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Our Ref: P9039-MRA
Date: 4th May 2020

Ken Yardley
Bellway Homes East Midlands
3, Romulus Court
Meridian Business Park
Braunstone Town
Leicester
LE19 1YG

Minerals Resource Assessment – Land Off Ashland Road West, Sutton in Ashfield, Nottingham (Planning Application Ref: V/2020/0184).

1.0 Introduction

GRM Development Solutions Limited (GRM) has been instructed by Bellway Homes East Midlands to produce a Minerals Resource Assessment (MRA) for a proposed development off Ashland Road West, Sutton in Ashfield. The site and surrounding area lie within a Minerals Protection Area for the Cadeby Formation and Pennine Middle Coal Measures.

A plan showing the proposed development and its location is included in Appendix A. The site area is located approximately 1.6km west of Sutton-in-Ashfield town centre and covers an area of approximately 9.75 hectares.

As part of the planning process the Local Authority has suggested that the proposed development would potentially sterilise mineral reserves by constructing a development directly over the mineral resource and further assessment of the mineral resource beneath the site is required.

Published information that has been used in the production of this MRA is listed below:

- British Geological Survey (BGS) Geological mapping at a scale of 1:50,000.
- BGS Mineral Resources Mapping at a scale of 1:100,000 (Appendix B).
- BGS Mineral Planning Factsheet: Industrial Dolomite.
- BGS Mineral Planning Factsheet: Construction Aggregates.
- BGS Mineral Planning Factsheet: Building Stone.
- BGS Mineral Resource Information in Support of Natural, Regional and Local Planning: Nottinghamshire.
- Site Appraisal Report by GRM (Ref: GRM/P5946/F.1) dated December 2012.

The BGS state that: *mineral resources are natural concentrations of minerals, or bodies of rock that are, or may become, of potential economic interest as a basis for the extraction of a commodity. They will exhibit physical and/or chemical properties that make them suitable for specific uses and be present in sufficient quantity to be of intrinsic economic interest. Areas that are of potential economic interest as sources of minerals change with time as new uses are developed, product specifications change, recovery technology is improved or more competitive sources become available.*

2.0 Geology

The BGS Geological Sheet for this area suggests the majority site to be underlain by a solid geology of the Cadeby Formation. However, the north western fringes of the site are reported to be underlain by a solid geology of the Pennine Middle Coal Measures, these deposits being present beneath the Cadeby Formation across the remainder of the site. No superficial deposits are indicated.

The Cadeby Formation present beneath the site is reported to comprise calcareous mudstone (dolomitic limestone is recorded to the south of the site), whereas the Pennine Middle Coal Measures are reported to comprise mudstones, siltstones and sandstones, with named coal seams.

An existing GRM ground investigation report for the site confirms the presence of cohesive Cadeby Formation strata from shallow depth beneath topsoil (0.3m begl), to the base of trial pits at 2.5m begl where excavations were terminated on bedrock comprising mudstones, siltstones and, occasionally, sandstones. Pennine Middle Coal Measures strata were encountered, beneath the Cadeby Formation strata, in the far north western reaches of the site, these comprising sandstones.

There are no relevant BGS borehole records in close proximity to the site.

3.0 Mineral Resource of the Cadeby Formation

The Cadeby Formation (in particular the limestone and dolomite elements of it) is included on the BGS Mineral Planning Factsheets for Building Stone, Crushed Rock Aggregates and Industrial Dolomite.

Industrial Dolomite

The principal use of industrial dolomite has been linked with iron and steel making since the latter part of the 19th century, other uses being in glass making and agricultural use. However, the suitability of the dolomite for these processes largely depends on its chemical properties and the distribution of suitable quality material is somewhat restricted, most of the supply being procured from quarries in Derbyshire, County Durham and Doncaster. Changes in iron and steel making technology during the 20th century have had a marked effect on the demand for dolomite for specific uses and the market continues to evolve, this ultimately resulting in a general decline for most uses, a noted exception being in the production of glass.

Crushed Rock Aggregates

The dolomites and dolomitic limestones of the Cadeby Formation occur on the western fringes of the county of Nottinghamshire, and are variable in lithology but are mostly porous, weak and friable. In the north of Nottinghamshire they are over 50m thick and are predominantly comprised of pare buff dolomite with mudstone partings, whereas towards Nottingham the formation is much thinner and the rock grades into sandy, yellow brown dolomitic limestone interbedded with mudstone. They have insufficient strength to produce good quality aggregate, but are sometimes suitable for granular sub-base, road stone, drainage media and fill.

Their production for aggregate use ceased on any substantial scale in the 1990s, but resources remain to the north of Mansfield and a quarry exists near Linby (for aggregate purposes).

Building Stone

The Cadeby Formation is quarried on a relatively small scale for building stone around Mansfield and Linby and many listed buildings are built from the dolomites and dolomitic limestones, sustaining a small demand for restoration. Many small quarries occur throughout the outcrop, but most are now backfilled.

4.0 Mineral Resource of the Pennine Middle Coal Measures

The Cadeby Formation strata are reported to be underlain by the strata of the Pennine Middle Coal Measures and the Coal Authority reports that the site is within the zone of influence from workings in six seams of coal at depth of between 170m to 520m, last mined in 1956. The Coal Authority do not state that the site is in an area where unrecorded mine workings could be present, and so it is assumed that there are no other known productive seams at shallower depth than those recorded.

5.0 Planning Permission for the Extraction of Minerals

There are no active Mineral Planning Permissions within 2km of the site.

It is considered highly unlikely that planning permission would be granted for the extraction of limestone/dolomite or other minerals beneath the site, and the UK supply would instead focus on existing quarries and more suitable quarrying sites remote from significant developments.

6.0 Practicality of Mineral Extraction.

Extraction of mineral resources from beneath the site would have to be undertaken by blasting and quarrying, resulting in a severe detrimental impact on the existing town, local structures and infrastructure.

It is also considered that extension of any existing limestone/dolomite quarries in the area is preferable to development of what is a very small site given the scale of existing operations.

