APPENDIX 6

BGS BOREHOLE LOGS, BGS MINERAL RESOURCES MAP FOR GREATER MANCHESTER AND GREATER MANCHESTER JOINT MINERALS PLAN MINERAL SAFEGUARDING MAP

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

Office of the Deputy Prime Minister
Creating sustainable communities

GREATER MANCHESTER

(comprising the Cities of Manchester and Salford and the Metropolitan Boroughs of Bolton, Bury, Oldham, Rochdale, Stockport, Tameside, Trafford and Wigan)

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

Mineral Resources

Scale 1:100 000

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Published 2006.

This map comprises part of a summary of the 'Mineral Resources of the North–West England Region'.
For more information see www.mineralsUK.com

BIBLIOGRAPHIC REFERENCE

Minchin D. J. and 5 others. 2006. Mineral Resource Information for National, Regional and Local Planning: Greater Manchester (comprising the Cities of Manchester and Salford and Metropolitan Boroughs of Bolton, Bury, Oldham, Rochdale, Stockport, Tameside, Trafford and Wigan). *British Geological Survey Commissioned Report CR/05/182N.*

Production of this map was commissioned and funded by the Office of the Deputy Prime Minister (Contract MP0677).

SAND & GRAVEL

Superficial deposits

- Sub-alluvial: Inferred resources
- River Terrace deposits
- Glaciofluvial deposits

PEAT

SANDSTONE

} Carboniferous: Millstone Grit and Pennine Coal Measures

BRICK CLAY

- Brick clay and Fireclay coincident with coal bearing strata - Shallow Coal/ Unproductive Coal Measures

} Carboniferous: Pennine Coal Measures

COAL

- Area of shallow coal
- Opencast coal: worked area

MINERAL PLANNING PERMISSION (as at 01.01.06)

Source: Mineral Planning Authorities

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

MINERAL WORKINGS

Harwood	Active site	
Cowbury Dale	Inactive (including yet to be worked), worked-out and/or restored site	

Mineral commodity

Cl	Clay & Shale	San	Sand
Co	Coal	Sec	Secondary aggregate
CR	Crushed Rock	SiS	Silica Sand
Fr	Fireclay	Ss	Sandstone
Gas	Natural Gas	Sg	Sand and Gravel
Min	Mineral, unspecified		

- Active rail aggregate depot

ENVIRONMENTAL DESIGNATIONS (as at 06/07/05)

- National nature conservation designations (SSSIs and NNRs)
- International nature conservation designations (SACs, SPAs and Ramsar sites)
- National Park: Peak District (part)
- Scheduled Monument

ADMINISTRATIVE AREAS

- Mineral Planning Authority (National Parks are also MPAs)

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 the 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 sites 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 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 reflect very local or 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.

BRICK CLAY (including FIRECLAY)

Brick clay is the term used to describe 'clay and shale' used in the manufacture of structural clay products, such as facing and engineering bricks, pavers, clay tiles and vitrified clay pipes. These clays may also be used in cement manufacture, as a source of constructional fill and for lining and sealing landfill sites. Brick manufacture is the largest tonnage use in England. Clay bricks are versatile construction materials and one of the most visible components of the built environment. They make an important contribution to local architectural styles.

Brick clays are essentially mudstones of different geological ages and compositions. Their mineralogy, chemistry and physical properties are critical to determining their suitability for the manufacture of structural clay products. These properties affect the forming behaviour of the clay (the process of shaping the ware) and also its behaviour during drying and firing. They will also determine the technical properties of the fired product, such as strength, water absorption (porosity) and frost resistance, and thus its durability and performance in service and, importantly, its architectural appearance, such as colour and texture. Most facing bricks, engineering bricks and refractories (clay-based building products are manufactured in large automated factories. These represent a high capital investment and are therefore increasingly dependent on raw material 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.

In Manchester, brick clay has been produced for local consumption from small brick pits for over two hundred years. Historically, a variety of clays were extracted for 'common' brick making, including boulder clay, Triassic Mercia Mudstone and mudstones from the Pennine Lower and Middle Coal Measures. Fireclay, the fine-grained seatearths that commonly underlie coal seams, was mined during lower in opencast and deep mines for use in fireclay goods and for making 'common' brick and consolidation of the brick industry, most of these clay quarries closed. Today, one active clay quarry remains at Harwood, northeast of Bolton, working the Pennine Lower Coal Measures. This quarry produces high quality brick clay for use in facing, engineering and paving bricks but has no associated brickworks. The clay is delivered to a brickworks at Denton, in Tameside, which has no associated quarry and sources clay from a variety of locations, mainly from a site in Glossop, approximately 13 km away in Derbyshire.

Pennine Coal Measures mudstones, which occur interbedded with siltstone, sandstone, coal seams and seatearths, are the principal brick clay resource in North West England. Resources occur across the north and east of the county but are currently only worked in Bolton. The clay mineralogy of Coal Measures mudstones is dominated by kaolinite and illite which tend to provide optimum firing characteristics. Carbon and sulphur contents are also critical to firing performance. Excessive amounts of either may lead to firing problems and sulphur may also give unacceptable emission levels, although blending of clays may reduce these problems. In general, carbon and sulphur contents should be less than 1.5 per cent and 0.2 per cent respectively. Both fireclays and mudstones occur in association with opencast coal, with which they may be worked. However, this is only rarely the case because of the variable quality of the clay, particularly of the fireclays, and due to operational and planning difficulties. Fireclays have relatively low iron content compared to other brick clays and they are primarily valued for the manufacture of buff-coloured bricks and pavers. There is no current fireclay extraction in the area.

PEAT

Peat is an unconsolidated deposit of compressed plant remains in a water-saturated environment such as a bog or fen. Bogs occur in areas where inputs of water (almost exclusively from precipitation) have a low nutrient content and where the rainfall is sufficient to maintain the ground surface in a waterlogged condition. The vegetation is characterised by acid-tolerant plant communities in which the moss genus *Sphagnum* is dominant. The two main types of bog are (i) raised bogs, characteristic of flat underlying topography and found on plains and broad valley floors and (ii) blanket bogs, which occur mainly in upland areas where conditions are suitably cool and wet. Many lowland raised bogs have been designated as sites of international and national conservation areas. Peat is dug in England mainly from raised lowland bogs, almost entirely (98 per cent) for horticultural use, either as growing media or as a soil improver. Areas of upland blanket peat are not worked and therefore not shown.

Peat is being extracted from three sites on Chat Moss to the west and north west of Irlam on the Wigan/Salford boundary. The peat deposits cover an area of 2587 ha of raised bogs up to 9 m thick on a flat underlying topography. Planning permission for peat extraction covers 305 ha, both in the Wigan and Salford districts. Smaller lowland peat deposits such as Carrington Moss and Ashton Moss cover approximately two square kilometres each, but are not worked.

Many of the peat deposits have been worked extensively in the past and today a large percentage of these areas have been 'reclaimed' to agricultural land. Due to the unavailability of up to date linework defining the extent of the reclamation, the entire resource as mapped is shown on the face of the map.

PLANNING PERMISSIONS FOR MINERAL EXTRACTION

The extent of all known extant and former planning permissions for mineral working is shown on the map, irrespective of their current planning or operational status. The polygons were supplied as digital files by the Greater Manchester Geological Unit, and also were digitised by BGS from Plotting Sheets and other documents supplied by Wigan, Rochdale and Bury Metropolitan Councils. In addition, planning permission information was digitally acquired from Ministry of Housing and Local Government maps for the area and incorporated in the data. This data has been checked and amended by the local Authority concerned. 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. Current planning status is not qualified on the map but is available in the underlying database.

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Bolton Metropolitan Borough Council, Environment Department, Town Hall, Bolton BL1 1RU. Tel: 01204 522311, Fax: 01204 387153, web address: www.bolton.gov.uk

Bury Metropolitan Borough Council, Development and Environmental Services Department, Craig House, 5 Bank Street, Bury BL9 0DN. Tel: 0161 253 5000, Fax: 0161 253 5290, web address: www.bury.gov.uk

Greater Manchester Geological Unit, University of Manchester, Oxford Road, Manchester M13 9PL. Tel: 0161 275 7150, Fax: 0161 275 7151, web address: www.gmgu.org.uk

Oldham Metropolitan Borough Council, Environmental Services Department, PO Box 30, Civic Centre, West Street, Oldham OL1 1UQ. Tel: 0161 911 3000, Fax: 0161 911 3104, web address: www.oldham.gov.uk

Rochdale Metropolitan Borough Council, Planning Services and Environmental Department, PO Box 32, Telegraph House, Baillie Street, Rochdale OL16 1JH, Tel: 01706 647474, Fax: 01706 864180, web address: www.rochdale.gov.uk

Salford City Council, Development Services Directorate, Planning & Building Control Division, Civic Centre, Chorley Road, Swinton M27 5BW, Tel: 0161 794 4711, Fax: 0161 727 8269, web address: www.salford.gov.uk

Stockport Metropolitan Borough Council, Environment and Economic Development Division, Hygarth House, 103 Wellington Road South, Stockport SK1 3TT, Tel: 0161 480 4949, Fax: 0161 953 0013, web address: www.stockport.gov.uk

Tameside Metropolitan Borough Council, Environmental Services Department, Council Offices, Wellington Road, Ashton under Lyne OL6 6DL, Tel: 0161 342 8355, Fax: 0161 342 3111, web address: www.tameside.gov.uk

Trafford Metropolitan Borough Council, Trafford Town Hall, Talbot Road, Stretford, Manchester M32 0YY, Tel: 0161 912 1212, Fax: 0161 912 4490, web address: www.trafford.gov.uk

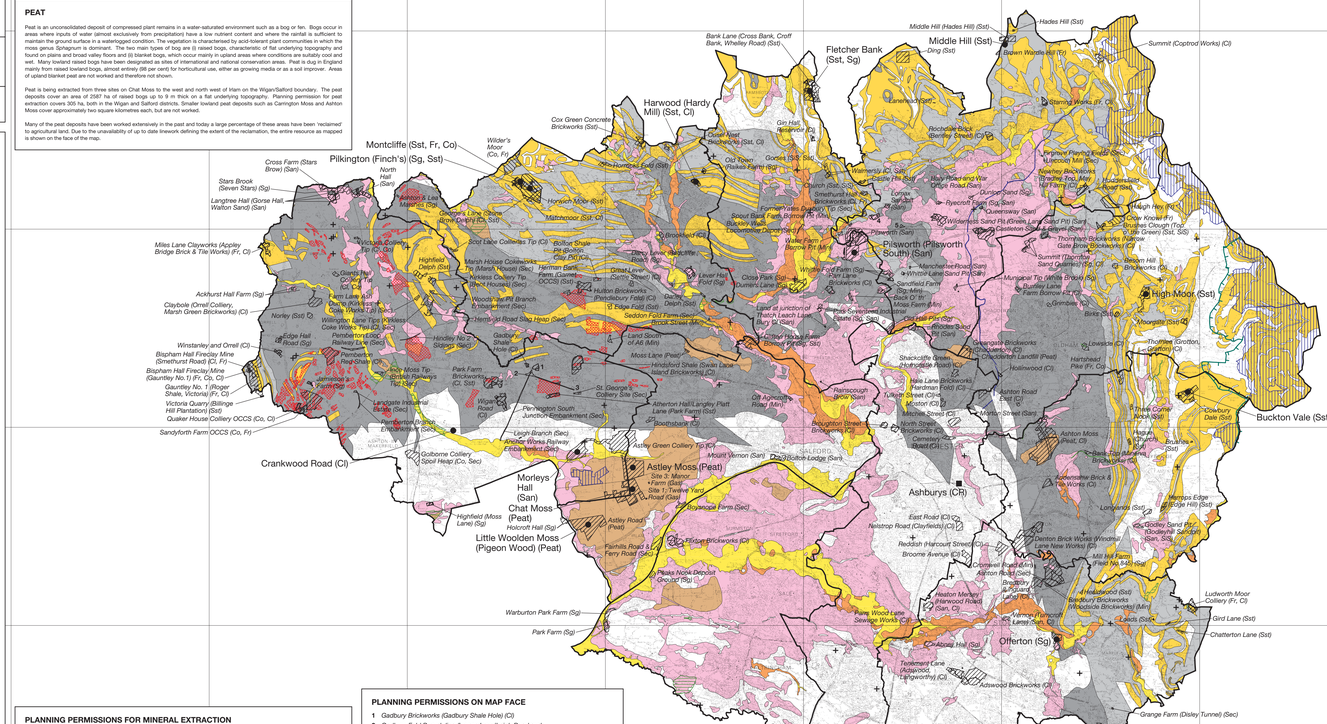
Wigan Metropolitan Borough Council, Borough Planning Department, Civic Buildings, New Market Street, Wigan WN1 1RP, Tel: 01942 244991, Fax: 01942 404222, web address: www.wiganmbc.gov.uk

COAL

The area lies predominantly within the South Lancashire Coalfield. The coal-bearing strata of the Pennine Coal Measures (Upper Carboniferous) generally dip to the southwest and west. The South Lancashire Coalfield crops out across an area of approximately 970 km^2, stretching from Rochdale in the east to St Helens in the west. A spur runs southwards from Rochdale to just south of Stockport. In the east and north, older Namurian strata are present at outcrop and to the west and south, Permo-Triassic strata uncorformably overlie the Coal Measures. To the south, the coalfield deepens significantly to greater than 3000 m below Ordnance Datum beneath Permo-Triassic strata and passes into the Cheshire Basin. A substantial portion of the coalfield is covered by urban development.

