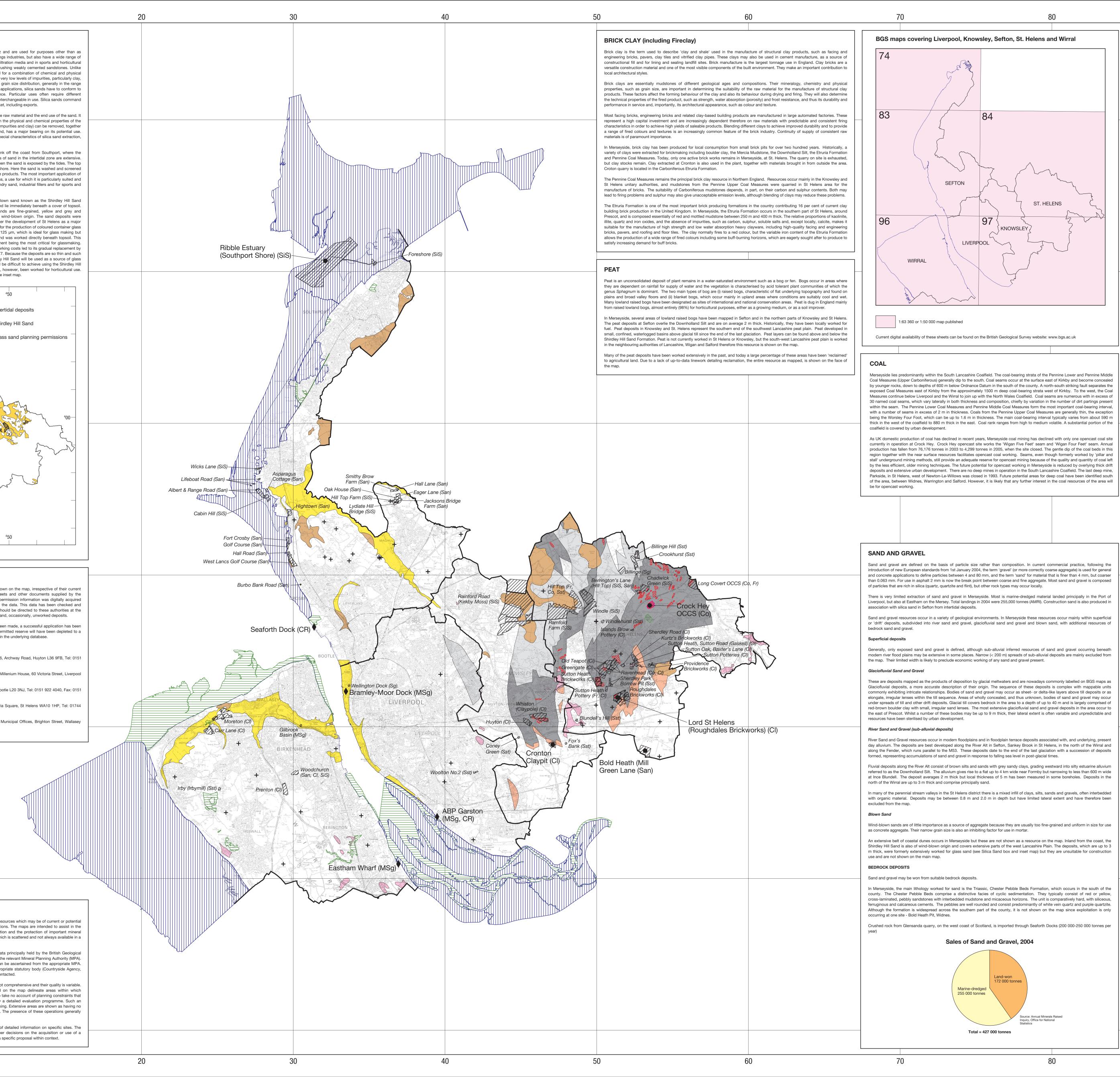
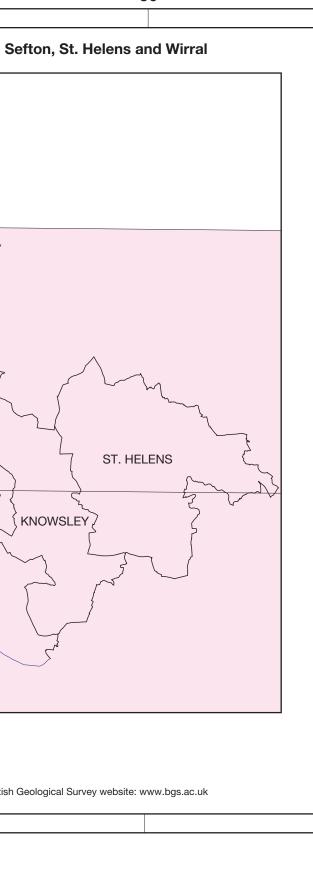
	90	300000	10
		SILICA SAND	I
	British Geological Survey	Silica (industrial) sands contain a high proportion of silic construction aggregates. They are essential raw materials other industrial applications, including in ceramics and che	for the glass and foundry castings
	Image: Natural environment research council Image: Construction of the second	applications. They are produced from both loosely consoli construction sands, which are used for physical properties properties. These include a high silica content in the form o	dated sand deposits and by crus s alone, silica sands are valued fo
	MERSEYSIDE	iron oxides and refractory minerals such as chromite. Silica 0.5 mm to 0.1 mm, although coarser grades are required for very closely defined specifications and consistency in	a sands typically have a narrow gr or some applications. For most ap quality is of critical importance
	(comprising City of Liverpool, Boroughs of	combinations of properties, consequently, different qualities a higher price than construction sands, this allows them to s Silica sand processing is of varying degrees of complexity a	serve a wider geographical market,
30	Knowsley, Sefton, St. Helens and Wirral)	typically requires a high capital investment in plant. Process sand to meet user specifications. The ease with which conta with the level of losses incurred in removing oversize and	sing is aimed at modifying both th aminants (such as iron-bearing imp
	Mineral Resource Information in Support of National,	Within the UK, deposits of silica sand occur in only limited a in particular the cost of processing, means that the industry	has a restricted distribution.
	Regional and Local Planning Mineral Resources	In Merseyside, silica sand is produced in Sefton from an foreshore is characterised by a wide intertidal expanse of s The extent of the workings is defined by the planning permi	sandbanks and flats. Resources o issions. Working takes place when
	Scale 1:100 000	0.5 m of sand is removed by excavator and transported by to remove shell fragments and coarse material, and then cla the sand is as a grinding and polishing medium for the mar	assified to produce different size p nufacture of polished wired glass,
	Compiled by D.J. Minchin, F.M. McEvoy, D.J. Harrison, D.G. Cameron, D.J. Evans,	alternatives have not been found. Other applications includ horticultural applications.	-
	G.K. Lott, S.F. Hobbs and D.E. Highley. Project Leader: D.E. Highley. Digital cartography by N.A. Spencer, British Geological Survey.	Large parts of the West Lancashire Plain are covered by Formation. The sands, which are up to 3 m thick, are youn They account for some of the most productive agricult characteristically uniform in both composition and grain s	ger than the glacial deposits and ural land in the area. The sand
	Published 2006.	formerly of considerable economic importance as a source glassmaking centre. The sands have been extensively worke and, more importantly, flat glass. Most of the sand particl	e of glass sand, particularly after ed in Lancashire and St Helens for
	This map comprises part of a summary of the 'Mineral Resources of the North-West England Region'.	unsuitable for construction use. For flat glass manufacture sand typically contains 97 per cent SiO_2 and 0.1-0.12 per However, the thinness of the deposit, the large areas requir	e only the top 0.5 to 1 m of sand cent Fe_2O_3 , the latter component
