# Appendix 2 Geological overview

**Overview of Geology**

In general, hard, resistant bedrock strata such as limestone and sandstone underlie the upland areas of the county while softer formations such as mudstone underlie the broad valleys and low-lying areas typified by the vales of York and Pickering.

Wide expanses of bedrock outcrop in the uplands, except where there is a capping of peat on the hilltops. In contrast, the bedrock of the vales is commonly concealed beneath thick superficial deposits that are mostly of glacial origin.

**Bedrock**

Bedrock strata range in age from Carboniferous in the west of the county to Cretaceous in the east (Figure 1). Carboniferous limestones, mudstones and sandstones (mainly the Craven Group, Great Scar Limestone Group, Yoredale Group, Millstone Grit Group and Pennine Coal Measures Group) form the Pennines and adjacent areas in the west of the county; Permian and Triassic dolomitic limestones, sandstones, mudstones (Zechstein Group, Sherwood Sandstone Group and Mercia Mudstone Group), and early Jurassic mudstones (Lias Group, predominantly mudstones of the Redcar Group) underlie the Vale of York. In the east of the county mid to late Jurassic sandstones and mudstones (Ravenscar Group and Corallian Group) form the North York Moors while the Vale of Pickering is underlain by late Jurassic (Ancholme Group) and, further East, early Cretaceous (Speeton Clay) mudstones. The late Cretaceous Chalk Group forms the rolling hills of the Yorkshire Wolds, the northern part of which occupies the county's south-eastern corner.