7.0 Conclusion

Whilst the Cadeby Formation has been confirmed to be present beneath the site, the strata largely comprise clay and mudstone strata, the reserves of limestone and dolomite being present off-site to the south. Based on the quality requirements for some of the uses of limestone and dolomite, its general absence on the site and the general decline in its use for nearly all commercial uses, it is considered unlikely that the Cadeby Formation strata beneath the site represent a viable resource of significant economic importance.

Whilst the Pennine Middle Coal Measures are present beneath the Cadeby Formation, it is considered that the seams of most economical importance have been worked, thus there is unlikely to be a viable reserve of coal remaining to represent a resource of significant economic importance.

We trust that the information provided is sufficient for your current requirements. If you require any additional information or clarification of the contents of this letter then do not hesitate to contact us.

Yours faithfully,
on behalf of GRM Development Solutions Ltd,

Matthew Tomkins Bsc (Hons) PGDip FGS
Acting Principal Engineering Geologist

Geoffrey Beckett CGeol FGS
Director

Appendices

Proposed Development and Location Plan	Appendix A
BGS Mineral Resources Mapping	Appendix B

APPENDIX A

GRM Development Solutions provides multi-disciplinary consultancy services, UK-wide:

- Geotechnical and Geo-environmental Services
- Civil and Infrastructure Services
- Structural Engineering Services
- Construction Management
- Site Services

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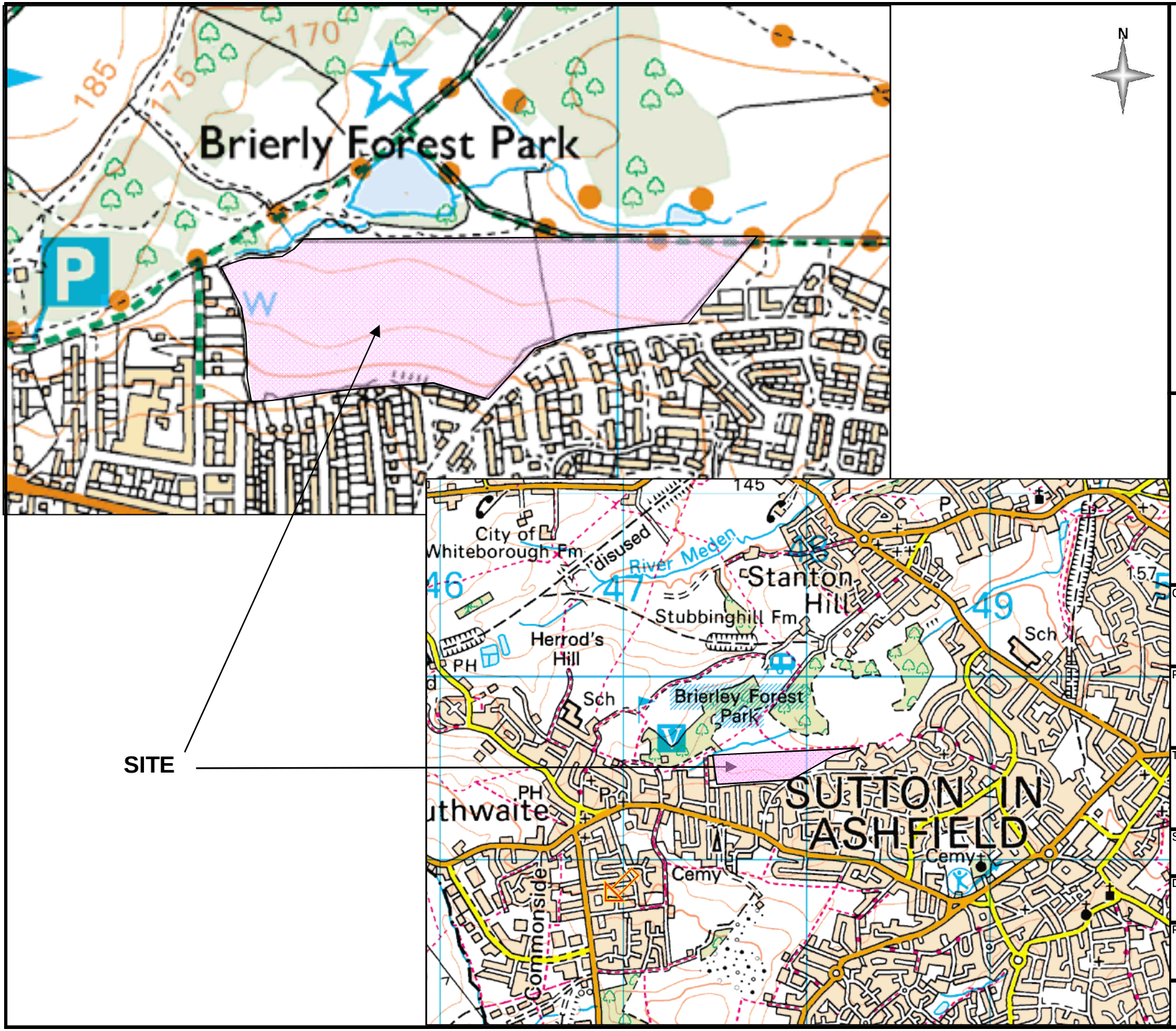

DO NOT SCALE

NOTES:

