

# **Worcestershire Minerals Local Plan Background Document**

## **Sand and Gravel in Worcestershire**

### **Background Document September 2018**

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# 1. Executive summary

- 1.1. Worcestershire contains important sand and gravel deposits of river terrace, fluvioglacial, and solid sands, all of which have been worked for decades. These quarries contribute to the local and national supply of construction aggregates and are essential to the continued smooth functioning of the construction industry.
- 1.2. The most up-to-date details on Worcestershire's production and permitted reserves of sand and gravel can be found in the Local Aggregates Assessment, published annually.
- 1.3. Nationally, sand and gravel is used for concrete, roadstone, asphalt, bulk fill and many other applications. The UK is a net exporter of sand and gravel, but is broadly self-sufficient in sand and gravel production, and only exports limited amounts. Economically, it is an important sector primarily because it is essential to the construction of buildings and infrastructure.
- 1.4. Minerals can only be extracted where they are found. Geological features that contain high-quality sand and gravel deposits are often co-located with areas targeted for development and so safeguarding the future supply from sterilisation by other development is important.
- 1.5. Aggregate quarries often operate at a large scale and the magnitude of potential impacts is correspondingly large. However, the potential for achieving restoration targets is also substantial. There are many excellent examples of sand and gravel sites that have been restored to a very high standard.

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## 2. Introduction to Sand and Gravel

### Sand and Gravel in the UK

"Aggregates are the most commonly used construction minerals in the UK. They are widely distributed with a range of potential sources and, while a low cost product, are used in very large quantities. They are essential for constructing and maintaining what is literally the physical framework of the buildings and infrastructure on which our society depends"<sup>1</sup>

- 2.1. The Council has a statutory duty to produce a Minerals Local Plan (MLP) to deliver minerals development. The current Hereford and Worcester MLP was adopted in 1997 and needs to be updated to reflect current policy, practice and guidance. The new Minerals Local Plan will replace the existing Minerals Local Plan and will be a Development Plan Document used to guide new development and determine planning applications.
- 2.2. Aggregates are defined as "hard, granular materials which are suitable for use either on their own or with the addition of cement, lime or a bituminous binder in construction"<sup>2</sup>. Aggregates are essential for the construction industry, and are used to make concrete, mortar, roadstone, asphalt, railway ballast, bulk fill. They also have many other uses.
- 2.3. Quarrying aggregates is a localised activity: you can only extract minerals from where they occur naturally due to the underlying geology. However, aggregates are widely distributed across the country, and can be won from various sources. Sand and gravel deposits are extensive, with river terrace sands and gravels being found along river valleys nationwide and glaciofluvial sands and gravels (laid down by glacial meltwaters after periods of glaciation) located in all parts of the country, with the exception of the extreme south and southwest which were never glaciated<sup>3</sup>.
- 2.4. Primary aggregates are those "produced from naturally occurring mineral deposits, extracted specifically for use as aggregate and used for the first time"<sup>4</sup>. Aggregates can also be obtained by crushing stone quarried from hard, strong rock formations into appropriate sizes or by extracting stone from "naturally occurring particulate deposits"<sup>5</sup>.
- 2.5. Though the term 'aggregates' can also include crushed stone, this background paper primarily discusses sand and gravel extraction. Despite some similarities in end use and the fact that some kinds of crushed rock can be further processed to meet some sand and gravel specifications, sand and gravel and crushed rock workings can operate very differently and have dramatically different landscape impacts. As a result, crushed rock is discussed in a separate background paper.

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<sup>1</sup> British Geological Survey (2013) Construction Aggregates Minerals Planning Factsheet.

<sup>2</sup> British Geological Survey (2013) Construction Aggregates Minerals Planning Factsheet.

<sup>3</sup> British Geological Survey (2013) Construction Aggregates Minerals Planning Factsheet.

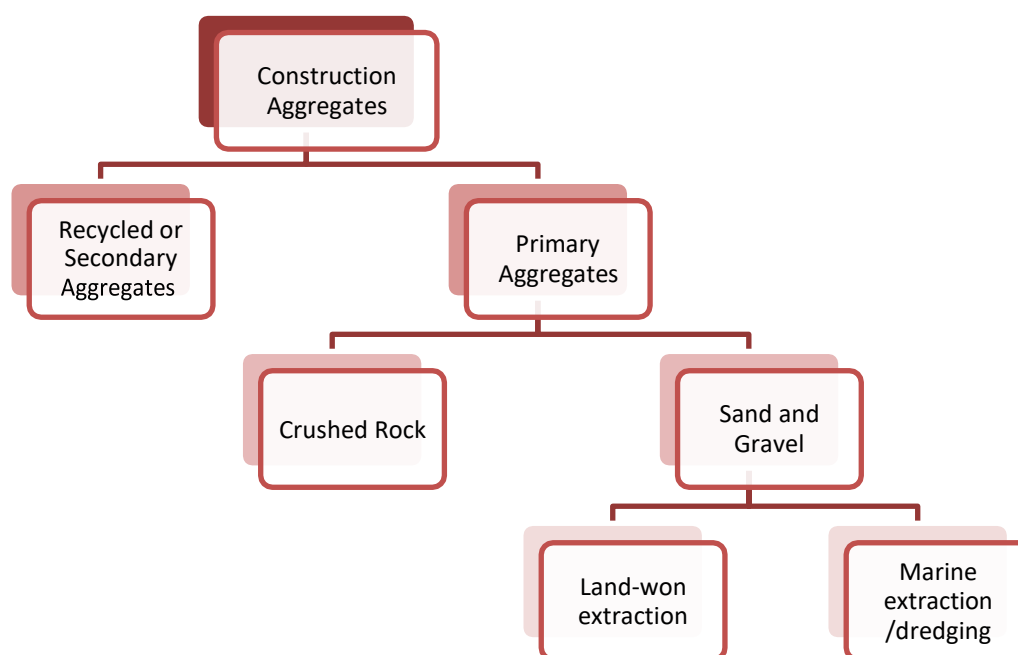
<sup>4</sup> British Geological Survey (2013) Construction Aggregates Minerals Planning Factsheet.

<sup>5</sup> British Geological Survey (2013) Construction Aggregates Minerals Planning Factsheet.

2.6. Secondary and recycled aggregates are also produced in the UK. These include material obtained as a by-product of other extractive industries or industrial processes, and from demolition and other construction works. Some information regarding recycled aggregates can be found in the Waste Core Strategy for Worcestershire.

2.7. Aggregates can be sub-divided as follows:

**Figure 1: Categories of Construction Aggregates**



2.8. As Worcestershire is a landlocked county, we are primarily concerned with land-won sand and gravel.

2.9. Land-won sand and gravel extraction can take place in wet or dry workings. This is explained further in the '

2.10. Sand and Gravel extraction' section below.

## Economics of Sand and Gravel

2.11. Sand and gravel represents approximately 35% of the UK's total primary aggregate production, with 76% of that coming from land-won sources and 24% from marine extraction. 46,400,000 tonnes of land-won sand and gravel were produced in the UK in 2014<sup>6</sup>.

2.12. The approximate value of the sand and gravel produced in the UK in 2014 was £643 million. There was a large drop in the UK market from 2008 (£814 million) to 2009 (£640 million)<sup>7</sup>.

<sup>6</sup> British Geological Survey (2012) Minerals produced in the United Kingdom in 2014 [online] available from <https://www.bgs.ac.uk/mineralsuk/statistics/downloads/MineralsProducedInTheUnitedKingdom.pdf> [Accessed 22.10.2018].

<sup>7</sup> British Geological Survey (2016) United Kingdom Minerals Yearbook 2015 [online] Available from <https://www.bgs.ac.uk/downloads/start.cfm?id=3094> [Accessed 22.10.2018].

- 2.13. Historically, the UK has been self-sufficient in the supply of primary aggregates. More recently, the UK has become a net exporter of sand and gravel, mainly due to exports of marine-won sand and gravel. However, there is also a small market for imported sand and gravel, mainly for specialised uses that the UK is not able to supply domestically. Imports of aggregates into England and Wales from Scotland and Europe account for 2.4% of total aggregates consumption (although almost all of the imports are crushed rock, rather than sand and gravel).<sup>8</sup>
- 2.14. There were 296 land-won sand and gravel quarries in England and Wales in 2014.<sup>9</sup> Producers range from small single quarry owners to large multi-national corporations operating many sites.
- 2.15. The Mineral Products Association (MPA) is the main trade association representing the industry. MPA members cover 90% of aggregates production<sup>10</sup>. Independent and privately owned quarries are represented by the British Aggregates Association which accounts for the remaining 10% of national production<sup>11</sup>.
- 2.16. The Landfill Tax was introduced in 1996 as a tax on waste disposal at landfill sites. The purpose was to encourage waste producers to produce less waste, recover more value from waste (for example through recycling or composting), and to use more environmentally friendly methods of waste disposal. The tax, however, led to unanticipated effects on the quarrying industry. Before 1996, quarry operators were able to accept landfill waste to raise the level of quarry voids to assist with restoration. After the introduction of the landfill tax, operators were required to pay for this material, which had impacts on the economic model of their operations.
- 2.17. Some types of waste is exempt from Landfill Tax, including "material arising from mining and quarrying operations and disposed of at an authorised landfill site". Certain material "which is used for the purposes of filling existing or former quarries may qualify for exemption", subject to meeting specified conditions.<sup>12</sup>
- 2.18. The Aggregates Levy was introduced in April 2002. The current levy rate is £2.00 per tonne, and it applies to all crushed rock produced in the UK. Aggregate exports are not taxed.

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<sup>8</sup> British Geological Survey (2016) Commissioned Report OR/16/005: Collation of the results of the 2014 Aggregate Minerals survey for England and Wales.

<sup>9</sup> British Geological Survey (2016) Commissioned Report OR/16/005: Collation of the results of the 2014 Aggregate Minerals survey for England and Wales.

<sup>10</sup> Mineral Products Association, Explore the MPA [online] available at <https://mineralproducts.org/> [Accessed 22.10.2018].

<sup>11</sup> British Geological Survey (2013) Construction Aggregates Minerals Planning Factsheet.

<sup>12</sup> HM Revenue & Customs (2018) Excise Notice LFT1: a general guide to Landfill Tax Updated 3 April 2018, sections 8.2 'Mining and quarrying material' and 8.4 'Filling of quarries' [online] Available at <https://www.gov.uk/government/publications/excise-notice-lft1-a-general-guide-to-landfill-tax/excise-notice-lft1-a-general-guide-to-landfill-tax#exemptions> [accessed 22.10.2018].