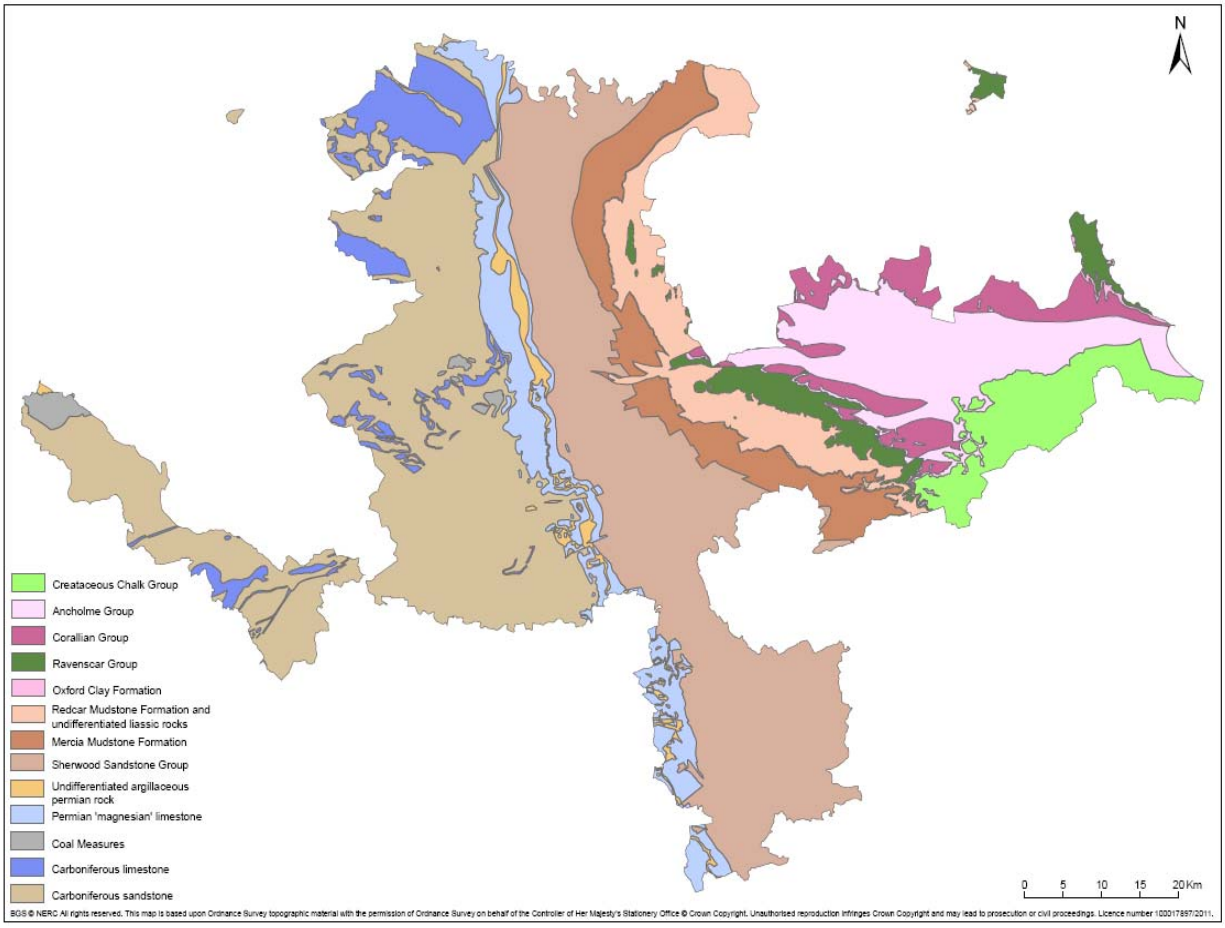


**Figure 1 Simplified bedrock geology for North Yorkshire**

## Superficial deposits

Superficial deposits in the county fall into three broad categories: glacial deposits, fluvial deposits and organic deposits. The last of these is the peat that caps some of the upland areas; it does not contain any sand and gravel and so will not be discussed further in this account.

Glacial deposits occur widely in the low-lying areas of the county but are largely absent from the uplands apart from some glacially-eroded valleys. The spatial and genetic relationships of the deposits and associated landforms are very complex; the following is a much-simplified account. There is evidence for two glaciations in the county. The first of these, the Anglian glaciation, occurred some 430,000 years ago but unequivocal deposits of Anglian age are rare. During the much more recent Devensian glaciation, which reached its zenith about 20,000 years ago, a tongue of ice from the Devensian ice sheet advanced southwards along the Vale of York eroding most of the pre-existing glacial and fluvial deposits and disrupting or diverting river systems. The southern limit of ice-advance is marked in the present landscape by the Escrick Moraine, a prominent linear landform that lies across the Vale of York (Figure 2). Simultaneously, another lobe of the same ice sheet advanced from what is now the North Sea into the eastern end of the Vale of Pickering: its maximum westward limit is also marked by a terminal moraine. As the ice advanced it overrode remnants of older superficial deposits and its own sand and gravel outwash that was deposited by meltwater issuing from the ice, before reaching a ‘still-stand’ during which the moraines were built up. In doing so it deposited a thick and widespread layer of till, consisting essentially of stiff gravelly and bouldery clay, over the pre-existing landscape.

As the Devensian glaciation waned the ice sheet ‘retreated’ leaving behind numerous glacial landforms that are visible today. Prominent amongst these are the York Moraine that lies across

the Vale of York a few mile to the north of the Escrick Moraine. It marks the position of a temporary ‘still-stand’ or pause in the retreat of the ice. Also prominent are long, narrow, linear sand and gravel ridges, known as eskers, which roughly parallel the axis of the Vale (Figure 2). These represent sand and gravel deposited by meltwater flowing in channels, or tunnels, beneath, within and upon the ice sheet. Following the retreat of the ice these deposits remained as upstanding features of the landscape.

Sheet-like bodies of sand and gravel deposited in front of an ice-sheet by meltwater are termed ‘sandur’ (pl. sandar). Sand and gravel deposited near the ice sheet as sandar or in meltwater channels or in contact with the ice sheet as eskers or within moraines are known collectively as glaciofluvial deposits.

During retreat of the ice sheet meltwater was ponded between the moraines, the ice and the valley sides, eventually forming extensive lakes. Material of glacial origin entering the lakes was deposited as a thick, flat-surfaced, blanket of glaciolacustrine deposits (Figure 2) usually consisting of mainly of laminated clay and silt but also, especially in the Vale of Pickering, including some sand. The lakes subsequently drained away leaving some landforms such as eskers and moraines partly buried by the glaciolacustrine deposits.

