller vessels would affect economies of scale.

#### 5.4.2.3 NORTHERN IRELAND

Supply has historically been variable and depended generally on road building and maintenance schemes in England. It is the view of the industry that exports could increase by around 20-25% without any significant issues. Aggregate is transported in small (5 000 tonne) barges. As the aggregate is specialised for road surfacing use means that it can be transported further distances than equivalent tonnages of less specialised aggregates and the use of small barges means that it could be landed at many wharves throughout England.

#### 5.4.2.4 NORWAY

Norway, would be the most likely source (outside of the UK) for increased future crushed rock aggregate supply to England. Norway has extremely large resources of hard rock which are suitable for aggregate use. Both national and local authorities are encouraging the development of the country's aggregate resources through large coastal quarries designed for the production and export of rock aggregates (Neeb, 2006). The eight coastal crushed rock quarries currently exporting to England have in excess of 2 000 million tonnes of reserves. Hard rock quarries have annual outputs in the range 1 to 2.5 Mt/y, with the largest quarry (Jelsa) operated by Norsk Stein A/S having annual production of about 3.5 to 5 Mt/y of screened aggregates. Recent investment has enabled a doubling in quarry output to 10 Mt/y. In addition to the current quarries there are continued investigations for potential future coastal sites for large quarries so that local government planners can classify these sites for future development.

Norway has deep-water anchorage, low tidal range and a well developed infrastructure to allow for harbour facilities for medium to large bulk carriers. It is felt that there is capacity to at least double the current total exports of 11.5 Mt/y of aggregates (NGU). In addition to investment in the source quarries certain sections of the industry have invested in expanding the number of ships in their fleet to meet expected future increased demand for aggregates in Europe (including England).

#### 5.4.2.5 INCREASED IMPORTS SUMMARY

The major constraint on the ability of overseas sources from exporting more aggregates to England is not the ability to supply, but more the capacity of the receiving wharves to unload and distribute the aggregates and that the cost of a bulk item such as aggregates is very sensitive to transport logistics. With the cost of a new large (97 000 tonne) bulk carrier being around £50 million and smaller 30 000 tonne ships £15 million, the industry require a guaranteed long term market to justify such an investment. A separate report *The need for indigenous aggregate production in England* (Brown et al., 2008) considers the costs associated with importing aggregates. For England to have the ability to import more aggregates from overseas will require significant investment in wharf facilities. Unless they are carrying higher value aggregates (e.g. high PSV roadstone) ships with a capacity in excess of 15 000 tonnes are required for it to be economical to import crushed rock aggregates. There are not many wharves that have deep enough water to take these ships. For those wharves that can take ships of this size, capacity is limited due to it being allocated to other bulk carriers importing higher value goods (e.g. coal, Liquefied Natural Gas and containers). Were the market to demand it, crushed rock aggregates could be landed at wharves with more limited water depth in berths and approach channels, however this would require offshore unloading into smaller ships for final delivery at the wharf (thus a two stage landing process) which would increase the sale price of the aggregates.

Further, in addition to adequate water depth in berths and approach channels, there is a requirement for suitable land area to stockpile material. A viable minimum is around 1.5 hectares. A 1.5 hectare stockpile area can be expected to hold around 125 000 tonnes of single size crushed rock aggregate or 70 000 tonnes of mixed grades. Stockpile areas at wharves in England vary in size from approximately 0.4 hectares up to 12 hectares.

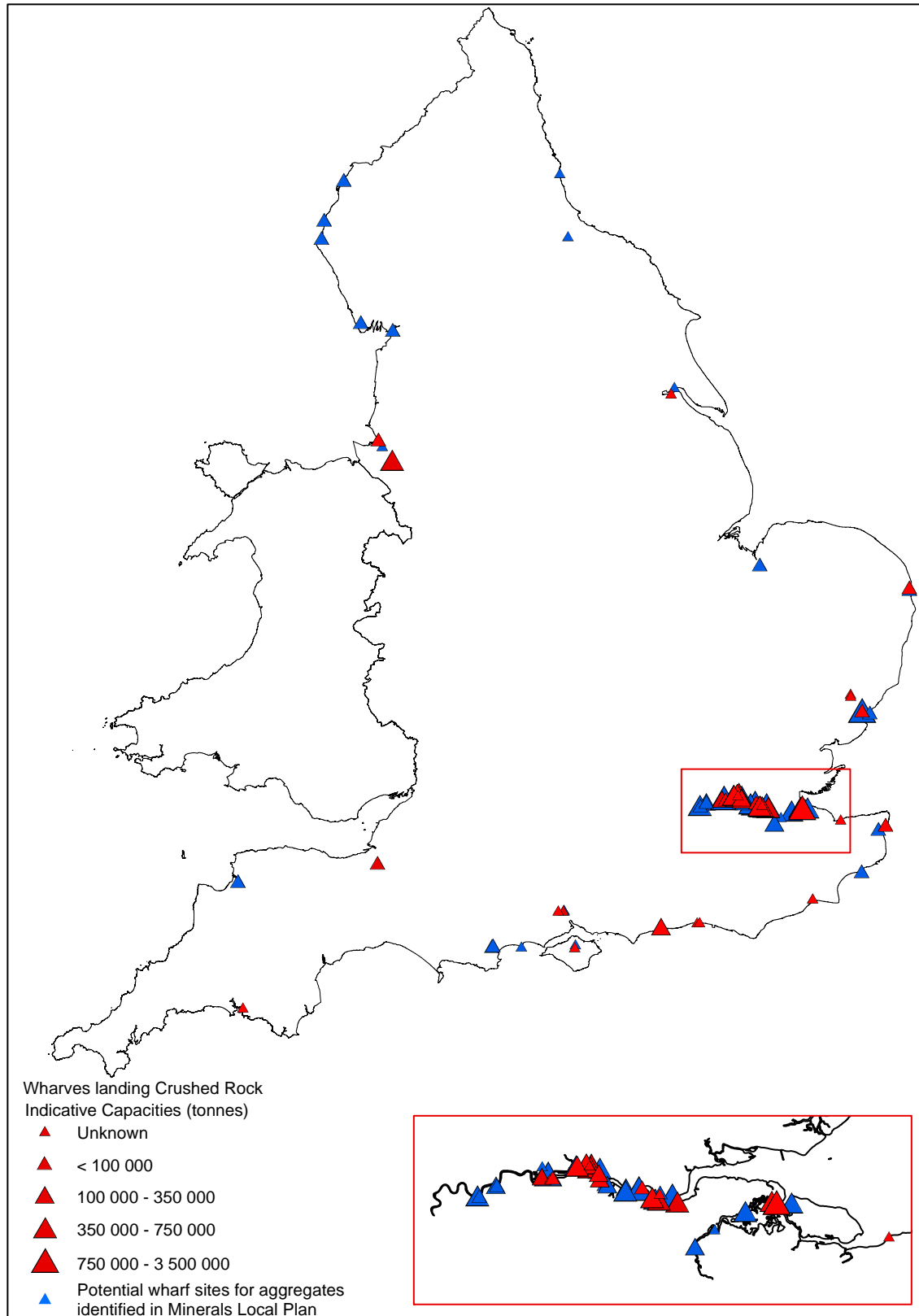
There are currently 30 wharves where crushed rock aggregate is landed. The average amount of crushed rock imported through each of the medium to large crushed rock wharves (Figure 24) in England ranges from 50 000 – 600 000 tonnes per year. The smallest wharves import less than 10 000 tonnes per year. The largest wharf unloading crushed rock aggregate, however, is the Isle of Grain which is capable of handling over 2 Mt/y of aggregates. It is here that the majority of aggregates imported from the Glensanda quarry in Scotland are landed. With current infrastructure / number of wharves and concerns over maintaining aggregates quality the maximum additional amount of crushed rock aggregates that could be landed is estimated at an additional 2 to 3 Mt/y. If more aggregate is to be imported then there will be a need for existing wharf capacity to increase. Several locations have been identified by MPAs as additional wharves with potential to land crushed rock aggregates (Figure 24). Six of these vacant wharves are in the North West with the bulk of the remainder in the South East. If they were all of average size and average stockpile area then they could potentially import an additional 1.5 - 2 Mt/y (if market conditions allowed it). Issues to be considered in locating future wharf sites include:

- access to adequate deep water;
- enough space to stockpile aggregates;
- access to suitable roads (and rail) with capacity to transport aggregates;
- neighbourhood issues (in particular with increased residential development adjacent to and opposite wharves).

