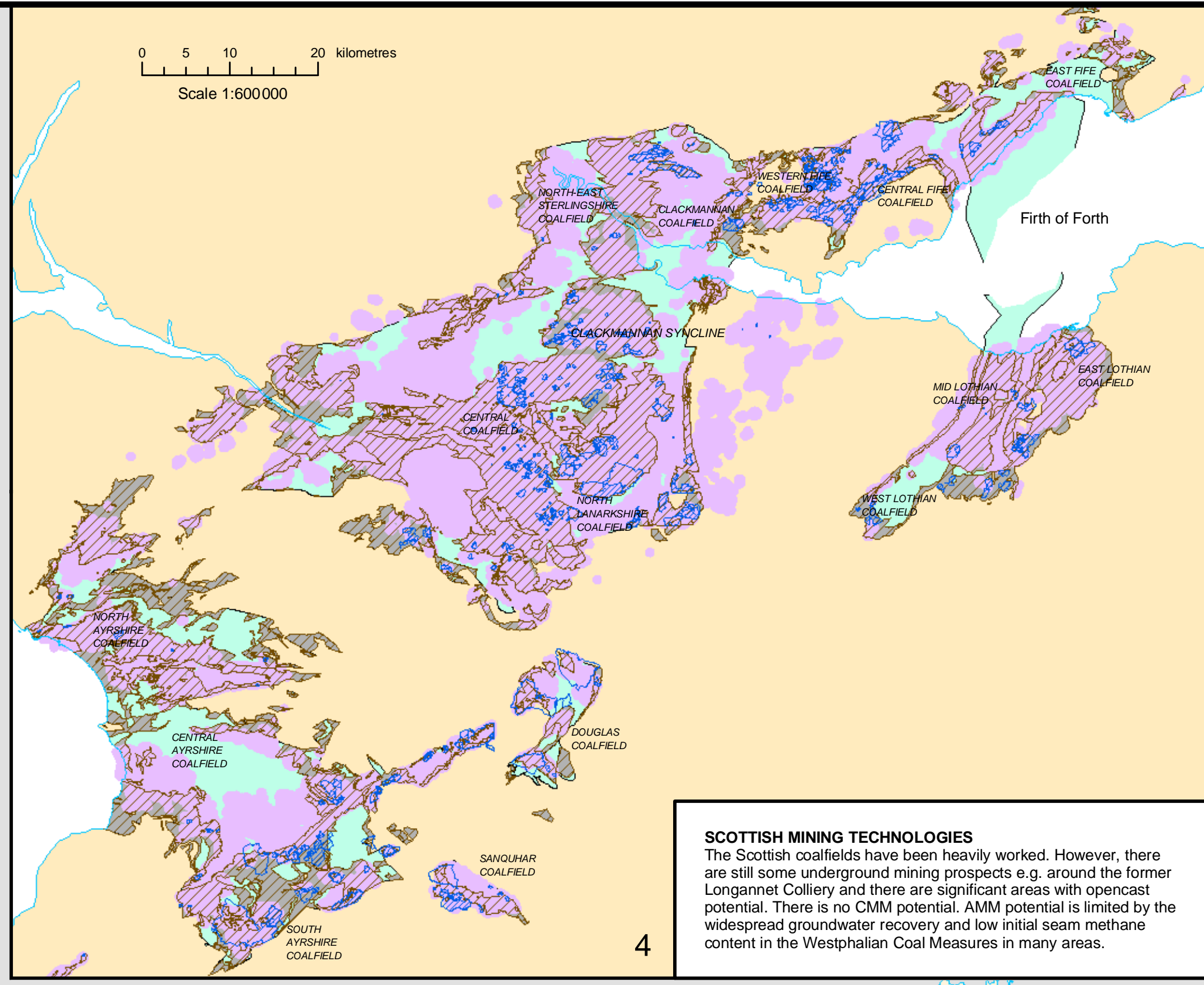


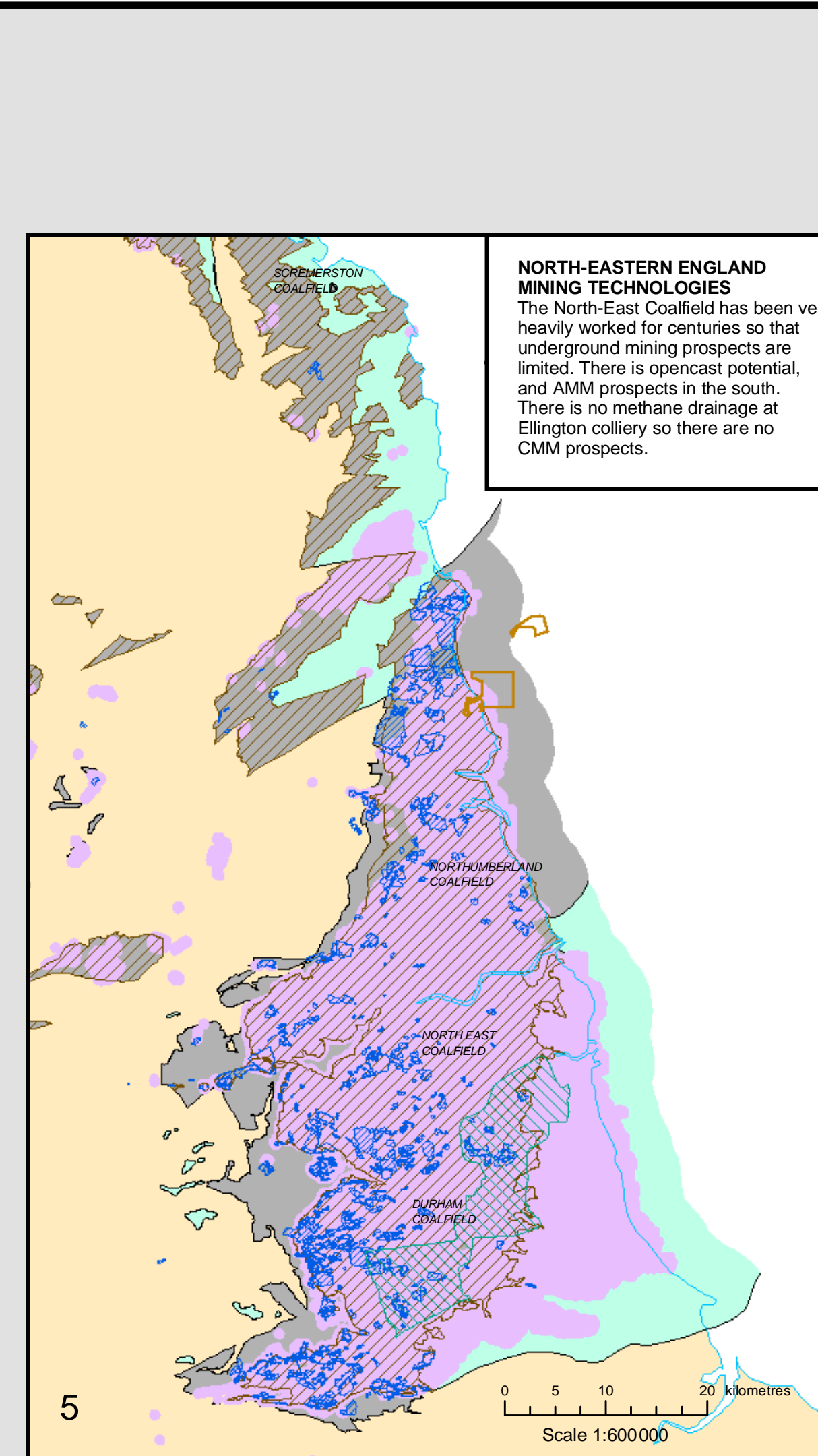
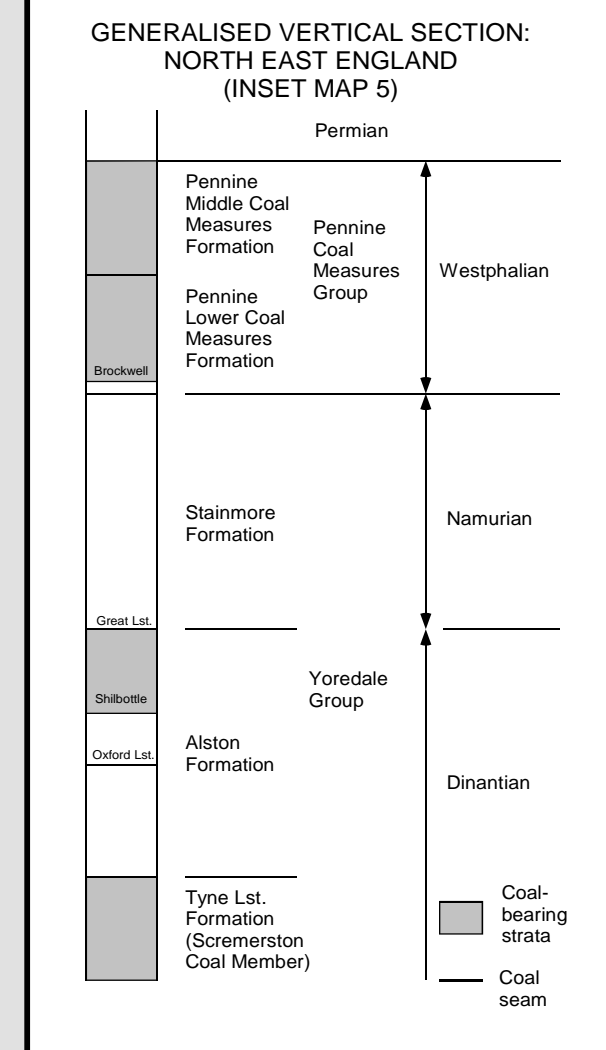
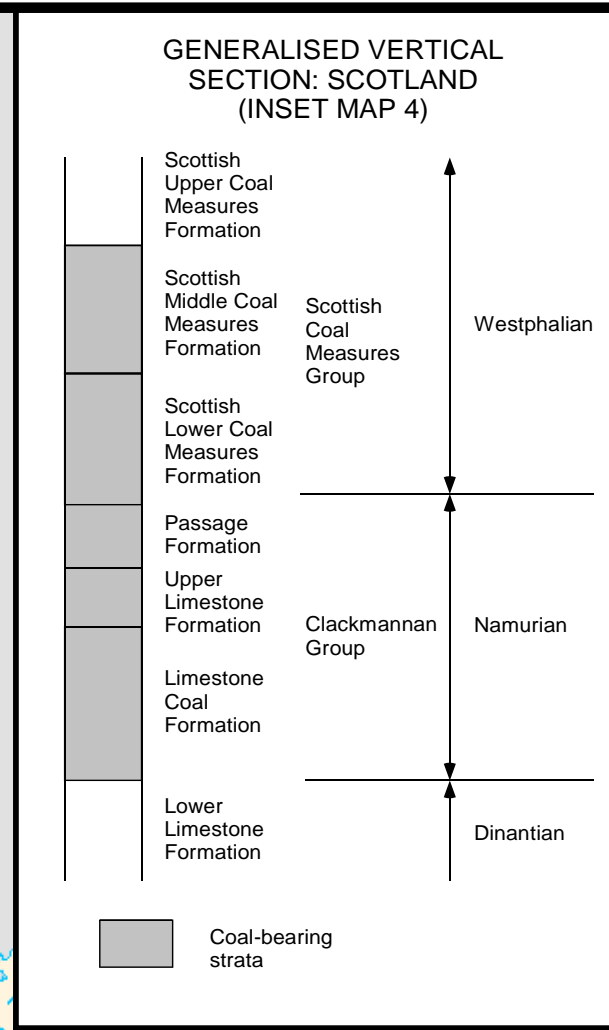
UK COAL RESOURCE FOR NEW EXPLOITATION TECHNOLOGIES

Mining and New Technologies Summary Map

Scale 1:1 750 000 and 1:600 000



SCOTTISH MINING TECHNOLOGIES
The Scottish coalfields have been heavily worked. However, there are still some underground mining prospects