Coal seams are numerous with in excess of 36 named coal seams, which vary laterally in both thickness and composition, chiefly by variation in the number of dirt partings present within the seam. Coals are mainly present within the Pennine Lower and Middle Coal Measures, with a few additional coals in the lower part of the Pennine Upper Coal Measures. The main coal-bearing interval typically varies from about 590 m in the west to 880 m in the east. The lower part of the Pennine Lower Coal Measures, below the Arley seam, typically contains coals that are thin and of variable quality. The rest of the Pennine Lower and Middle Coal Measures form the most important coal-bearing interval, with a number of coals in excess of 2 m in thickness. Coals from the Pennine Upper Coal Measures are generally thin, the exception being the Worsley Four Foot, which can be up to 1.8 m in thickness. Coal rank ranges from high to medium volatile.

There are no operating deep mines in the area, the last, Parkside, was closed in 1993. Any future commercial interest in coal extraction is likely to be confined to coal that can be recovered by surface mining. Historic opencast mining has occurred in the Wigan Coalfield, which has been mined for seven centuries, and across the north of the area. Opencast mining in the east has been limited by the steeper dip of the strata in this area. Recent, small-scale opencast production has been confined to the Wigan Coalfield, but there has been no production since 2000. Although there is potential for further opencast mining this is reduced by a number of factors. Firstly the basal part of the Pennine Lower Coal Measures does not contain many thick seams. Hence areas on the northern and eastern flank of the coalfield are probably not economically viable. Secondly there are thick drift deposits (up to 50 m in places) across the coalfield and, thirdly, much of the area is sterilised by urban development. Areas of shallow coal resources and former opencast worked areas are shown on the map.



PLANNING PERMISSIONS ON MAP FACE

1 *Gadbury Brickworks (Gadbury Shale Hole) (Cl)*
2 *Gauley Road Branch line (Lowes Lane/Leigh Road and Gadbury Fold, Atherton) (Sec)*
3 *Squires Lane Branch line (Howe Bridge, Atherton to Squires Lane, Tyldesley (Sec)*
4 *Boo Hole Sand Pit (Bury New Road) (San)*
5 *Former Broadfield Station (Sec)*

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Contact address:
English Nature, Northminster House, Northminster, Peterborough, PE1 1UA. Tel: 01733 455000, Fax: 01733 455103, Web page: www.english-nature.org.uk

Positions of Scheduled Monuments at 25th September 2003 as supplied by English Heritage.
The majority of monuments are plotted using a centred NGR symbol. Consequently the actual area and/or length of a monument protected by the legal constraints of scheduling cannot be represented here. Monuments scheduled since that date are not accounted for. ©Copyright English Heritage.
Contact address:
English Heritage, 23 Savile Row, London, W51 2ET, Tel: 020 7973 3130, Web page: www.english-heritage.org.uk

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Contact address:
Countryside Agency, John Dower House, Crescent Place, Cheltenham, Gloucestershire, GL50 3RA, Tel: 01242 521381, Fax: 01242 584270, Web page: www.countryside.gov.uk

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Contact address:
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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 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.

The crushed rock aggregate resources of Greater Manchester are confined to Carboniferous sandstones, which are relatively extensive but do not provide a source of high quality aggregate.

Sandstone

The Carboniferous sandstones of the Millstone Grit and Pennine Coal Measures of Greater Manchester have traditionally been extensively used as a source of building stone and today both disused and working quarries are a common feature of the landscape.

Carboniferous sandstones consist of sand-sized particles, with minor pebbles, composed dominantly of quartz, but also with some feldspar, which are cemented by silica, to a greater or lesser extent. The sandstones are typically buff-coloured, although locally grey, and vary from fine to coarse-grained.

Most of the sandstones are too weak and porous to make good quality aggregate for roadstone and concrete, but maybe suitable for fill and for the production of manufactured sand to produce reconstituted stone products.

There are currently 7 working sandstone quarries working Carboniferous sandstones in Greater Manchester. Most quarries produce blockstone or a range of masonry products and some produce crushed aggregate for less demanding specifications.

There are many sandstones of Carboniferous age. However the Haslingden Flags, the Fletcher Bank Grit, Kinderscout Grit (Millstone Grit), Ousel Nest Grit and Old Lawrence Rock (Pennine Lower Coal Measures) are the most extensively worked. Production of sandstone in Greater Manchester was just over 1 million tonnes in 2004. Permitted reserves are of the order of 20 million tonnes.

SAND AND GRAVEL

Sand and gravel are defined on the basis of particle size rather than composition. In current commercial practice, following the introduction of new European standards from 1st January 2004, the term 'gravel' (or more correctly coarse aggregate) is used for general and concrete applications to define particles between 4 and 80 mm, and the term 'sand' for material that is finer than 4 mm, but coarser than 0.063 mm. For use in asphalt 2 mm is now the break point between coarse and fine aggregate. Most sand and gravel is composed of particles that are rich in silica (quartz, quartzite and flint), but other rock types 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 construction fill.

Production of sand and gravel in Greater Manchester is about 0.24 million tonnes in 2004, according to the Annual Minerals Raised Inquiry, Office for National Statistics. No separate figures are available for permitted reserves in Greater Manchester but these are believed to be small. In 2003 total permitted reserves of sand and gravel in Greater Manchester, Merseyside, Halton and Warrington were 6.7 million tonnes. (North West Regional Aggregates Working Party Annual Report, 2003).

Sand and gravel resources occur in a variety of geological environments. In Greater Manchester these resources occur mainly within superficial or 'drift' deposits, subdivided into river sand and gravel and glaciofluvial sand and gravel; the most important are the glaciofluvial deposits.

Superficial Deposits

Glaciofluvial sand and gravel

These are deposits mapped as the products of deposition by glacial melt waters and are nowadays commonly labelled on BGS maps as glaciofluvial 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 mappable, irregular lenses within the till sequence. Areas of wholly consisted, and thus unknown, bodies of sand and gravel may occur under spreads of till and other drift deposits.

Glaciofluvial deposits cover large areas of Rochdale, Bury and Trafford but are mainly fine-grained and are largely devoid of gravel. They vary considerably in thickness but may be over 30 m thick where they fill pre-glacial hollows or buried valleys or form moraines. Sands and gravels are derived from the erosion of local bedrock by the action of ice and water and, as such, mudstones and coal fragments can be common and make the working of a deposit difficult. Glaciofluvial sand and gravel are being worked at Pilsworth South pit in Heywood, Bury. Large areas of potential resource have been sterilized by urban development.

Extensive sheets of sand and gravel, averaging 2 m to 3 m thick, were laid down in the valley of the Mersey east of Stockport, the Bollin below Styal, the Micbenhey Brook, Irwell, Dane and Weaver, all of which drain into the Mersey Estuary. In the lower reaches of all these rivers there is the same pattern of a top terrace, in places more than 10 m above present river level, and very wide compared with the later terraces, which form a gravel including present day alluvium confined to the immediate vicinity of the river. At the formation of the high terrace there took place an event that suddenly lowered the base level to which the rivers were being graded. This happened to all the rivers mentioned above simultaneously, for their high terraces are at grade with one another. This high terrace phenomenon is limited in this area to the Mersey watershed.

The high terraces of the Mersey Basin were most probably formed at the end of the last ice Age when the mouth of the river was still blocked by ice in the Irish Sea; thus water was ponded up in the lower Mersey valley and escaped over the neck of the Wirral peninsula. The spillway over the Wirral controlled the base level and it is to this that the high terrace is graded to. The sudden fall in the base level of the rivers took place when the last glacial ice melted and the present Mersey channel became open. The high terrace is currently being worked along with more recent river terraces of the River Mersey at Offerton Gyratory.

River Sand and Gravel (terrace and sub-alluvial deposits)

Resources occur in both raised river terrace sequences flanking the modern floodplains and in floodplain terrace deposits associated with, and underlying, present day alluvium. This sequence of deposits are best developed along the Rivers Mersey, Irwell, Croal and Roch with a succession of deposits formed representing accumulations of sand and gravel in response to falling sea level in Pleistocene times. Less developed terrace deposits occur along the River Tame, Middle Brook, Hey Brook and Moss Brook. The deposits typically consist of upwardly fining and laterally graded spreads of gravel, sand, silt and clay. Alluvium deposits in the area are usually thin and of little significance when compared to the sands and gravels of the high terrace. The composition of river sand and gravel generally reflects the rocks drained by the river and its tributaries. In this case it is mainly Carboniferous sandstones and mudstone, which are weak and friable and only suitable for low-grade uses such as construction fill.

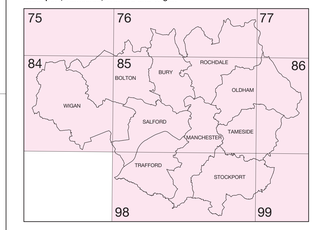
Blown sand

Overlying the glacial till is an irregular, discontinuous layer of wind blown sand referred to as the Shirdley Hill Sand. The sand, which is typically only about 1 to 1.5 m thick, although locally thicker, is younger than the glacial deposits and has immediately beneath a cover of topsoil. The sand is characteristically uniform in both composition and grain size distribution, reflecting its wind-blown origin. Most of the sand particles fall in the range 0.5 mm to 0.1 mm, which is unsuitable for construction use. The Shirdley Hill Sand was formerly worked in St Helens and Lancashire for glass sand, and particularly for flat glass manufacture. However, these operations ceased in the mid-1970s. A number of thin spreads of blown sand resembling Shirdley Hill Sand have been noted on the terraces of the Mersey and Bollin but are too thin to be considered economic. Wind-blown sands are generally too fine-grained and uniform size for aggregate use. They are therefore not shown on the map.

Bedrock deposits

Additional resources of sand and gravel may be won from exploiting suitable bedrock deposits. Triassic sandstones of the Sherwood Sandstone Group are being worked at Morleys Hall Quarry, southeast of Leigh, to produce sand for mortar and asphalt. The Sherwood Sandstone has been deeply weathered in places by a tropical climate during pre-glacial times. The upper part of the sandstone, immediately below the drift cover, is sometimes weathered to the extent that the cementing material between the sand grains has disintegrated leaving the original quartz grains in the form of sand that can be worked without substantial crushing. The weathered portions of the Sherwood Sandstone usually do not have an ideal particle size distribution for use in mortar, concrete or asphalt and usually the sand is too fine grained or too weak for use as concrete aggregate. Difficulties in removing overburden in the form of glacial till and extra treatment in crushing, however minor, together with washing and slime removal can often make the resource uneconomic compared to more easily worked glacial sands. The Sherwood Sandstone is, therefore, rarely worked and is not shown on the map.