- 2.19. The Landfill Tax did result in an increase in recycled and secondary aggregates before the introduction of the Aggregates Tax, but the Aggregates Tax has led to other unintended impacts. These include:
- the transport of untaxed aggregates over longer distances,
  - difficulties with disposing poor-quality materials (overburden) for primary aggregates companies, and
  - build-up of unsalable materials at quarries sterilising permitted reserves<sup>13</sup>.
- 2.20. There is some debate over the value of the Aggregates Levy, as the government originally justified its introduction as a means of addressing the environmental costs of quarrying. The tax was designed to:
- recognise the significant environmental impact of extracting aggregates, and
  - encourage the use of alternative materials.
- 2.21. The Mineral Products Association disagrees with the appropriateness of this justification on the basis that the Levy is environmentally inefficient and operates effectively as a tax on production.<sup>14</sup> However, until 2011, part of the Aggregates Levy was used for the Aggregates Levy Sustainability Fund, which provided funding for local environmental and community projects that mitigated the effects of quarrying, including restoration and conservation schemes, and was positively viewed by many conservation agencies.
- 2.22. Secondary and recycled aggregates are also economically important as they make a contribution towards total reserves of aggregates and help reduce reliance on primary extraction. The Minerals Product Association estimates recycled and secondary materials currently account for under 30% of the aggregates market. The UK leads Europe in recycled materials production. This issue is mentioned in the Local Aggregates Assessment, but will be covered in more detail in a separate background paper.

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<sup>13</sup> BDS Marketing Research (2009) The Effects of the Landfill Tax and Aggregates Levy by an Analysis of Aggregates Markets since 1990 [online] Available at [https://www.british-aggregates.co.uk/news/doc119\\_2.pdf](https://www.british-aggregates.co.uk/news/doc119_2.pdf) [Accessed 22.10.2018].

<sup>14</sup> Mineral Products Association website, General Issues: the Aggregates Tax [online] Available at [https://mineralproducts.org/iss\\_key01.htm#tax](https://mineralproducts.org/iss_key01.htm#tax) [Accessed 22.10.2018].



**Image 1:** Church Farm East sand and gravel working. (Photo: Worcestershire County Council)

## Sand and Gravel extraction

- 2.23. Minerals are only able to be worked where they are found and those locations are predetermined by the underlying geology. This means that quarry locations are fixed, and reserves of all mineral types are limited.
- 2.24. Taking the view that any mineral working must be restored, mineral extraction is considered a temporary land use, even though it might take place over a long time.
- 2.25. Sand and gravel workings are usually fairly shallow. Nationally, even a depth of 5 or 6 metres deep is considered notable, and in Worcestershire workings have often been even shallower.
- 2.26. Sand and gravel sites are often worked and restored in progressive rolling phases. That means that the area exposed can be minimised, and that land being worked is out of productive use (for example for agriculture) for a limited period of time<sup>15</sup>.
- 2.27. Sand and gravel pits typically produce between 10,000 to 1 million tonnes per annum (tpa), with most falling in the 100,000 to 300,000 tpa range.

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<sup>15</sup> Mineral Products Association (undated) How Quarries Work: Sand and Gravel [online] Available at [https://mineralproducts.org/iss\\_how01.htm](https://mineralproducts.org/iss_how01.htm) [Accessed 22.10.2018].





**Image 2:** Processing at Ryall sand and gravel working. (Photo: Worcestershire County Council)

- 2.28. Material can be extracted via wet or dry workings. Some gravel pits are worked above the water table and so are worked 'dry', while others are pumped to allow them to be worked 'dry'. Others may be operated 'wet' with the material being excavated from below water level. Dry workings do not discharge water, which frees them from certain Environment Agency requirements. More information on this can be found in the 'Cotswolds Area of Outstanding Natural Beauty Management Plan
- 2.29. The Cotswold Area of Outstanding Natural Beauty (AONB) extends into Worcestershire in the area of Bredon Hill and Broadway. This area contains the recently closed Fish Hill quarry which produced Cotswold stone.
- 2.30. Policy CE3 of the Cotswold AONB Management Plan states that "Provision should be made for the quarrying of limestone, at an appropriate scale, in order to provide building materials that help maintain and enhance the local distinctiveness of the AONB. Any such mineral sites should be required to demonstrate that they do not have any significant adverse effects on the special qualities of the AONB or integrity of existing wildlife sites". There is nothing specific in the policy or elsewhere in the plan relating to sand and gravel.

### **Cotswolds Area of Outstanding Natural Beauty Minerals and Waste Planning position paper**

- 2.31. Although this position statement pre-dates the latest AONB Management Plan, it nevertheless sets out a position on minerals. Most of its content is concerned with crushed rock, walling and roofing stone, but it does state that

"The Board will wish to see the use of secondary aggregates promoted in Minerals Core Strategies/Local Plans".

### **Malvern Hills Area of Outstanding Natural Beauty Management Plan**

- 2.32. The Malvern Hills AONB Management Plan includes policy BDP8 to "Support the recycling, re-use and limited extraction of small quantities of locally distinctive building materials, such as Malvern stone, where this is needed to help retain local distinctiveness in the built environment". However, the focus is predominantly on building stone, rather than aggregates.

### **Malvern Hills Conservators Management Plan**

- 2.33. The Malvern Hills Conservators were established under the Malvern Hills Act 1884 to manage and protect the hills. One of their key aims is to prevent unlawful digging and quarrying on the hills.
- 2.34. The Malvern Hills Conservators Management Plan (2016-2021) identifies disused quarries as being important features of geological interest. It states that "geological exposures play a significant and charismatic role in the heritage of this area. While all rock outcrops contribute, the designated 25 Local Geological Sites showcase Malvern geology to a high standard. Here, the accessibility to the exposure and visibility of the rock face/landform are excellent allowing their interpretation and use by people and habitation by appropriate species including lichens and the grayling butterfly".

### **Herefordshire and Worcestershire Earth Heritage Trust Geodiversity Action Plan**

- 2.35. The Earth Heritage Trust is a charity active in Worcestershire and Herefordshire. Their mandate is to record, protect and promote geology and landscape and to raise general awareness of earth heritage by offering educational programmes to the public.
- 2.36. The Trust has produced a Geodiversity Action Plan (GAP) for Worcestershire, which identifies a number of objectives and actions to "provide long term and sustainable support for the conservation of geodiversity within Worcestershire". Objective 7 of the GAP is to "improve and sustain the links between geodiversity, biodiversity, archaeology and landscape".

### **Abberley and Malvern Hills Geopark**

- 2.37. The Abberley and Malvern Hills Geopark encompasses parts of Gloucestershire, Herefordshire, Shropshire and Worcestershire. It is driven by a collection of local organisations and exists to allow "people from all

walks of life the opportunity to experience geology and to appreciate the importance of their geological heritage".



**Image 3:** The Abberley Hills from Teme Valley Road (Photo: Worcestershire County Council).

2.38. Regulatory framework' section below.

2.39. Whether a site is worked wet or dry may have some bearing on the future restoration plans for sand and gravel sites. This is detailed in the 'Potential for restoration' section below.

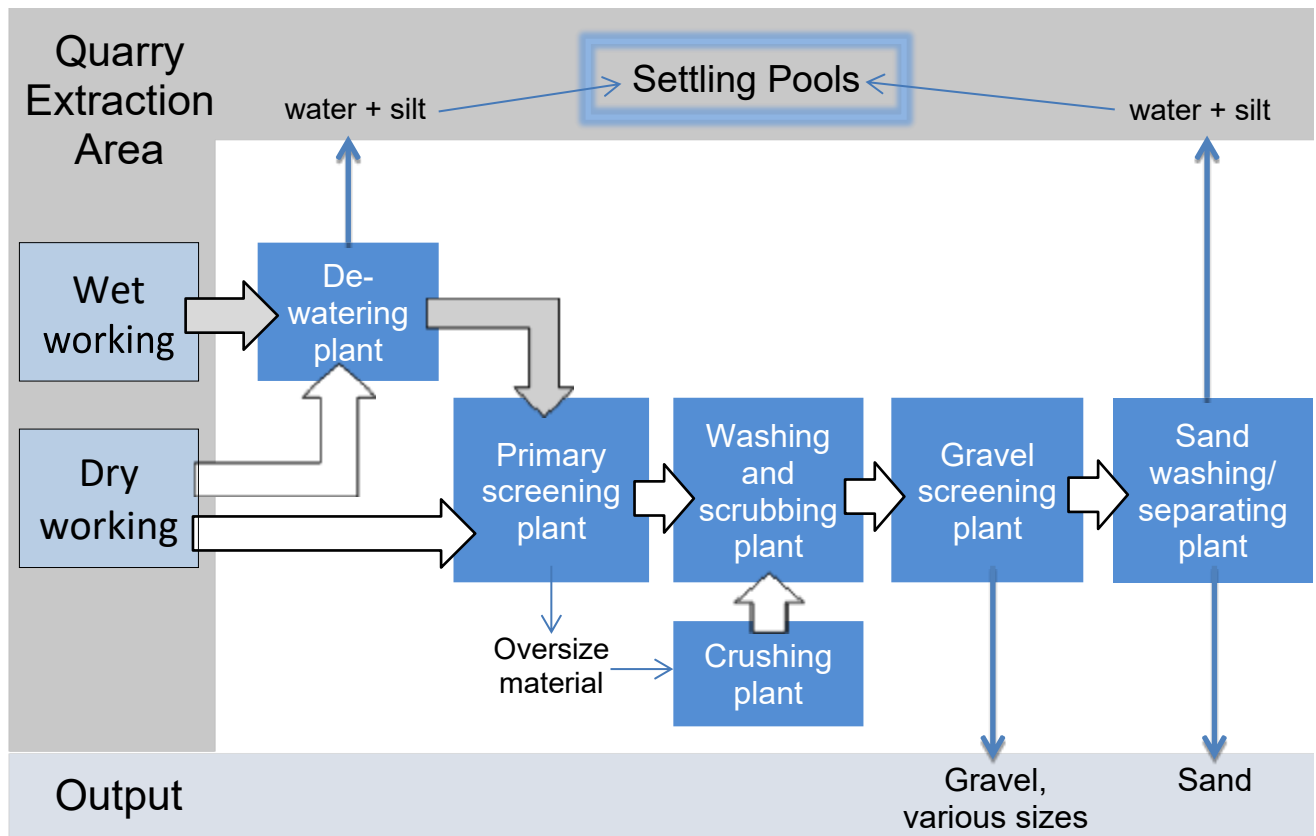
2.40. As most extracted minerals cannot be used as construction materials immediately upon extraction, some processing, as described in the table below, is usually required. Processing typically involves crushing, milling, screening or grading and washing activities, and may occur on site at the quarry or off site at a dedicated processing facility.

2.41. Solid sand workings are often smaller in area and deeper than workings on river terrace or glacial deposits. Solid sand deposits are usually worked dry, and may include a crushing stage prior to screening.

2.42. Unlike some other minerals, sand and gravel are defined based on particle size rather than composition. In accordance with European standards, "gravel" refers to particles between 4mm and 80mm in diameter, and "sand" (also referred to as "fine aggregate") refers to particles that are finer than 4mm but coarser than 0.063mm.