Blown sand, probably originating as a glaciofluvial deposits but fine enough to be carried on katabatic winds (i.e. strong winds blowing from the ice), accumulated on west-facing slopes of the Howardian Hills. Blown sand may also have been deposited in the glacial lakes where it was reworked into glaciolacustrine deposits.

Fluvial deposits have been deposited by late glacial river systems. River terrace deposits, comprising mainly sand and gravel, are best developed along the Rivers Swale, Nidd, Wharfe, Aire, Tees and Derwent typically as a low ‘staircase’ of elongate tabular bodies that represent remnants of sand and gravel floodplain deposits left behind as fast-flowing rivers cut down to successively lower levels in response to uplift and climate change during Pleistocene times. Following the amelioration of the climate and the retreat of ice sheets from the British Isles some 11,000 ago, the middle and lower reaches of rivers became slow-flowing, meandering and muddy although, in their upper reaches they may at times be sufficiently vigorous to transport and deposit sand, gravel and boulders. The floodplain deposits of these modern rivers are known as alluvium. In the middle and lower reaches of rivers the floodplain deposits typically comprise silt and clay, possibly with a thin basal gravel. Alluvium may overlie part of the lowest (youngest) river terrace deposits. Because many present day rivers originated as meltwater channels in glacial times, alluvium and river terrace deposits may conceal older glaciofluvial deposits of considerable thickness.