	For more information see www.mineralsUK.com	Chelford Sand from the Cheshire Basin. Extraction for flat g large areas of land would be required to maintain producti sand in the future. In addition, current market trends are fo	lass manufacture ceased in 1977. on it is unlikely that the Shirdley H
20	BIBLIOGRAPHIC REFERENCE Minchin D J, and 7 others. 2006. Mineral Resource Information for National, Regional and Local Planning: Merseyside (comprising City of	Sand. Consequently they are not shown as a resource on The extent of the Shirdley Hill Sand and their historic plannin	the main map. The sands have, h
	Liverpool and the Metropolitan Boroughs of Knowlsey, Sefton, St. Helens and Wirral). British Geological Survey Commissioned Report CR/05/129N.	⁴ 25	
	Production of this map was commissioned and funded by the Office of the Deputy Prime Minister (Contract MP0677).		Inter Shiro
	SAND & GRAVEL		Glass
	Superficial deposits		
	Sub-alluvial: Inferred resources		
	Glaciofluvial deposits	han the	
	PEAT		R C
10			
	Etruria Formation		
	Brick clay and Fireclay coincident with coal bearing strata - Shallow Coal/		<i>A</i>
	COAL Coal Measures Coal Measures Coal Measures Group		
	Area of shallow coal		
	Opencast coal: worked area		
	COAL LICENCE AREAS (as at 01.01.06)		And the second s
	Source: The Coal Authority Opencast coal	425	•
	MINERAL PLANNING PERMISSION (as at 01.10.05)		
400000	Source: Mineral Planning Authorities	PLANNING PERMISSIONS FOR MINE	RAL EXTRACTION
	Surface planning permission (valid and expired)	The extent of all known extant and former planning permis planning or operational status. The polygons were digitis	-
	Underground planning permission other than coal (valid and expired)	Metropolitan Boroughs of Knowsley, Sefton, St Helens and from Ministry of Housing and Local Government maps fo amended by the local Authorities shown below. Any querie	r the area and incorporated in these regarding the sites shown sho
	 Extent of planning permission, undefined 	addresses shown below. The polygons cover active, former Planning Permissions represent areas where a commercial	decision to work mineral has been
	MINERAL WORKINGS Cronton Active site	dealt with through the provisions of the Town and Country greater or lesser extent. Current planning status is not qualif	
	Prenton Inactive (including yet to be worked), worked-out	Contact addresses: Knowsley Metropolitan Borough Council, Planning & Develo	
	and/or restored site	489 6000, Fax: 0151 443 2370, web address: www.knowsle Liverpool City Council, Planning, Transportation & Building L1 6JF, Tel: 0151 227 3911, Fax: 0151 233 4290, web addre	Surveying Services, 2nd Floor, Mil
	Cl Clay & Shale Fr Fireclay Sg Sand and Gravel	Sefton Metropolitan Borough Council, Planning Department 934 3587, web address: www.sefton.gov.uk	
	CoCoalOilOilSanSandCRCrushed RockSstSandstoneSiSSilica Sand	St Helens Metropolitan Borough Council, Chief Executives 456000, Fax: 01744 733337, web address: www.sthelens.go	
90 -	MSg Marine Sand and Gravel	Wirral Metropolitan Borough Council, Planning and Econo L44 8ED, Tel: 0151 638 7070, Fax: 0151 691 8180, web add	mic Development Department, M
	 Active marine aggregate wharf ENVIRONMENTAL DESIGNATIONS (as at 06/07/05) 		
	National nature conservation designations		