2.43. The basic steps in sand and gravel extraction are as follows:

**Figure 2: Sand and gravel extraction process**



## 3. Sand and Gravel resources in Worcestershire

### Geological context

- 3.1. Sand and gravel deposits can be highly variable. This means that, unlike other bulk minerals, it can be difficult to determine the precise location and extent of workable resources from geological maps<sup>16</sup>. The economic potential of a sand and gravel deposit is influenced by the following criteria:
- Sand-to-gravel ratio
  - Proportion of fines and/or oversized material
  - Presence of undesirable rock types in the deposit
  - Thickness of the deposit and overburden ratio
  - Position of water table
  - Presence of unwanted inter-bedded material
  - Location relative to demand<sup>17</sup>

Every site is, however, influenced by locally specific considerations.

- 3.2. Whether an aggregate is fit for a certain purpose "depends principally on its physical and mechanical properties...for general purpose applications an aggregate of high strength and durability with low porosity is required"<sup>18</sup>. However, some uses require additional mineralogical or chemical specifications. These can include particle shape and grading, resistance to chemical and physical weathering, volume stability, frost resistance and others.
- 3.3. Worcestershire contains extensive sand and gravel deposits which can be divided into two main categories: superficial drift deposits, and bedrock (solid) deposits. As Worcestershire has no direct sea access and river dredging is not undertaken to any significant extent, all of our current production is land-won.
- 3.4. Superficial drift deposits can be further subdivided into glacial and river sands and gravels.
- 3.5. Solid or bedrock deposits are mainly found in the north of the county in the Triassic Kidderminster and Wildmoor Sandstone Formations. The name 'bedrock' may be slightly misleading, as these deposits are often relatively unconsolidated and easily worked. The north-east Worcestershire area yields coarse sand and gravel with a high gravel content that is capable of producing high-grade concreting aggregate. Elsewhere in the same formation, where there are no pebbly strata, soft sands are present. The Wildmoor Formation is similar but also contains nationally scarce sources of silica (moulding) sand, historically used in the foundry industry.

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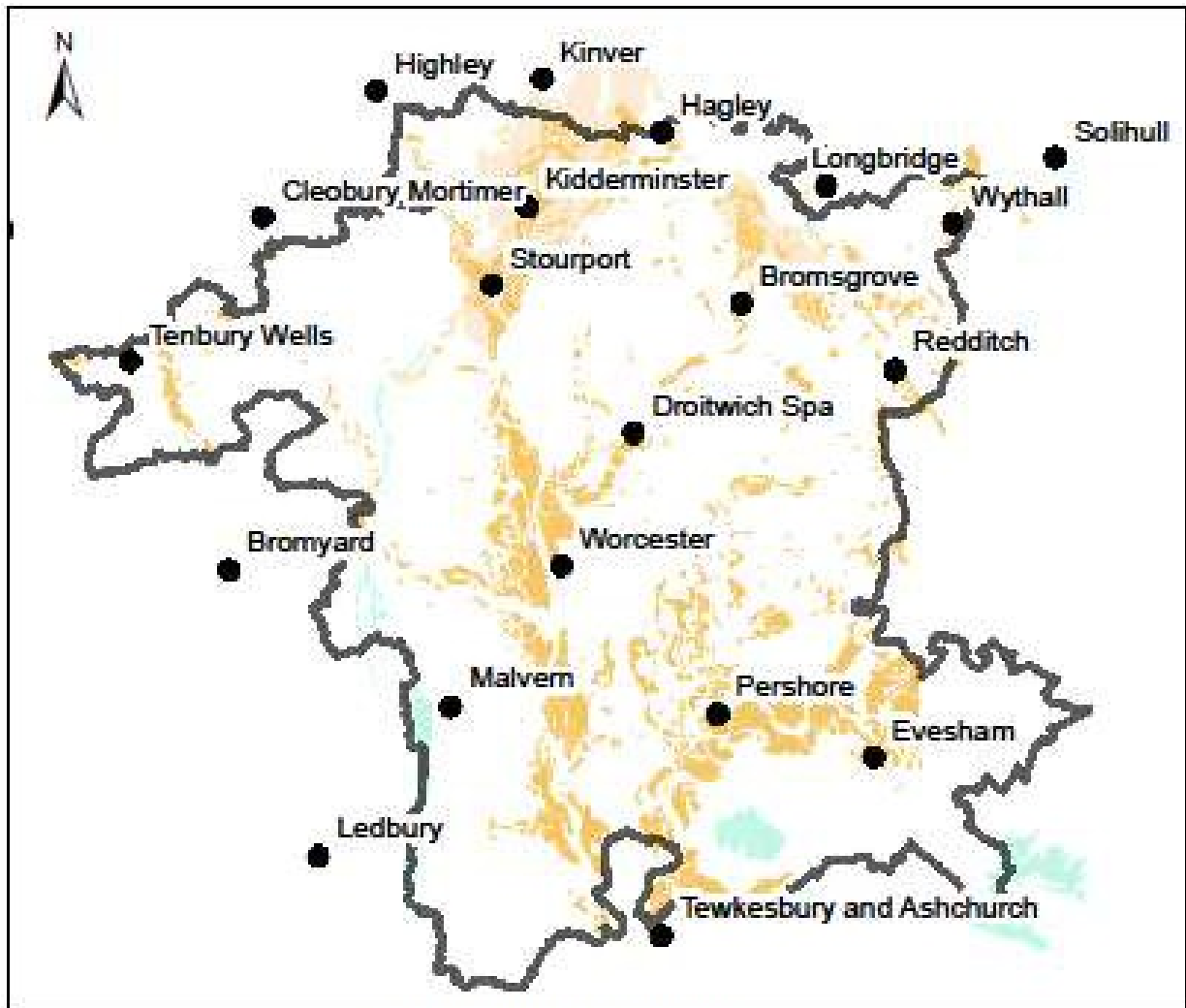
<sup>16</sup> Bloodworth, A.J., et al. (1999) Mineral Resource Information for Development Plans: Phase One Herefordshire and Worcestershire: Resources and Constraints British Geological Survey Technical Report WF/99/4

<sup>17</sup> Bloodworth, A.J., et al. (1999) Mineral Resource Information for Development Plans: Phase One Herefordshire and Worcestershire: Resources and Constraints British Geological Survey Technical Report WF/99/4

<sup>18</sup> British Geological Survey (2013) Construction Aggregates Minerals Planning Factsheet.

- 3.6. River terrace deposits of sand and gravel of Quaternary age are most widespread in the Severn and Avon valleys, and glacial deposits are found in association with boulder clay in the north-east of the county and to the north-west of Evesham around the Lenches.

**Figure 3: Geological distribution of sand, gravel and crushed rock in Worcestershire**



### Aggregate Minerals

**Legend**

- Terrace and glacial sand and gravel
- Solid sands
- Crushed rock

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 Ordnance Survey 100024230.  
 Derived from 1:50,000 scale, BGS Digital Data under Licence 2001/125.  
 Amended British Geological Survey © NERC

- 3.7. As shown on the map above, all types of sand and gravel deposits found in Worcestershire also extend across the county border into neighbouring counties. All of the surrounding counties produce some sand and gravel, but Staffordshire is the largest producer in the West Midlands, producing about two thirds of the region's supply. Staffordshire is followed by Warwickshire in terms of production, with Worcestershire and Shropshire producing similar volumes and the West Midlands and Herefordshire producing rather less.

- 3.8. There are also silica sand deposits in the county. Silica sand is a specialised product that was historically important for the foundry industry, and is often found in discrete strata within other solid sand deposits. It has been worked in the area north of Bromsgrove near Wildmoor and Blackwell, primarily for iron founding and moulding. The progressive decline in heavy manufacturing in the UK, including the foundry industry, has resulted in a significant decline in the demand for foundry sand.<sup>19</sup> The properties of naturally-bonded sand cannot be controlled as easily as synthetic foundry sand and this, together with the wider use of chemical binders, has contributed to the decline in its use.<sup>20</sup> Silica sand resources in Worcestershire are examined in detail in the 'Silica Sand' background paper.
- 3.9. The latest Aggregates Minerals survey for England and Wales shows that permitted reserves of sand and gravel in the West Midlands have declined from 144 million tonnes in 2001 to just 89 million tonnes in 2014, a fall of 38%. This is similar to the picture for England and Wales, where reserves have fallen 42% over the same period.<sup>21</sup>

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<sup>19</sup> British Geological Survey (2009) Silica Sand Minerals Planning Factsheet.

<sup>20</sup> BGS, DETR (1999) Mineral Resource Information for Development Plans, Herefordshire and Worcestershire: Resource Constraints [online] Available at <https://www.bgs.ac.uk/mineralsuk/planning/resource.html> [Accessed 22.10.2018].

<sup>21</sup> British Geological Survey (2016) Commissioned Report OR/16/005: Collation of the results of the 2014 Aggregate Minerals survey for England and Wales.

## History of Sand and Gravel extraction in Worcestershire

- 3.10. There is evidence that aggregate quarrying in Worcestershire began during Roman times along the county's watercourses. Like modern builders, the Romans excavated sand and gravel for building and road construction. The sand and gravel deposits of the Avon, Severn, Stour and Teme river valleys have all been exploited for centuries<sup>22</sup>. There are extensive former workings along the Carrant Brook, but these have all ceased.
- 3.11. Sand and gravel quarries in Worcestershire are often co-located with archaeological remains, including Neolithic, Roman and medieval sites.
- 3.12. More recent evidence of quarrying is available from documentary sources:
- "During the late 18<sup>th</sup> and 19<sup>th</sup> centuries, many parishes had their own small sand and gravel pits, and these are often shown on tithe maps and early editions of the Ordnance Survey. They can also be located through recorded field names of the time [...] including 'Sandpits', 'Parish Gravel Pit' and 'Quarry Pit Field'. Up until the middle of the 20<sup>th</sup> century these small quarries remained commonplace and were largely dug by hand."<sup>23</sup>
- 3.13. The Second World War proved to be a catalyst for much larger quarrying operations, bringing industrial-scale machinery to the sector. This led to a reduction in the number of quarries in operation, but the quarries that remained became much larger in size<sup>24</sup>.
- 3.14. Until recently there were close to 40 sand and gravel pits operating in the county but by the early 2000s this number had fallen to fewer than 10.

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<sup>22</sup> Worcestershire County Council (2013) Archive and Archaeology: Quarries Old and New [online] Available at [http://www.worcestershire.gov.uk/download/downloads/id/5176/quarries\\_old\\_and\\_newpdf.pdf](http://www.worcestershire.gov.uk/download/downloads/id/5176/quarries_old_and_newpdf.pdf) [Accessed 22.10.2018].

<sup>23</sup> Worcestershire County Council (2013) Archive and Archaeology: Quarries Old and New [online] Available at [http://www.worcestershire.gov.uk/download/downloads/id/5176/quarries\\_old\\_and\\_newpdf.pdf](http://www.worcestershire.gov.uk/download/downloads/id/5176/quarries_old_and_newpdf.pdf) [Accessed 22.10.2018].