Approximate site location

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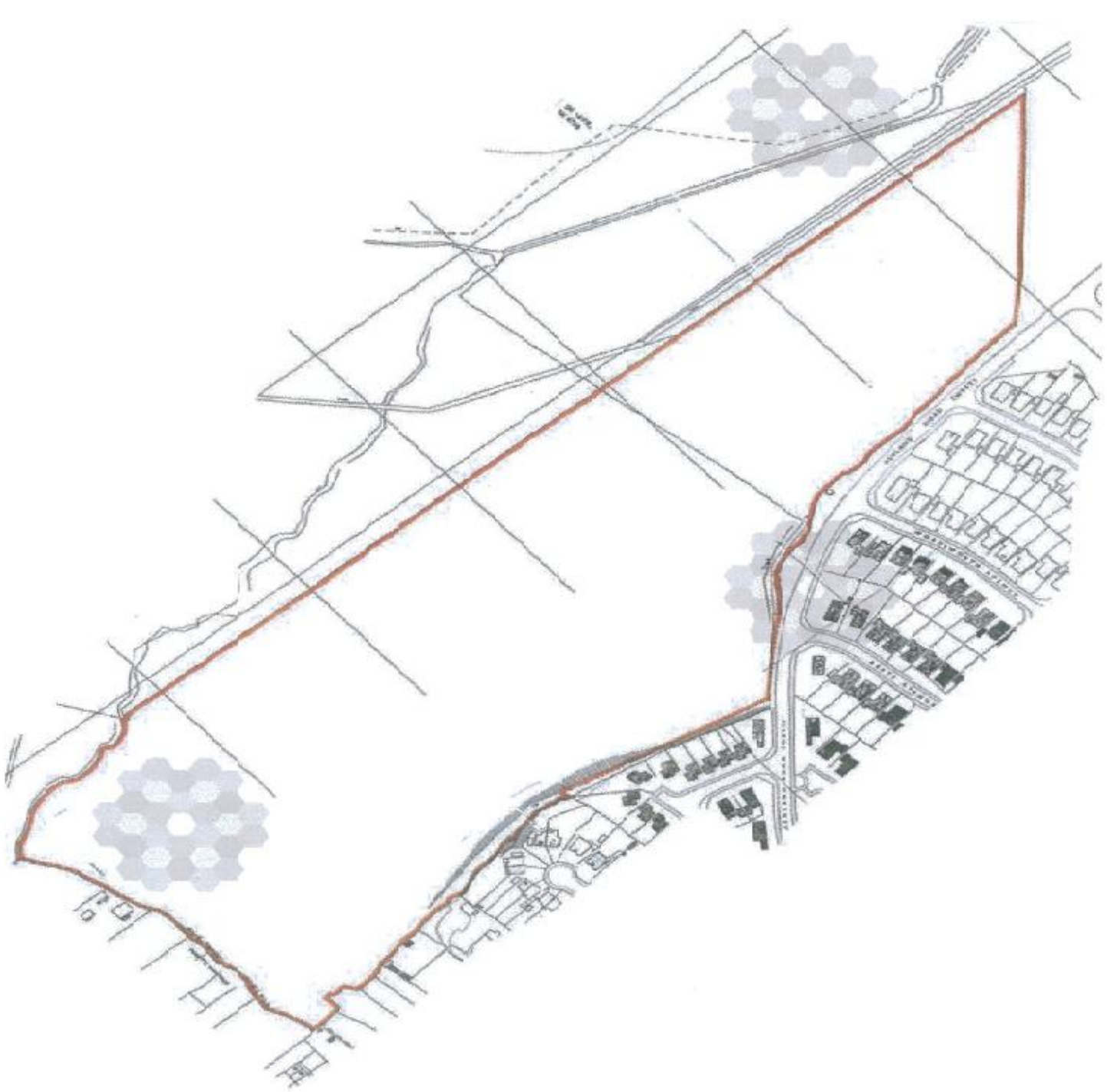
mail@grm-uk.com www.grm-uk.com

CLIENT:
Bellway Homes East Midlands

PROJECT:
Ashland Rd, Sutton in Ashfield

TITLE:
Site Location Plan

SCALE@SIZE :	ISSUE:
NTS	FINAL
DESIGN/DRAWN :	DATE:
MJT	05/2020
PROJECT No:	DRAWING No:
P9039	Figure 1



DO NOT SCALE

NOTES:

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mail@grm-uk.com www.grm-uk.com

CLIENT:
Bellway Homes East Midlands

PROJECT:
Ashland Rd, Sutton in Ashfield

TITLE:
Site Boundary Pan

SCALE@SIZE :	ISSUE:
NTS	FINAL
DESIGN/DRAWN :	DATE:
MJT	05/2020
PROJECT No:	DRAWING No:
P9039	Figure 2

Planning | Design | Environment | Economics | Heritage
East Midlands

Ashland Road West, Sutton in Ashfield - **Illustrative Masterplan**

| Drawn by: LJE | Approved by: PS | Date: 24/01/20 | Scale: 1:1250 @ A1 | DRG: P19-1014 007 Sheet No: 1 Rev: B | Client: Bellway Homes |

Pegasus Group

APPENDIX B

GRM Development Solutions provides multi-disciplinary consultancy services, UK-wide:

- Geotechnical and Geo-environmental Services
- Civil and Infrastructure Services
- Structural Engineering Services
- Construction Management
- Site Services

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NOTTINGHAMSHIRE

(comprising City of Nottingham and Nottinghamshire)

Mineral Resource Information in Support of National, Regional and Local Planning

Mineral Resources

Scale 1:100 000

Compiled by D.J. Harrison, P.J. Henney, D.G. Cameron, S.F. Hobbs, S. Holloway, G.K. Lott, K. Linley and E.L. Bartlett.
Project Leader: D.E. Highley.
Digital cartography by N.A. Spencer, British Geological Survey.

Published 2002.

This map comprises part of a summary of the 'Mineral Resources of the East Midlands Region'.
For further information see www.mineralsUK.com

Production of this map was commissioned and funded by the Department for Transport, Local Government and the Regions (Contract MP0677).

SAND & GRAVEL

Superficial deposits

- Sub-alluvial: Inferred resources
- Sub-alluvial: Indicated resources in area assessed by BGS
- River Terrace deposits
- Glaciofluvial deposits
- Glaciofluvial deposits: Concealed (only in area assessed by BGS)
- Blown sand
- Undifferentiated deposits: Concealed (only in area assessed by BGS)
- Boundary of area assessed for sand and gravel at the indicated resource level

Bedrock deposits

- Construction Sand and Silica sand — Triassic: Sherwood Sandstone Group

LIMESTONE

- Dolomite and dolomitic limestone — Permian: Cadeby Formation (Lower Magnesian Limestone)

COAL

- Areas of shallow coal — Carboniferous: Coal Measures
- Opencast: worked area

GYPSUM

- Outcrop of main gypsum-bearing formation (Cropwell Bishop Formation) — Triassic: Mercia Mudstone Group

BRICK CLAY

- (Triassic: Mercia Mudstone Group)
- Fireclay (coincident with areas of shallow coal) — Carboniferous: Coal Measures