	(SSSIs and NNRs)		
	(SACs, SPAs and Ramsar sites)		
	+ Scheduled Monument ADMINISTRATIVE AREAS		
	Mineral Planning Authority		
	Topography reproduced from the OS map by British Geological Survey with the permission of Ordnance Survey on behalf of The		
00	Controller of Her Majesty's Stationery Office, © Crown copyright. All rights reserved. Unauthorised reproduction infringes Crown copyright and may lead to prosecution or civil proceedings. Licence number: 100037272 2006.		
80	Digital SSSI, NNR, SAC, SPA and RAMSAR boundaries © English Nature 2005. 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.	Aims and Limitations	
	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.	The purpose of the maps in this series is to show the broad economic interest and to relate these to selected national	
	Contact address: English Heritage, 23 Savile Row, London, WS1 2ET, Tel: 020 7973 3132, Web page: www.english-heritage.org.uk	consideration and preparation of development plan policie resources against sterilisation. They bring together a wide ra convenient form.	es in respect of mineral extraction
	Digital AONB boundaries © Countryside Commission 1986 (now Countryside Agency). Contact address: Countryside Agency, John Dower House, Crescent Place, Cheltenham, Gloucestershire, GL50 3RA, Tel: 01242 521381, Fax: 01242	The maps have been produced by the collation and interp Survey. Information on the extent of mineral planning permis	
	584270, Web page: www.countryside.gov.uk Coal Licence Areas © The Coal Authority 2005.	Some of these permissions may have lapsed or expired. T Location information on national planning designations has English Nature and English Heritage). For further information	he status of individual areas can s been obtained from the approp
	Contact address: The Coal Authority, 200 Lichfield Lane, Mansfield, Nottinghamshire, NG18 4RG, Tel: 01623 427162, Fax: 01623 638338, Web page: www.coal.gov.uk	The mineral resource data presented are based on the best The inferred boundaries shown are, therefore, approxima	available information, but are not o ate. Mineral resources defined o
	Published for the Office of the Deputy Prime Minister © Queen's Printer and Controller of Her Majesty's Stationery Office 2006.	potentially workable minerals may occur. These areas are n may limit their working. The economic potential of specifi investigation is an essential precursor to submitting a plann	ic sites can only be proved by a ning application for mineral working
	This publication (excluding logos) may be reproduced free of charge in any format or medium for research, private study or circulation within an organisation. This is subject to it being reproduced accurately and not used in a misleading context. The material must be acknowledged as Crown Copyright and the title of the publication specified.	mineral resource potential, but some isolated mineral work reflect very local or specific situations.	
70	Applications for reproduction should be made in writing to: The Copyright Unit, Her Majesty's Stationery Office, St Clements House, 1-16 Colgate, Norwich NR3 1BQ. Fax 01603 723000 or e-mail: copyright@hmso.gov.uk	The maps are intended for general consideration of mineral maps should not be used to determine individual plannin particular piece of land, although they may give useful backs	ng applications or in taking other