BGS maps covering Bolton, Bury, Manchester, Oldham, Rochdale, Salford, Stockport, Tameside, Trafford and Wigan



1:63 360 or 1:50 000 map published

Current digital availability of these sheets can be found on the British Geological Survey website: www.bgs.ac.uk

BUILDING STONE

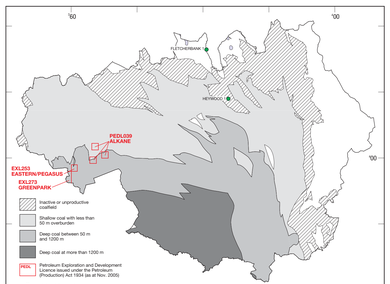
Natural stone is the traditional building material of Britain and the built environment is perhaps the most visible aspect of our cultural heritage. Production and usage of natural stone has declined since the high point of the industry in the late 19th Century, largely because of competition from cheaper alternatives, such as brick and concrete. However, more recently there has been an increased interest in natural stone and the prospects for the industry remain buoyant.

A wide range of rock types is used as building stones. In the area these comprise building sandstones, principally of Carboniferous and Permo-Triassic age. The working of local sandstones for block stone, flagstone and roofing 'slate' was very widespread in the past and almost every Carboniferous sandstone outcrop shows evidence of quarrying. However, currently only four quarries in the area are working Carboniferous sandstone for building stone.

The oldest rocks that were quarried for building stone and flagstone are from the Millstone Grit Group (Carboniferous) which crops out along the northern and eastern margins of the area. The principal sandstone quarries were located around Littleborough (Calderbrook and Long Lees) in the Huddersfield White Rock; at Stalybridge (Buckton Moor) in the Kinderscout Grit; around Horwich (Smithills Moor), Ramsbottom (Quarlton, Crowthorne, Limefield, Badlingstone, Holcombe, Rooley, Ashworth), Milnrow, Gee Cross and Marple Bridge in the Rough Rock.

Quarrying of the Pennine Lower Coal Measures sandstones was extensive e.g. at Whitworth (Middle Hill, Hades Hill and Higher Slack), Burnt House Moor (Pinfold); near Bolton (Doffcocker, Moor Gate, Ridgeway in the Ouzel Nest Grit); and near Stalybridge. The Pennine Middle Coal Measures sandstones were quarried at Oldham Edge, Farnworth and Peel Hall. The small outcrop of Pennine Upper Coal Measures at Collyhurst (Worsley Delf Rock) was also an important source of building stone in the past.

The red Permian and Triassic sandstones at Collyhurst (Appleby Group) and Timperley (Sherwood Sandstone Group) were worked for building stone to a limited extent in the past.



HYDROCARBONS

Conventional Oil and Gas

Greater Manchester is perceived as having poor hydrocarbon prospectivity. Permo-Triassic strata in the south of the area form the Cheshire Basin. This is linked to the offshore East Irish Sea Basin, within which hydrocarbons (mainly gas) have been discovered in a number of fields. Oil has also been produced from the Douglas and Lennox fields. There is also the presence of the small enigmatic Formby Oilfield onshore to the west in Merseyside. The oilfield is thought to owe its existence to the breaching and migration from a deeper (older) Carboniferous trap and is capped by glacial boulder clay.

Carboniferous strata (Namurian mudstones and Westphalian Coal Measures) provide source rock potential both in Greater Manchester area and surrounding districts and the wider area has attracted interest from oil companies. Exploration has been ongoing for many years, with many kilometres of seismic reflection data acquired and hydrocarbon exploration wells drilled. Many of these wells have tested Triassic prospects within the Cheshire Basin, but have proved to be dry. Within the Greater Manchester area, the Fletcherbank 1 and Heywood 1 wells (see Table below) tested Carboniferous plays. Both wells were plugged and abandoned as dry, although Heywood had minor hydrocarbon shows.

Perhaps the best prospects, therefore, represent intra-Carboniferous plays with accumulations that have been little disturbed since their formation and charging. The yields from such plays would be small and the current hydrocarbon licence situation reflects the fact that prospectivity in Greater Manchester is not presently perceived as great. Indeed, the four small licence blocks presently operated are from former larger licence block areas and relate not to oil exploration, but to coalbed methane or mine gas (methane) development (see below).

Hydrocarbon exploration wells in Greater Manchester

Exploration Well	Drilling date	Original operator	Current licence area and operator	Status
Fletcherbank 1	1958-59	Steel Brothers Company Ltd	open acreage	Plugged and abandoned, dry
Heywood 1	1984	BP Development Company Ltd	open acreage	Plugged and abandoned, dry, minor hydrocarbon shows

Abandoned Mine Methane (AMM), Coal Mine Methane (CMM) and Coalbed Methane (CBM) potential

During the process of coal formation through the conversion of plant matter into coal, gases are produced which are either adsorbed onto the coal or dispersed into pore spaces around the coal seam. The generic term for this gas is coalbed methane (CBM). The majority of the gas is attached to the coal surface in micropores. However, during mining the coal is destressed or fractured which releases significant quantities of CBM. Further gas is released during the life of the mine and after mining has ceased. This gas is an environmental hazard but it is also a potential source of energy. This potential depends on the gas content, permeability and total thickness of the coal present.

CBM can be exploited in various ways:

- Extraction from operational mines for safety reasons prior to it entering the mine air stream (coal mine methane - CMM),
- Coal extracted from abandoned mines (abandoned mine methane - AMM),
- Extraction from virgin or unmined coal from surface boreholes (virgin coalbed methane - VCBM)

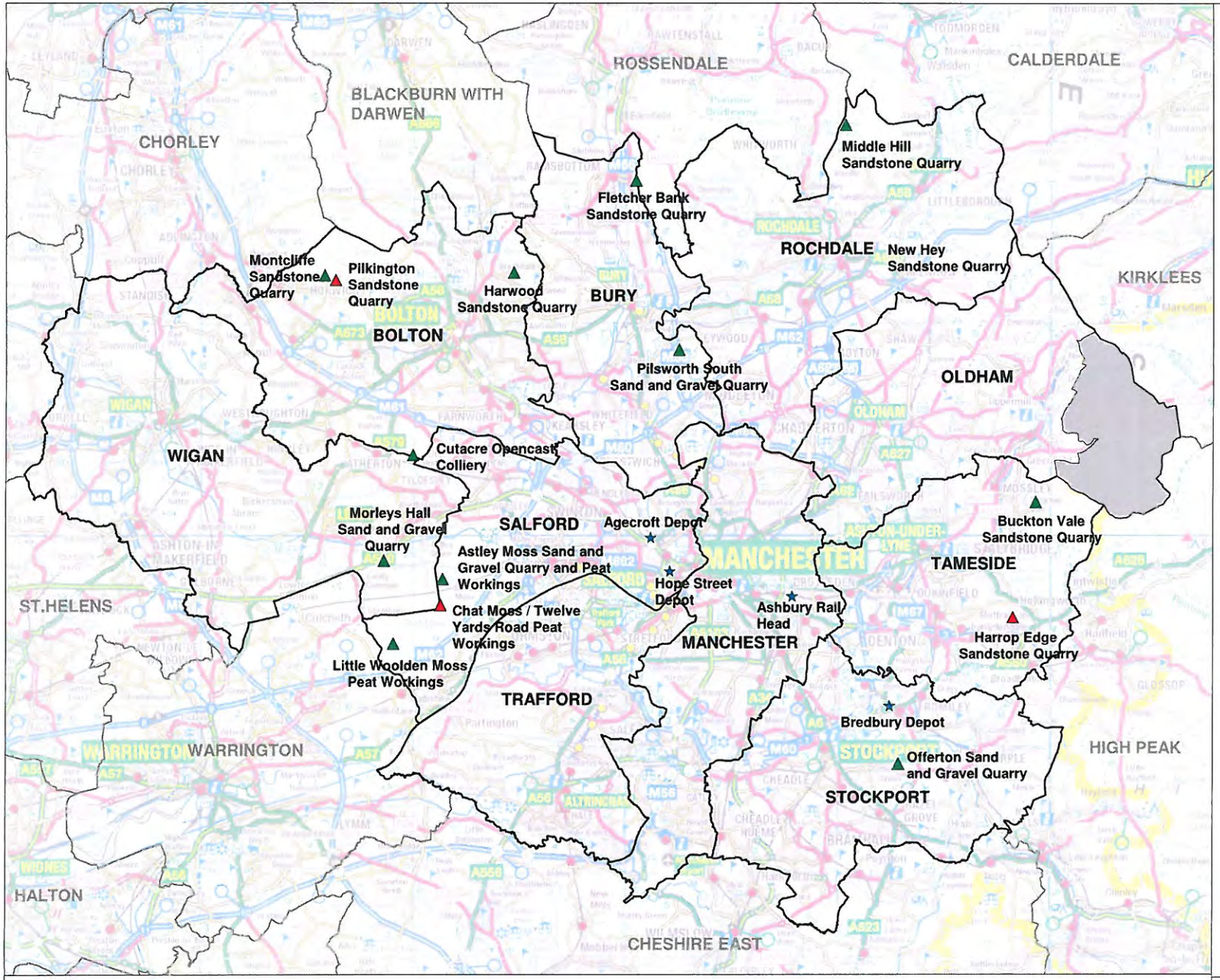
There are no operational coal mines in the area and thus there is no CMM potential.

The Pennine Lower and Middle Coal Measures of the South Lancashire coalfield comprise a succession up to 880 m thick, with 36 named coals present, attaining a maximum seam thickness of >3 m and producing 20-25 m total coal thickness. Historically, gas has been encountered in the coalfield, with some seams noted for their 'coal gas' the fuel gas produced from a high-volatile bituminous coal. The coals are high to medium, volatile bituminous types with methane contents of up to 9.53 m^3 per tonne of coal, and average methane contents of 8.2m^3 per tonne of coal.

The concept of Abandoned Mine Methane capture in the UK goes back to the 1950s when Old Boston Mine in the Lancashire Coalfield was sealed and then topped to supply gas to the adjacent Wood Colliery. This previously successful scheme has perhaps been influential in the interest generated in Abandoned Mine Methane (AMM), Coal Mine Methane (CMM) and Coalbed Methane (CBM) in the South Lancashire and North Wales coalfield areas over recent years.

Old Boston Mine lies just to the west of the area. Currently, the small licence areas EXL253 (Eastern/Pegasus) and PEDL029 (Alkane Energy) representing AMM and CBM interests in the west of the county, adjacent to the Old Boston Mine area, represent the retained areas of formerly much larger licence block areas. The relinquishment of large areas of these licence blocks perhaps suggests that prospects for AMM (and CBM) in the area are not now perceived as particularly good. This may be because any former mines are long abandoned and thus are likely to be flooded, provide poor yields, or that the financial/taxation scheme is unhelpful at present.

In the USA, coalbed methane is produced from virgin coals containing 7 or more m^3 of methane per tonne of coal. The average gas content of the coals in the South Lancashire Coalfield is 8.2 m^3 of methane per tonne of coal, which is above the economic threshold in America. However, the South Lancashire Coalfield has been heavily worked and CBM development from virgin coals may not be a prospect in unmined areas.



Greater Manchester Districts

Neighbouring District Boundaries

Peak District National Park - although located within Oldham it is not part of the Minerals Plan area

Inactive Mineral Extraction Sites

Active Mineral Extraction Sites

Rail Depots

Inactive sites are those which have not been worked at any point within the previous year. In this case January - December 2010.