As with the marine sand and gravel, the wharves act like virtual quarries and therefore are constrained by the same general transportation limits as land-won aggregates (~50 km by road and ~130 km by rail (if the rail infrastructure exists at the wharves). Currently 62% of all crushed rock aggregates landed at wharves is distributed by road.

Associated with any form of imports is the issue of England exporting its environmental damage and also increasing carbon emissions from the transport of aggregates. There is also the potential

for both political sensitivities and security of supply issues to emerge if England were seen to be overly relying on imports to meet its demand for aggregates. However, for the volumes of additional material likely to be capable of being landed at wharves, it is felt that this is unlikely to be a significant issue in the short term.



**Figure 24.** Wharves landing crushed rock imports.



## 5.5 UNDERGROUND MINING OF AGGREGATE

### 5.5.1 Review of current situation

Aggregates are currently produced from surface quarrying operations. As surface reserves become depleted and where available resources for construction aggregates are limited in surficial extent the option of extracting aggregates by underground mining is a consideration. The Verney Committee recommended the possibility of underground mining of aggregates in 1976. As such, the report *The Verney report – Beyond the way ahead* (Thomas et al., 2008) investigating the relevance of Verney recommendations today contains further details regarding the underground mining of aggregates. To date there has been no underground production of aggregates, but it remains a long term option and is currently under consideration in England.

The advantages of the underground mining of aggregates includes access to previously unavailable rock resources, reduced impacts on the environment (noise, dust, vibration and visual intrusion), an all-year round working environment with a constant temperature, no need to remove overlying rock, the amount of restoration required is much smaller and the space created by mining can in itself be a valuable asset for storage purposes. The disadvantages of underground mining include the greater health and safety risks, and higher extraction costs (Iannacchione, 1999; Benardos *et al*, 2001).

Currently, there is no underground mining carried out to produce construction aggregates in the UK. The closest most recent parallel was the Middleton mine in Derbyshire, which produced industrial-grade limestone; however this mine closed in 2005.

An international example of a country that mines aggregates for construction is the USA. According to the U.S. Geological Survey (USGS), in 2005, 77 Mt of aggregates were produced in 84 underground mines in the USA. According to the available data, the average production per operation was 0.7 Mt/y, with the largest mines producing at least 2 to 3 Mt/y (Ewell, 2007a, b; Willett, 2007).

### 5.5.2 Ability to supply more aggregate

The majority of underground aggregate mines in the USA are working limestone; the principal reasons being it often occurs in relatively thick flat-lying beds, is relatively easy to extract (as it is a comparatively non-abrasive rock), it provides a safe mining environment with minimal risk of subsidence and enables the creation of easily manageable uniform spaces. In England, the Carboniferous limestone would be a good candidate for mining; it is the most extensively used source of crushed rock aggregate and is suitable for both concrete aggregate and roadstone. In Derbyshire it is up to 500 metres thick and has uniform beds that extend over a large area. The Carboniferous limestone currently hosts 27 quarries including some on a very large scale such as Tunstead quarry near Buxton which works the Bee Low Limestone. The Carboniferous limestone is known to occur beneath younger rocks in parts of southern and eastern England; in the Cambridge and Northampton-Bedford areas it occurs at comparatively shallow depth (100 to 200 metres); this is a similar depth to many of the currently active underground limestone mines in the USA. Further to the south-east, in Kent, it occurs at greater depths (over 300 metres); whereas technically feasible to extract by underground mining it would be more expensive to work at these greater depths. The Carboniferous limestone in the Mendips in Somerset is a strategic, rail-linked resource known to extend underground; however, it would be less suitable for underground mining as it is extensively faulted and folded.

Other resources that could be considered for underground mining include the igneous rock resources in Leicestershire. Quarries such as Mountsorrel, Bardon Hill and (Old) Cliffe Hill are strategic, rail-linked quarries with resources known to extend in depth. As existing reserves become depleted there may be the option of extending the quarries underground. However, the

igneous rocks being extracted would be expensive to mine as they are often hard and abrasive. Sandstone is another source of crushed rock aggregate that may be worth considering for underground mining, especially strategically valuable resources of high-specification aggregates used as non-slip (high PSV) roadstone. Although not as hard as igneous rocks they would be abrasive and more expensive to mine than limestone. However, the end (sales) value of high specification aggregates, such as high PSV sandstones, may make them economically attractive for underground mining.

The technical requirements of underground mining of aggregates are well known and it is feasible for aggregate production in England. Some of the large aggregate producers in the UK are part of global business groups that also have underground aggregate mining operations in the USA. These companies would be in the position to make use of existing knowledge and technology to start up underground mining of aggregate in the UK.

The economic feasibility of underground mining of aggregates is less clear with varying estimates of the costs of extraction by surface quarrying and underground mining. Work carried out by the Royal School of Mines in the 1970s indicated that the cheapest cost of mining limestone is double that of quarrying (Royal School of Mines, 1974). Recent communication with a UK aggregate company indicated that the likely costs of underground mining would be at least 20% higher than surface quarrying.

Other factors also come into play. If the amount of rock that has to be removed by a surface quarrying operation ('overburden'), exceeds 25 metres then underground mining becomes an attractive proposition (McCraig, 2003). In most cases, underground mining of limestone is associated with an existing surface quarrying operation; often the mine entrance is developed in a quarry rock face and the rock mined is the same as that quarried. This means that many mines are comparatively shallow, on average 80 metres in depth (ranging from 7 to 610 metres). In many shallow mines, access is by a horizontal tunnel; an entrance road is driven into the quarry rock face or floor depending on the level of the rock to be mined. Where the rock to be extracted is deeper, declines may be used to reach the rock. Also, if the underground mine is 25 to 30 km closer to the market than the nearest competing quarry it will become an economically feasible option due to the lower transportation costs (Royal School of Mines, 1974). However, more up-to-date work is required to confirm this.

In England, the most likely sites for underground mining of aggregate would be existing surface quarrying operations where the aggregate resources are known to extend underground. These would benefit from the existence of aggregate processing plants, transportation infrastructure and established markets. However, the possibility of completely new mines need not be discounted. For many years Kent County Council has supported the concept of a limestone mine in east Kent as a means of securing long term supplies of construction aggregates. Initial feasibility studies have been carried out by industry with favourable results and plans for an exploratory drilling programme are being developed.