e.g. around the former Longannet Colliery and there are significant areas with opencast potential. There is no CMM potential. AMM potential is limited by the widespread groundwater recovery and low initial seam methane content in the Westphalian Coal Measures in many areas.



NORTH-EAST ENGLAND MINING TECHNOLOGIES
The North-East Coalfield has been very heavily worked for centuries so that underground mining prospects are limited. There is opencast potential, and AMM prospects in the south. There is no methane drainage at Ellington colliery so there are no CMM prospects.

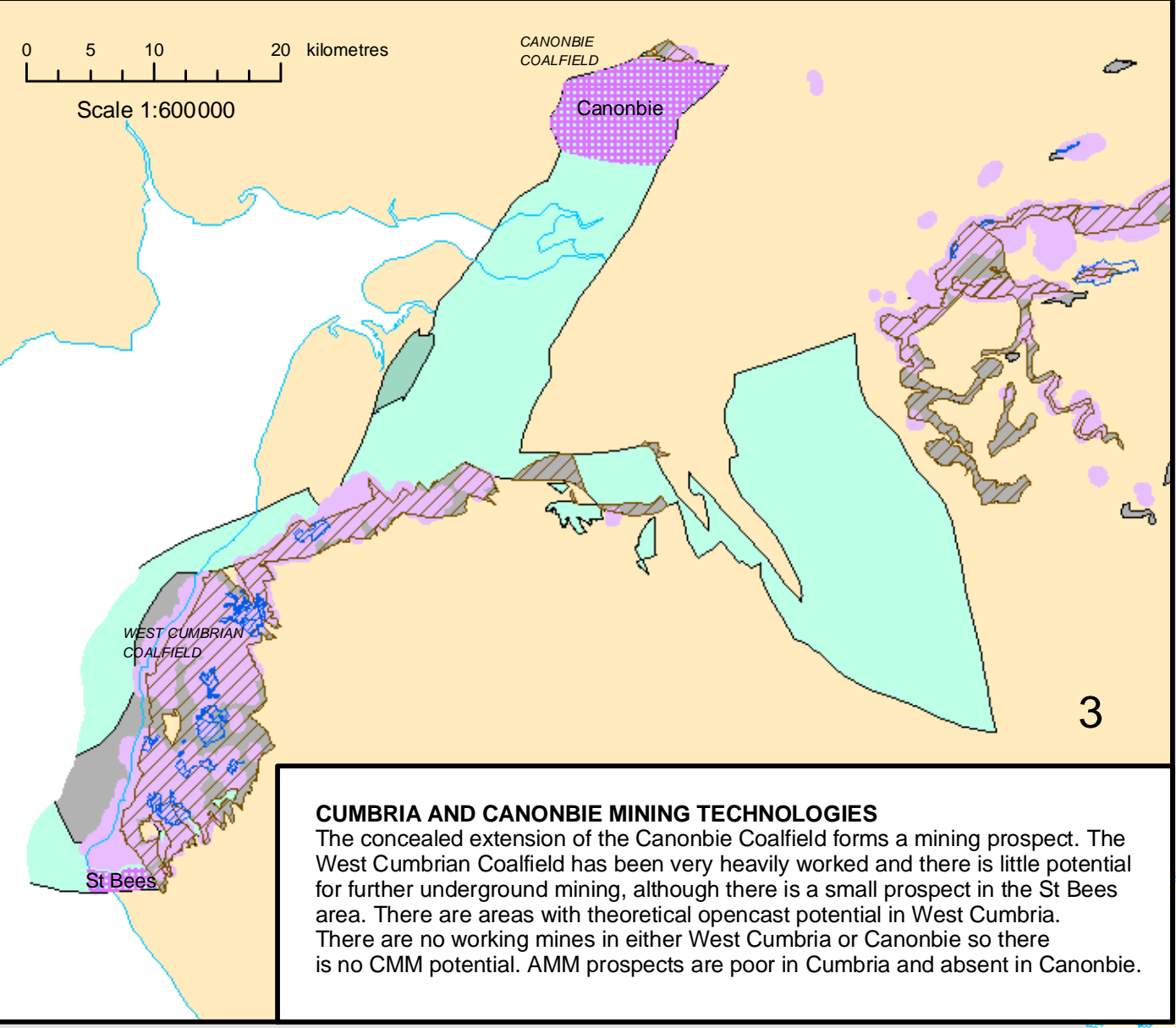
INTRODUCTION

The UK contains extensive resources of coal, both at the surface and in the subsurface. The coals occur in layers (seams) in sequences of sedimentary rock and the geographical areas where coal-bearing sequences occur are