<sup>24</sup> Worcestershire County Council (2013) Archive and Archaeology: Quarries Old and New [online] Available at [http://www.worcestershire.gov.uk/download/downloads/id/5176/quarries\\_old\\_and\\_newpdf.pdf](http://www.worcestershire.gov.uk/download/downloads/id/5176/quarries_old_and_newpdf.pdf) [Accessed 22.10.2018].



## Local economic context

- 3.15. Hereford and Worcester County Council existed as a single minerals planning authority between 1974 and 1998 and during this period data was collated for the area as one unit. In 1998, Herefordshire and Worcestershire were split, and data became available for both counties independently.
- 3.16. Sand and gravel sales in Herefordshire and Worcestershire declined fairly steadily from a peak of about 1.7 million tonnes in 1986. Though there was some variation in the decade from 1986 to 1996, sales have been in steady decline since then. The most recent ten years' data for Worcestershire alone, covering the period 2007-2016, show minor year-on-year fluctuations in sales, but an overall decline.<sup>25</sup>
- 3.17. Worcestershire's total production in 2016 (the most recent figures available) was 399,000 tonnes.

**Table 1: Sand and gravel sales: Worcestershire 2007 – 2016 (mt)**

|                | 2007 | 2008 | 2009 | 2010 | 2011 | 2012  | 2013   | 2014  | 2015  | 2016  |
|----------------|------|------|------|------|------|-------|--------|-------|-------|-------|
| Worcestershire | 0.81 | 0.76 | 0.52 | 0.62 | 0.63 | 0.62* | 0.659* | 0.520 | 0.538 | 0.399 |

Source: West Midlands Regional Aggregate Working Party Annual Reports

\* Figures for Herefordshire and Worcestershire were combined in 2012 and 2013 for confidentiality.

- 3.18. More detailed analysis of sand and gravel sales, production, and landbank levels can be found in the latest Local Aggregates Assessment and in the West Midlands Aggregates Working Party annual reports.

<sup>25</sup> West Midlands Aggregate Working Party (2016) Annual Monitoring Report 2016, incorporating data from January – December 2016, Revised version – January 2018.

## Current Sand and Gravel operations in Worcestershire

- 3.19. There are currently<sup>26</sup> six sand and gravel sites in Worcestershire. These are operated by Wildmoor Quarry Products Ltd., Tarmac, J&V Kelly Ltd., Cemex UK Materials Ltd., and Veolia ES Landfill Ltd. The latest Local Aggregate Assessment states that three of these sites are active, two inactive, and one permitted but not yet commenced. River terrace deposits are worked along the Severn, and solid sands north of Bromsgrove.
- 3.20. The new Minerals Local Plan for Worcestershire will supersede the Hereford and Worcester Minerals Local Plan and identify areas of search for future sand and gravel workings.
- 3.21. The most up-to-date information on permitted sites and current planning applications can be found in the latest Local Aggregate Assessment.

## 4. Policy context for Sand and Gravel extraction

### National Planning Policy Framework

- 4.1. The National Planning Policy Framework (NPPF) sets out policies on the development of mineral resources. It states that "great weight should be given to the benefits of mineral extraction, including to the economy"<sup>27</sup>. Authorities must ensure that there are no unacceptable adverse effects on natural or historic environments, or on human health.
- 4.2. The NPPF also requires that minerals planning authorities should "provide for restoration and aftercare at the earliest opportunity, to be carried out to high environmental standards".<sup>28</sup>
- 4.3. In addition, the NPPF requires local planning policies to "provide for the extraction of mineral resources of local and national importance".<sup>29</sup> Minerals of local and national importance are defined as "minerals that are necessary to meet society's needs, including aggregates".<sup>30</sup> The NPPF also stipulates that minerals planning authorities should "adopt appropriate policies so that known locations of specific minerals resources of local and national importance are not sterilised by non-mineral development where this should be avoided".<sup>31</sup>

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<sup>26</sup> As at December 2016.

<sup>27</sup> Ministry of Housing, Communities and Local Government (2018) National Planning Policy Framework, paragraph 205.

<sup>28</sup> Ministry of Housing, Communities and Local Government (2018) National Planning Policy Framework, paragraph 205.

<sup>29</sup> Ministry of Housing, Communities and Local Government (2018) National Planning Policy Framework, paragraph 204.

<sup>30</sup> Ministry of Housing, Communities and Local Government (2018) National Planning Policy Framework, Annex 2: Glossary.

<sup>31</sup> Ministry of Housing, Communities and Local Government (2018) National Planning Policy Framework, paragraph 204.

## Planning Practice Guidance

- 4.4. The web-based Planning Practice Guidance (PPG) contains further detail on the NPPF's policies in an extensive 'Minerals' section which includes a "planning for aggregate minerals" chapter. The Managed Aggregates Supply System, Local Aggregates Assessments, Aggregate Working Parties, and landbank requirements are all covered, alongside other issues which apply to all mineral sites.
- 4.5. Issues which must be addressed at any mineral site include amenity, dust, noise, stability and restoration and aftercare.
- 4.6. For amenity, the key issues are proximity to occupied properties and the impacts on local community.
- 4.7. For dust and noise emissions, the PPG requires assessments to be carried out. The assessments should identify all potential sources of the nuisance, and for each source, consider the procedures and mitigation measures that may be necessary. For noise, this assessment should be in accordance with the Noise Policy Statement for England. In the case of dust, health impacts must be considered, and in both cases the impacts on site neighbours and sensitive facilities must be taken into account<sup>32</sup>. More detail can be found in the 'Emissions' section.
- 4.8. Slope stability issues should also be appraised to identify potential hazards.
- 4.9. Finally, restoration of mineral sites is a priority in the NPPF, and its importance is reflected in the detailed information contained in the Guidance. Restoration and aftercare plans should incorporate, at a minimum, an overall restoration strategy, information about soil resources and hydrology and how soils and overburden materials will be handled during excavation, an assessment of the agricultural land classification (where the land is agricultural) and a landscape strategy. Applicants must also provide an outline strategy of their commitments for the five-year aftercare period<sup>33</sup>. Key issues for restoration are covered in the 'Potential for restoration' section.

## Local planning policies

- 4.10. The adopted Minerals Local Plan from 1997 forms part of the existing Development Plan. Only policies 1,2,5,6 and 7 have been "saved" by the Secretary of State. The saved policies in the adopted Minerals Local Plan (1997) will be superseded by the emerging Minerals Local Plan.

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<sup>32</sup> Ministry of Housing, Communities and Local Government (2014) National Planning Practice Guidance: Minerals [online] Available at <https://www.gov.uk/guidance/minerals> [Accessed 22.10.2018].

<sup>33</sup> Ministry of Housing, Communities and Local Government (2014) National Planning Practice Guidance: Minerals [online] Available at <https://www.gov.uk/guidance/minerals> [Accessed 22.10.2018].

## **District and Borough Council Plans**

- 4.11. Policies contained in District, Borough and City plans do not typically mention sand and gravel extraction specifically. However, local plans set out the amount of development for each area. As most sand and gravel is used within 30 miles of its point of extraction<sup>34</sup>, district and borough council development projections are directly related to the need for sand and gravel extraction, as well as to policies on local materials.
- 4.12. Other policies in these plans address protecting green open space, green infrastructure and amenity, all of which may be impacted by applications for sand and gravel extraction. Restoration plans for sand and gravel sites may also contribute to achieving these types of objectives.

## **Borough of Redditch Local Plan No. 4**

- 4.13. Policy 15 'Climate change' of the Borough of Redditch Local Plan No.4 includes a requirement for all proposals to "demonstrate that the use of sustainable, locally sourced and recycled materials has been considered".

## **Wyre Forest Core Strategy**

- 4.14. The Wyre Forest Core Strategy contains development objectives to "safeguard and enhance natural resources" (DO7) and to "safeguard and enhance the District's unique landscape character, Green Belt, natural environment and green infrastructure" (D05).

## **Bromsgrove District Plan**

- 4.15. The Bromsgrove District Plan strategic objective SO8 aims to "protect and enhance the unique character, quality and appearance of the historic and natural environment, biodiversity and Green Infrastructure throughout the District". SO9 aims to "Safeguard and enhance the District's natural resources such as soil, water and air quality; minimise waste and increase recycling including re-use of land, buildings and building materials".

## **South Worcestershire Development Plan (SWDP)**

- 4.16. The South Worcestershire Development Plan contains a reference to the adopted Minerals Local Plan (1997). SWDP 32: Minerals seeks to protect minerals from being sterilised and encourages the recycling and reuse of construction waste on-site and encourages the use substitute or secondary and recycled minerals within development.
- 4.17. The SWDP contains further direction on safeguarding and best practice, including several local examples, and sections on secondary and recycled aggregates and the legacy of mineral extraction.

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<sup>34</sup> British Geological Survey (2013) Construction Aggregates Minerals Planning Factsheet.

## Other local policies

- 4.18. There are also a number of local planning policies and guidelines in place in Worcestershire that make reference to local materials. There are parts of two Areas of Outstanding Natural Beauty (AONB) within the county, and the management plans for these areas contain guidance on issues related to minerals development. The Cotswolds Conservation Board has also produced a position statement on Minerals and Waste Planning.

### Cotswolds Area of Outstanding Natural Beauty Management Plan<sup>35</sup>

- 4.19. The Cotswold Area of Outstanding Natural Beauty (AONB) extends into Worcestershire in the area of Bredon Hill and Broadway. This area contains the recently closed Fish Hill quarry which produced Cotswold stone.
- 4.20. Policy CE3 of the Cotswold AONB Management Plan states that "Provision should be made for the quarrying of limestone, at an appropriate scale, in order to provide building materials that help maintain and enhance the local distinctiveness of the AONB. Any such mineral sites should be required to demonstrate that they do not have any significant adverse effects on the special qualities of the AONB or integrity of existing wildlife sites". There is nothing specific in the policy or elsewhere in the plan relating to sand and gravel.

### Cotswolds Area of Outstanding Natural Beauty Minerals and Waste Planning position paper<sup>36</sup>

- 4.21. Although this position statement pre-dates the latest AONB Management Plan, it nevertheless sets out a position on minerals. Most of its content is concerned with crushed rock, walling and roofing stone, but it does state that "The Board will wish to see the use of secondary aggregates promoted in Minerals Core Strategies/Local Plans".

### Malvern Hills Area of Outstanding Natural Beauty Management Plan<sup>37</sup>

- 4.22. The Malvern Hills AONB Management Plan includes policy BDP8 to "Support the recycling, re-use and limited extraction of small quantities of locally distinctive building materials, such as Malvern stone, where this is needed to help retain local distinctiveness in the built environment". However, the focus is predominantly on building stone, rather than aggregates.