If increasing scarcity drives up prices sufficiently, underground mining could become economically attractive. But major new investment will be needed if it is to make a significant contribution to future supply.

## 6 Conclusions

England is fortunate that a wide range of aggregate sources contribute to overall supply and this diversity, in turn, helps to provide security of supply. England provides over 90% of its primary aggregate needs with the remainder being made up from imports. Adequate production capacity, i.e. sufficient quarries to extract and process aggregates in the right quantities, qualities, at the right locations and at the right time to meet demand, is clearly crucial. Fundamentally, this depends on the availability of land with workable deposits, with the necessary planning permissions for minerals extraction and with the ability to deliver to the market.

Meeting society's needs for aggregates while protecting designated areas will certainly not become an easier task. Even without any changes in policy or opinion, the continued working of the 'more acceptable' sites for aggregates will necessitate a move over time into the 'less acceptable' sites. Policies contained within MPS1 look to ensure an adequate supply of aggregates whilst limiting the amount of environmental damage and the quantity extracted in environmental designations.

Currently 32% of active aggregates quarries are associated with at least one of the statutory environmental designations included in this study (National Park, AONB, SPA/SAC, SSSI). Between them they produce 47 Mt/y of aggregates (33.4% of total land-won sales in England). Total permitted reserves in quarries (both active and inactive) in or associated with these environmental designations were 1 704 Mt in 2005 (41% of total permitted reserves in England).

Areas designated for their national or international importance for landscape and wildlife therefore collectively possess substantial permitted reserves. The 1 704 Mt of permitted reserves in 2005 represents 36 years' worth of working at 2005 rates. Although some of these reserves may be lost as a result of Appropriate Assessments of Natura 2000 sites, there will still be very large reserves available. In addition, the evidence available suggests that these designated areas do not impose absolute constraints on aggregates working, and that new permissions can still be granted if the relevant tests are satisfied. As a result, the conclusion can be drawn that the need for reserves in designated areas to be replaced by some kind of alternative supplies will be both at a slow rate and spread over many years.

The exact timing of the rundown of supplies from designated areas depends on the rate at which individual quarries are worked out or their permissions expire. A case study in the Peak District National Park indicated that in 2042 the National Park would still be supplying about half its current output (assuming no further replenishment of reserves).

There are 111 active aggregates quarries located within either a National Park or AONB. Between them they produce 22.6 Mt/y of aggregates (16% of total land-won sales in England). Total permitted reserves in quarries (both active and inactive) within these designations were 988 Mt (24% of total permitted reserves in England). A large number of permissions for these quarries within National Parks, and to a lesser extent AONBs are valid until 2042. However between now and 2042, if no further permissions are granted for extraction of aggregates, supply from National Parks and AONBs will gradually decline (as is evidenced from the case study of the Peak District National Park). If the demand for aggregates remains at current levels there will be a shortfall that is required to be made up from elsewhere. One source for this is indigenously supplied aggregates from quarries located outside these designations. There are already large quarries located in areas outside of the National Parks and AONBs which have some capacity to meet short term supply requirements. However, these quarries must ultimately be in the right locations to meet the market demand and any increase in supply will increase the rundown of their own permitted reserves. In the medium to longer term supplies would have to be met from new quarries located outside environmental designations. Given the limited amounts of unconstrained aggregate resources in certain regions (as is evidenced from the A0 regional maps

that accompany this report) this could potentially lead to higher concentrations of quarries on the available resource (which also may be adjacent to the designations).

Ultimately England has a diversity of sources for aggregate to meet supply requirements which, due to their relative capacities to supply is hierarchical. In order to meet the objectives of the sustainability agenda this results in an emphasis on utilisation of local indigenous supplies (including marine dredged aggregates), utilisation of secondary and recycled aggregates and imports from elsewhere in the UK and overseas. Maximising the use of recycled and secondary sources is very important but these are neither sufficient in quantity nor quality to meet all demand. It is therefore essential to maintain primary aggregate supplies.

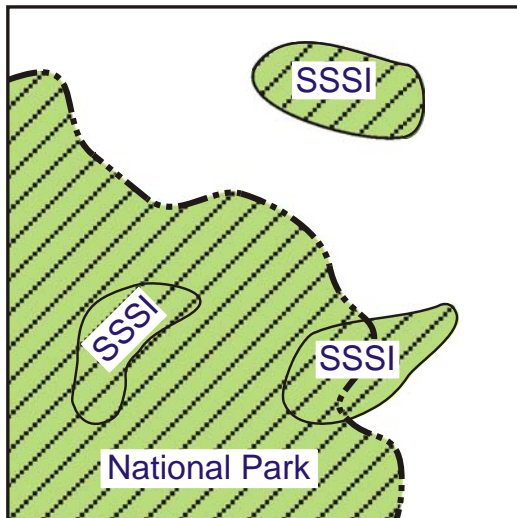
Each of the alternative sources of aggregates summarised in this report have some potential and capacity to increase their share of supply of aggregates. However, in order to do this there are issues within each that limit any additional contribution that they may make. Of overarching significance is the confidence of the industry to make the, often, large capital investments required to maintain continuity of supply.

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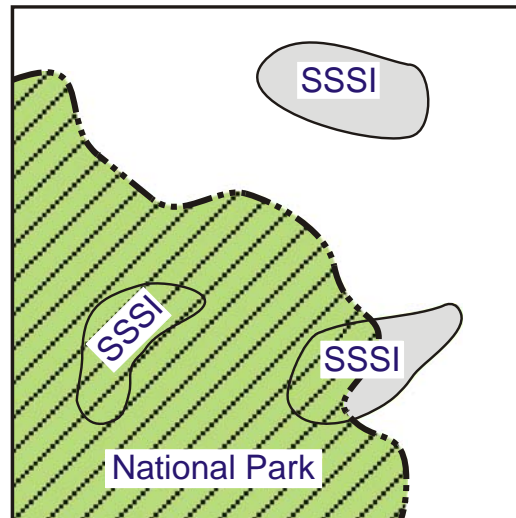
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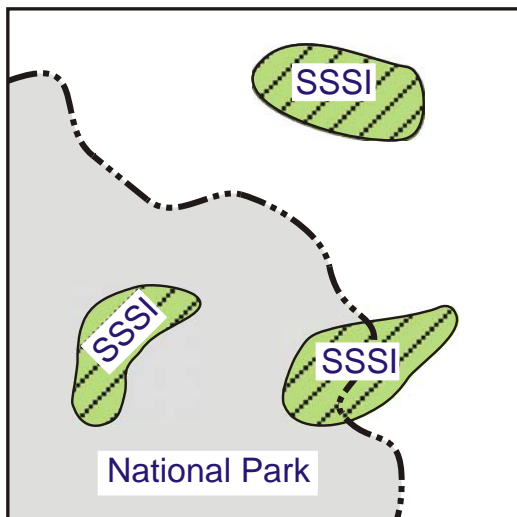
# Appendix 1 Reporting the areas of environmental designations