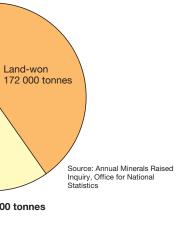


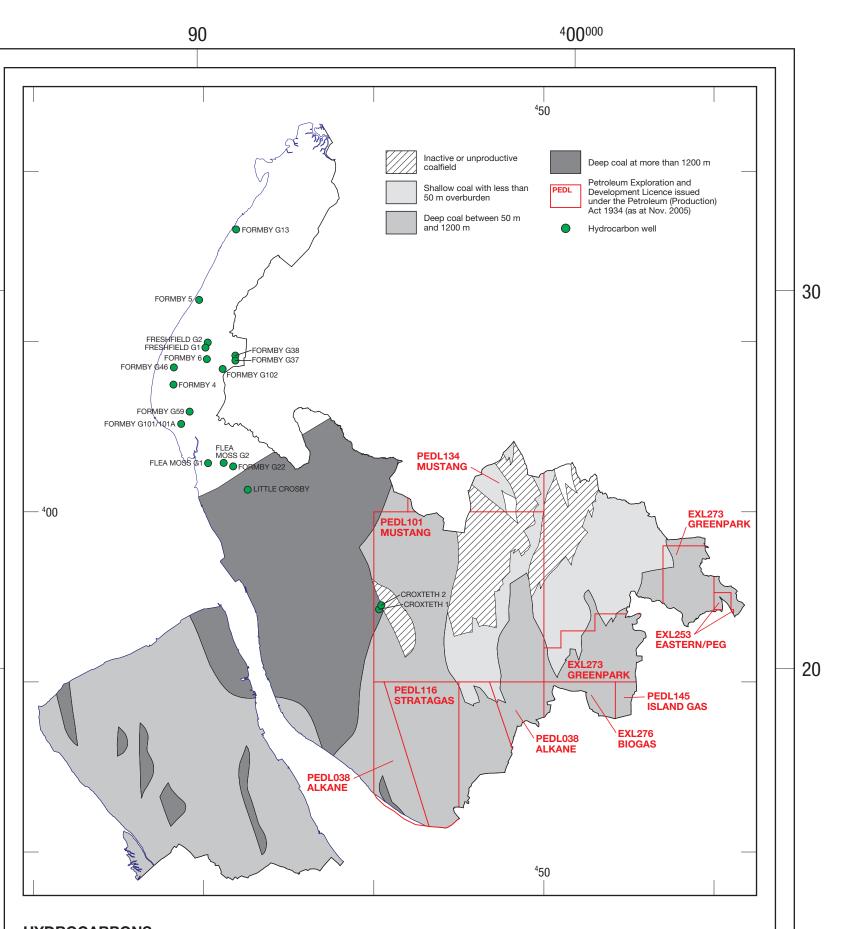
Coal Measures (Upper Carboniferous) generally dip to the south. Coal seams occur at the surface east of Kirkby and become concealed by younger rocks, down to depths of 600 m below Ordnance Datum in the south of the county. A north-south striking fault separates the exposed Coal Measures east of Kirkby from the approximately 1500 m deep coal-bearing strata west of Kirkby. To the west, the Coal Measures continue below Liverpool and the Wirral to join up with the North Wales Coalfield. Coal seams are numerous with in excess of 30 named coal seams, which vary laterally in both thickness and composition, chiefly by variation in the number of dirt partings present within the seam. The Pennine Lower Coal Measures and Pennine Middle Coal Measures form the most important coal-bearing interval, with a number of seams 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 1.6 m in thickness. The main coal-bearing interval typically varies from about 590 m thick in the west of the coalfield to 880 m thick in the east. Coal rank ranges from high to medium volatile. A substantial portion of the

currently in operation at Crock Hey. Crock Hey opencast site works the 'Wigan Five Feet' seam and 'Wigan Four Feet' seam. Annual stall' underground mining methods, still provide an adequate reserve for opencast mining because of the quality and quantity of coal left deposits and extensive urban development. There are no deep mines in operation in the South Lancashire Coalfield. The last deep mine, Parkside, in St Helens, west of Newton-Le-Willows was closed in 1993. Future potential areas for deep coal have been identified south

hese are deposits mapped as the products of deposition by glacial meltwaters and are nowadays commonly labelled on BGS maps as commonly exhibiting intricate relationships. Bodies of sand and gravel may occur as sheet- or delta-like layers above till deposits or as

day alluvium. The deposits are best developed along the River Alt in Sefton, Sankey Brook in St Helens, in the north of the Wirral and