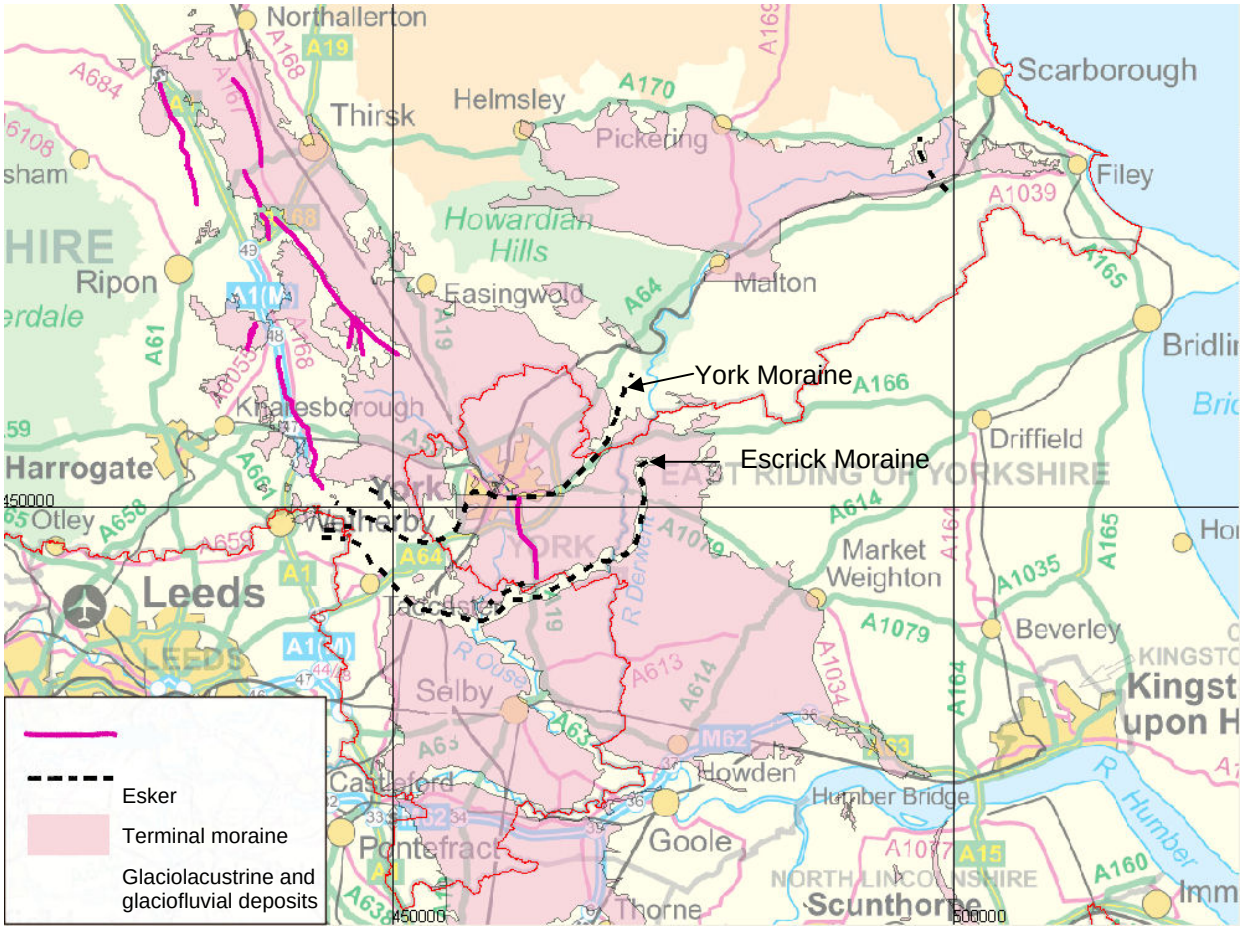




**Figure 2 Major glacial landforms of North Yorkshire**

# Appendix 3 Resources proposed for safeguarding and justification for initial consultation

MineralsUK
Centre for sustainable mineral development

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

## Economic minerals – decisions on safeguarding

Please insert any comments if you have anything to add with regards to the justification for the decision about safeguarding each mineral resource.

| | Safeguard? | Justification if not safeguarded | Any other comments |
|---|---|---|---|
| Sand and gravel | Y | | |
| Limestone (crushed rock and industrial) | Y | | |
| Sandstone (crushed rock) | Y | | |
| Igneous | X | There are no resources of this type identified in the 'County report[1]'. | |
| Chalk | Y | | |
| Silica sand | Y | | |
| Brick Clay | Y | | |
| Building Stone | Y | | |
| Coal (shallow) | Y | | |
| Coal (deep) | N | Deep coal is mined by underground mining methods and is not as susceptible to the risks posed by sterilisation by other non-mineral development. | |
| Evaporite minerals (potash, salt, gypsum and | N | These mineral resources are mined by underground mining methods and are, not as | |

[1] Harrison, DJ, Henney, PJ, Minchin, D, McEvoy, FM, Cameron, DG, Hobbs, SF, Evans, DJ, Lott GK, Ball, EL, and Highley, DE. 2006. Mineral Resource Information in Support of National, Regional and Local Planning: North Yorkshire (comprising North Yorkshire, Yorkshire Dales and North York Moors National Parks and City of York). *British Geological Survey Commissioned Report CR/04/228N.* 24 pp.

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| | | | |
|---|---|---|---|
| anhydrite) | | susceptible to the risks posed by sterilisation by other non-mineral development. | |
| Hydrocarbons (conventional oil and gas, abandoned mine methane, coal mine methane potential) | N | The location of surface infrastructure to access these resources is flexible, so the resources are not as susceptible to the risks posed by sterilisation by other non-mineral development. | |
| Shale gas | N | This is an emerging technology that takes place deep underground. It is not yet clear whether domestic shales have the correct rock properties to exploit for shale gas. | |

Please add here any other considerations that you feel are not covered by the above.

# Appendix 4 Consultation letters

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Centre for sustainable mineral development

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**North Yorkshire County Council**
**Mineral Safeguarding Areas**

21st September 2011

Dear XXXXXX

North Yorkshire County Council (NYCC) has asked the British Geological Survey (BGS) to assist them in delineating Mineral Safeguarding Areas (MSAs). The purpose of this correspondence is to inform you that this is taking place and that the BGS would be grateful if you would agree to help as local knowledge is essential to the process.