COAL LICENCE AREAS (as at 01.08.00)

SOURCE: The Coal Authority

- Deep mine

MINERAL PLANNING PERMISSIONS (as at 01.01.02)

Source: Mineral Planning Authorities

- Surface planning permission (valid and expired)
- Underground planning permission other than coal (valid and expired)

MINERAL WORKINGS

- Dorket Head — Active site
- *Bassingfield* — Inactive, worked-out and/or restored site
- ▲ Active underground mine site
- ■ Active power station

Mineral commodity

Lst	Limestone	Gyp	Gypsum	Sg	Sand and Gravel
SiS	Silica Sand	Gas	Natural Gas	CMM	Coal Mine Methane
Co	Coal	Cl	Common clay and shale	AMM	Abandoned Mine Methane
Oil	Oil	Sst	Sandstone	Sec	Secondary aggregates

ENVIRONMENTAL DESIGNATIONS

- National nature conservation designations (SSSIs and NNRs)
- International nature conservation designations (SACs, SPAs and Ramsar sites)
- + Scheduled Monument

ADMINISTRATIVE AREAS

- Mineral Planning Authority
- District

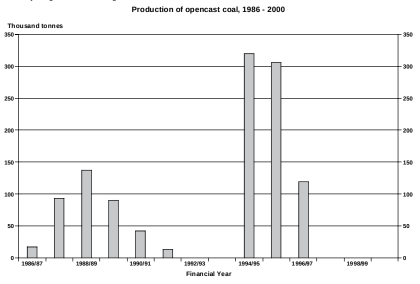
COAL

Coal-bearing strata are principally confined to the Lower and Middle Coal Measures (Upper Carboniferous) rocks of Nottinghamshire. In general the coal-bearing horizons dip from the exposed coalfield in SW Nottinghamshire gently towards the ENE under central and eastern Nottinghamshire. Within the coalfield there is a general increase in calorific value, caking properties and rank from south to north and with increasing depth of burial. Chlorine contents also show a general increase eastwards, particularly in coals associated with marine bands, which can also show high sulpher values. The resources consist largely of bituminous coal with the majority of the coals are bright or 'soft' coals but some contain distinct hard bands rich in durain. The Nottinghamshire coalfield is also characterised by generally thick seams with flat roofs that are flat lying over large areas and are not unduly affected by faults and which lie at only moderate depths. Seams worked include the Top (Barnsley) Hard, the Parkgate, High Hazles and Clowne, Low Main and Deep Soft. Some of the 'bright' coals of the 'Hard' seams are of coking quality but the majority is extracted as steam coal and for household use.

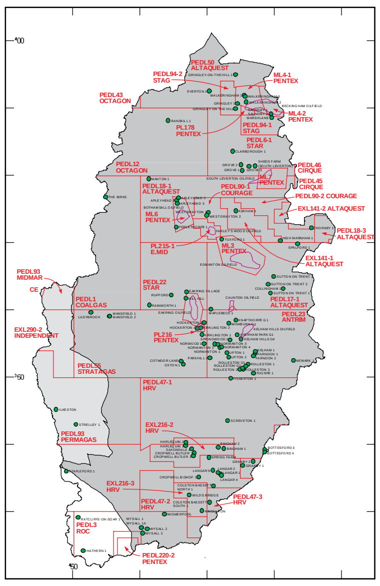
Although UK domestic production of coal has declined in recent years, Nottinghamshire remains one of the most important coal mining counties in the UK with four deep mines in operation (Clipstone, Harworth, Welbeck and Thoresby) and a total deep mine production of some 4 Mt. A significant deep coal reserve has been identified by UK Coal on the Notts/Lincs border, the so called Witham Prospect Area which may be developed should the economic circumstances warrant and if an environmentally acceptable proposal can be made.

Opencast operations have been carried out in SW Nottinghamshire within the exposed coalfield, however, no opencast coal is currently being extracted in Nottinghamshire.

Production of opencast coal, 1986 - 2000



Source: Opencast Coal Mining Statistics and the Coal Authority



- Hydrocarbon Well
- PEDL — Petroleum Exploration and Development Licence issued under the Petroleum (Production) Act 1934 (as at August 2000)
- Shallow coal with less than 50 m overburden
- Deep coal between 50 m and 1200 m

HYDROCARBONS

Conventional Oil and Gas

Nottinghamshire has been intensively explored for oil and gas since before the Second World War. This is illustrated by the large number of exploration wells in the county (see inset map). Exploration has resulted in the discovery of eleven oil fields to date. Seven fields are still producing. Production is shown in the table below.

Name of Oilfield	Operator	Discovery Date	Production started	Production ceased	Total production (tonnes)
Apley Head	BP	1960	1966	1979	3,252
Beckingham	Pentex	1959	1964	Still producing	293,369
Beckingham West	BP	Jul-1985	Oct-87	Still producing	16,000
Bothamsall	BP	1958	1958	?1981	331,943
Caunton	BP	?1943	1943	1965	37,644
Eakring*	BP	Jun-1939	1939	1973	880,756
Egmanton	Pentex	1955	1955	Still producing	433,020
Farley's Wood	ROC Oil	Mar-1983	Jul-1985	Still producing	33,000
Langar	BP	?	1958	1959	85
Kelham Hills	BP	?1941	1941	1965	292,086
Kirklington	Pentex	Dec-1985	Mar-91	Still producing	4,000
Rempstone	Pentex	Dec-1985	Jun-91	Still producing	25,000
South Leverton	Pentex	1960	1960	Still producing	49,337
Total					**2,597,492**

* includes Duke's Wood (sometimes described as a separate field)

Exploration to date indicates that the best potential for the discovery of oilfields lies in the east of the county.
Large parts of the county are currently licensed for oil and gas exploration (see inset map) and it is likely that there will be further small oil discoveries in the future.

Coal Mine Methane

Mine gas is currently drained from Harworth Colliery, which has an unusually high make of gas during mining. The drained gas is recovered and used to power an 18 MW(e) CHP power plant which generates electricity for use on site, with any surplus for sale to the regional electricity company.