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<sup>35</sup> Cotswolds AONB Conservation Board (2018) Cotswolds AONB Management Plan 2018-2023

<sup>36</sup> Cotswolds AONB Conservation Board (2013) Position Statement on Minerals and Waste Planning.

<sup>37</sup> Malvern Hills Area of Outstanding Natural Beauty (2014) Malvern Hills AONB Management Plan 2014-2019

## Malvern Hills Conservators Management Plan

- 4.23. The Malvern Hills Conservators<sup>38</sup> were established under the Malvern Hills Act 1884 to manage and protect the hills. One of their key aims is to prevent unlawful digging and quarrying on the hills.
- 4.24. The Malvern Hills Conservators Management Plan (2016-2021) identifies disused quarries as being important features of geological interest. It states that "geological exposures play a significant and charismatic role in the heritage of this area. While all rock outcrops contribute, the designated 25 Local Geological Sites showcase Malvern geology to a high standard. Here, the accessibility to the exposure and visibility of the rock face/landform are excellent allowing their interpretation and use by people and habitation by appropriate species including lichens and the grayling butterfly".

## Herefordshire and Worcestershire Earth Heritage Trust Geodiversity Action Plan

- 4.25. The Earth Heritage Trust is a charity active in Worcestershire and Herefordshire. Their mandate is to record, protect and promote geology and landscape and to raise general awareness of earth heritage by offering educational programmes to the public.
- 4.26. The Trust has produced a Geodiversity Action Plan (GAP) for Worcestershire, which identifies a number of objectives and actions to "provide long term and sustainable support for the conservation of geodiversity within Worcestershire". Objective 7 of the GAP is to "improve and sustain the links between geodiversity, biodiversity, archaeology and landscape".<sup>39</sup>

## Abberley and Malvern Hills Geopark

- 4.27. The Abberley and Malvern Hills Geopark encompasses parts of Gloucestershire, Herefordshire, Shropshire and Worcestershire. It is driven by a collection of local organisations and exists to allow "people from all walks of life the opportunity to experience geology and to appreciate the importance of their geological heritage".<sup>40</sup>

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<sup>38</sup> The Malvern Hills Conservators have used the working name of the Malvern Hills Trust since 2017.

<sup>39</sup> Earth Heritage Trust (2009) Geodiversity Action Plan Worcestershire [online] available at <http://www.earthheritagetrust.org/pub/category/local-gaps/> [Accessed 17.10.2018].

<sup>40</sup> Information available at <http://geopark.org.uk/pub/>.



**Image 3:** The Abberley Hills from Teme Valley Road (Photo: Worcestershire County Council).

## Regulatory framework

### European Union Directives

- 4.28. EU Directives are transposed into national legislation through a number of regulations. These cover several areas which affect aggregates extraction including waste, recycling, water, habitats, and sustainability.
- 4.29. The Waste Framework Directive established the waste hierarchy as the governing paradigm for waste management in the UK. Encouraging recycling is enshrined in national policy, and currently recycled aggregates account for approximately 29% of the total national supply<sup>41</sup>.
- 4.30. Strategic Environmental Assessment is required by an EU Directive, and is often integrated within Sustainability Appraisal, in the UK. Its goal is to increase the consideration of environmental issues during the development of strategic documents. This is a high-level process that is intended to guide decision-making.
- 4.31. The European Environmental Impact Directive has been enshrined in national legislation through the Town and Country Planning (Environmental Impact Assessment) Regulations 2017. Environmental Impact Assessments occur at the project level, and the objective is "to provide a high level of protection of the environment and to help integrate environmental considerations into the preparation of proposals for development to reduce their impact on the environment".<sup>42</sup>
- 4.32. The Habitats Directive protects plants, animals and 'habitat types' which may include designated landscapes, and is the primary piece of European nature conservation policy.
- 4.33. Air quality, safety and pollution are all also subject to EU directives that are expressed in statutory requirements and national policy.

<sup>41</sup> British Geological Survey (2013) Construction Aggregates Minerals Planning Factsheet.

<sup>42</sup> 2017 No. 671, Explanatory Memorandum to the Town and Country Planning (Environmental Impact Assessment) Regulations 2017.

## Environment Agency

- 4.34. The Environment Agency handles the permitting system for many EU directives in the UK. These are collectively known as "Environmental Permitting Regulations" and are determined by legislation and policy. They primarily cover environmental protection and waste management.
- 4.35. The Mining Waste Directive is part of the Waste Framework Directive mentioned above, and requires sites which manage waste generated by extraction to obtain a permit. Rock, overburden, or other soils may be considered extractive waste under these regulations.
- 4.36. The Water Framework Directive protects surface and ground water. Water use is also regulated under the Environmental Permitting Regulations by Water Abstraction Licences. A licence is required if an operation intends to "impound water or take more than 20 cubic meters (4000 gallons) of water per day" from a water source<sup>43</sup>.

## Managed Aggregate Supply System (MASS)

- 4.37. The Managed Aggregate Supply System works through networks of national, sub-national and local partners in order to ensure a steady and adequate supply of aggregates. This is necessary because of the geographical variation in the occurrence of suitable aggregate resources and the areas which have the highest demand for these products.
- 4.38. The MASS effectively redistributes aggregates, by requiring minerals planning authorities "which have adequate resources of aggregates to make an appropriate contribution to national as well as local supply [...] it also ensures that areas with smaller amounts of aggregate make some contribution towards meeting local and national need".<sup>44</sup> Government guidance on the provision of aggregates in England is set out in the National and Regional Guidelines for Aggregates Provision in England, 2005 to 2020 and in the NPPF.
- 4.39. At the local level, the MASS requires mineral planning authorities to produce a Local Aggregates Assessment (LAA) on an annual basis. The LAA assesses the supply of and the demand for aggregates within that authority's area. Sub-nationally, Aggregate Working Parties made up of mineral planning authorities and other bodies (by invitation) produce comprehensive data on aggregates covering specific broader areas. They scrutinise and provide advice on the Local Aggregate Assessment of each mineral planning authority in their area, and provide advice to the National

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<sup>43</sup> Guidance: Apply for a water abstraction or impoundment licence [online] Available at <https://www.gov.uk/guidance/water-management-apply-for-a-water-abstraction-or-impoundment-licence> [Accessed 18.10.2018].

<sup>44</sup> Ministry of Housing, Communities and Local Government (2014) Planning Practice Guidance: What is the Managed Aggregate Supply System? Paragraph: 060 Reference ID: 27-060-20140306, Revision date: 06 03 2014 [online]. Available at <https://www.gov.uk/guidance/minerals#The-Managed-Aggregate-Supply-System> [Accessed 18.10.2018].



Aggregate Co-ordinating Group. The role of the National Aggregate Co-ordinating Group is to monitor the overall provision of aggregates in England.

- 4.40. The volume and adequacy of aggregate supply in Worcestershire and effectiveness of local policy are also monitored annually in the Council's Authority Monitoring Report published on the Council's website.

## 5. Planning issues arising from Sand and Gravel extraction

- 5.1. The emerging Minerals Local Plan is required to provide a policy framework that will ensure that the environmental, amenity and other impacts from any sand and gravel extraction in the county are acceptable. Potential impacts and other planning issues are detailed below.
- 5.2. Actual impacts will vary depending on the location of the site, and even a small site located within a designated area may have the potential to be "more damaging to important habitats and species than a large aggregates quarry located in a less sensitive, undesignated area".<sup>45</sup>
- 5.3. As the scale of production at a quarry or gravel pit largely determines the amount of road traffic as well as the amount of noise, dust, and vibration caused, these issues must be handled on a case-by-case basis with each individual application.

### Traffic and transport

- 5.4. Sand and gravel extraction will almost inevitably cause some traffic impacts. As sand and gravel workings in Worcestershire are typically relatively small employers, the impact from staff movement on the highway is usually very limited; the main transport impacts come from the transportation of sand and gravel off site to customers. Developing quarries near to major centres of demand can help to reduce transport costs.
- 5.5. Aggregates are usually transported by road; however they are frequently used in fairly close proximity to the quarry. Nationally, the average delivery distance for aggregates is about 30 miles<sup>46</sup>.
- 5.6. Aggregates are a 'low value, high weight/volume' product. This means that the cost of transport is an important consideration for the commercial viability of a deposit, as it can have a large effect on the final delivered cost of the material.
- 5.7. Issues will be most acute near the quarry site, as "more distant transport movements are generally dissipated within the whole transport system"<sup>47</sup> and as most aggregates are used near their source. It may be possible to mitigate traffic issues, and any future applications would need to assess the potential transport implications.

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<sup>45</sup> Thompson, A. et al. (2004) Planning for the Supply of Natural Building and Roofing Stone in England and Wales (The Symonds Report) Office of the Deputy Prime Minister, London p.94

<sup>46</sup> British Geological Survey (2013) Construction Aggregates Minerals Planning Factsheet.

<sup>47</sup> British Geological Survey (2013) *Construction Aggregates Minerals Planning Factsheet*.



**Image 4:** Transporting sand and gravel on the River Sever in Worcestershire. (Photo: Worcestershire County Council)

- 5.8. The noise from traffic can be effectively reduced through natural screening using trees and hedgerows or temporary earth bunds or acoustic fencing. To keep local traffic to a minimum, the use of other means of transport including rail, private roads and waterways or canals should be considered.
- 5.9. According to the British Geological survey "in 2010, approximately 10% of primary aggregates were moved by non-road means for part of their delivery journey, although local deliveries from rail depots or wharves are also carried out by road".<sup>48</sup> There is currently one operation in the county transporting aggregates by water from the point of extraction to a processing site located upstream. As many of Worcestershire's sand and gravel deposits are found in river terraces, water transport may be a viable option for new applications and should be considered. It may also be possible to consider rail transport where facilities are suitably located. Transport issues are discussed further separate background documents.

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<sup>48</sup> British Geological Survey (2013) *Construction Aggregates Minerals Planning Factsheet*.

## Emissions

5.10. The PPG indicates that "significant environmental impacts are best addressed through consideration of an Environmental Statement which will have to accompany nearly all planning applications for new mineral working".<sup>49</sup> Operators will also have consulted statutory regulators as part of the Environmental Impact Assessment process.

## Dust

5.11. Dust is the most important air quality issue that arises from sand and gravel working, and is an almost "inevitable consequence of all mineral extraction due to the processes of breaking and handling rock and soils".<sup>50</sup> Dust can also be generated during the transportation of material within and off the site, during soil stripping operations, and from exposed strata. The NPPF requires that unavoidable dust emissions be controlled, mitigated or removed at source, and the PPG provides detailed guidance on dust.

5.12. Modelling the possible effects of dust is a complex task because of the large number of factors that affect dust levels, and so predicting the level of dust emissions from a new quarry or gravel pit is very difficult.