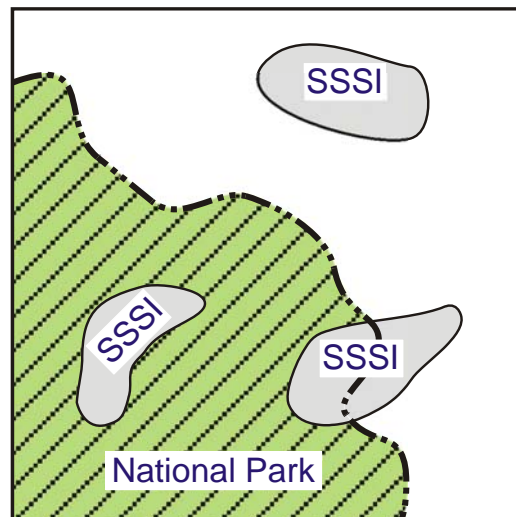
1. Total area of National Park and SSSI



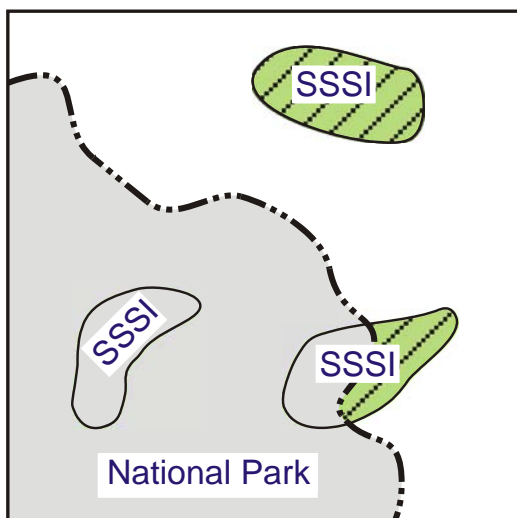
2. Total area of National Park



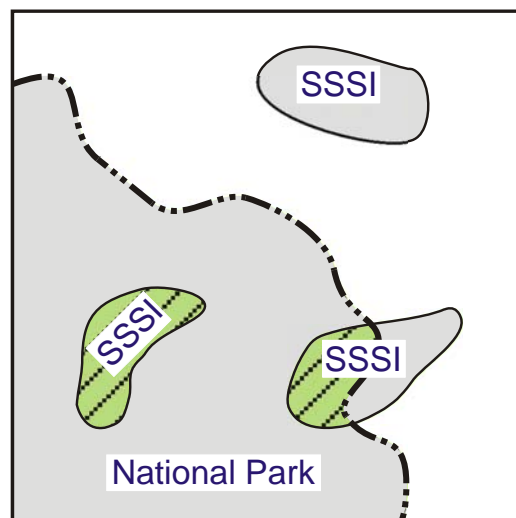
3. Total area of SSSI



4. Area which is exclusively National Park



5. Area which is exclusively SSSI



6. Area which is both National Park and SSSI

## Appendix 2 Definition of mineral resources and limitations

Mineral resources are natural concentrations of minerals, or bodies of rock, that are or may become of potential economic interest as a basis for the extraction of a mineral product. They will exhibit physical and/or chemical properties and be present in sufficient quantity to be of intrinsic economic interest. Mineral resources are thus economic as well as physical entities.

The identification and delineation of mineral resources is inevitably somewhat imprecise. It is limited not only by the quantity and quality of data currently available, but also involves predicting what might, or might not, become economic to work in the future. The assessment of mineral resources is, therefore, a dynamic process, which must take into account a range of factors. These include geological reinterpretation as additional data becomes available. Also included is the continually evolving demand for minerals, or specific qualities of minerals, due to changing economic, technical and environmental factors. Consequently, areas that are of potential economic interest as sources of minerals may change with time. In addition, criteria used to define resources, for example in terms of mineral to waste ratios, also change with location and time. Thus a mineral deposit with a high proportion of waste may be viable if located in close proximity to a major market, but uneconomic if located further away. These criteria vary depending on the quality of the information available. The extent of aggregate resources outlined for this project are generally the surface expression of the resource. However, readers should note that workable minerals may extend beneath overburden which is adjacent to the outcrop area shown.

**Inferred resources:** are those defined from available geological information. The majority of resources depicted on the maps produced for this study fall within this category. They have neither been evaluated by drilling or other sampling methods, nor had their technical properties characterised, on any systematic basis.

**Indicated resources:** are those in which there is a greater degree of geological assurance and the tonnage and grade are computed partially from specific measurements, in this case borehole data. Indicated resources are only given in areas assessed for sand and gravel by BGS resource surveys (Industrial Minerals Assessment Unit) which defined them by overburden to mineral ratios. In these areas, the possible extent of sand and gravel concealed beneath till (boulder clay) and/ or other material is shown. IMAU resource polygons are displayed on the maps in those areas where they exist.

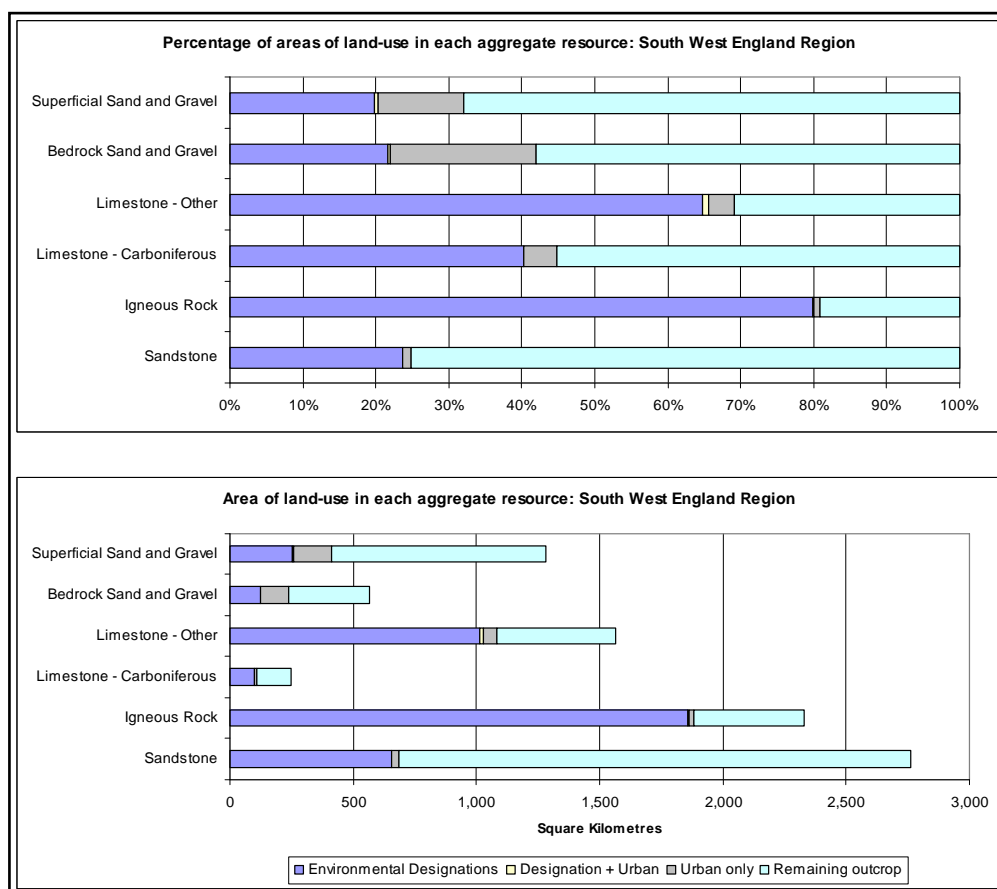
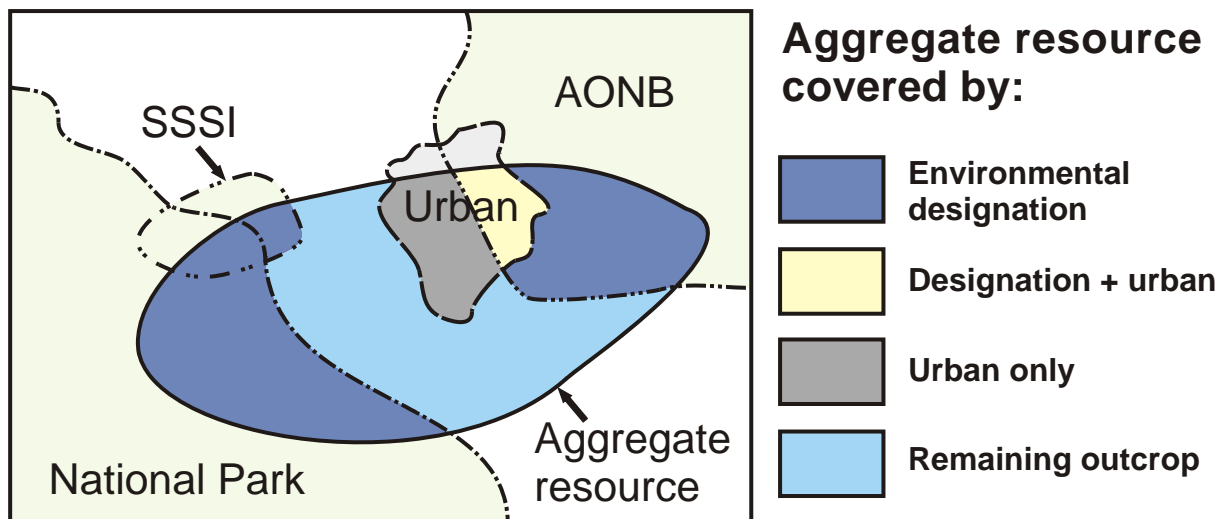
Readers should note that, at the interface between areas surveyed at different levels of detail, apparent mismatches between mineral resource linework may occur (e.g. between indicated and inferred resources).