HYDROCARBONS Conventional Oil and Gas

The county is dominated by the large urban developments of Liverpool, Birkenhead and St Helens. Much of this development is over the crop of the Permo-Triassic strata, whilst that of St Helens in the northeast of the county, is over the crop of Pennine Coal Measures (Westphalian) strata, forming part of the important and neavily-mined South Lancashire Coalfield.

Permo-Triassic strata represent the onshore continuation of the East Irish Sea Basin, offshore, within which hydrocarbons (mainly gas) have been discovered in the Morecambe, Lennox, Millom, Hamilton (including East and North), Bains, Calder, Dalton, Ormond South and Crossans fields. Oil has also been produced from the Douglas and Lennox fields.

Onshore, oil and gas is encountered in the Pennine Coal Measures of the South Lancashire Coalfield to the east in the Wigan area. There have also been records of oil seeps in the Formby area (most notably in the Thirty Acre Lane and Downholland Brook area) since 1637, with a shaft sunk in 1918 to investigate the Downholland seep. It is also noteworthy that just to the south of the county a few kilometres WSW of the Kemira/Ince CBM well, two CEGB wells drilled around 1984 for other purposes had methane associated with them. Consequently the region has, for many years, attracted interest from oil companies, with the main exploration targets c candetones in 1939 D'A Formby oilfield. Many wells were only shallow, with the last ones having been drilled in about 1956. They include shafts (Downholland Brook) and over 45 shallow and deeper wells, many named Formby, with others known as Flea Moss (G1 and G2) and Freshfield (G1 and G2). This oilfield straddles the Merseyside and Lancashire county boundary (Table 1). The oilfield proved almost unique; oil being trapped in Triassic sandstones with the seal formed by glacial boulder clay. It produced 71,557 barrels of oil until the oilfield was shut down in 1965. Much work has gone into trying to identify the origin of the oil, with most observers believing it represents a deeper and breached Carboniferous trap.