The following quarries have been identified by the English Heritage BGS Strategic Stone Study (SSS) as being important for maintaining and repairing historic buildings:

Buckton Vale
Harwood Quarry
Fletcher Bank Quarry
Middle Hill Quarry
Montcliffe Quarry

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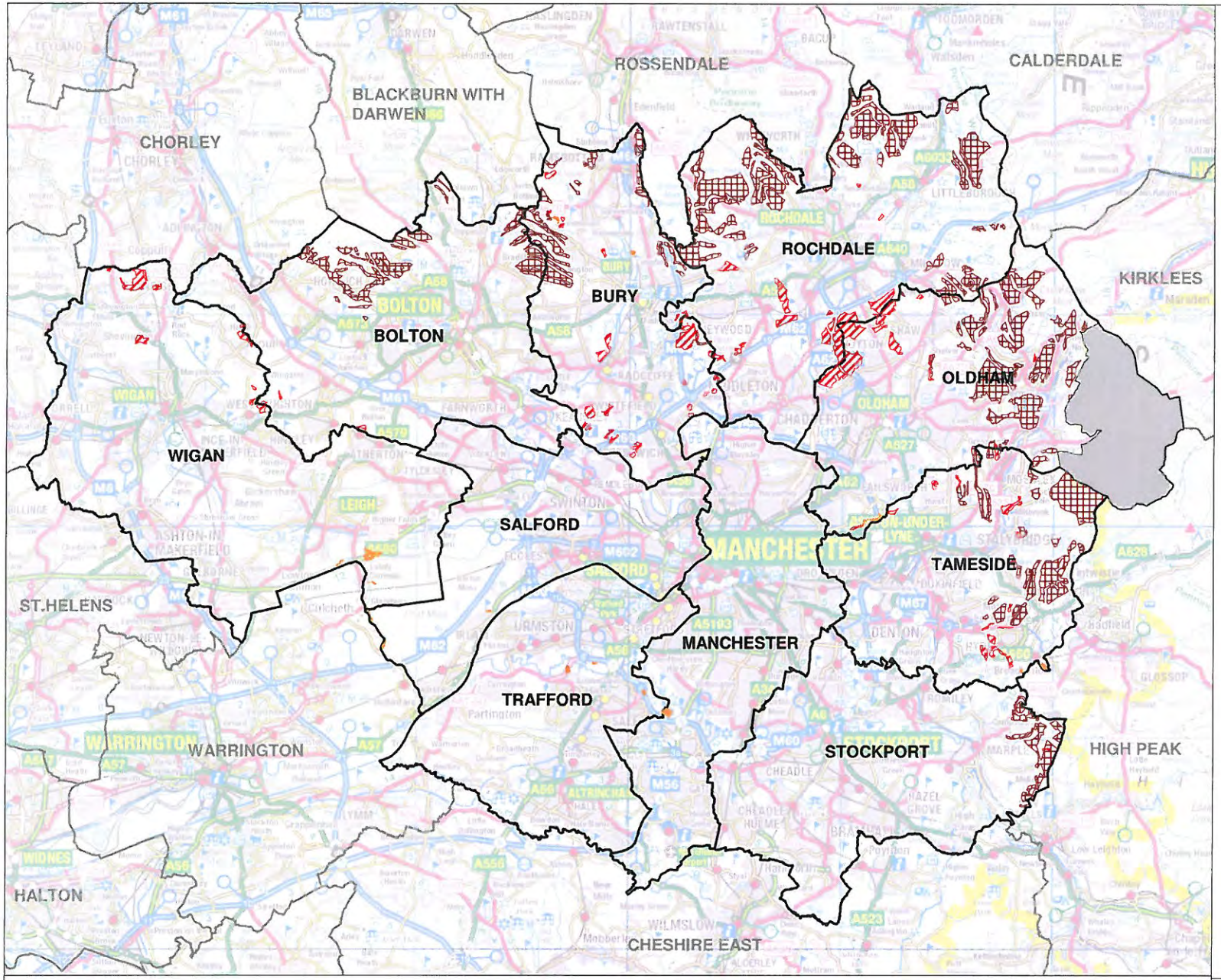
Scale @ A3
1cm = 1.85km

Map 1 - Existing Quarries with planning permission and Rail Depots used for minerals transportation within Greater Manchester



Neighbouring District Boundaries

Greater Manchester District Boundaries

Peak District National Park - although located within Oldham it is not part of the Minerals Plan area

Area of Search for Sand

Area of Search for Sandstone

Area of Search for Gravel

Map 2 - Areas of Search for Minerals in Greater Manchester

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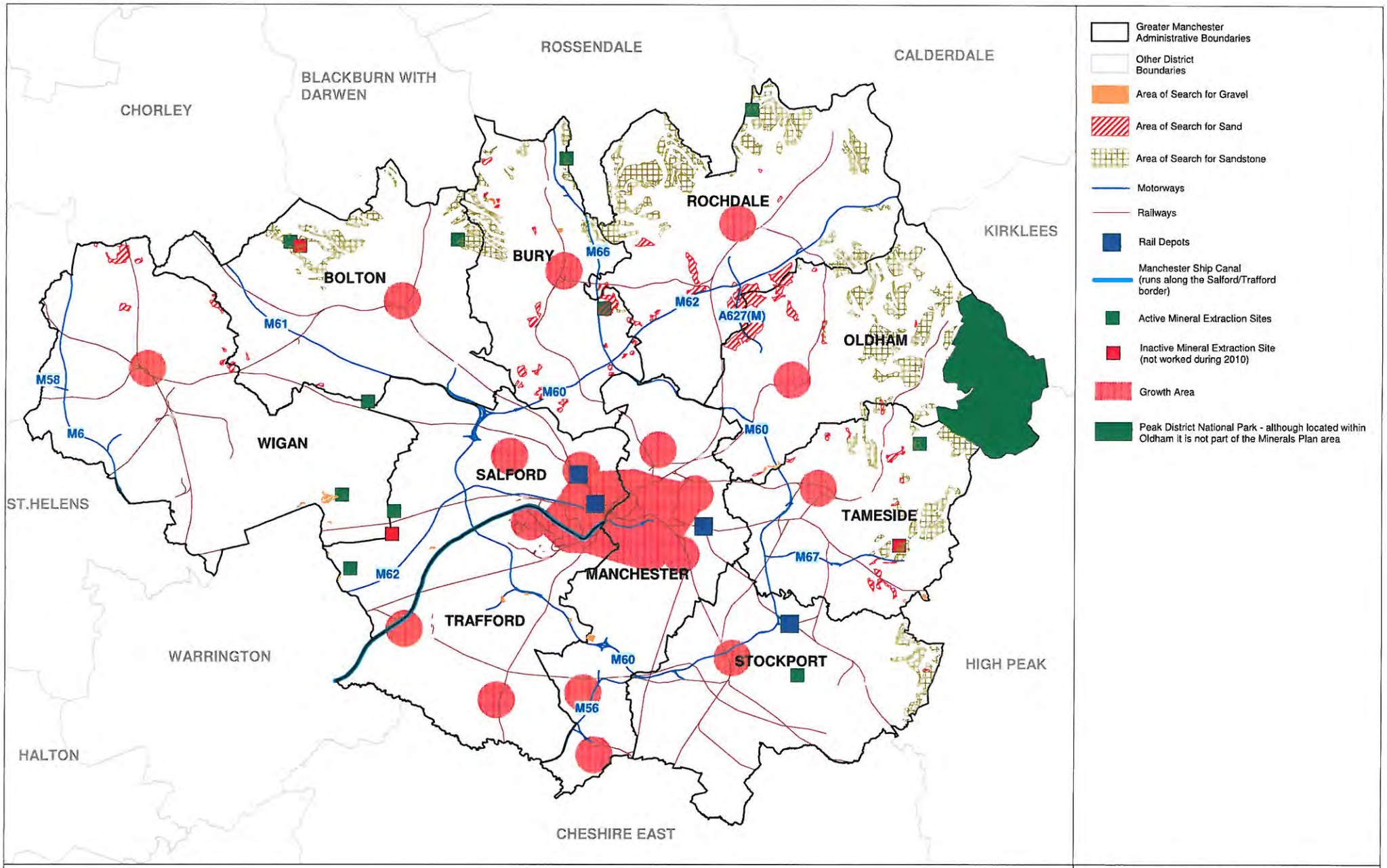

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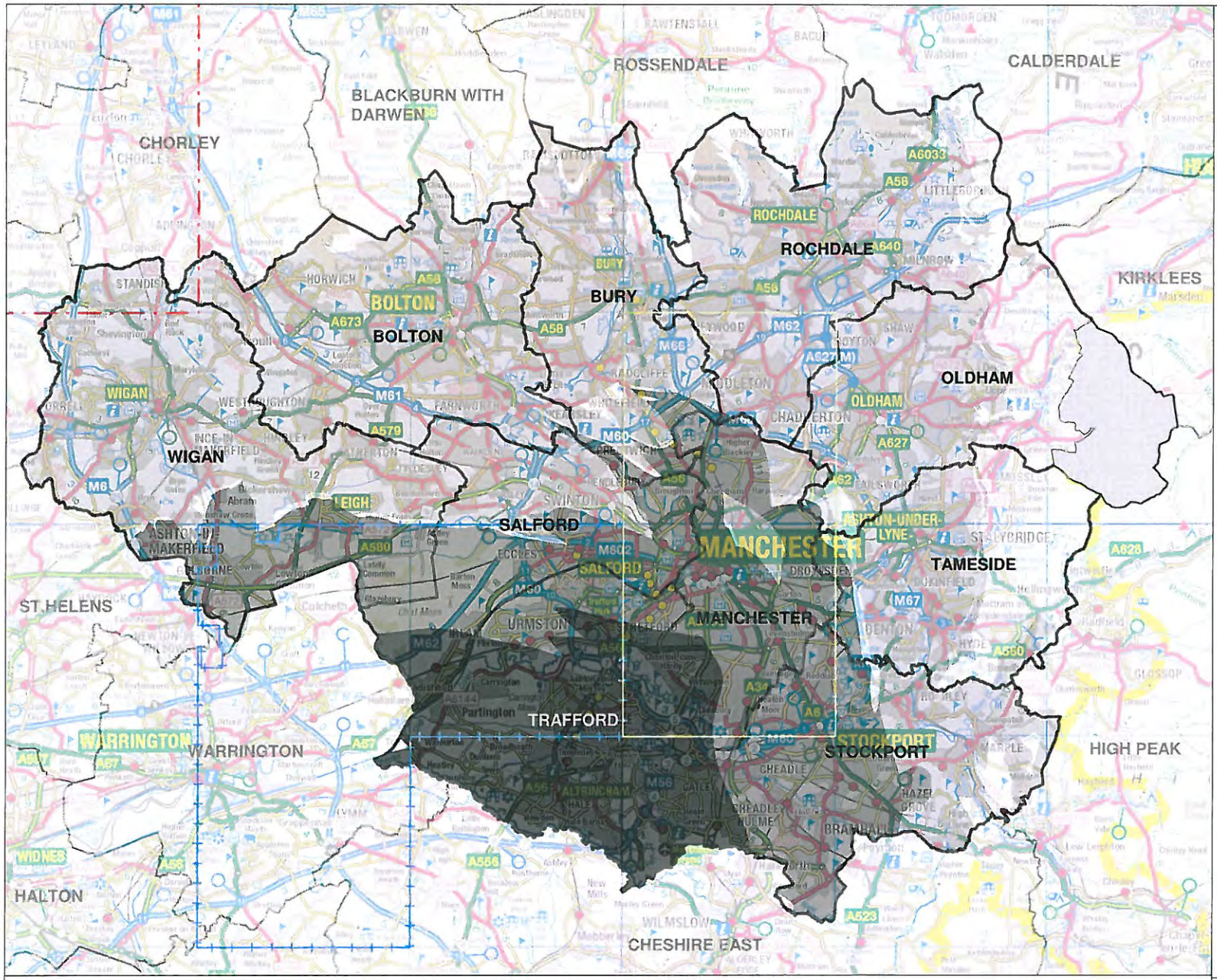
Scale @ A3
1cm = 1.85km

Map 2a - Greater Manchester Spatial Distribution of Mineral Sites and Rail Depots with Key Locational Criteria



Greater Manchester Districts

Neighbouring District Boundaries

PEDL 165

PEDL 166

PEDL 193

Deep Coal Resource (1,200m +) - potential for Coal Bed Methane and other unconventional gas resource

Shallow Coal Resource (50 - 1,200m) - potential for Coal Bed Methane and other unconventional gas resource

Workable Surface Coal Resource

Peak District National Park - although located within Oldham it is not part of the Minerals Plan area

The extent of the coalfield with reserves at depths of 200 - 1,500m have potential for Coal Bed Mathane Extraction