Abandoned Mine Methane

The artifical voids left in abandoned coal mines form excellent potential reservoirs for coal mine gas and have high levels of permeability. Pumps have recently been installed to extract coal mine gas from the abandoned colliery workings at Steetley Colliery near Worksop. The produced gas contains around 70% methane and is a valuable fuel which is being used to generate electricity on site. Production started in March, 1999. There is potential to expand coal mine methane production to other abandoned mines in Nottinghamshire.

Coalbed Methane

The term coalbed methane is used here to refer to the extraction of methane via boreholes from coal seams other than in abandoned or active coal mines. The levels of coalbed methane in the coal seams of Nottinghamshire are relatively low. Average measurements are 1.79 m^3/tonne of coal in south Nottinghamshire and 5.13 m^3/tonne in north Nottinghamshire. Thus the prospects for coalbed methane development from virgin coal seams in Nottinghamshire are not particularly good at the moment. Coalbed methane potential in Nottinghamshire may also be adversely affected by the widespread mining of the thicker coal seams. However, mining does have a positive side for coalbed methane extraction. The process of longwall mining creates a zone of enhanced permeability in the strata surrounding the extracted seam, up to about 150 m above the seam and 40-50 m below it. Coalbed methane production might be improved in this zone if it contains significant coal seams that have not been mined.

Licencing

The Department of Trade and Industry grants licences for exclusive rights to explore and exploit oil and gas onshore within Great Britain. The rights granted by landward licences do not include any rights of access, and the licensees must also obtain any consent under current legislation, including planning permissions. Licensees wishing to enter or drill through coal seams for coalbed methane and abandoned mine methane must also seek the permission of the Coal Authority.

PLANNING PERMISSIONS FOR MINERAL EXTRACTION

The extent of all known extant and non-extant planning permissions for the extraction of minerals is shown on the map, irrespective of their current planning or operational status. The polygons were digitised by BGS from Plotting Sheets and other documents supplied by Nottinghamshire County Council and Nottingham City Council and any queries regarding the sites shown should be directed to these authorities at the addresses shown below. The polygons cover active, former and restored mineral workings and, occasionally, unworked deposits.

Planning Permissions represent areas where a commercial decision to work mineral has been made, a successful application has been dealt with through the provisions of the Town and Country Planning legislation and the permitted reserve will have been depleted to a greater or lesser extent. The current planning status is not qualified on the map but is available in the underlying database.

Contact addresses:

Nottinghamshire County Council, Environment Department, Trent Bridge House, Fox Road, West Bridgford, Nottingham, NG2 6BJ, Tel: 0115 977 4277, Fax: 0115 977 2418,
Web Page: www.nottscc.gov.uk

Nottingham City Council, Development Department, Exchange Buildings North, Smithy Row, Nottingham, NG1 2BS, Tel: 0115 915 5555, Fax: 0115 915 5483,
Web Page: www.nottinghamcity.gov.uk

BIBLIOGRAPHIC REFERENCE

Harrison, D.J, and 9 others. 2002. Mineral Resource Information in Support of National, Regional and Local Planning: Nottinghamshire (comprising City of Nottingham and Nottinghamshire). *British Geological Survey Commissioned Report CR/02/23N.*

CRUSHED ROCK AGGREGATES

A variety of hard rocks are, when crushed, suitable for use as aggregates. Their technical suitability for different applications depends on their physical characteristics, such as crushing strength and resistance to impact and abrasion. Higher quality aggregates are required for coating with bitumen for road surfacing, or for mixing with cement to produce concrete. For applications, such as constructional fill and drainage media, with less demanding specifications, lower quality materials are acceptable.

Nottinghamshire has very limited resources of rock suitable for use as crushed rock aggregate.

Limestone and dolomite

Dolomites and dolomitic limestones of the Cadeby Formation (Magnesian Limestone) of Permian age occur on the western margin of the county. They are very variable lithologically but are mostly porous, weak and friable. They have insufficient strength to produce good quality aggregate but are sometimes suitable for granular sub-base roadstone, drainage media and fill. Their production for aggregate use ceased on any substantial scale in the early 1990s, but resources remain to the north of Mansfield. One quarry near Linby produces aggregate materials.

In north Nottinghamshire the Cadeby Formation is over 50 m thick and is predominantly composed of pale buff dolomite with mudstone partings, whereas towards Nottingham the formation is much thinner and the rock grades into a sandy, yellow-brown dolomitic limestone interbedded with mudstone.

SECONDARY AGGREGATES

The term 'secondary aggregates' is used to describe a range of materials which may be used as alternatives to primary aggregates (subject to considerations of quality and contamination), but which arise as wastes from a variety of activities (such as mineral extraction and industrial processing). In general, secondary aggregates are only suitable for less demanding applications, and their production and use may not always be environmentally or economically desirable.

Power station ash

Coal-fired power stations burn pulverised coal and the main residue is a fine-grained powder called Pulverised Fuel Ash. Nottinghamshire is a major source of power station ash from the county's four coal-fired power stations. Power station ash is the largest source of secondary aggregates in the county and around 0.5 Mt of ash is sold annually for use as a secondary aggregate. Its largest applications are as structural fill for civil engineering and as a cement additive, although the coarse-grained Furnace Bottom Ash is used mainly in the manufacture of concrete building blocks.

Colliery spoil

Colliery spoil is the waste from mining and processing coal. It consists mainly of mudstone and siltstone and is a source of potential secondary aggregates. In Nottinghamshire, however, all the waste is disposed of within local spoil heaps which have been largely reclaimed/restored and are not available as a source of secondary aggregates.

Construction and demolition wastes

These materials are excluded from this study as their arisings are highly variable in location, type and duration.

SAND AND GRAVEL

Sand and gravel are defined on the basis of particle size rather than composition. In current usage, the term 'gravel' is used for material that is coarser than 5 mm, with a maximum size of 40 mm, and the term 'sand' for material that is finer, but coarser than 0.075 mm. Most sand and gravel is composed of particles that are rich in silica (quartz, quartzite and flint), but other rock types, mainly limestone, may occur locally.
The principal uses of sand are as fine aggregate in concrete, mortar and asphalt. The main use of gravel is as coarse aggregate in concrete. Substantial quantities of sand and gravel may also be used for constructional fill. Nottinghamshire is the leading sand and gravel producer in the East Midlands with an output of 3.2 million tonnes in 1999. Recent production is shown on the graph.