referred to as coalfields. The major coalfields of the UK are of Carboniferous age. The exceptions to this are small accumulations of Tertiary lignites in Devon (Bovey Tracey) and Northern Ireland and a Mesozoic (Jurassic) bituminous coal deposit in Brora, north-east Scotland. Within the Carboniferous the majority of the coals are of Westphalian age, occurring within the Lower and Middle Coal Measures, although some coals are known from the Upper Coal Measures. In Scotland and north-east England coals of Dinurian and Namurian age are also important.

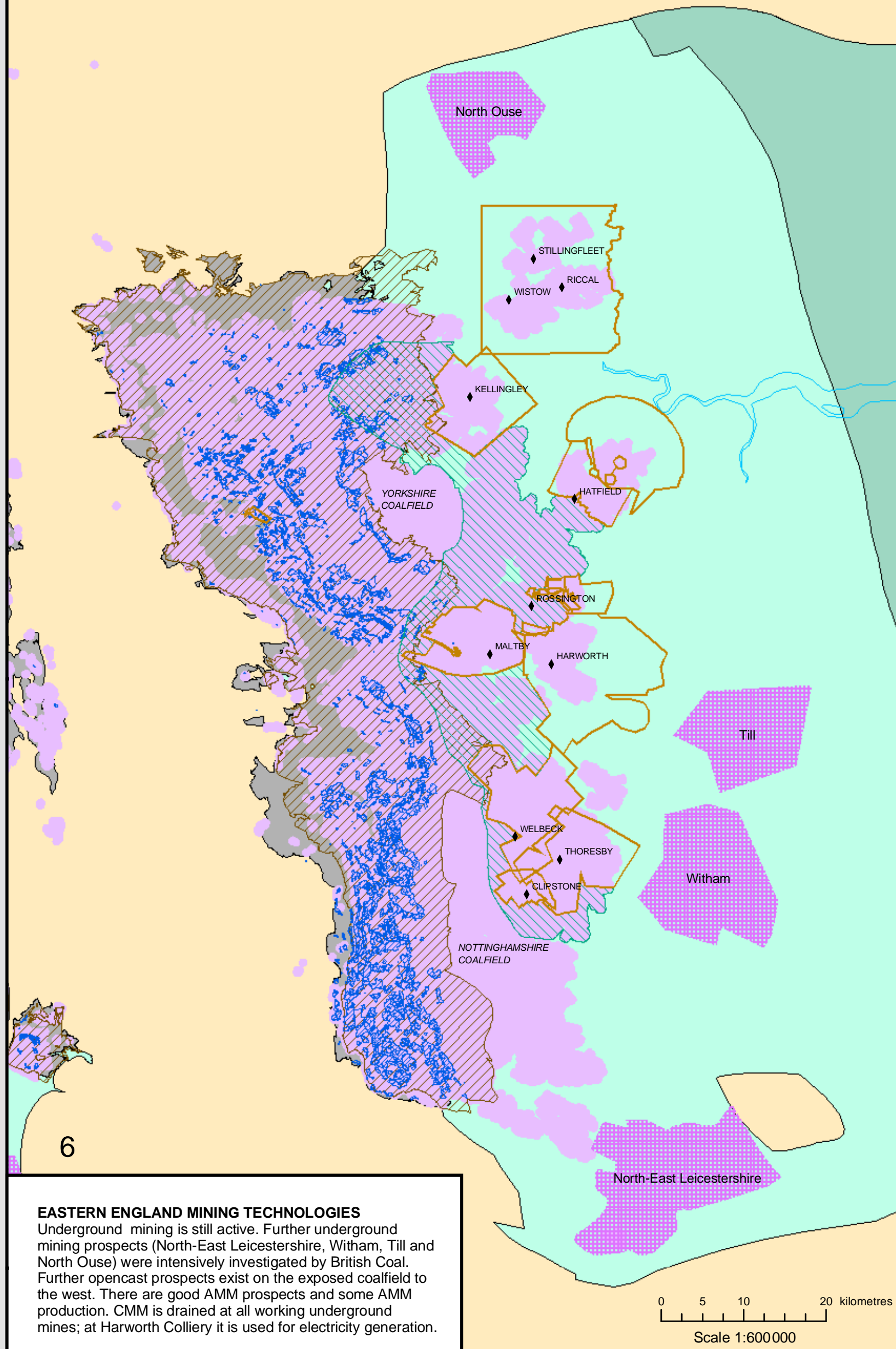
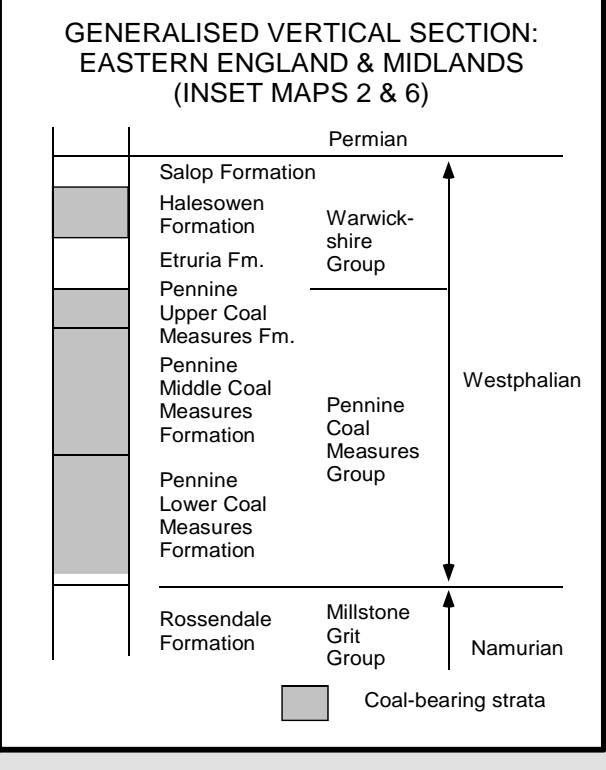
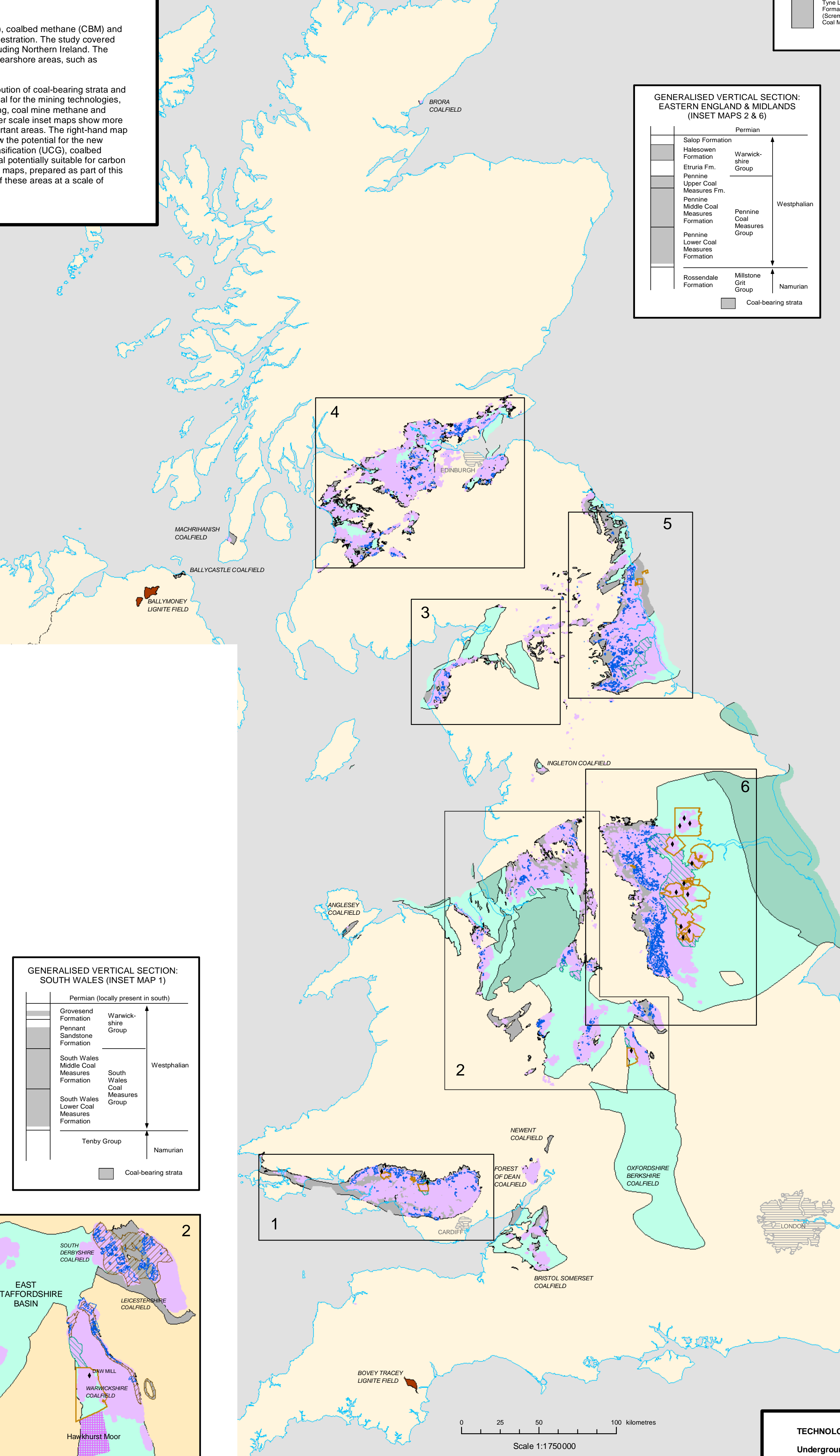
A study of the UK coal resource base was carried out to identify areas which are suitable for future exploitation of coal. The two maps illustrated represent a summary of the findings of this study. The key technologies considered were underground and opencast mining, coal mine methane (CMM), abandoned mine methane (AMM).

underground coal gasification (UCG), coalbed methane (CBM) and the potential for carbon dioxide sequestration. The study covered all onshore coalfields in the UK, including Northern Ireland. The offshore was not studied, although nearshore areas, such as estuaries, were included.