The information displayed on the maps has been produced by the collation and interpretation of mineral resource data principally held by the British Geological Survey. The mineral resource data presented are based on the best available information, but are not necessarily comprehensive and their quality is variable. The inferred boundaries shown are, therefore, approximate. Mineral resources defined on the map delineate areas within which potentially workable minerals may occur. These areas are not of uniform potential and also take no account of planning considerations that may limit their working. The economic potential of specific sites can only be proved by a detailed evaluation programme. Such an investigation is an essential precursor to submitting a planning application for mineral working. The individual merits of the site must then be judged against other land-use planning issues. Extensive areas are shown as having no mineral resource potential, but some isolated mineral workings may occur in these areas. The presence of these operations generally reflect very local or specific situations.

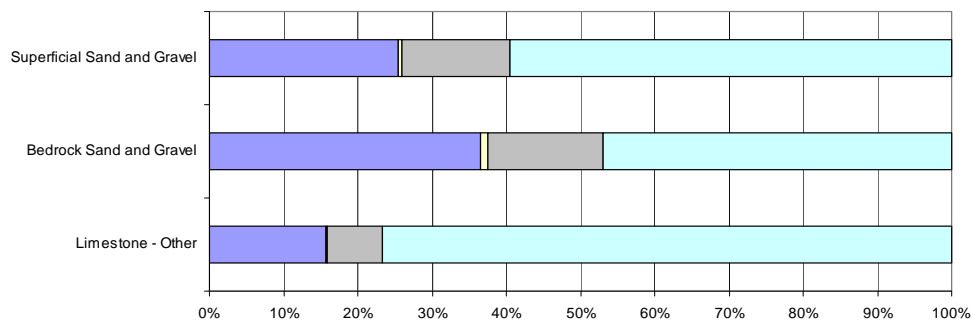


## Appendix 3 Results of spatial assessment of aggregate mineral resources

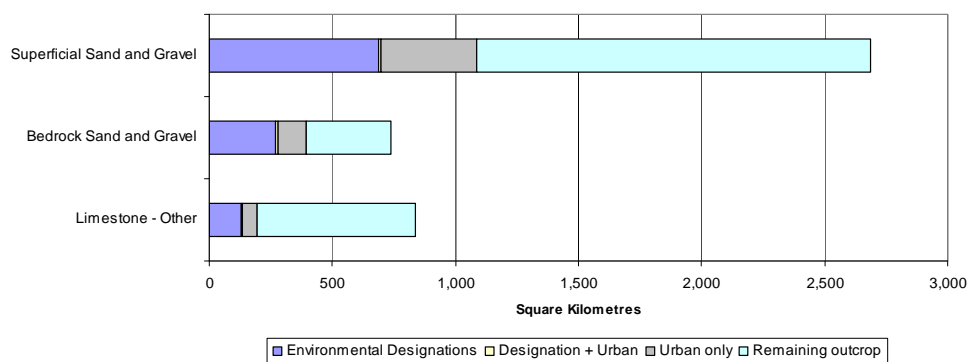
Charts summarising the amount of aggregate mineral resource covered by National Parks, AONBs, SSSIs, SPAs, SACs and Urban areas are shown on each of the eight regional maps of aggregate resources that accompany this report. They are re-produced here for completeness. The figure below helps to explain the analysis and legends on the charts.



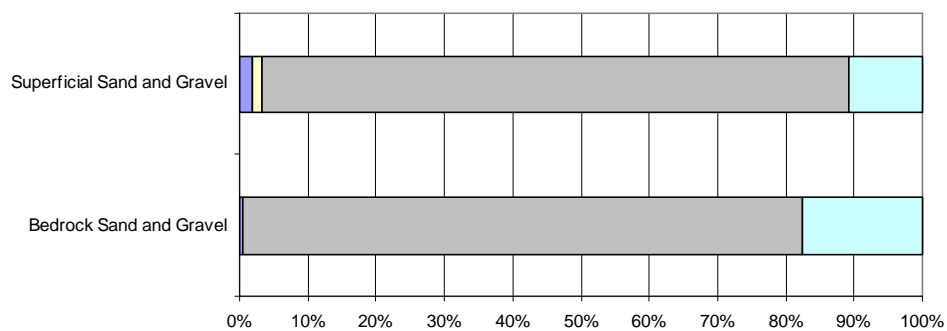
Percentage of areas of land-use in each aggregate resource: South East England Region



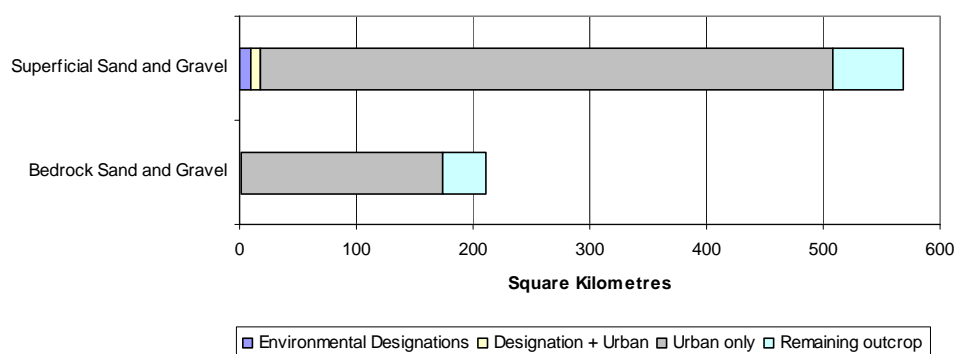
Area of land-use in each aggregate resource: South East England Region