Following Formby, further exploration wells have proved unsuccessful (Table 2). In 1947, D'Arcy Exploration drilled the Flea Moss G1 and G2 wells, both of which were plugged and abandoned as dry. In the mid 1950s, Steel Brothers drilled two exploration wells at Croxteth. Both recorded oil shows and bituminous material but were, however, subsequently plugged and abandoned as dry with no further development. Despite these failures, companies have continued to apply for exploration licences that have, at one time or another, covered much of the county. There has also been extensive acquisition of seismic reflection data. However, Little Crosby 1, drilled by Fina Petroleum Development Ltd in 1990 and currently in open acreage, stands as the only hydrocarbon exploration well drilled in the county since the 1950s. It too was plugged and abandoned as dry. The two Croxteth wells fall within the area of one of two current hydrocarbon exploration licences (PEDL101) that exist in the county. PEDL101 was awarded in the 9th onshore licensing round and is presently operated by Mustang Oil Ltd, which also operates the adjoining 12th round license PEDL134 to the north, covering part of south Lancashire.

Many Triassic prospects have been tested in the Cheshire Basin with no success and perhaps the better hydrocarbon prospects lie in the west of the county, adjacent to the producing East Irish Sea Basin. Potential may yet exist for an intra-Carboniferous play if accumulations that have been little disturbed since their formation and charging can be found. The current licence situation reflects the fact that the hydrocarbon prospectivity of the county is not presently perceived as great. Hydrocarbon licences held in early 2005 relate mainly to coalbed methane or abandoned mine methane development (see below).

Name of field	Field type (oil or gas)		rator at of discovery	Current operator	Discovery date	Production started	Status at 2005	Total production (tonnes/barrels)	
Formby			cy Exploration pany Ltd	Currently open acreage	1939	1939	Shut down (1965)	10,195 / 71,557	
able 2: Hydrocar	rbon exploratio	n wells	and shafts in Mer	seyside					
Exploration We	ell Drilling	date	Original opera	ator	Current license area and operator		Status		
Croxteth 1	195	3	Steel Brothers		PED	L 101	Plugged and abandoned, oil shows		
Croxteth 2	1950	6	Hamilton Oil Company Ltd		PED			lugged and abandoned, dry, minor traces il & bituminous material	
Downholland Brook	1918	8	Charles Stopforth		Oper	n acreage	acreage Plugged and abandoned, dry		
Flea Moss G1	194	7	D'Arcy Explora	ation Company Ltd	Oper	n acreage	Plugged and abandoned, dry		
Flea Moss G2	194	7	D'Arcy Exploration Company Ltd		Oper	n acreage	Plugged and abandoned, dry		
Freshfield G1	1940	D	D'Arcy Exploration Company Ltd		Oper	n acreage	Plugged and abandoned, dry		
Freshfield G2	1940	D	D'Arcy Exploration Company Ltd		Oper	Open acreage Plugged		Plugged and abandoned, dry	
Little Crosby 1	1990	D	Fina Petroleum Development Ltd		Oper	n acreage	Plugged and abandoned, dry		
bandoned Mine	e Methane (AN	1M) and	Coalbed Metha	ne (CBM) potentia	I				
lsewhere, to the ounty, coal mea resent, attaining	north of the R sures in the So a maximum se	iver Mei outh Lai eam thio	rsey, they subcro ncashire coalfield ckness of >3 m a	p beneath Permo-T have been extensi nd producing 20-25	iassic strata at vely worked in m total thickn	t depths of greater t many areas. The s ess. Historically, oil	han 1500 m. Although thuccession is up to 880 m and gas have been enco	and dip mainly to the south. ere is no active mining in the n thick, with 33 named coals nuntered in the coalfield, with y volume, being 50 per cent	

hydrogen, 30 per cent methane, 8 per cent carbon monoxide, 4 per cent other hydrocarbons, and 8 per cent carbon dioxide, nitrogen and oxygen). Coals are high to medium, volatile bituminous types and yield a seam gas content of up to 9.5, with an average of 8.2 m³ CH₄ per tonne.