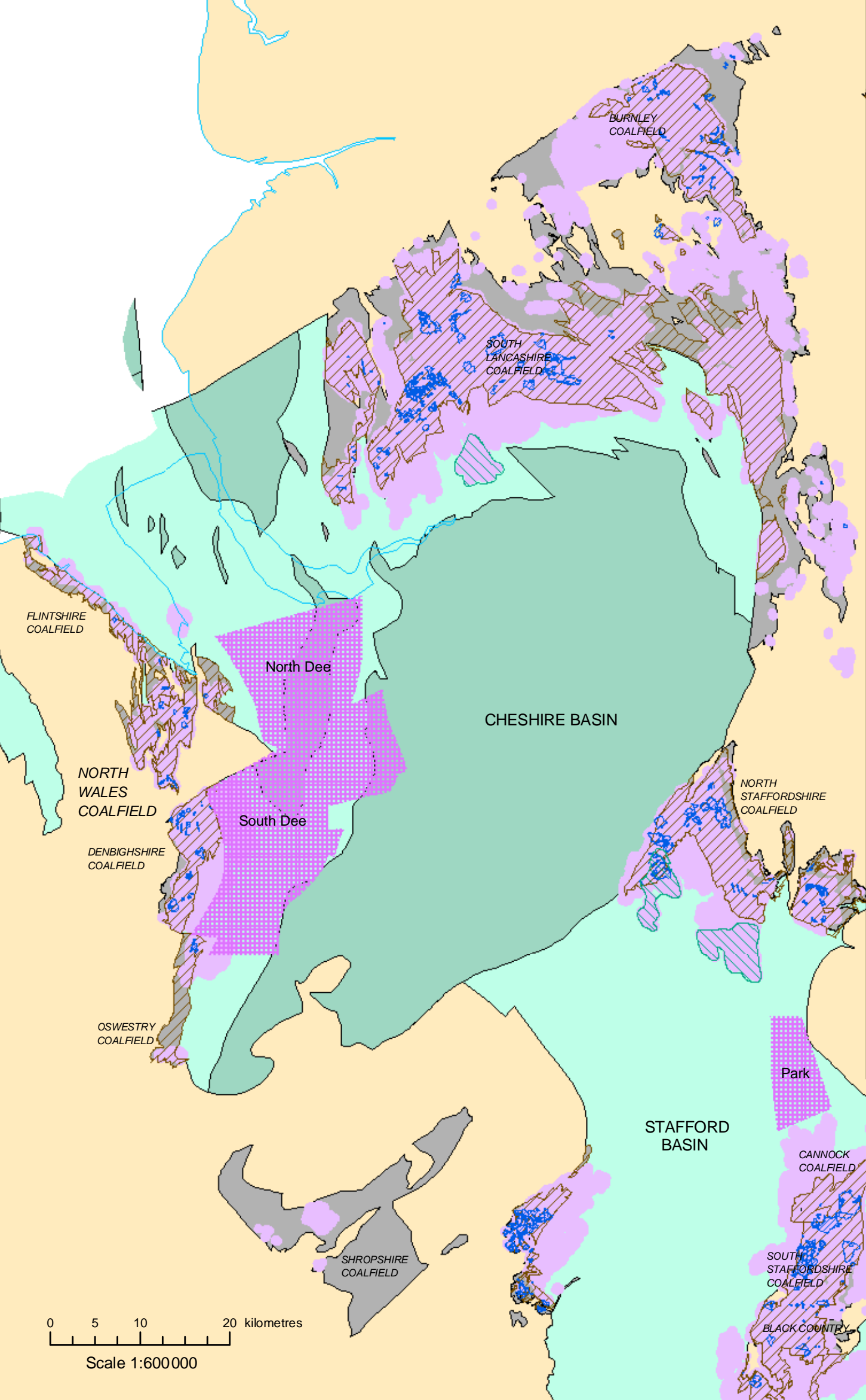
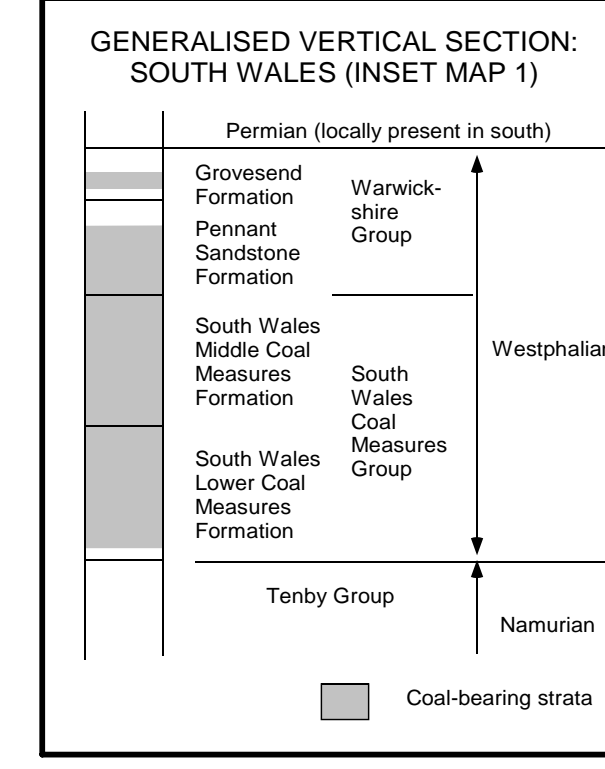
The left-hand map depicts the distribution of coal-bearing strata and illustrates the past and future potential for the mining technologies, i.e. underground and opencast mining, coal mine methane and abandoned mine methane. The larger scale inset maps show more detail for a number of the more important areas. The right-hand map and the larger scale inset maps show the potential for the new technologies of underground coal gasification (UCG), coalbed methane (CBM) and the areas of coal potentially suitable for carbon dioxide sequestration. More detailed maps, prepared as part of this project, are also available for each of these areas at a scale of 1:100000.