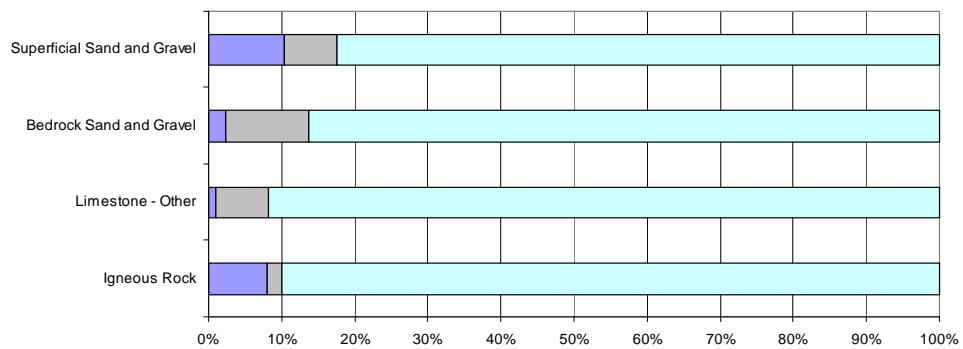
Percentage of areas of land-use in each aggregate resource: London Region



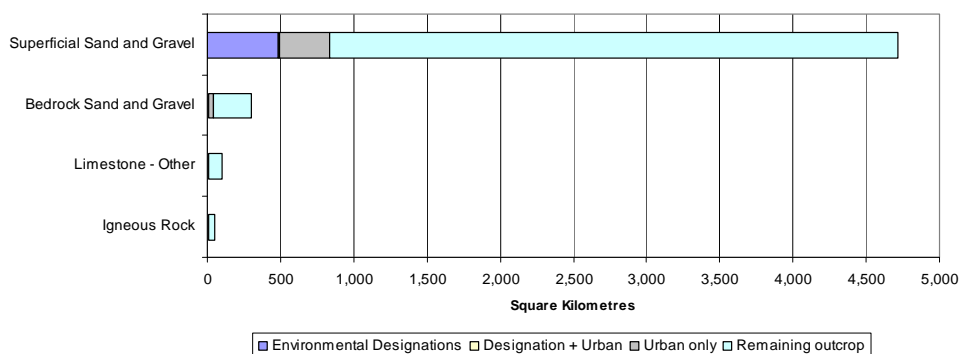
Area of land-use in each aggregate resource: London Region



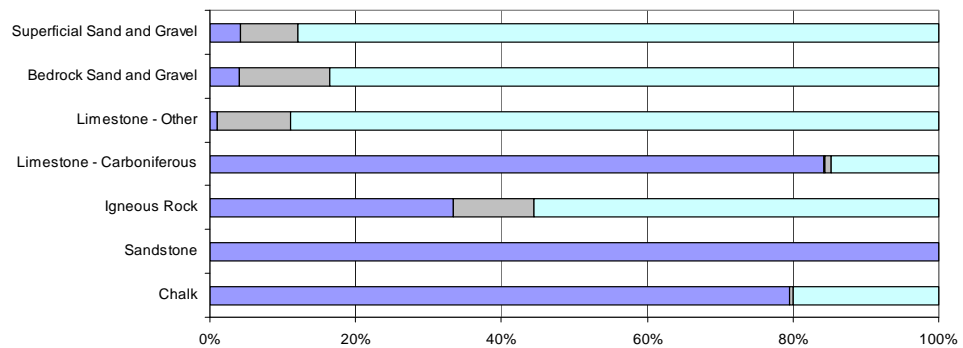
Percentage of areas of land-use in each aggregate resource: East of England Region



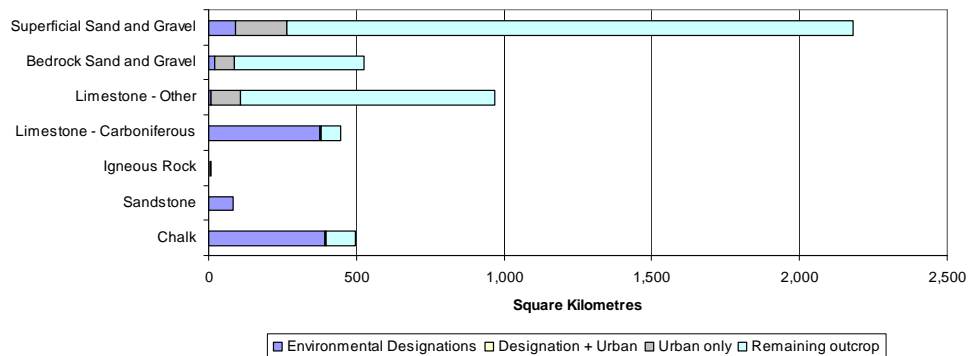
Area of land-use in each aggregate resource: East of England Region