Information on PEDLs was up to date at time of Publication. For up to date PEDL information please refer to the Department of Energy and Climate Change (DECC)

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Scale @ A3
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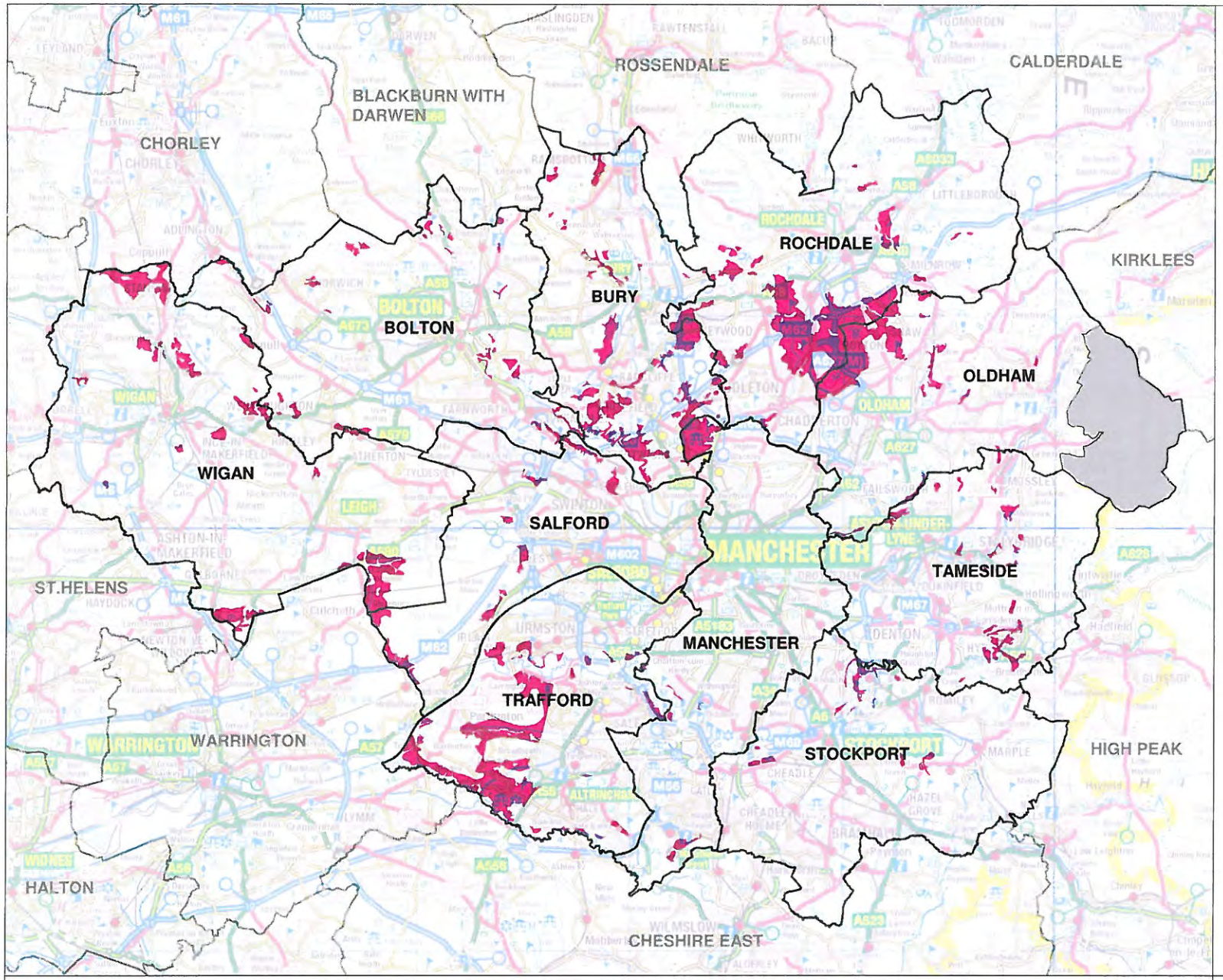
Map 3 - Coal Resource and Petroleum Exploration Development Licenses (PEDLs) in Greater Manchester



Greater Manchester Districts

Neighbouring District Boundaries

Mineral Safeguarding Area for Sand and Gravel

Peak District National Park - although located within Oldham it is not part of the Minerals Plan area

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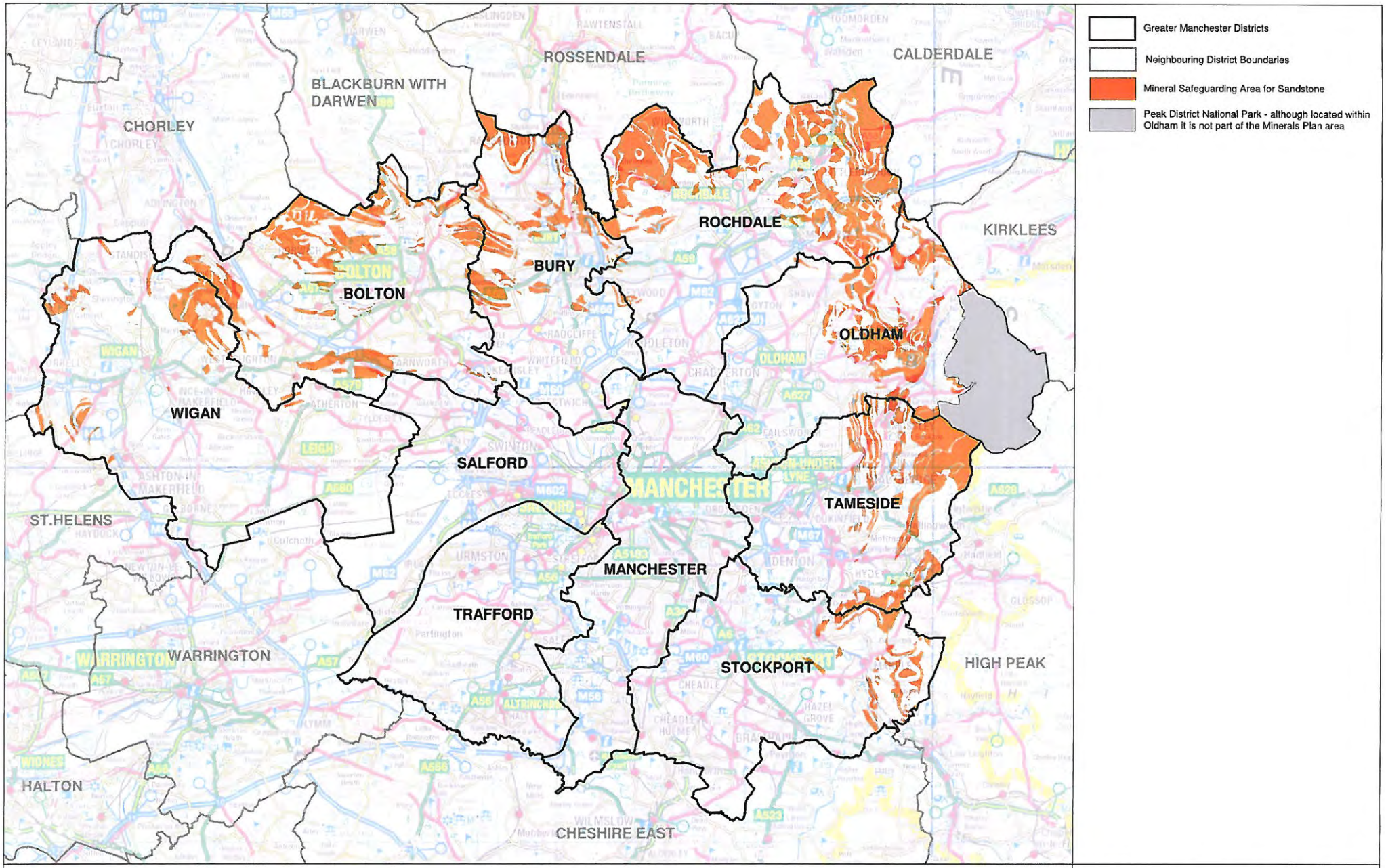
Map 4 - Mineral Safeguarding Area for Glaciofluvial Sand and Gravel



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Scale @ A3
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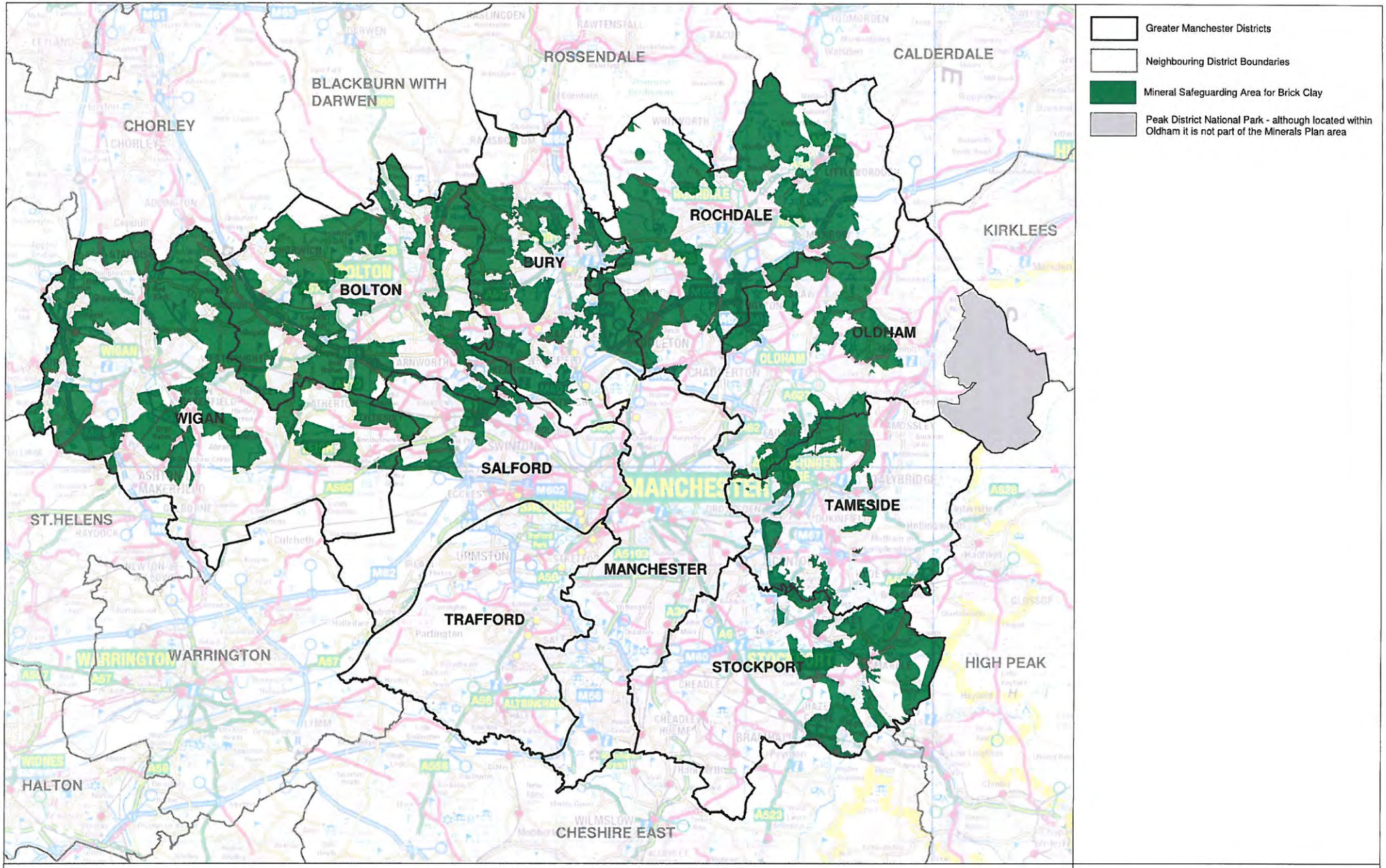
Map 5 - Mineral Safeguarding Area for Sandstone