The sand and gravel resources in Nottinghamshire fall into two main categories:

- Superficial, or drift deposits, subdivided into river and glaciofluvial sand and gravel.
- Bedrock, or solid, sand deposits represented by the Triassic, Sherwood Sandstone Group

The areas assessed for sand and gravel by BGS are identified on the map and the resources shown here are taken from these maps. In these areas, the possible concealed extent of sand and gravel beneath till (boulder clay) and alluvium is shown. Outside these areas, available data are more limited. Only exposed sand and gravel is defined.

River sand and gravel (River Terrace deposits and sub-alluvial)

The main sources of these materials in Nottinghamshire are Pleistocene and Recent age deposits in the valleys of the Trent and Idle, where generally clean, well-bedded sand and gravel rests on weathered bedrock. Resources occur in both raised river terrace sequences flanking the modern floodplains and in flood plain terrace deposits associated with, and underlying, present day alluvium. This sequence of deposits is best developed along the River Trent with a succession of terrace deposits formed at heights up to 35 m above OD, representing accumulations of sand and gravel in response to falling sea level in post-glacial times. Thickness varies from between less than 1 m up to maximum values of around 10 m. The gravel content is highly variable and medium-grained sand generally forms at least 50 percent of the deposits. Sand from the Trent Valley deposits is generally coarser, with a more angular particle shape than typical sands from the River Idle deposits.

Glaciofluvial deposits

These are sands and gravels that have been deposited by glacial meltwaters. On more recent BGS maps they are commonly described as glaciofluvial and fluvioglacial deposits, a more accurate description of their origin. The sequence of these deposits is complex, with mappable units commonly exhibiting intricate relationships. Bodies of sand and gravel may occur as sheet- or delta-like layers above till deposits or as elongate, irregular lenses within the till sequence. Areas of wholly concealed, and thus unknown, bodies of sand and gravel may occur under spreads of till (boulder clay) and other drift deposits, although this is not thought to be a major problem in Nottinghamshire. Glaciofluvial deposits are worked at East Leake in the south of the county and around Retford in north Nottinghamshire. These deposits are volumetrically minor sources of sand and gravel compared to the deposits found in the Trent and Idle valleys

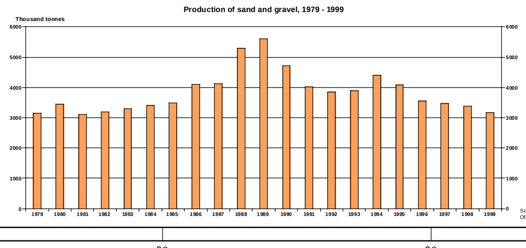
Bedrock sands

The sandstones and conglomerates of the Triassic Sherwood Sandstone Group, in particular the Nottingham Castle Sandstone Formation or "Bunter Sandstone" are worked at several sites in Nottinghamshire, from Nottingham northwards to Scrooby and Bawtry. This material is mainly friable, loosely consolidated and easily worked. It is largely composed of a fine sand with generally <2% gravel and is generally more suitable for building sand and asphalting than the 'sharper' alluvial sands which are used for concreting. Where more gravel is present or conglomeratic horizons occur, the clasts are mainly rounded and subrounded quartz and quartzite pebbles, with subordinate Carboniferous sandstone fragments. Sands within the Lenton Formation at the base of the Sherwood Sandstone are not shown because of their generally fine-grained nature.

Blown sand

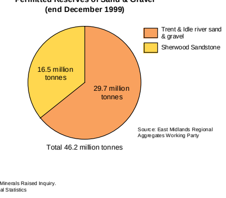
This is generally composed of a fine- to medium-grained sand with a mean fines (<75 micron) content of around 8%. The sand comprises subrounded to well-rounded quartz grains. These deposits are believed to be largely of very late Quaternary age and result from aeolian reworking of fluvial and fluvioglacial sands. Deposits are generally thin and occur as both recognisable dunes and as thin linear spreads of sand, mainly in northern and eastern Nottinghamshire. These deposits are of minor importance as a resource.

Production of sand and gravel, 1979 - 1999



Source: Annual Minerals Raised Inquiry. Office for National Statistics

Permitted Reserves of Sand & Gravel (end December 1999)



Total 46.2 million tonnes

Source: East Midlands Regional Aggregates Working Party

BUILDING STONE

A wide range of rock types is used as a source of building stone. Their suitability depends not only on aesthetic qualities, such as colour and textural consistency, but also on factors such as strength and durability, and commercial considerations such as the size of block or slab that can be extracted. A continuing supply of building stone from a variety of sources is important for new build and conservation work. Building stone operations range from small sites supplying local markets, to larger concerns that trade across Britain and sometimes overseas.

Limestone

The Permian Cadeby Formation (Magnesian Limestone) is quarried on a relatively small scale for building stone (walling stone, ashlar cladding, paving stone, etc) around Mansfield and Linby. Many buildings, including Newstead Abbey, Southwell Minster and the Houses of Parliament, are built of the stone and there is a small demand for stone for restoration. Many small quarries occur throughout the outcrop, but most are now backfilled. In north Nottinghamshire the pale coloured limestones and sandy dolomites are known as 'Mansfield White', but further south, towards Nottingham, the character of the rock changes and here the brownish dolomitic limestones are coarsely crystalline and are known as 'Bulwell' (after the former extensive quarries in the locality) or 'Linby Stone'.

BRICK CLAY AND SHALE, including FIRECLAY

'Brick clay' is the term used to describe clay and shale used predominantly in the manufacture of bricks and, to a lesser extent, roof tiles and clay pipes. These clays may sometimes be used in cement manufacture, as a source of constructional fill and for lining and sealing landfill sites. The suitability of a clay for the manufacture of bricks depends principally on its behaviour during shaping, drying and firing. This will dictate the properties of the fired brick such as strength and frost resistance and, importantly, its architectural appearance.