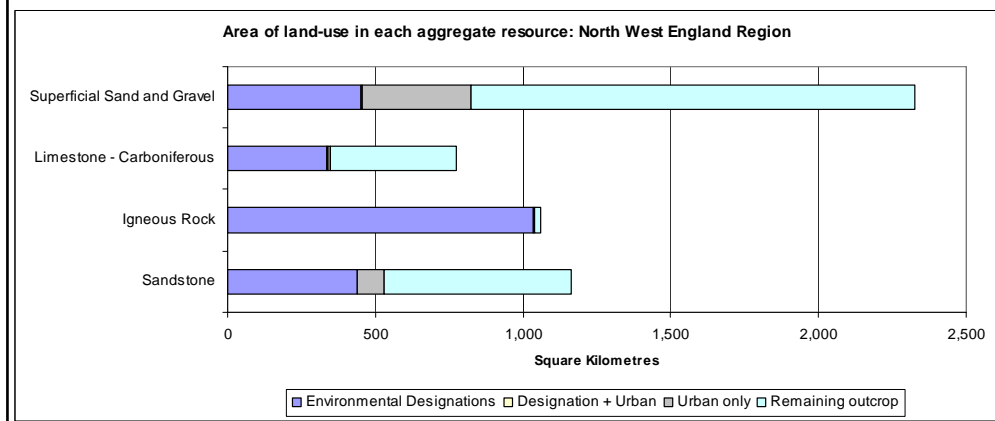
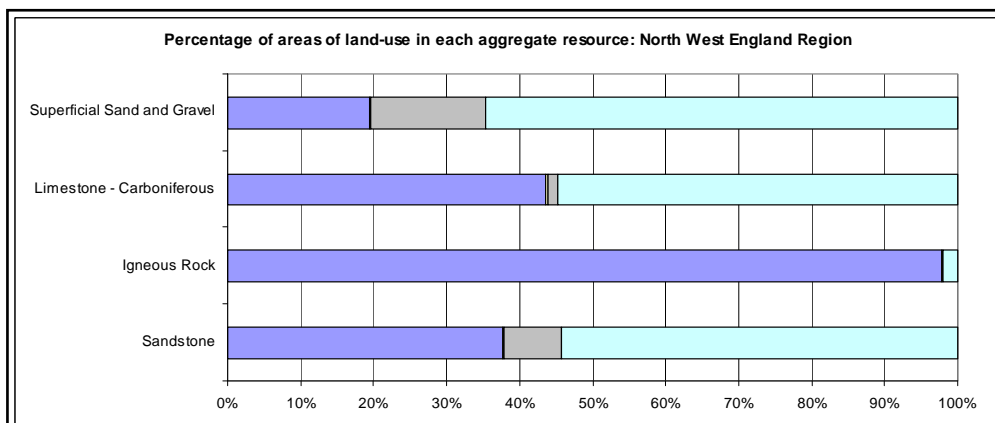
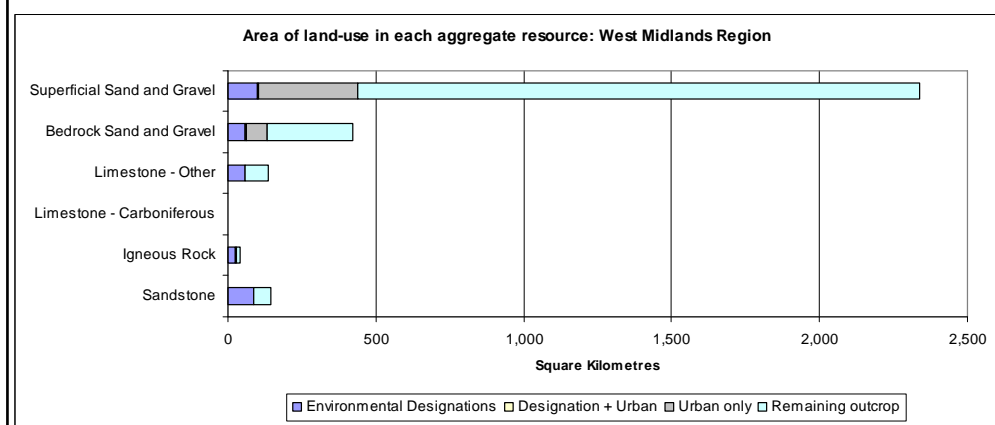
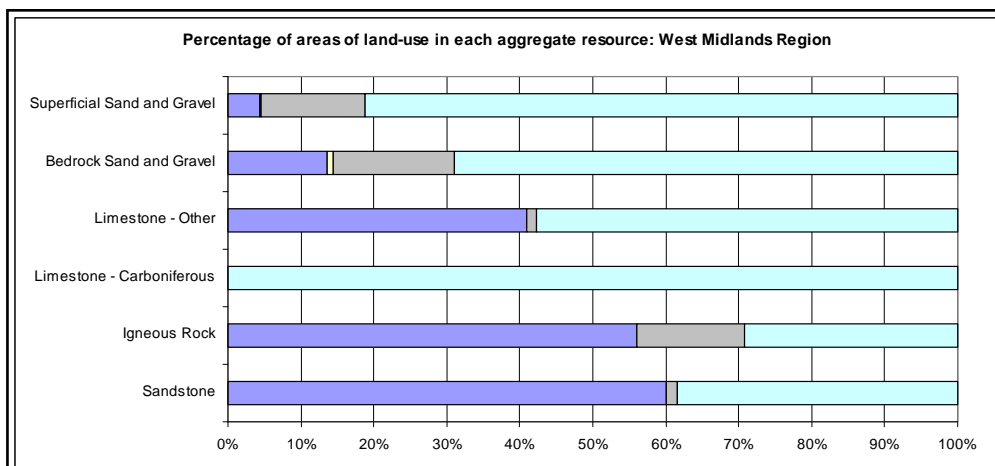


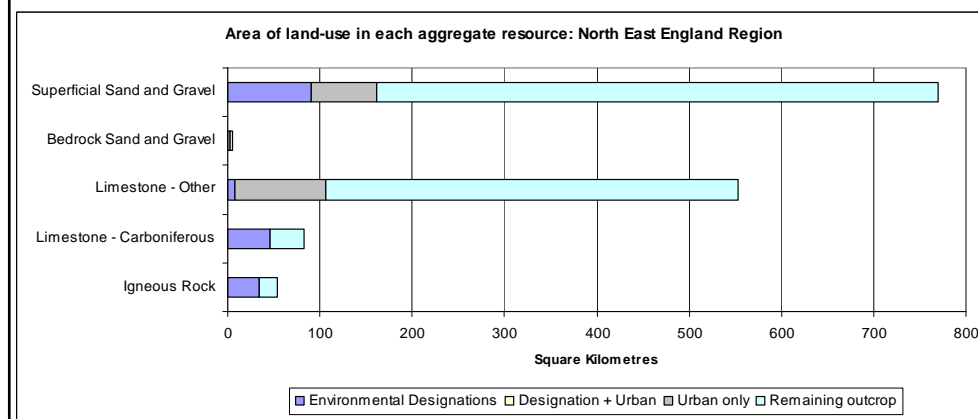
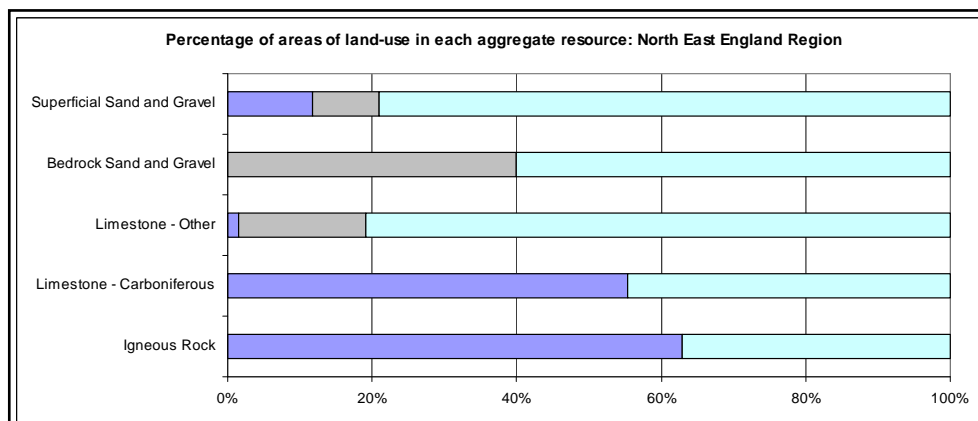
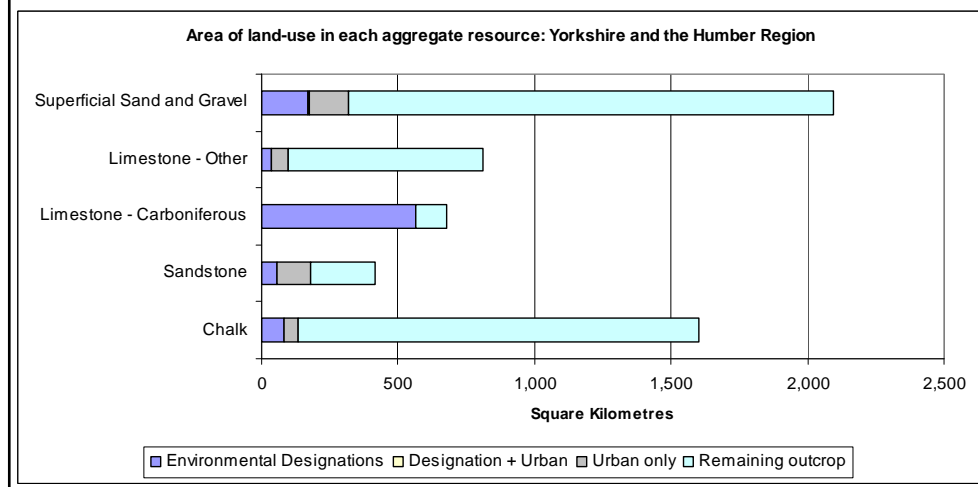
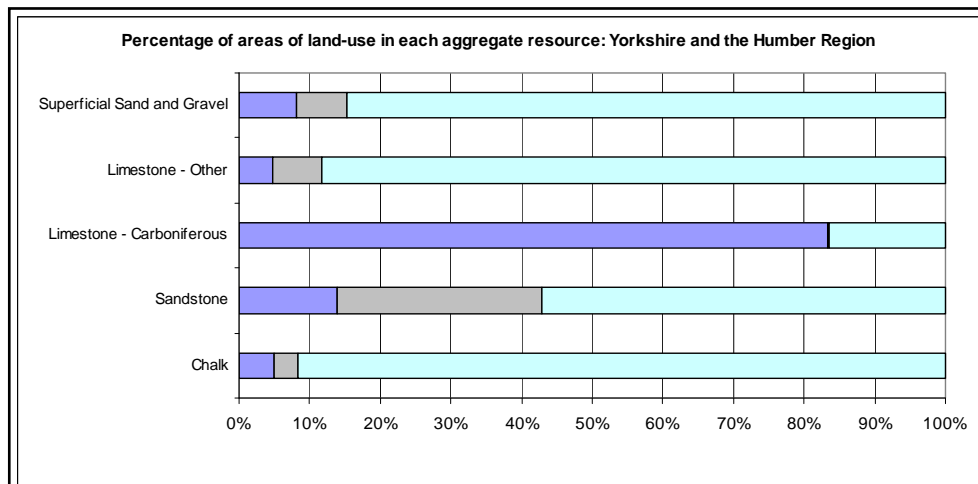
Percentage of areas of land-use in each aggregate resource: East Midlands Region