5.13. The amount of dust emitted from a quarry or gravel pit is affected by:

- weather (temperature, wind speed and direction, precipitation, humidity),
- quarry design (deep or shallow workings),
- working methods (drilling, blasting),
- type of working (hard crushed rock, sand and gravel),
- size of the working,
- type of soils or overburden,
- the extent of exposed soil and other strata,
- local topography, hydrogeology and vegetation cover, and
- the dust control measures employed by the site operator.<sup>51</sup>

5.14. Concerns about dust generally fall into two categories: nuisance effects and health effects. There is also the possibility of negative impacts on the wider environment, including heritage, ecology, agriculture and designated nature conservation sites.

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<sup>49</sup> Ministry of Housing, Communities and Local Government (2014) Planning Practice Guidance: How and when are the details of any significant environmental impacts best addressed? Paragraph: 011 Reference ID: 27-011-20140306, Revision date: 06 03 2014 [online]. Available at <https://www.gov.uk/guidance/minerals#The-Managed-Aggregate-Supply-System> [Accessed 18.10.2018].

<sup>50</sup> Sustainable Aggregates (2011) Information Gateway: Operational considerations: Dust [online] [Accessed on 5.12.2013 from [http://sustainableaggregates.com/sourcesofaggregates/landbased/dust/dust\\_introduction.htm](http://sustainableaggregates.com/sourcesofaggregates/landbased/dust/dust_introduction.htm), but no longer available].

<sup>51</sup> Sustainable Aggregates (2011) Information Gateway: Operational considerations: Dust [online] [Accessed on 5.12.2013 from [http://sustainableaggregates.com/sourcesofaggregates/landbased/dust/dust\\_introduction.htm](http://sustainableaggregates.com/sourcesofaggregates/landbased/dust/dust_introduction.htm), but no longer available].

- 5.15. "Nuisance" dust is dust that collects on windows, cars and surfaces. This is the most frequently mentioned cause of public concern. The rate of deposition can vary enormously depending on weather conditions, and qualitative measurement of the rate and severity of dust accumulation can be difficult due to variation in public perception. There are a number of measurement methods available, but the "wide range of values and subjective descriptions used to define 'acceptable' nuisance dust deposition or spoiling, together with the fact that complaints received are often received well below these levels"<sup>52</sup> indicates that there is no broadly accepted useful standard.
- 5.16. The health effects of dust are linked to airborne particulate matter. Although any particles smaller than 2mm are sometimes called dust, the industry standard defines dust as particulate matter between 1 and 75µm in diameter. Particles smaller than 10µm are considered "inhalable", while particles smaller than 2.5µm are "respirable" which means they are small enough to be taken down into the lungs. Generally, particles larger than 10µm are associated with nuisance and particles smaller than that cause concerns for health effects<sup>53</sup>. Industry body Sustainable Aggregates states that "it is not thought that there are any substantiated claims that health has been affected around working quarries", but if any evidence to the contrary is brought to our attention, we will revise our guidance as appropriate.
- 5.17. Good site management can help reduce the impacts of dust at the source. The PPG indicates that mineral operators are expected to prepare a dust assessment study where dust emissions are likely to arise.
- 5.18. The key stages of a dust assessment as identified by the PPG are:
- establish baseline conditions of the existing dust climate around the site of the proposed operations;
  - identify site activities that could lead to dust emission without mitigation;
  - identify site parameters which may increase potential impacts from dust;
  - recommend mitigation measures, including modification of site design; and
  - make proposals to monitor and report dust emissions to ensure compliance with appropriate environmental standards and to enable an effective response to complaints.
- 5.19. The severity of dust impacts can also depend on the types and sensitivities of nearby receptors. Special care must be taken to ensure that facilities that are sensitive to dust are not unduly impacted by quarry workings. Dust

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<sup>52</sup> Sustainable Aggregates (2011) Information Gateway: Operational considerations: Dust [online] [Accessed on 5.12.2013 from [http://sustainableaggregates.com/sourcesofaggregates/landbased/dust/dust\\_introduction.htm](http://sustainableaggregates.com/sourcesofaggregates/landbased/dust/dust_introduction.htm), but no longer available].

<sup>53</sup> Sustainable Aggregates (2011) Information Gateway: Operational considerations: Dust [online] [Accessed on 5.12.2013 from [http://sustainableaggregates.com/sourcesofaggregates/landbased/dust/dust\\_introduction.htm](http://sustainableaggregates.com/sourcesofaggregates/landbased/dust/dust_introduction.htm), but no longer available].

impacts arising from extraction can be mitigated through the following means<sup>54</sup>:

- Using dust filters on equipment where possible,
- Restricting dust-creating activities to certain times or locations,
- Using water sprays and wheel-washes,
- Protecting materials and active work areas from wind.

## Noise

5.20. Noise is an inevitable consequence of mineral workings. It is an important health and safety consideration for employees in the sector, and becomes an issue for the surrounding area when it disrupts or disturbs people outside the site boundary<sup>55</sup>.

5.21. Noise can be created during stone extraction, processing, and during the transportation of material around and off the site. The PPG requires that a noise emissions assessment be carried out, and that the mineral planning authority establish appropriate noise limits for any extraction occurring in proximity to noise-sensitive properties.<sup>56</sup>

5.22. In addition to setting noise limits, there are a number of other ways to mitigate the noise impacts caused by building stone quarrying:

- Limiting working hours
- Taking care with reversing alarms
- Minimising drop heights from lorries or plant
- Using rubber linings in chutes or transfer points where appropriate
- Switching off machinery when not in use

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<sup>54</sup> Arup Environmental/Ove Arup & Partners (1995) The Environmental Effects of Dust from Surface Mineral Workings. Report on behalf of the Department of the Environment.

<sup>55</sup> Sustainable Aggregates (2011) Information Gateway: Operational considerations: Noise [online] [Accessed on 5.12.2013 from [http://sustainableaggregates.com/sourcesofaggregates/landbased/dust/dust\\_introduction.htm](http://sustainableaggregates.com/sourcesofaggregates/landbased/dust/dust_introduction.htm), but no longer available].

<sup>56</sup> Ministry of Housing, Communities and Local Government (2014) Planning Practice Guidance: How should minerals operators seek to control noise emissions? Paragraph: 019 Reference ID: 27-019-20140306, Revision date: 06 03 2014 [online]. Available at <https://www.gov.uk/guidance/minerals#The-Managed-Aggregate-Supply-System> [Accessed 18.10.2018].



**Image 5:** Processing at Clifton sand and gravel working in Worcestershire. (Photo: Worcestershire County Council)

5.23. Site design is also an important factor for managing noise impacts, and planted screens and bunds may assist with noise management in addition to addressing dust and visual impacts (though in some cases the bunds themselves may cause a nuisance – see below under 'Visual impacts'). Because most sand and gravel excavation happens in the open in shallow workings, there may be limits to the amount of noise attenuation that is possible.<sup>57</sup>

5.24. Sand and gravel is typically extracted directly with an excavating shovel or wheeled loader. Blasting and high explosives are not used in the excavation of sand and gravel from river terraces. Solid sand deposits may require blasting depending on the hardness of the deposit, but the deposits found in Worcestershire are able to be worked directly using similar methods to unconsolidated sand and gravel.

## Visual impacts

5.25. Any large minerals extraction operation will have visual impacts on the landscape, as will any large buildings or machinery. Smaller quarries or pits will likely have correspondingly smaller visual impacts. Any mineral working must consider the effect it will have on the surrounding area, both during working phases and in the final restoration scheme.

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<sup>57</sup> Sustainable Aggregates (2011) Information Gateway: Operational considerations: Noise [online] [Accessed on 5.12.2013 from [http://sustainableaggregates.com/sourcesofaggregates/landbased/dust/dust\\_introduction.htm](http://sustainableaggregates.com/sourcesofaggregates/landbased/dust/dust_introduction.htm), but no longer available].

- 5.26. The superficial sand and gravel deposits in Worcestershire tend to be both near the surface and shallow, especially river terrace deposits. Although deposits sometimes exceed 10m in thickness, most deposits in the county are shallower and workings on these sites reflect this, in that they are often broad and fairly shallow, on low-lying land.
- 5.27. Solid sand deposits by contrast are much thicker (though they may also be near the surface) and strata can be over 200m thick in places. Although no pits have been worked to this depth in the county, several excavations have been well over 20m deep, and have created large steep-sided holes. Historically these were restored by being landfilled but this is increasingly unlikely to be acceptable and is discouraged in the Waste Core Strategy.
- 5.28. Planting of tree screens, hedgerows or other vegetation may help mitigate the visual effects of a quarry or gravel pit. Topsoil, subsoil, and other overburden that must be removed prior to extraction may be used to construct bunds or mounds around the site that could help reduce the visual impact of the site (as well as contribute to noise and dust mitigation) and ensure that the materials are retained on site for use in site restoration.
- 5.29. However, any measures to mitigate visual impacts must also be handled sensitively to ensure that they do not become intrusive features in their own right. For example, in a very flat landscape, bunds may be out of keeping with the surrounding area and be more intrusive than simply leaving the working site unscreened.

## Protected sites and designated landscapes

- 5.30. Generally, sand and gravel deposits are not as heavily constrained by national landscape designations as hard rock resources.<sup>58</sup> However, as they are often located in river valleys, archaeological and agricultural issues are much more likely to be important site factors.
- 5.31. This means that habitats and protected sites may be affected, as well as historical monuments and sites. Where sand and gravel is proposed to be worked in close proximity to these areas, working practices, phasing, and restoration plans can be designed in order to ensure that there are no unacceptable impacts on protected sites or habitats.
- 5.32. Safeguarding the natural environment as well as sites of historical importance can give rise to occasional conflict. The Green Infrastructure approach adopted by the council is founded in the idea that it is possible to successfully address both priorities through comprehensive restoration plans.
- 5.33. These competing priorities can be especially acute in designated areas "where geological diversity has contributed [both] to the attractiveness of the landscape and to distinctive styles of traditional architecture".<sup>59</sup> While quarries in designated areas may be at less risk of being lost through

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<sup>58</sup> British Geological Survey (2013) Construction Aggregates Minerals Planning Factsheet.

<sup>59</sup> English Heritage (2008) Mineral Extraction and the Historic Environment



brownfield development or landfill<sup>60</sup> their importance as sources of nationally important reserves should not be overlooked.

- 5.34. National and international designations for protected areas afford a high degree of protection from development, including mineral development. Local sites can also be designated for a variety of purposes including nature and geological conservation, and the County Council regards these sites as material considerations.