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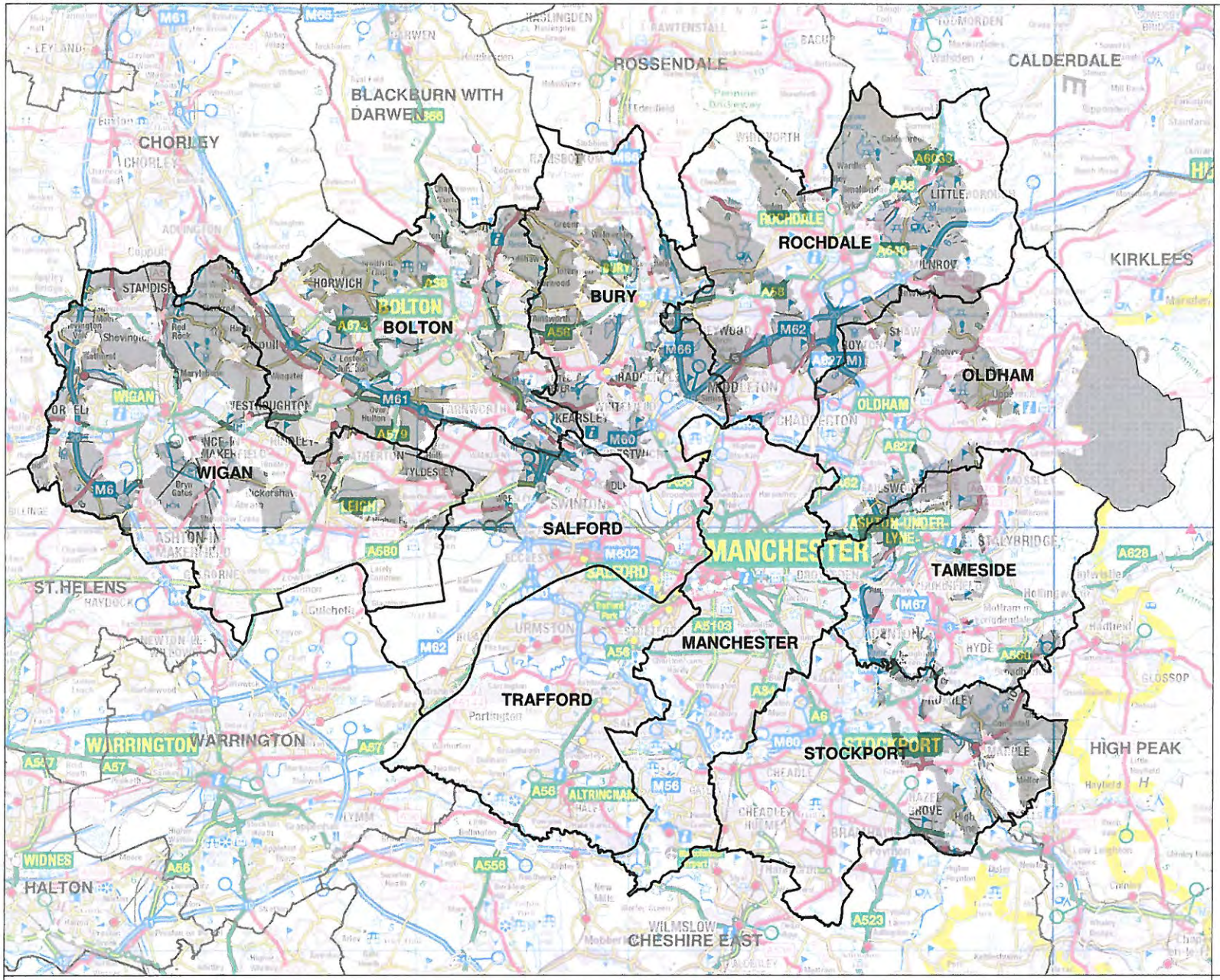
Scale @ A3
1cm = 1.85km

Map 6 - Mineral Safeguarding Area for Brick Clay



Greater Manchester Districts

Neighbouring District Boundaries

Mineral Safeguarding Area for Coal

Peak District National Park - although located within Oldham it is not within the Minerals Plan area

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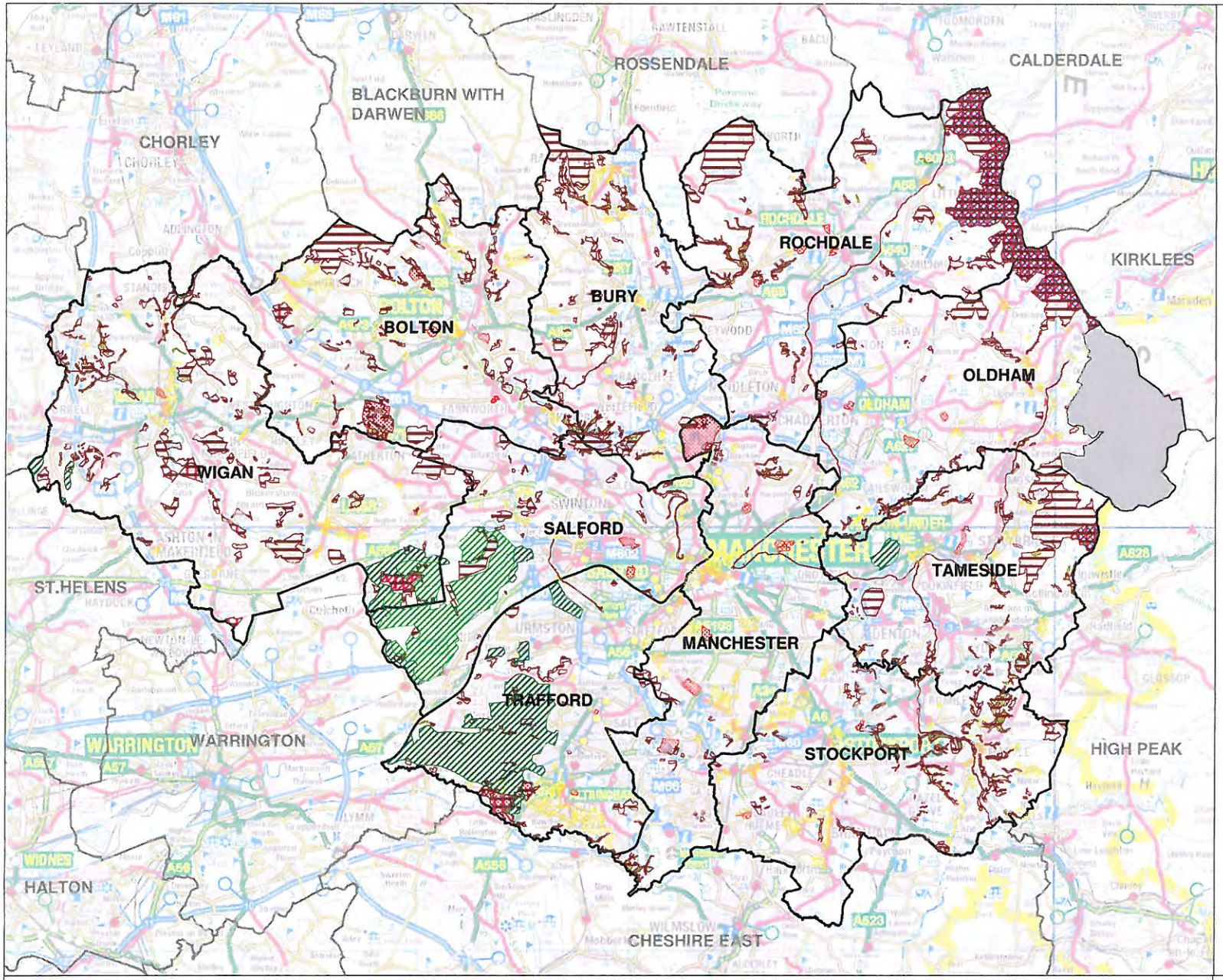
Scale @ A3
1cm = 1.85km

Map 7 - Mineral Safeguarding Area for Coal



- Greater Manchester Districts
- Neighbouring District Boundaries
- Registered Parks and Gardens
- Ancient Woodland
- Special Area of Conservation
- Grade 1 Agricultural Land
- Grade 2 Agricultural Land
- Source Protection Zone
- National Park
- Sites of Special Scientific Interest
- Sites of Biological Importance
- Conservation Areas

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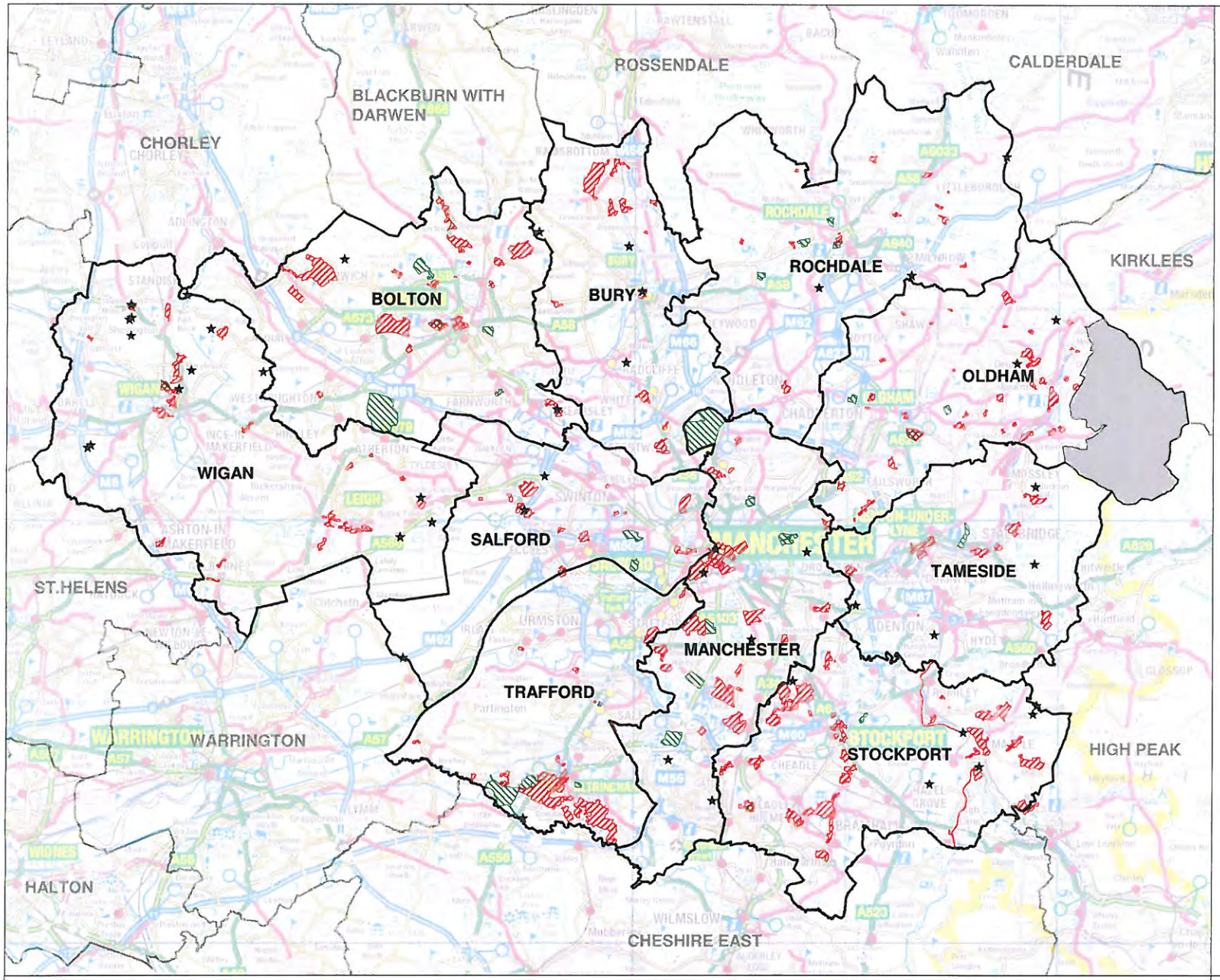
Scale @ A3
1cm = 1.85km

Map 8 - Environmental Designations within Greater Manchester



Greater Manchester Districts

Neighbouring District Boundaries

Peak District National Park - although located within Oldham it is not included within the Minerals Plan area

Conservation Areas

Scheduled Ancient Monuments

Registered Parks and Gardens

There are numerous Listed Buildings within the Greater Manchester sub-region which would be seen as a constraint to developing land. They have not been included on this map as it would make the map un-readable due to the high quantity of them.