The national minerals policy statement MPS1 outlines the need to 'safeguard' and conserve mineral resources in accordance with the principles of sustainable development. It addresses, among other things, the issue of the loss of access to mineral resources by development, a concept known as *'mineral sterilisation'* and aims to negate future problems caused by the effects of unnecessary sterilisation by providing a stronger national policy for the 'safeguarding' of minerals.

The process of mineral safeguarding is essential to ensure that the ability of future generations to meet their needs for minerals is not compromised by planning decisions that are being made in the present day. The essence of any safeguarding process is that it should introduce the consideration of minerals into the decision making balance, so that access to mineral resources for future generations is preserved as far as possible. The first part of that process is the identification of mineral resources and the definition of MSAs based on these resource areas. This is the stage of the process that NYCC has asked BGS to assist with, and is the reason for my letter.

Later in the development plan making process, finalised MSAs will be shown in Local Development Documents produced by NYCC. At this stage the MSAs will also be linked to appropriate local planning policies so that the process can be implemented. This enables planning authorities to ensure that mineral resources are not unnecessarily sterilised when they consider planning applications.

**This consultation**

The aim of the consultation is for you to have the opportunity to view the mineral resource linework and provide any additional local information that might help us to define MSAs.

INVESTOR IN PEOPLE

The BGS Mineral Resource maps, on which the draft MSAs will be based, show the surface extent of mineral resources inferred from available geological information. Where you can provide more detailed geological or operational information, we can incorporate it into the proposed safeguarding maps for NYCC. In particular we are interested in local geological and operational considerations that might affect the extent of the safeguarding areas (one example might be if there is a shallow dip in the strata – how far should the MSA extend to effectively safeguard the resource that exists beneath overburden; another might be that a resource has been worked out and there is no need for an MSA to extend through an area).

We would also be interested in your views on how far MSAs should extend beyond the identified 'edge' in order to prevent sterilisation of the mineral resource by non-mineral development close by. It is likely that this would vary according to extraction technique, for example, 200 metres for sand and gravel resources and 500 metres for limestone resources.

Annotated maps can be returned to me at the address on the letterhead, or maps can be sent with the areas that you wish to discuss highlighted, and one of our team will call you to discuss those areas. **Alternatively, if you would like to meet with a BGS representative we will be in the area on 4 and 5 October 2011**. If you would like to make an appointment, please contact me using the details in the letterhead. Larger scale maps are available on request.

**The deadline for comments is 14 October 2011.** If you are not the most appropriate contact I would be grateful if you could forward this correspondence or let me know who I need to contact.

Yours sincerely,

Chloe Wrighton
British Geological Survey

**Enc (please comment on those that are relevant to you):**

- Justification for those mineral resources that will not be safeguarded
- Published map of the Mineral Resources of North Yorkshire (as an example of the base data used, larger scale maps are available on request)
- Brick clay resources consultation map
- Sand and gravel including silica sand resources consultation map
- Shallow coal resources consultation map (see Appendix 2 for further definitions)
- Limestone resources consultation map
- Sandstone resources consultation map
- Chalk resources consultation map
- Building stone resources consultation map

**Documents of interest**

Minerals Policy Statement 1 (MPS1): *Planning and minerals*

http://www.communities.gov.uk/documents/planningandbuilding/pdf/152993.pdf

Planning and Minerals: Practice Guidance
http://www.communities.gov.uk/documents/planningandbuilding/pdf/153421.pdf

A guide to mineral safeguarding in England (scroll down to the link)
http://www.bgs.ac.uk/mineralsuk/planning/legislation/home.html

**Site status on the BGS mines and quarries database, 'Britpits' (as appears on the maps)**

Active
Site which is actively extracting mineral products, or in the case of wharfs and rail depots, is actively handing minerals

Yet to be worked
Sites which have been notified by operators or mineral planners but have not started extracting mineral at date of entry into the database. They will be considered as 'Active' by the Mineral Planning Authority.

Inactive
Sites which, at the date of entry into the database, are not extracting minerals but which still have valid planning permission to do so. They can restart at any time. They may be described as 'Mothballed' by the operator.