## Potential for restoration

- 5.35. Quarrying is ultimately a temporary land use, and quarries present excellent opportunities for restoration and for biological, geological and cultural conservation. Restored sites can make an important contribution toward green infrastructure goals, including recreation opportunities. The NPPF requires that planning authorities ensure that high quality restoration of minerals sites is planned for at the earliest opportunity.
- 5.36. The nature of many sand and gravel sites is such that sections of the site may be worked in sequence, with earlier phases of excavation being progressively restored as extraction continues on adjacent land. The industry considers this type of 'rolling' reclamation to be best practice as it allows the area exposed and the visual intrusion caused to be kept to a minimum.
- 5.37. There are many examples of sand and gravel pits that have been successfully restored to various productive uses, including agriculture, new habitats and leisure and amenity uses. As an example, over the last twenty years, a succession of ten workings at Top Barn Farm, Grimley have been restored to agriculture and recreational use and the site now includes fishing, wind surfing, an activity centre and business park. Another site, at Lower Moor, Pershore, has been restored to wind surfing, fishing, camping and caravanning. Three workings at Bredon's Hardwick have been restored to a Carp Fishing Lake, activity, camping and caravanning centre and to agriculture and a nature reserve. The former workings at Aston Mill have been restored to agriculture and a shooting estate. Workings at Beckford have been restored to an agricultural reservoir, a silk mill and a village nature trust. Appendix 1: Restoration case studies provides examples of successful restorations elsewhere in the country.
- 5.38. Much of the best practice guidance for quarry restoration applies to large scale sand and gravel sites that are able to progressively return large areas of former workings to productive use and contribute to biodiversity or habitat creation targets. Wetlands are a special priority for sand and gravel sites<sup>61</sup>.

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<sup>60</sup> Hughes, T. (2006) 'Sourcing Stone for Building Conservation'. In: The Building Conservation Directory, Cathedral Communications [online] Available from <http://www.buildingconservation.com/articles/sourcingstone/sourcingstone.htm> [Accessed 23.10.2018].

<sup>61</sup> White, G. and Gilbert, J. (Eds.) (2003) Habitat Creation Handbook for the Minerals Industry, Royal Society for the Protection of Birds: UK.



**Image 6:** Kemerton Lake Nature Reserve, a restored sand and gravel site in Worcestershire. (Photo: Worcestershire County Council)

- 5.39. The extraction method used at a sand and gravel pit (wet versus dry) can have implications for the restoration potential of the site. Research at the ARC Wildfowl Centre in Great Linford completed from 1971 to 1992 revealed significant differences in the type of wetland habitat resulting from wet and dry workings.
- 5.40. Sites are worked wet where groundwater is present at the water table level, and extraction occurs underwater using a suction dredger or a drag-line. The gravel is removed from the lakebed and placed in a barge for further processing. The removal of aggregates stirs up the bottom and, as the gravel is removed, "silt-laden water flows directly back into the lake to form a thick carpet of loose sediment on the new lake bed".<sup>62</sup> Lower Moor near Pershore was worked in this way but most sand and gravel pits in the county have been worked "dry".
- 5.41. Lakes resulting from wet workings "typically have a poorly developed aquatic plant community and a rather species-poor invertebrate population"<sup>63</sup> – they have deep layers of fine bottom silt which is easily disturbed, leading to turbidity. This can provide an excellent habitat for some fish species, but is less suitable for birds and biodiversity.
- 5.42. Sites with high water tables can be worked dry after topsoil and subsoil are removed and stored and any groundwater entering the excavation is pumped away. The gravel is removed by digger or conveyor belt, and any waste water from washing processes is run off into silt settlement lagoons which themselves can become excellent conservation habitats. Once a dry site is worked out, the overburden can be returned to the quarry or pit to

<sup>62</sup> Game Conservancy (1992) *Wildlife After Gravel: Twenty Years of Practical Research* by the Game Conservancy and ARC BAS Printers: UK (p.13).

<sup>63</sup> Game Conservancy (1992) *Wildlife After Gravel: Twenty Years of Practical Research* by the Game Conservancy and ARC BAS Printers: UK (p.14).

landscape the banks and future shorelines, and the excavation fills naturally with water once the pumping ceases.<sup>64</sup>

- 5.43. Lakes resulting from dry workings "are clear, with good light penetration. They have many dense weed beds with a variety of plant species [...and] are in general more attractive to breeding and overwintering waterfowl [and] have generally greater opportunities for creating suitable habitat as machines can gain access to create the required range of complex landforms".<sup>65</sup>
- 5.44. The potential for restoration of solid sand workings is strongly related to the quarry design. Historically, phased working for solid sands in Worcestershire has entailed the excavation of a series of large square-sided holes to be eventually refilled with landfill. Occasionally, solid sand deposits are worked in a hillside in a similar manner to crushed rock. Under these circumstances, progressive restoration may prove difficult, but is not impossible. For example, the Shepley site in Worcestershire could only be restored by working it in three phases, each taking several years, rather than in smaller phases which are restored as quickly as possible (as is common in river terrace gravel restoration). Once extraction at each phase at Shepley had finished, the resulting excavation could only be restored by landfilling. Sites in glacial deposits of sand and gravel at Lickhill and Brant Farm were landfilled and restored to agriculture in a similar way. The adopted Waste Core Strategy actively discourages landfill as a restoration option, and in future we may have to carefully consider restoration options for these sites that will result in acceptable landforms that are sympathetic to their surroundings and in keeping with the landscape character of the area.
- 5.45. In some ways, the restoration of a solid sand working may resemble the restoration of a crushed rock site. In terms of biodiversity and habitat creation, these types of excavation may provide appropriate conditions for burrowing insects (some of which are very rare) and nesting sites for some bird species. More details on restoration options for crushed rock workings can be found in the 'Crushed rock' background paper.

## Historical conservation

- 5.46. The historical aspects of sand and gravel extraction may fit into one of several categories: archaeological remains on the site (including the remains of other historical workings in the same location which require preservation); the impact of the development on the settings of listed buildings, monuments or other sites; and changes to historic landscape character.
- 5.47. Each of these categories presents unique circumstances for site restoration. In the case of archaeological remains, discoveries may ultimately be removed from the site altogether after excavation and therefore not have

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<sup>64</sup> Game Conservancy (1992) *Wildlife After Gravel: Twenty Years of Practical Research* by the Game Conservancy and ARC.

<sup>65</sup> Game Conservancy (1992) *Wildlife After Gravel: Twenty Years of Practical Research* by the Game Conservancy and ARC.

any implications for the site's restoration plan. However, if remains are deemed nationally significant, best practice might demand that they be preserved in situ. Part of a minerals site at Kemerton in Worcestershire was left unworked in this way. A restoration plan for a site that impacts the setting of a listed building might be dedicated to improving that setting and enhancing the historic landscape character, leaving it in better condition than it was found, or in a state that better reflects the historical context in which the building was originally found.

- 5.48. Like minerals, archaeological remains can only be extracted from where they occur. As these remains are irreplaceable once they have been removed, it is critical to take proper care with their handling. Archaeological remains may be found in the topsoil, subsoil, overburden, or within the deposit itself.
- 5.49. Archaeological remains are frequently found on sand and gravel terraces as these areas were "typically free-draining and fertile" and therefore favoured "as locations for Neolithic monuments, later prehistoric and Roman settlements and field systems and Anglo-Saxon settlements".<sup>66</sup> The potential presence of these types of remains may be determined by pre-application assessments using a number of methods, including desk-based assessment, aerial photography, field walking, test pits and full excavation. Not all of these methods may be required. Several sites in Worcestershire have required all of these methods, and the good working relationship between the County Council's Archaeological Service and the companies concerned ensured that costs and delays to the developers were minimal.
- 5.50. Sand and gravel terraces may also have Palaeolithic materials contained within the deposit proper. These can include flint tools and mammoth bones. The presence of these types of remains depends on the age of the deposit and the way it was deposited. Preliminary work should reveal whether a given site may contain Palaeolithic remains and whether these features may merit special attention. Sites in Worcestershire - notably at Aston Mill and Ripple – have deposits from this period.
- 5.51. If the preliminary work for a project has identified archaeological issues, a full archaeological assessment (which would normally form part of the Environmental Impact Assessment) may be required. This may be sufficient, but in some cases, further work might be required or there may be a requirement to preserve any new finds in situ during the work where appropriate. Guidance from English Heritage (now Historic England) states that:

The quality of pre-determination information required for proposed mineral developments is a significant consideration for developers and curators because there is usually limited potential for amending permissions to take account of nationally important

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<sup>66</sup> Waddington, C. (2008) Mineral Extraction and Archaeology: A Practice Guide [online]. Available from <https://content.historicengland.org.uk/images-books/publications/mineral-extraction-and-archaeology/mineral-archaeology.pdf/> [Accessed 23.10.2018].

archaeological remains should these be found post-determination<sup>67</sup>.



**Images 7 and 8:** Archaeological exploration and a Roman clay oven at a sand and gravel site in Worcestershire. (Photos: Worcestershire County Council)

5.52. Restoration plans for sand and gravel sites will also need to consider potential impacts on the settings of listed buildings or monuments or other sites, as well as potential changes to the landscape character. In some cases, the restoration of former workings may present opportunities to improve or enhance these settings.

## Geological conservation

5.53. Because mineral deposits are finite, mineral extraction can permanently destroy geological features that may merit conservation. Ensuring that geoconservationists are allowed to record the structures within a deposit as they are exposed is important, and this requires good working relationships with quarry operators.

5.54. The possibility of maintaining geological exposures in sand and gravel restorations may be somewhat reduced due to the nature of sand and gravel deposits. Material may fall from, or be washed down, the faces, thereby obscuring the geology. Such deposits may therefore require more active management than more solid deposits, especially to avoid the inadvertent destruction of a deposit in its entirety (as occurred at Madeley Heath SSSI).<sup>68</sup> However, at least one such exposure in Worcestershire (at Beckford) has nonetheless been successfully maintained for many years. This site was designated an SSSI as it demonstrates the inter-relationships between several deposits which are important for understanding environmental change in the Severn Basin during the Late Devensian period.<sup>69</sup> Research into preserving sand and gravel exposures has been carried out in Warwickshire as well<sup>70</sup>.

<sup>67</sup> Waddington, C. (2008) Mineral Extraction and Archaeology: A Practice Guide [online]. Available from <https://content.historicengland.org.uk/images-books/publications/mineral-extraction-and-archaeology/mineral-archaeology.pdf> [Accessed 23.10.2018].

<sup>68</sup> Earth Heritage Trust (2013) Response to First Stage Consultation on Worcestershire Minerals Local Plan, response reference A21-1936.

<sup>69</sup> Herefordshire and Worcestershire Earth Heritage Trust (2010) The Geology of Beckford Nature Reserve (Beckford Gravel Pit) [online] Available at <https://www.beckfordnature.org.uk/documents/BeckfordNatureReserveGeology.pdf> [Accessed 23.10.2018].

<sup>70</sup> Radley, J. et al. (2012) The conservation of unconsolidated Pleistocene strata: an experiment at Wood Farm Pit, Bubbenhall, Warwickshire, UK Proceedings of the Geologists'

- 5.55. Solid sand deposits can present good opportunities for geoconservation where workings expose important strata and where slopes are stable. A substantial exposure of the Kidderminster Formation has been preserved at the former Shepley Pit north of Bromsgrove. Superficial sand and gravel deposits are more difficult to retain as geological exposures because they tend to be more prone to both erosion and re-vegetation. Both of these can, however, be controlled by management (such as being scraped every few years).
- 5.56. Restoration which incorporates an element of geoconservation presents excellent opportunities for active community participation. The Earth Heritage Trust's 'Champions' project has resulted in nine former minerals sites in Worcestershire being supported by community 'Champions' who have been trained in geoconservation and who work with land owners to arrange for educational use of the sites.