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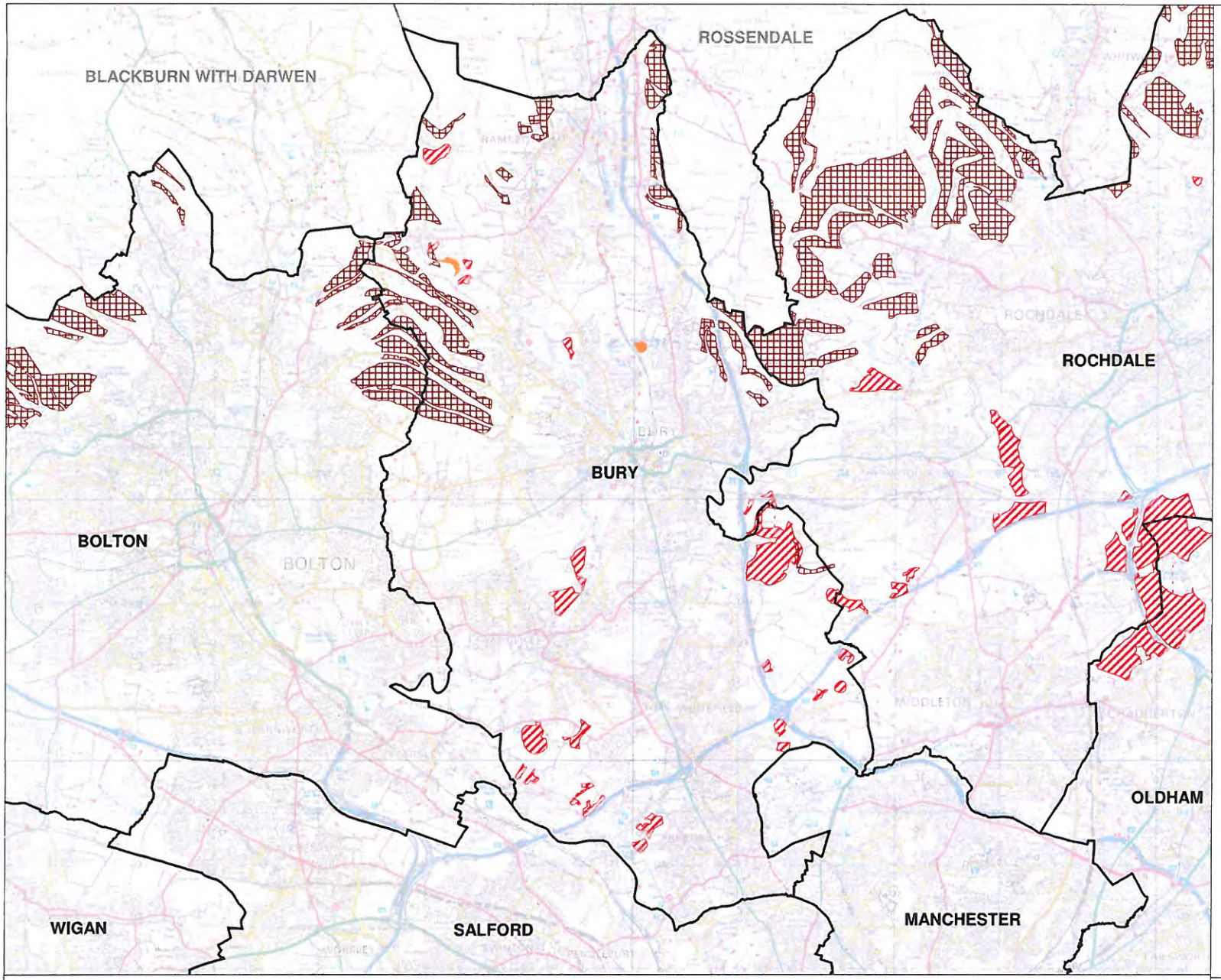
Scale @ A3
1cm = 1.85km

Map 9 - Designated Sites of Historical Importance



Neighbouring District Boundaries

Greater Manchester District Boundaries

Area of Search for Sandstone

Area of Search for Sand

Area of Search for Gravel

Map 11 Areas of Search for Aggregates in Bury

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Scale @ A3
1cm = 0.75km

GEO-RESEARCH LTD.

CALE STREET, CALE GREEN,
STOCKPORT, CHESHIRE

SD 80 SE 1003

CONTRACT: Rochdale Road Relief Sewer. 8620

LOCATION: Manchester 0351

Borehole No. 9

Sheet No. 1

Date Commenced 14th. December 1963

Date Completed 16th. December 1963.

Scale $\frac{1}{4}$ inch = 1 foot.

Stratum	Legend	Thickness	Depth	Sample No.	N Value	Level	Remarks
			G.L.				
Cinder, sand & brick fill.		0'9"	0'9"				
Firm brown and grey mottled clay.			2'0"	D1			
							Very damp.
		6'0"	6'9"				
Firm dark brown sandy clay.			8'0"	D2			
							Damp
		13'9"	20'6"				
Firm brown boulder clay with fine sandy bands.			21'6"	D3			
		3'6"	24'0"				
Borehole complete							On completion of borehole - dry. On withdrawing casing borehole dry.

British Geological Survey

GEO-RESEARCH LTD.
CALE STREET, CALE GREEN,
STOCKPORT, CHESHIRE

SD80SE 1004

CONTRACT: Rochdale Road Relief Sewer

LOCATION: Manchester.

8629
0338

Borehole No. 10
Sheet No. 1
Date Commenced 16th. December 1963
Date Completed 19th. December 1963.
Scale ½ inch = 1 foot.

Stratum	Legend	Thickness	Depth	Sample No.	N Value	Level	Remarks
			G.L.				
Soil and brick fill.		1'0"	1'0"				Moist
Fairly firm brown sandy clay.			2'6"	D1			Very damp.
		5'0"	6'0"				
Medium well graded brown sand.			6'6"	D2			Damp
		1'6"	7'6"				
Fine brown sandy silt.			8'0"	D3			Moist
		4'6"	11'0"				
Fine brown sandy silt.			12'0"	D4			Very moist
							Water struck @ 14'0 Standing level 13'0 Wl 13'0"
		7'0"	18'0"				

Continued on sheet 2.

British Geological Survey

GEO-RESEARCH LTD.

CALE STREET, CALE GREEN,
STOCKPORT, CHESHIRE SD80SE 1004

CONTRACT: Rochdale Road Relief Sewer

LOCATION: Manchester.

Borehole No. 10

Sheet No. 2

Date Commenced 16th. December 1963

Date Completed 19th. December 1963.

Scale ¼ inch = 1 foot.

Stratum	Legend	Thick-ness	Depth	Sample No.	N Value	Level	Remarks
			18'0"				
Fairly fine well graded brown sand with occasional bands of very fine sandy silt.			20'0"	D5			Damp water added
			32'0"	D6			
			35'6"	D7			
		31'0"	49'0"				Borehole @ 51'0" Casing @ 51'0"
gravel and cobbles.			49'6"	D8			
		2'0"	51'0"				5.0pm. 17/12/63 water level [illegible]
Stiff brown sandy boulder clay with 4" cobbles.			52'0"	D9			8.15am. 18/12/63 water level [illegible]
		3'0"	54'0"				Dry

British Geological Survey

GEO-RESEARCH LTD.

CALE STREET, CALE GREEN,
STOCKPORT, CHESHIRE

SD80SE 1004

CONTRACT: Rochdale Road Relief Sewer

LOCATION: Manchester

Borehole No. 10

Sheet No. 3

Date Commenced 16th. December 1963

Date Completed 19th. December 1963.

Scale ¼ inch = 1 foot.

Stratum	Legend	Thickness	Depth	Sample No.	N Value	Level	Remarks
			54'0"				
Very stiff brown boulder clay.			55'0"	D10			Dry
							Borehole @ 66'0" Casing @ 57'0" 5.15pm. 18/12/63 water level 62'0" 8.15am. 19/12/63 water level 62'0"
		14'0"	68'0"				
Fairly fine well graded brown sand with bands of very fine sandy silt.							Damp
			71'0"	D11			water added
			75'0"	D12			
			78'0"	D13			19/12/63
							On completion borehole @ 8' Casing @ 60'0
		13'0"	81'0"				
Borehole complete							Borehole dr
							On withdrawi casing to 20' hole dry, an to 76'0"
							20/12/63 8.30 with no in hole wate
							W2 13'6"

British Geological Survey

GEO-RESEARCH LTD.

CALE STREET, CALE GREEN, STOCKPORT, CHESHIRE

SD80SE 1005

CONTRACT: Rochdale Road Relief Sewer.

8018 0333

LOCATION: Manchester

Borehole No. 11

Sheet No. 1

Date Commenced 20th. December 1963

Date Completed 23rd. December 1963.

Scale: ¼ inch = 1 foot.

Stratum	Legend	Thickness	Depth	Sample No.	N Value	Level	Remarks
			G.L.				
Dark top soil.		2'0"	2'0"				Moist
Fairly fine well graded brown sand.		2'0"	2'6" 4'0"	D1			Damp
Fine brown sandy silt.		4'0"	5'0" 8'0"	D2			Very moist
Medium well graded brown sand.		4'0"	9'0" 12'0"	D3			Damp
Fairly fine well graded brown sand with occasional bands of very fine sandy silt.			13'0"	D4			Damp Water added Borehole @ 22'0" Casing @ 22'0" 5.pm. 20/12/63 Standing level 17' 8.45am. 21/12/63 Standing level 17' WL 17'6"
			26'0"	D5			Water added
Stiff brown sandy boulder clay.		10'0" 2'0"	32'0" 33'0" 34'0"	D6			Borehole sealed on driving casing into boulder clay. Dry

Continued on sheet 2.

British Geological Survey

GEO-RESEARCH LTD.

CALE STREET CALE GREEN
STOCKPORT, CHESHIRE

SD80SE 1005

Borehole No. 11

Sheet No. 2

Date Commenced 20th. December 196

Date Completed 23rd. December 1

CONTRACT: Rochdale Road Relief Sewer.

LOCATION Manchester.

Scale ½ inch = 1 foot.