Closed
Sites which, at the date of entry into the database, have ceased to extract minerals. They may be considered as 'Closed' by the operator. They may be considered to have 'Active', 'Dormant' or 'Expired' planning permissions by the Mineral Planning Authority.

Historic
Historic building stone sites where not currently active and location is not known for certain.

MineralsUK
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**North Yorkshire County Council**
**Mineral Safeguarding Areas**

06 October 2011

Dear XXXXXX

Further to our correspondence dated 21 September 2011, North Yorkshire County Council and the British Geological Survey are pleased to invite you to an event at which mineral resource information for North Yorkshire and final drafts of the mineral safeguarding maps will be presented and discussed. It will be the final opportunity to view and comment on the proposed safeguarding areas before they are provided to North Yorkshire County Council for further consideration during preparation of the Minerals and Waste Development Framework. An agenda is attached for your information.

The event will be held in the Grand Committee Room at **County Hall in Northallerton, DL7 8AD on 27 October 2011 between 1030 and 1300**, with registration from 1000. If you are able to attend, please contact Naomi Idoine using the details provided in the letterhead. Refreshments will be provided, and we anticipate that the event will finish at approximately 1pm.

Should you have any queries, please do not hesitate to contact us.

Yours sincerely,

Chloe Wrighton
British Geological Survey

**Documents of interest**

Minerals Policy Statement 1 (MPS1): *Planning and minerals*
http://www.communities.gov.uk/documents/planningandbuilding/pdf/152993.pdf

Planning and Minerals: Practice Guidance
http://www.communities.gov.uk/documents/planningandbuilding/pdf/153421.pdf

Mineral safeguarding in England: good practice advice (scroll down to the link)
http://www.bgs.ac.uk/mineralsuk/planning/legislation/home.html

# Appendix 5 Summary of consultation responses

| | | |
|---|---|---|
| | | |
| Links to safeguarding maps for the Cumbria area are provided. | Cumbria defined the Mineral Consultation Areas as 250m buffer around the MSAs. | No change is necessary to the safeguarding maps, but buffers have been extended to 250m for minerals that are not extracted by blasting techniques. |
| Darlington area: Tees Valley Authorities have adopted a minerals and waste DPD which includes safeguarding areas. Plan is provided. | | No change is necessary to the safeguarding maps. |
| Doncaster Council are interested in further consultation on proposals as the magnesian limestone ridge runs into North Yorkshire at Barnsdale Bar.<br>Recommends asking local industry to comment on the viability of the inferred glacial sand and gravel resources near Knottingley, including getting them to consider whether the area is worth safeguarding. | | No change necessary. BGS has revised the sand and gravel linework based on borehole evidence and in consultation with industry. The geology in NYCC is different to Doncaster, and the glacial material is more prospective for sand and gravel. |
| Response explaining the Leeds City Council policy position with respect to specific minerals. | | No change necessary to the safeguarding maps. |

| Content | Buffers | Changes to linework |
|---|---|---|
| | Buffers may not prevent the sterilisation of the identified 'edges' of the resource, as they don't seem to be large enough. For resources that are extracted by blasting, 500m should be the minimum. The angle of draw could be used to define the buffer for underground minerals. | Buffer for minerals that are extracted by blasting techniques have been extended to 500m. |
| Wykeham:<br>Resource has been proven on both sides of the Derwent<br>General: worked out areas are being displayed as resource.<br>Pateley bridge (also Coldstone quarry) - The polygon may need to extend further to the South as the deposit is worked under overburden. | Approximately 100m for sand and gravel and 200m for a quarry might be appropriate (although properties do exist closer to this on existing Hanson Sites – conditions for each site vary). | Area of sand and gravel resource around Wykeham quarry extended to match resource proved by Hanson. No change to Limestone resources around Pateley Bridge quarry as the deposit is bounded by a fault to the South. |
| Sand and Gravel: Safeguard deposits around Seamer in North Yorkshire.<br>Limestone: resources to the east of Whitewall quarry to be safeguarded.<br>Building stone: Whitewall also produces building stone.<br>Grimston Quarry is inactive, although should be safeguarded. | | Sand and gravel deposits around Seamer and limestone resources around Whitewall Quarry are covered by MSAs so no action is required. Whitewall Quarry and Grimstone Quarry have been added to the building stone safeguarding map. |