Most facing bricks, engineering bricks and related clay-based building products are manufactured in large automated factories. These represent a high capital investment and are increasingly dependent, therefore, on raw materials with predictable and consistent firing characteristics in order to achieve high yields of saleable products. Blending different clays to achieve improved durability and to provide a range of fired colours and textures is an increasingly common feature of the brick industry. Continuity of supply of consistent raw materials is of paramount importance.

The main brick clays in Nottinghamshire are in the Triassic Mercia Mudstone Group (formerly known as the Keuper Marl) which crops out extensively in the Midlands. The Group consists of six formations, the Blue Anchor Formation (youngest), Cropwell Bishop Formation (the main gypsum resource), the Edwalton Formation, the Gunthorpe Formation, the Radcliffe Formation and the Sneinton Formation (oldest). Current extraction by the brick industry is confined to the lower part of the Mercia Mudstone Group (beneath the Edwalton Formation), although in the past brick clays have been worked from other parts of the Mercia Mudstone. It has not been possible to separately show the individual formations and the total outcrop of the Mercia Mudstone Group is shown.

Red-brown mudstones and siltstones are worked as brick clays at Dorket Head in northeast Nottingham and at Kirton near Ollerton. The brick clay pits are situated on steep slopes, capped by resistant sandstones, allowing easy access for extraction with minimal overburden. The presence of small amounts of carbonate minerals in some horizons within the Mercia Mudstone Group produces bricks with a distinctive pale colour. This can form a good substrate for a range of applied facing finishes. Other horizons are also worked to produce bricks with a deeper red colour. Gypsum contamination can cause problems in some parts of the Mercia Mudstones Group.

Fireclays typically occur beneath coal seams and resources are confined to coal-bearing strata. Opencast coal sites provide one of the few viable sources. Resources of fireclay are thus coincident with opencast coal resources. Although originally valued as refractory raw materials, fireclays are now used in the production of buff-coloured facing bricks and pavers. With no opencast coal production in Nottinghamshire there is no production of fireclay. However, not all fireclays are suitable for buff brick production because of the presence of impurities.

SILICA SAND

Silica sand is marketed for a wide range of industrial uses rather than for direct application in the construction industry. For most applications silica sands have to conform to very closely defined specifications.

The Triassic Sherwood Sandstone Group is an important source of sand, particularly from weakly-cemented parts of the sequence. It is worked mainly as a source of fine aggregate, although in many places the sands are too fine grained for use as concreting aggregate. The fine grain size and clay content of certain deposits made it ideally suited for use as a naturally-bonded moulding sand but there is little demand for this material today. Fine-grained, weakly cemented Sherwood Sandstone is worked at Ratcher Hill and Oakfield Lane, near Mansfield as a source of silica sand for specialist uses, including a range of premium products for sports applications, specialist foundry sands and sands for shotblasting, block paving and asphalt.

GYPSUM/ANHYDRITE

Gypsum ($CaSO_4.2H_2O$) and anhydrite ($CaSO_4$) are forms of calcium sulphate. They are worked from natural deposits, but may also be derived as by-products of certain industrial processes, notably flue gas desulphurisation (FGD). The amount of natural gypsum extracted in Britain has declined appreciably in recent years due to the availability of substantial amounts of high quality synthetic gypsum obtained from FGD plants. Gypsum has many applications but is used principally in the production of plaster and plasterboard. A mixture of gypsum/anhydrite is used as a retarder in cement manufacture.