Stratum	Legend	Thickness	Depth	Sample No.	N Value	Level	Remarks
			34'0"				
Very stiff brown boulder clay.			36'0"	D7			Dry Water added
		9'0"	43'0"				
Stiff brown clay with fine sandy bands.			43'6"	D8			Dry
		1'6"	44'6"				
Fairly fine well graded brown sand with bands of very fine sandy silt.			46'0"	D9			Damp Water added
			52'0"	D10			
		14'6"	59'0"				On completion Borehole @ 59 Casing @ 57 Standing level 5
Borehole Complete							On withdrawi casing stanni level of water 5

British Geological Survey

APPENDIX 7

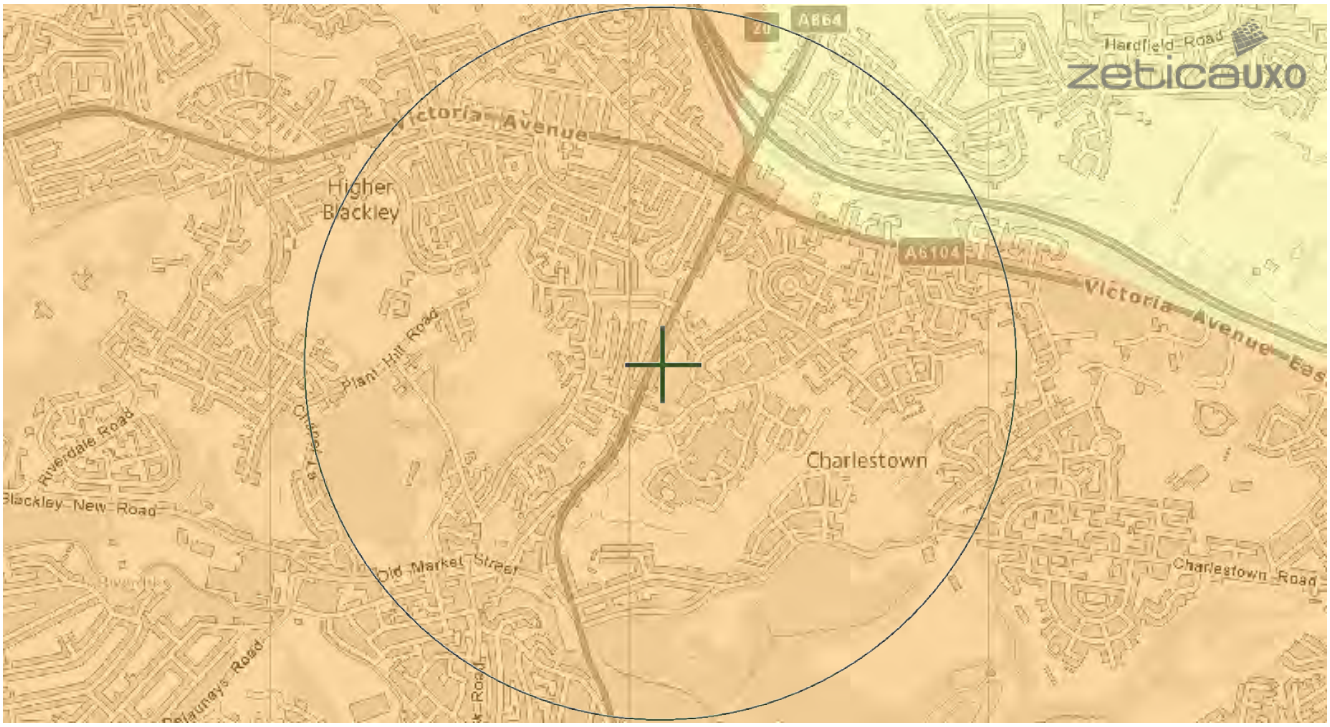
ZETICA UXO RISK MAP

UNEXPLODED BOMB RISK MAP

zeticauxo

SITE LOCATION

Location: M9 7EQ,
Map Centre: 386098,403499



LEGEND

- **High:** Areas indicated as having a bombing density of 50 bombs per 1000acre or higher.
- **Moderate:** Areas indicated as having a bombing density of 15 to 49 bombs per 1000acre.
- **Low:** Areas indicated as having 15 bombs per 1000acre or less.

miltary | **industry** | **UXO find**
transport | **dock** | **Luftwaffe targets**
utilities | **Bombing decoy** | **other**

How to use your Unexploded Bomb (UXB) risk map?

The map indicates the potential for Unexploded Bombs (UXB) to be present as a result of World War Two (WWII) bombing.

You can incorporate the map into your preliminary risk assessment* for potential Unexploded Ordnance (UXO) for a site. Using this map, you can make an informed decision as to whether more in-depth detailed risk assessment* is necessary.

What do I do if my site is in a moderate or high risk area?

Generally, we recommend that a detailed UXO desk study and risk assessment is undertaken for sites in a moderate or high UXB risk area.

Similarly, if your site is near to a designated Luftwaffe target or bombing decoy then additional detailed research is recommended.

More often than not, this further detailed research will conclude that the potential for a significant UXO hazard to be present on your site is actually low.

Never plan site work or undertake a risk assessment using these maps alone. More detail is required, particularly where there may be a source of UXO from other military operations which are not reflected on these maps.

If my site is in a low risk area, do I need to do anything?

If both the map and other research confirms that there is a low potential for UXO to be present on your site then, subject to your own comfort and risk tolerance, works can proceed with no special precautions.

A low risk really means that there is no greater probability of encountering UXO than anywhere else in the UK.

If you are unsure whether other sources of UXO may be present, you can ask for one of our **pre-desk study assessments (PDSA)**

If I have any questions, who do I contact?

tel: **+44 (0) 1993 886682**

email: **uxo@zetica.com**

web: **www.zeticauxo.com**

The information in this UXB risk map is derived from a number of sources and should be used in conjunction with the accompanying notes on our website: **(https://zeticauxo.com/downloads-and-resources/risk-maps/)**

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It is important to note that this map is not a UXO risk assessment and should not be reported as such when reproduced.

*Preliminary and detailed UXO risk assessments are advocated as good practice by industry guidance such as CIRIA C681 'Unexploded Ordnance (UXO), a guide for the construction industry'.

STAGE 1 PRELIMINARY UXO RISK ASSESSMENT

REPORT REF: PRA-22-1949 | Revision: 0

Client: IGE Consulting Ltd
Project: Blackley Fire Station, Manchester
Date: 03/11/2022

BRIMSTONE SITE INVESTIGATION
Suite 6, Delta House, Laser Quay,
Culpeper Close, Rochester, ME2 4HU
0207 117 2492
www.brimstoneuxo.com

INTRODUCTION

The Stage 1 Preliminary Risk Assessment is an initial screening assessment designed to highlight any sources of unexploded ordnance (UXO) with the potential to contaminate a given site.

The aim of the Stage 1 assessment is to identify or discount the need for further detailed research a Stage 2 Detailed UXO Risk Assessment.

This desktop assessment has been researched and written by a dedicated Researcher / Risk Assessor and produced in accordance with the CIRIA C681 Guidelines: 'Unexploded Ordnance, a Guide for the Construction Industry' (published in 2009).

In preparation for this assessment, original wartime records, historic OS mapping and the *Brimstone UXO Sources Database* have been reviewed. The latter incorporates multiple datasets plotting the positions of a variety of domestic military sites and confirmed historic German bombing targets.

The Stage 1 Preliminary Risk Assessment considers the following:

1. The Proposed Works
2. Enemy Action during WWI and WWII
3. British / Allied Military Activity
4. Historic Site Occupancy
5. Risk Mitigating Factors

THE SITE

The Site (approximately centred on the National Grid Ref: SD 86066 03390) is located in Blackley, within Manchester, approximately 225m west of Plant Hill Park.
The Site comprises areas of hardstanding, including car parks and two low rise structures. It is bound to the north by residential structures on Rochdale Road, to the east by mature vegetation, to the south by a car park and open ground, and to the west by Rochdale Road.

THE PROPOSED WORKS

Planned SI works on Site will include deep boreholes to c. 10m bgl, although possibly deeper.
Proposed development works will comprise the construction of a new fire station, including the possible use of piled foundations.

ENEMY ACTION DURING WWI AND WWII

Potential Source of UXO	Significant?	Details	
WWI German Bombing	×	Manchester was not subject to any air raids during WWI.	
WWII German Bombing	✓	British District Bombing Density Statistics	The Site is located within the WWII-era County Borough of Manchester which sustained 27.1 bombs / 1,000 acres, a low-to-moderate bombing density.

		Evidence of bomb strikes / damage	No bomb strikes are recorded within an approximate 500m radius of the Site, with the closest incident recorded approximately 530m south-east. Historical aerial photography does not show any obvious signs of bomb damage or ground disturbances on Site. A ground depression is visible approximately 15m south of the Site, however this is not thought to be due to bomb damage due to its square shape. Instead, it is likely associated with the numerous sand pits in the wider area.
		Local Bombing Decoy Sites	None located within a significant distance. The closest was located approximately 10.8km south-east.
		Local German Bombing Targets	The Site was located approximately 3.8km to the east of the Heaton Park Reservoir, an identified bombing target within Luftwaffe reconnaissance photography. Although Booth Hall Hospital, situated approximately 430m south-east of the Site during WWII, was visible from the air, there is no evidence that it was identified as a target of opportunity.
WWII German Cross Channel Artillery Shelling	×	n/a	
BRITISH / ALLIED MILITARY ACTIVITY			
Potential Source of UXO	**Significant?**	**Details**	
WWII Home Guard (HG) activity	×/✓	Soldiers of the 49th, 57th GPO, 58th GPO and 59th GPO Lancashire (Manchester) HG Battalions will have been active locally during WWII. The possibility that the Site was accessed by armed HG troops on patrol cannot be discounted at this stage.	
Site requisitioned for wartime military use	×/✓	No such evidence found at this stage. The possibility that the Site was requisitioned for temporary wartime use cannot be ruled out entirely (e.g. tented military camp, LAA gun battery, searchlight battery, RAF barrage balloon site).	
Existing or historic Army or RAF training area / weapons range	×	n/a	
Existing or historic military bases and other installations	×	n/a	
Existing or historic munitions or explosives factories	×	n/a	
Existing or historic military storage depots	×	n/a	
Existing or historic military defensive fortifications	×	n/a	
WWII light and / or heavy anti-aircraft (LAA and HAA) fire	✓	Numerous (>30) permanent HAA batteries were active within range of the Site during WWII. Luftwaffe activity in the region was somewhat frequent. Therefore, these guns are likely to have fired a notable amount of ammunition in the vicinity of the Site. Given this, it is possible that an unexploded AA shell struck the Site and penetrated to a shallow depth.	
WWII pipe-mined locations and beach minefields	×	n/a	

SITE HISTORY	
What was the Site occupancy historically, especially during WWI and WWII?	During WWII the Site was occupied entirely by open, undeveloped ground. It was bound by additional open ground to the north, east and south, with Rochdale Road to the west.
RISK MITIGATING FACTORS	
Post-conflict ground works	Post-WWII redevelopment has consisted of the construction of Brackley Community Fire Station on Site. This comprises a large single-storey structure covering a majority of the Site, with a two-storey structure also present in the south. The west of the Site has been paved over to be utilised as an accessway and car park, whilst sections of the Site in the north and east remain undeveloped. The foundations for the structures on Site likely disturbed ground to a shallow (1-2m bgl) depth, whilst the laying of hardstanding likely disturbed ground to very shallow (>1m bgl) depths.
Likelihood of UXO remaining	The risk associated with (any) very shallow or shallow buried UXO has likely been partially mitigated. The risk associated with (any) deep (>2m bgl) buried UXO almost certainly remains unmitigated.

CONCLUSIONS

German UXO:

- The Site is located in the WWII-era County Borough of Manchester which sustained 27.1 bombs / 1,000 acres, a low-to-moderate bombing density. Indeed, no identified targets were located within 3.5km of the Site.
- Furthermore, there is no visual or anecdotal evidence of bombing within the Site boundary or its surrounds, as inferred from bomb plot/damage mapping, a map of civilian casualties and 1948 aerial photography.
- A depression in the ground is visible approximately 15m south of the Site; however, the regular and seemingly deliberate square shape is not consistent with cratering resulting from a bomb strike. Instead, it is thought to be associated with the various sand pits located in the wider Site area, perhaps a trial pit.
- Conditions on Site, which comprised undeveloped open ground during WWII, are typically considered to be unconducive to the detection of evidence of UXO, such as cratering and entry holes. However, there is not thought to be a significant likelihood that a UXB would have struck the Site and remain there today due to the lack of bombing recorded in the wider area.
- In summary, the risk of UXO contamination on Site is not considered to be elevated above the background level for Manchester.

British / Allied UXO:

- In 2007, a grenade was uncovered in a residential garden approximately 310m to the north-east of the Site. While neighbours suggested that it may have been left by a former resident, who had fought in both world wars, the precise reason for its presence is unknown.[1] Despite this, no evidence of significant military activity specifically on Site has been found and none is likely to have occurred. Due to the uncertain nature of the grenade find to the north **UXO Safety Awareness Briefings** are strongly recommended.
- Numerous (>30) permanent HAA batteries were active within range of the Site during WWII. It is possible that an unexploded AA shell struck the Site and penetrated to a shallow depth.

RECOMMENDATION(S)	
SI Works	A Stage 2 Detailed Risk Assessment is not considered necessary prior to works commencing. However, the possibility of UXO remaining on Site cannot be completely ruled out at desktop stage. Therefore, a **UXO Safety Awareness Briefing** to all personnel conducting ground works would be considered prudent.
Development Works	

[1] https://www.manchestereveningnews.co.uk/news/local-news/garden-grenade-blown-up-990197