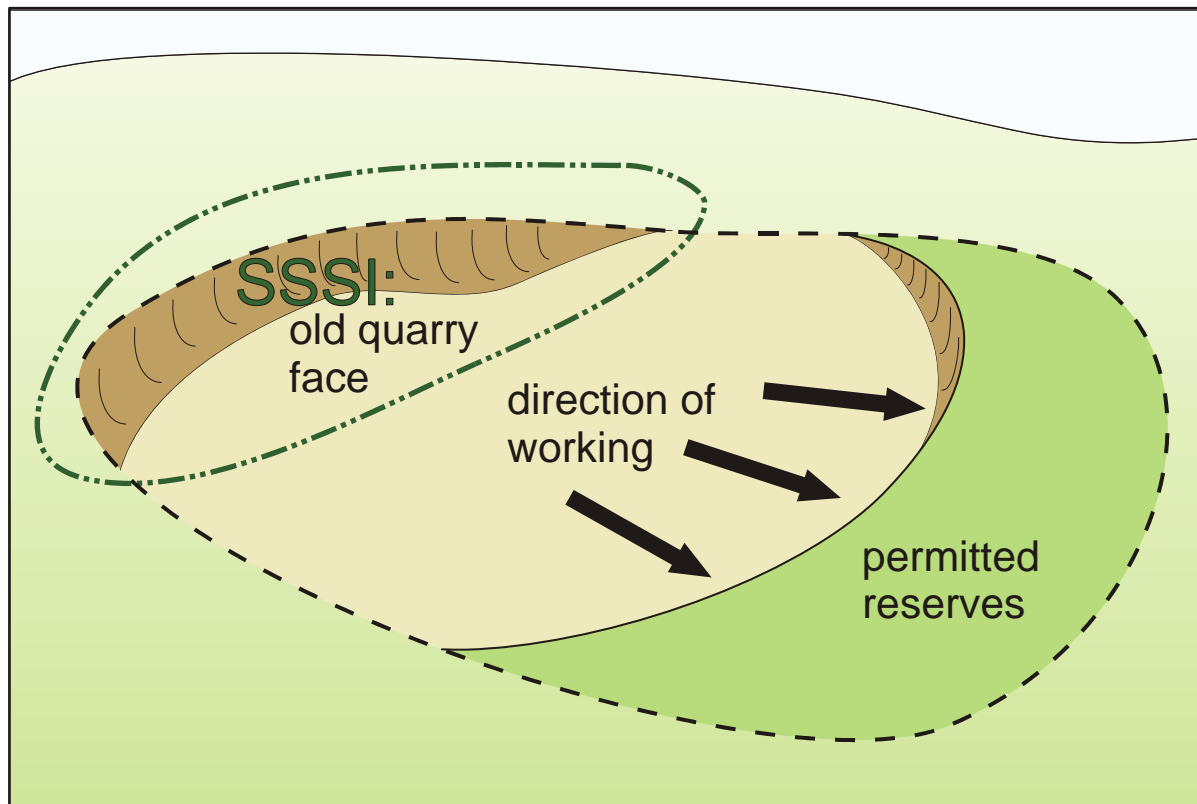
Area of land-use in each aggregate resource: East Midlands Region







## Appendix 4 Potential interaction between a quarry and an SSSI/SPA/SAC



A quarry in an SSSI (also applies to SACs and SPAs):

Quarrying aggregates can expose important geology which may later be designated as an SSSI. More recent quarrying activity will be towards permitted reserves, away from the SSSI. However, because part of the quarry is covered by an SSSI, the total amount of sales and permitted reserves are presented in the analysis of sales and reserves from environmental designations (Table 6 and Table 7).

## Appendix 5 Significance of 2042 on the expiry of old permissions

The Town and Country Planning (Minerals) Act 1981 made provision to impose an end-date on all planning permissions for mineral working which did not have their own specified end-date. This was set at February 2042, sixty years after the power came into effect, by which time all investment in a minerals operation would have been amortised. Subsequent legal interpretation resulted in the 2042 end-date being applied even to sites where an alternative pre-2042 end-date had been negotiated as part of the review of mineral permissions.

The result will be that a large number of mineral permissions, including aggregates permissions, will all expire on the same day in 34 years' time. Many sites will by then have been worked out or nearly so, though some may still have reserves available. This will provide an opportunity to reconsider the future of working at these sites, judging them against the policies prevailing at that time. If those sites in designated areas were judged against policies for aggregates working which prevail now, many of them would probably not meet the requirements for allowing them to work in these areas and their permissions would not be renewed.

If that assumption is correct, then a range of consequences is foreseeable in the period prior to 2042:

- (i) There will be a flurry of planning applications seeking renewals of planning permissions to allow quarries to continue operations after 2042. This will include affected quarries in designated areas.
- (ii) Those sites affecting designated areas that are unlikely to be granted renewed permissions, or are denied, them may well be worked harder in the period up to 2042, in order to maximise the benefit of the existing permissions before they expire.
- (iii) Those sites with permission affecting designated areas but where working is dormant may well be brought back into use some years prior to 2042 if this can be done economically, to obtain mineral from them before their permissions expire.
- (iv) Closer to 2042, mineral companies will seek the alternative planning permissions they need to enable them to continue serving the market after 2042. This will have to be on a scale sufficient to replace those permissions which will expire and be unable to obtain renewed permissions, and (on the assumption above) may well differentially affect quarries in designated areas.