| | | |
|---|---|---|
| | | |
| No comments to add regarding the extent of the sand and gravel resources at this stage. They refer back to a response regarding the sand and gravel questionnaire which identified specific areas of suitable sand and gravel resources. These included: the Allerton - Leeming and the Ure Valley area as well as resources in the Lower Swale valley; the Catterick area; and the area east of the A1 especially to the south and around Thirsk. | 250m would seem appropriate for sand and gravel resources, providing that this distance is applied flexibly to allow for the consideration of site specific circumstances. | No change necessary to the safeguarding maps. These areas have been considered as part of the sand and gravel re-assessment work. |
| | | |
| Coal Authority: All surface coal resources should be safeguarded. The split between primary, secondary and tertiary coal is not necessary as this concerns extraction. Prior extraction policies should be included [not relevant to this stage of the study]. Deep coal should be considered with particular emphasis on consultation with the industry as it can be sterilised by highly sensitive surface development. | No preferred approach to the extent of buffers although justification may be greater for a buffer around individual MSAs and not a combined one. | UK Coal has been consulted as part of the consultation process, and as a result deep coal is now proposed for safeguarding. Buffers of 700m for deep coal (on the basis of 0.7 multiplied by the depth of working) and 250m for shallow coal have been applied. |
| UK Coal: Concerned that deep reserves could be sterilised as has already occurred by a glass factory being built on some existing reserves (Selby District). Sensitive uses such as this were of most interest. UK Coal is of the opinion that deep resources need to be safeguarded. For the BGS | Deep coal: Buffer- a horizontal distance of 0.7 x depth of working is usually used for sensitive development and 0.5 x depth of working for normal development. | Identify safeguarding areas for deep coal. A suitable accompanying policy could be used to manage sensitive development in this area. Buffers of 700m have been applied for deep coal. |

| | | |
|---|---|---|
| Warwickshire safeguarding work, deep coal had been included on safeguarding maps (Hannis and Brown 2009). | | |
| | | |
| Enclosure of plan showing land in respect of a potential extension to the area of mineral extraction around a brickworks site. | Happy to discuss with NYCC / BGS methods of working to inform the development of mineral safeguarding areas. | No changes necessary to safeguarding maps. |
| Include the area around Riccal Airfield | | Include resource on the Brick Clay safeguarding map |
| | | |
| Site at Settrington is noted on the limestone map, yet the safeguarding for chalk or limestone does not extend in this area (see attached plans). | | Include the full outcrop of Jurassic Limestones in the vale of Pickering - which includes the quarry at Settrington. |
| | Not necessarily in favour of a prescribed buffer around the resource as very much against the opposite situation where blanket buffers are put on developments to prohibit mineral development: However, if buffers were applied 500m may be appropriate. | Buffer for minerals that are extracted by blasting techniques have been extended to 500m. |
| | | |
| Request for a more detailed plan to be provided (around silica sand resource areas). | | More detailed plan was provided. No action was required - the MSA for silica sand adequately covered the resource |

| | | |
|---|---|---|
| | | |
| The upper potassium chloride seam has a plastic quality and, due to pressure and depth, flows over time. This can have an effect on the surface by a ground lowering of approximately 0.5m at the surface. Safeguarding should, therefore, be considered. Disagreed with the linework in the national park. | | Although subsidence issues are highly unlikely they could not be proved to be negligible therefore safeguarding is proposed. This is also consistent with the proposed safeguarding methodology for deep coal resources. |
| The uniform and large lateral extent of subsidence should not cause an issue for the sterilisation of resources if development goes ahead in most cases. | | N/A |
| | | |
| Agreed that safeguarding is not required for hydrocarbons as the location of surface facilities is (to some extent) flexible, and therefore not as susceptible to the risks posed by sterilisation as some other forms of mineral extraction. | | N/A |
| Petroleum, Exploration and Development Licence areas should be safeguarded. | | No changes necessary - a separate policy in the plan should cover their concerns. |

# References

British Geological Survey holds most of the references listed below, and copies may be obtained via the library service subject to copyright legislation (contact libuser@bgs.ac.uk for details). The library catalogue is available at: http://envirolib.nerc.ac.uk.