The Wirral area is underlain by generally easterly dipping Pennine Lower-Middle Coal Measures of the North Wales Coalfield. The succession includes numerous thin coal seams of mainly medium volatile coking coal at depths of between 250 and 1500 m. Average gas seam content ranges between 7.1 and 8.4 m³ CH₄ per tonne

The concept of abandoned or coal mine methane capture in the UK goes back to the 1950s when Old Boston Mine in the Lancashire coalfield was sealed and then tapped to supply gas to the adjacent Wood Colliery. Old Boston Mine lies in the east of the county in EXL273, operated by Greenpark. This previously successful scheme has perhaps been influential in the interest generated in AMM and CBM in the South Lancashire and North Wales coalfields over recent years. Licences (and operators) relating to methane extraction in the county presently include: PEDL116 (Stratagas), PEDL038 (Alkane), EXL273 (Greenpark), EXL276 (Biogas), PEDL145 (Island Gas) and EXL253 (Eastern/Pegasus).

Prospects for AMM in the county to the north of the Mersey may not be perceived as particularly good because any former mines are long abandoned and thus are likely to be flooded. Coal measures in the North Wales Coalfield have been mined and prospects for AMM are good, providing mines have not flooded.

In the USA, most coalbed methane production is from coals containing 7 or more m³ CH₄ per tonne. Gas content of the coals in the South Lancashire and North Wales coalfields is thus above the economic threshold in America. Between 1994 and mid 2003 Evergreen Resources UK held exploration licences that covered southeastern areas of the county and extended over much of the area from Warrington to south of the Mersey and down to near Wrexham. A series of pilot well schemes were drilled to evaluate the CBM potential in these areas, most notably to the west of Chester and around Warrington. Those licences in the county have H now been relinquished or ownership transferred to Biogas (EXL 276) and Island (PEDL 145). Evaluation of CBM potential is presumably still ongoing in those part blocks retained, or interest has turned to AMM. The South Lancashire Coalfield has been heavily mined and therefore CBM development from virgin coal seams may only be a prospect in unmined areas of the

coalfield in the south of county. CBM potential is thought to be particularly good in the North Dee area of the North Wales Coalfield, although structural complexities and rapid deepening into the Cheshire Basin may limit potential. If similar conditions extend beneath the Wirral, then similar potential may exist there.

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.

BUILDING STONE

Building stone has been produced from a number of horizons within the Carboniferous and Permo-Triassic rocks of the area. In the past, working of local sandstones was widespread. However, today there is no quarrying of building sandstone in the area.

The oldest rocks that were quarried for building stone and flagstone are of Carboniferous age and crop out in the St Helens area of the South Lancashire Coalfield. The principal sandstone quarries were located in the Millstone Grit at Pimbo's Bush and in the Pennine Lower Coal Measures at Billinge, Rainsford, Thatto Heath, Crookhurst and Huyton.

The red and white sandstones of the Sherwood Sandstone Group (Permo-Triassic) were by far the most important source of building stone in the Merseyside area. Red, white and yellow sandstones were quarried extensively in many suburbs of the present city of Liverpool, for example, at Knowsley, Litherland, Bootle, St James's Mount, Everton, Anfield and Toxteth. There were also important sandstone quarries at Rainhill and Woolton Hill. Across the Mersey Estuary, in the Wirral, many large quarries also worked the Sherwood Sandstone Group around Thingwall, West Kirby, Irby, Heswell, High Bebington, Storeton, Oxton, Bidston and Wallasev