## Green Belt

- 5.57. The north-eastern part of Worcestershire lies within the Green Belt. Kidderminster, Bromsgrove and Redditch are completely surrounded by Green Belt and the area between Worcester and Droitwich is also designated as Green Belt. National policy on mineral working in Green Belt land will apply here.
- 5.58. The NPPF states that there should be no inappropriate development in the green belt, but that mineral extraction is not inappropriate in the Green Belt provided it preserves its openness and does not conflict with the purposes of including land within it.<sup>71</sup> The site at Shepley, near Bromsgrove, was worked in the Green Belt and - because it straddles the M42 - was highly visible. It was, nonetheless, successfully worked and restored by infilling in accordance with national policy at the time.
- 5.59. The areas of the county within the Green Belt primarily contain large deposits of solid sand but strata of riverine or glaciofluvial sand and gravel also exist. The nature of particular deposits will determine the configuration of any site proposed within the Green Belt.

## Climate change and resilience

- 5.60. The Council's 'Minerals and Climate Change' background paper outlines some of the key climate change sustainability issues for the minerals sector and areas in which the minerals industry can contribute to sustainability targets. These include energy efficiency and renewable energy,

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Association [online] Available at <https://www.sciencedirect.com/science/article/abs/pii/S0016787812000806> [Accessed 23.10.2018].

<sup>71</sup> Ministry of Housing, Communities and Local Government (2018) National Planning Policy Framework, paragraph 146

transportation and other emissions, flood mitigation, habitat creation and biodiversity<sup>72</sup>.

5.61. The capacity for sand and gravel pits to contribute to these targets is heavily influenced by the sites' particular characteristics. Restored sand and gravel workings are likely to be able to make significant contributions towards biodiversity, flood mitigation, and habitat creation targets.

## Safeguarding mineral deposits

5.62. The NPPF requires minerals planning authorities to "adopt appropriate policies so that known locations of specific minerals resources of local and national importance are not sterilised by non-mineral development where this should be avoided".<sup>73</sup> It also requires that appropriate facilities which support minerals production and processing be safeguarded.

5.63. Safeguarding is a key aspect of sustainable development, as it ensures that non-renewable resources are conserved for the use of future generations. The Planning Practice Guidance includes sections on minerals safeguarding. Among other issues, the guidance addresses mineral sterilisation, which occurs when other development or designation causes a mineral deposit to become inaccessible. It also provides detailed information about creating Minerals Safeguarding Areas (MSAs)<sup>74</sup> and Mineral Consultation Areas (MCAs).<sup>75</sup>

5.64. Robust safeguarding policies begin from identifying the best geological and mineral resource information, and deciding which minerals to safeguard and the extent of those safeguards. This can require a high degree of technical knowledge, input from industry, and careful handling of safeguarding in urban areas.

5.65. There are a number of important issues for defining safeguarding areas, including buffer zones, criteria for controlling development within MSAs, and prior extraction policies. There is currently some debate nationally about the viability of prior extraction policies.

## 6. Conclusions

6.1. Aggregates extraction is essential to the building industry and, as most aggregates are used within 30 miles of their point of extraction, continued local supply of these minerals is critical to the future prosperity of the county.

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<sup>72</sup> Worcestershire County Council (2013) Minerals and Climate Change Background Paper [online] available at <http://www.worcestershire.gov.uk/mineralsbackground> [Accessed 23.10.2018].

<sup>73</sup> Ministry of Housing, Communities and Local Government (2018) National Planning Policy Framework, paragraph 204.

<sup>74</sup> An area designated by a Mineral Planning Authority which covers known deposits of minerals which are desired to be kept safeguarded from unnecessary sterilisation by non-mineral development. <sup>76</sup> As of December 2016.

<sup>75</sup> A geographical area, based on a Mineral Safeguarding Area, where the district or borough council should consult the Mineral Planning Authority for any proposals for non-minerals development.

Worcestershire contains extensive sand and gravel and solid sand deposits which have been worked productively for decades. There are six sand and gravel sites in the county (three active, two inactive, and one permitted but not yet commenced)<sup>76</sup>.

6.2. In order to ensure that production in the county continues, it is important that the emerging Minerals Local Plan makes provision for the steady and adequate supply of sand and gravel.

6.3. Protecting sand and gravel deposits for the future is important, and this will be addressed through safeguarding policies to be included in the emerging Minerals Local Plan.

6.4. Sand and gravel sites present excellent opportunities for restoration, and have the capacity to make significant contributions towards habitat, biodiversity, flood mitigation, food production and conservation targets.



## Appendix 1: Restoration case studies

### Needingworth Quarry Cambridgeshire: Restoration to habitat

Needingworth is one of the largest sand and gravel extraction sites in the UK. It covers an area of approximately 975 hectares near the Great Ouse river in Cambridgeshire. Extraction began in 1995, and will continue over the next 30 years. Over 28 million tonnes of aggregate will be removed from the site<sup>77</sup>.

The restoration will create Britain's largest reedbed – 460 hectares – located within a 700 hectare nature reserve. This will contribute to the larger enhancement of the Ouse Washes. The quarry operator, Hanson, has worked closely with the RSPB to develop the restoration plans. Creating new wetlands is a national priority in the UK Biodiversity Action Plan as over 97% of the UK's original fen wetlands have been lost since 1600<sup>78</sup>.

The site is being progressively restored, and several phases have already been handed over. There has been ongoing community involvement throughout the process with local people having been invited to assist with planting the first reeds. Public rights of way run through the site, and when it is complete over 30km of walking trails will be open to the public. Extensive archaeological works have also been undertaken in the area.



**Image 9:** Reedbeds at Needingworth quarry. (Photo: Hanson Aggregates, Aggregates Business Europe)

<sup>77</sup> Aggregates Business Europe (2010) Restoration at Sand and Gravel Quarry [online] Available at <http://www.aggbusiness.com/sections/health-safety-environment/features/restoration-at-sand-and-gravel-quarry/> [Accessed 23.10.2018].

<sup>78</sup> The Quarry Life Award – Heidelberg Cement (undated) Needingworth [online] Available at <https://www.quarrylifeaward.com/quarries/united-kingdom/needingworth> [Accessed 23.10.2018].

### **Cotswold Water Park: Restoration to recreation**

Extensive sand and gravel extraction in the area of the Water Park began in the 1920s, and the first lakes date from around that time. The water table in the area is high, and the first quarries were dug wet, but today they are de-watered during extraction and then left to fill naturally. Since extraction began, 137 lakes have been created providing almost 1,000 hectares of open water.

The Cotswold Water Park was formed in 1967 "with a joint resolution by the Cotswold Water Park Joint Committee that confirmed that 'the area should become a water park serving the interests of aquatic sportsmen, naturalists and others who wish to enjoy in a general way a stretch of inland water.' This resolution [...] affirmed their commitment to the management of a process of landscape change that had been evolving for some years as a consequence of the extensive mineral extraction that had taken place within the area, and the widespread restoration to inland lakes".<sup>79</sup>

There are currently seven minerals companies working on 360 hectares. A further 370 hectares have permission for extraction, and emerging minerals plans allocate another 550 hectares.

Over 20,000 people live in settlements within the Water Park. It provides employment for many people, and attracts over 500,000 visitors each year.

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<sup>79</sup> Wiltshire Council (2012) Cotswold Water Park: An Introduction [online] Available at <http://www.wiltshire.gov.uk/3.0-the-cotswold-water-park-an-introduction.pdf> [Accessed 23.10.2018].

## Appendix 2: Glossary

**Crushed Rock:** Crushed rock is produced using heavy machinery which mines a suitable deposit of hard, strong rock and then crushes it into uniform particle sizes. Crushed rock is typically sharp and angular.

**Designated Areas:** A collective term that includes a number of statutory designations including European Designated Sites (Special Areas of Conservation, SACs, and Special Protection Areas, SPAs), National Nature Reserves, Sites of Special Scientific Interest, Scheduled Monuments, Areas of Outstanding Natural Beauty, Conservation Areas, Listed Buildings, Registered Battlefields, Local Geological Sites, Registered Parks and Gardens, and Local Wildlife Sites.

**Gravel:** An unconsolidated mixture of rock fragments or pebbles produced by natural processes including weathering or erosion. European standards define gravel as having particles between 4 and 80mm in diameter. Gravel is typically rounder in shape than crushed rock.

**Gravel pit, or sand and gravel pit:** Site where sand and gravel are extracted by excavation below ground level.

**Landbank:** This term is used to refer to the stock of mineral reserves with planning permission in a given area.

**Moulding Sand:** Sand used for metal casting processes. These sands are normally mixed with a binding agent in order to give them additional strength and plasticity.

**Quarry:** A site where rock or minerals are extracted from the earth.

**Restoration:** A process whereby a former mineral extraction site is returned to beneficial after-use. Sand and gravel extraction is often a temporary or intermittent land use, and once all of the mineral has been won the site will no longer be useful for mineral extraction and an after-use will have to be established. This is often referred to as "restoration", even though sites are not always returned to their original use or condition. For example, it may be more appropriate for low-grade agricultural land to be 'restored' as a lake or nature reserve rather than returned to agriculture.

**Sand:** Sand is a naturally occurring granular substance made up of very fine particles of rock and minerals. The composition of sand is highly variable. European standards define sand particles as ranging in size from 0.0625mm to 4mm.

## Appendix 3: Additional resources

Resources about sand and gravel in Worcestershire (and nationally) are available online. Listed below are some of the most useful websites.

### **British Geological Survey Mineral Planning Fact Sheet: Aggregates**

Construction Aggregates sheet available for download at

<http://www.bgs.ac.uk/mineralsuk/planning/mineralPlanningFactsheets.html>.

### **Earth Heritage Trust**

A charity whose aim is to record, protect and promote geology and landscape in Worcestershire and Herefordshire. The Trust also runs the Geological Records Centre at the University of Worcestershire which holds paper and GIS information on the geology of the whole county, as well as a database of over 2000 geological sites of interest. More information is available at <http://www.earthheritagetrust.org/pub/>.

### **Worcestershire Local Aggregates Assessment (LAA)**

Producing an annual LAA is a statutory requirement. Worcestershire's LAA contains detailed demand forecasting, an analysis of current supply, and an approach to addressing supply of sand and gravel and crushed rock in the county. The latest LAA is available to download at [http://www.worcestershire.gov.uk/downloads/download/264/annual\\_monitoring\\_report](http://www.worcestershire.gov.uk/downloads/download/264/annual_monitoring_report).