Bide T P, Morigi A N, Shaw R P and Linley K A. 2011. *North Yorkshire Sand and Gravel Assessment.* British Geological Survey Commissioned Report, CR/11/133.

British Geological Survey. 2007. Mineral Planning Factsheet: *Building and roofing stone* [Online]. Available at: http://www.bgs.ac.uk/mineralsuk/planning/mineralPlanningFactsheets.html

British Geological Survey. 2011a. Mineral Planning Factsheet: *Coal* [Online]. Available at: http://www.bgs.ac.uk/mineralsuk/planning/mineralPlanningFactsheets.html

British Geological Survey. 2011b. Mineral Planning Factsheet: *Alternative fossil fuels* [Online]. Available at: http://www.bgs.ac.uk/mineralsuk/planning/mineralPlanningFactsheets.html

British Geological Survey. 2011c. Mineral Planning Factsheet: *Potash* [Online]. Available at: http://www.bgs.ac.uk/mineralsuk/planning/mineralPlanningFactsheets.html

British Geological Survey 2011d. Mineral Planning Factsheet: *Oil and gas* [Online]. Available at: http://www.bgs.ac.uk/mineralsuk/planning/mineralPlanningFactsheets.html

Department of Communities and Local Government (DCLG). 2006. *Planning and Minerals: Practice Guide* [Online]. Available at: http://www.communities.gov.uk/documents/planningandbuilding/pdf/153421.pdf .

Department of Communities and Local Government (DCLG). 2006. *Mineral Policy Statement 1: Planning and Minerals* [Online]. Available at: http://www.communities.gov.uk/documents/planningandbuilding/pdf/152993.pdf.

Department of Communities and Local Government (DCLG). 2008. *Planning Policy Statement 12: Local Spatial Planning* [Online]. Available at: http://www.communities.gov.uk/publications/planningandbuilding/pps12lsp.

Jones, N.S. 2006. *Coal Resource Appraisal Maps: methodology and datasets used*. British Geological Survey Commissioned Report, CR/06/159N. 19pp

Hannis, S D, Brown, T J. 2009. *Mineral Safeguarding Areas for Warwickshire* [Online]. Available at: http://www.warwickshire.gov.uk/Web/corporate/pages.nsf/Links/57B502D48FDE4EB0802575EB004BBF9A/$file/Report_WCC_MSA_OR08065.pdf.

Harrison, D J, Henney, P J, Minchin, D, McEvoy, F M, Cameron, D G, Hobbs, S F, Evans, D J, Lott, G K, Ball, E L, and Highley, D E. 2006. *Mineral Resource Information in Support of National, Regional and Local Planning: North Yorkshire (comprising North Yorkshire, Yorkshire Dales and North York Moors National Parks and City of York).* British Geological Survey Commissioned Report, CR/04/228N. 24pp.

Mankelow, J M, Bate, R, Bide, T, Mitchell, C, Linley, K, Hannis, S and Cameron, D. 2008. *Aggregate resource alternatives: options for future aggregate minerals supply in England.* British Geological Survey Commissioned Report, OR/08/025. 79pp.

North Yorkshire County Council (NYCC). 2011. *Minerals Core Strategy Issues Paper July 2011* [Online]. Available at: http://www.northyorks.gov.uk/CHttpHandler.ashx?id=13334&p=0.

Wrighton, C E, McEvoy, F M, Bust, R. 2011. *Mineral safeguarding in England: good practice advice*. British Geological Survey Open Report, OR/11/046. 53pp.