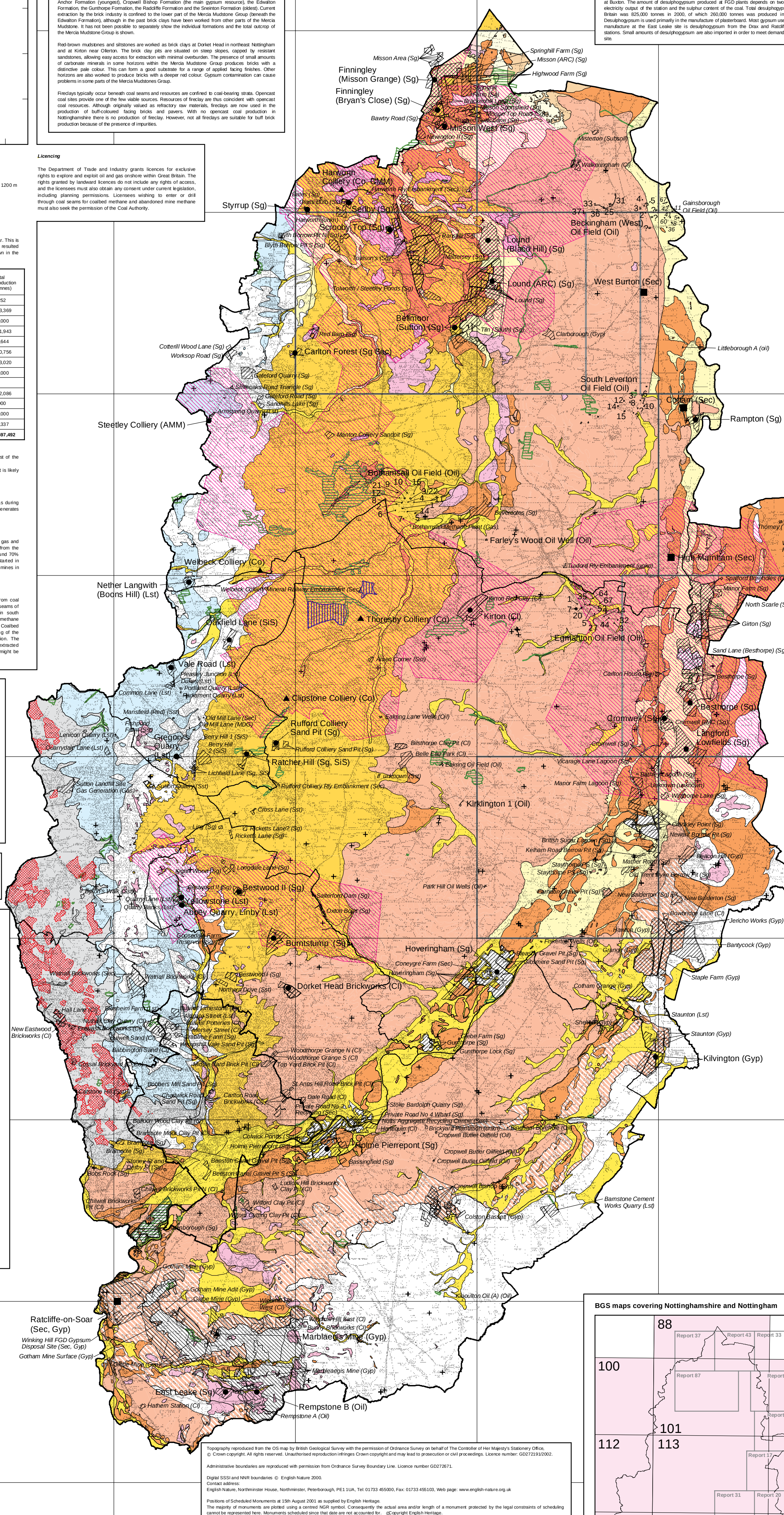
Natural gypsum

Gypsum and anhydrite occur as beds, or nodular masses, up to a few metres thick. Gypsum is formed by the hydration of anhydrite at or near surface but passes into anhydrite generally at depths of more than 100 m. Nottinghamshire has traditionally been one of the most important sources of gypsum in Britain. The mineral was formerly worked from various horizons in the Triassic Mercia Mudstone Group but is now only extracted from two horizons, the Tutbury and Newark gypsum beds in the Cropwell Bishop Formation near the top of the Group. The Tutbury Gypsum is up to 6 m thick but averages about 2.5 m. It has been extensively worked by underground pillar and stall mining in the southwest of the county near Gotham and East Leake. It is still worked at the Marblaegis Mine at East Leake mostly for use in the cement industry, although a small amount is used for plasterboard. Unlike the Tutbury Gypsum, the Newark Gypsum comprises multiple beds and nodular bands of gypsum of variable thickness and purity spread over some 18 m of strata. It can only be worked by opencast methods. The Newark Gypsum can be traced from Cropwell Bishop, where it was formerly worked, to Newark. Here there are two sites, although only one is currently worked. Three different grades of gypsum are produced from the Newark Gypsum, the main aim being to produce as much high-grade gypsum as possible. This is used to produce special plasters for plaster moulds for pottery manufacture, dentistry, brewing and the filler industry.

Gypsum resources extend beneath overlying Jurassic rocks. In the southwest of the county, where gypsum occurs as a single bed, underground mining is feasible beneath extensive areas of Jurassic rocks. However, where gypsum is worked by opencast methods, extraction is only feasible for a short distance beneath Jurassic rocks.

Synthetic gypsum

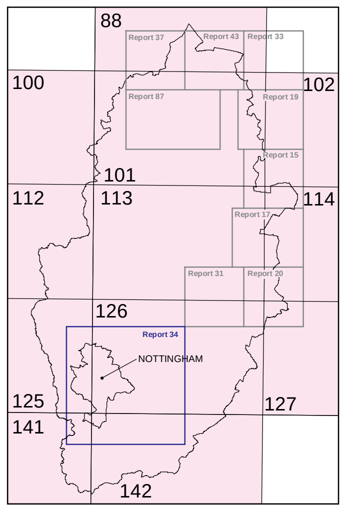
Synthetic gypsum (known as desulphogypsum or FGD gypsum) is produced by the neutralisation of sulphur dioxide contained in flue gases at coal-fired powered stations at two sites in Britain. The largest is the 4000 MW Drax Power Station in North Yorkshire and the other is the 2000 MW Ratcliffe-on-Soar station in Nottinghamshire. High-purity limestone for use in the process is obtained from Tunstead Quarry at Buxton. The amount of desulphogypsum produced at FGD plants depends on two main factors; the electricity output of the station and the sulphur content of the coal. Total desulphogypsum production in Britain was 825,000 tonnes in 2000, of which 260,000 tonnes was produced in Nottinghamshire. Desulphogypsum is used primarily in the manufacture of plasterboard. Most gypsum used for plasterboard manufacture at the East Leake site is desulphogypsum from the Drax and Ratcliffe-on-Soar power stations. Small amounts of desulphogypsum are also imported in order to meet demand at the East Leake site.



Aims and Limitations

The purpose of the maps in this series is to show the broad distribution of those mineral resources which may be of current or potential economic interest and to relate these to selected nationally-recognised planning designations. The maps are intended to assist in the consideration and preparation of development plan policies in respect of mineral extraction and the protection of important mineral resources against sterilisation. They bring together a wide range of information, much of which is scattered and not always available in a convenient form.
The maps have been produced by collation and interpretation of mineral resource data principally held by the British Geological Survey. Information on the extent of mineral planning permissions has been obtained from the relevant Mineral Planning Authority (MPA). Some of these permissions may have lapsed or expired. The status of individual areas can be ascertained from the appropriate MPA. Location information on national planning designations has been obtained from the appropriate statutory body (Countryside Agency, English Nature and English Heritage). For further information the relevant body should be contacted.
The mineral resource data presented are based on the best available information, but are not comprehensive and their quality is variable. The inferred boundaries shown are, therefore, approximate. Mineral resources defined on the map delineate areas within which potentially workable minerals may occur. These areas are not of uniform potential and also take no account of planning constraints that may limit their working. The economic potential of specific sites can only be proved by a detailed evaluation programme. Such an investigation is an essential precursor to submitting a planning application for mineral working. Extensive areas are shown as having no mineral resource potential, but some isolated mineral workings may occur in these areas. The presence of these operations generally reflects very local of specific situations.
The maps are intended for general consideration of mineral issues and not as a source of detailed information on specific sites. The maps should not be used to determine individual planning applications or in taking other decisions on the acquisition or use of a particular piece of land, although they may give useful background information which sets a specific proposal within context.

BGS maps covering Nottinghamshire and Nottingham



- 126 — 1:63 360 and 1:50 000 map published
- Report 34 — 1:25 000 map published (Applied Geology Map)
- Report 31 — 1:25 000 map published (Industrial Minerals Assessment Sand and Gravel Resource Map)

Current digital availability of these sheets can be found at the British Geological Survey website www.thebgs.co.uk or www.british-geological-survey.co.uk