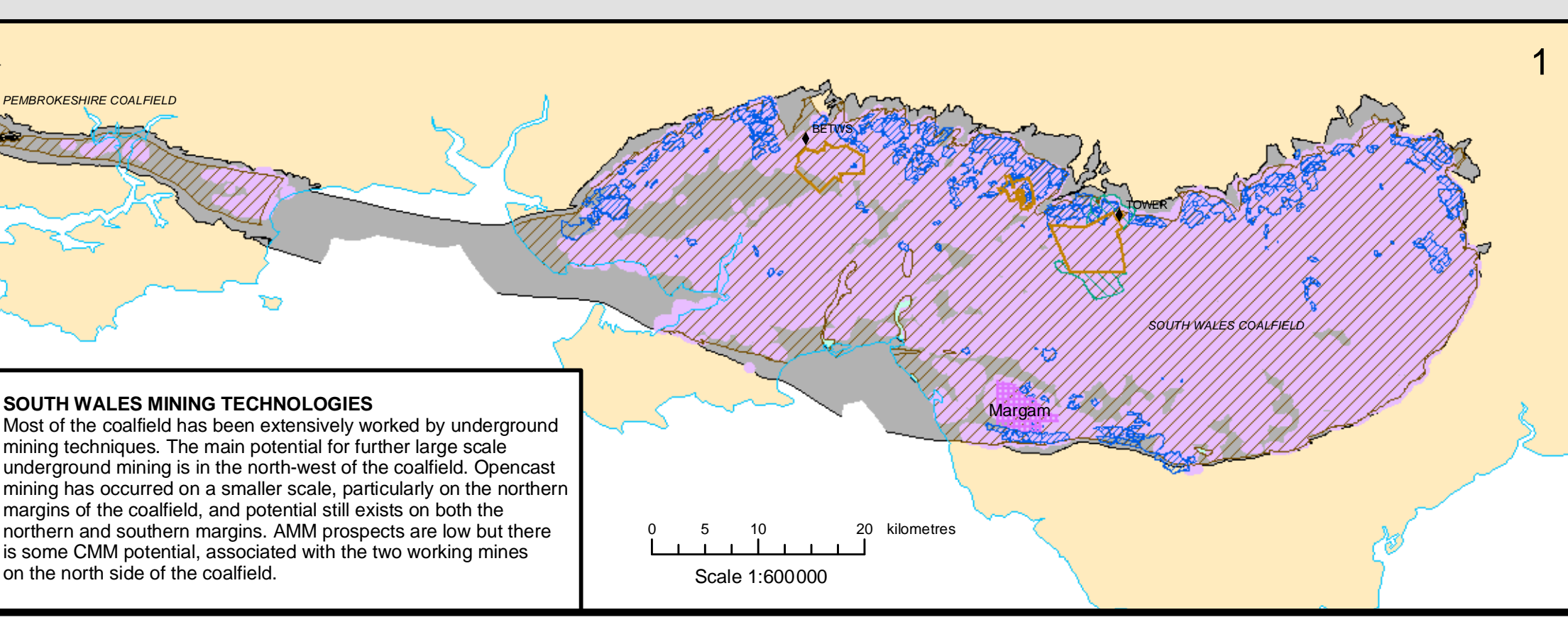
CUMBRIA AND CANONBIE MINING TECHNOLOGIES
The concealed extension of the Canonbie Coalfield forms a mining prospect. The West Cumbrian Coalfield has been very heavily worked and there is little potential for further underground mining, although there is a small prospect in the St Bees area. There are areas with theoretical opencast potential in West Cumbria. There are no working mines in either West Cumbria or Canonbie so there is no CMM potential. AMM prospects are poor in Cumbria and absent in Canonbie.



EASTERN ENGLAND MINING TECHNOLOGIES
Underground mining is still active. Further underground mining prospects (North-East Leicestershire, Witham, Til and North Ouse) were intensively investigated by British Coal. Further opencast prospects exist on the exposed coalfield to the west. There are good AMM prospects and some AMM production. CMM is drained at all working underground mines; at Harworth Colliery it is used for electricity generation.



MIDLANDS AND NORTH-WEST ENGLAND MINING TECHNOLOGIES
There has been extensive opencast and underground mining in this area. However, there is still potential for deep mining to the south of the South Lancashire Coalfield and in the North Dee, South Dee, Park and Hawkstun Moor prospects, and opencast potential in the exposed coalfields of South Lancashire, North Wales and North and South Staffordshire. There are no working mines hence no CMM potential. There are opportunities for AMM, particularly in South Lancashire and the southern part of the North Staffordshire Coalfield.

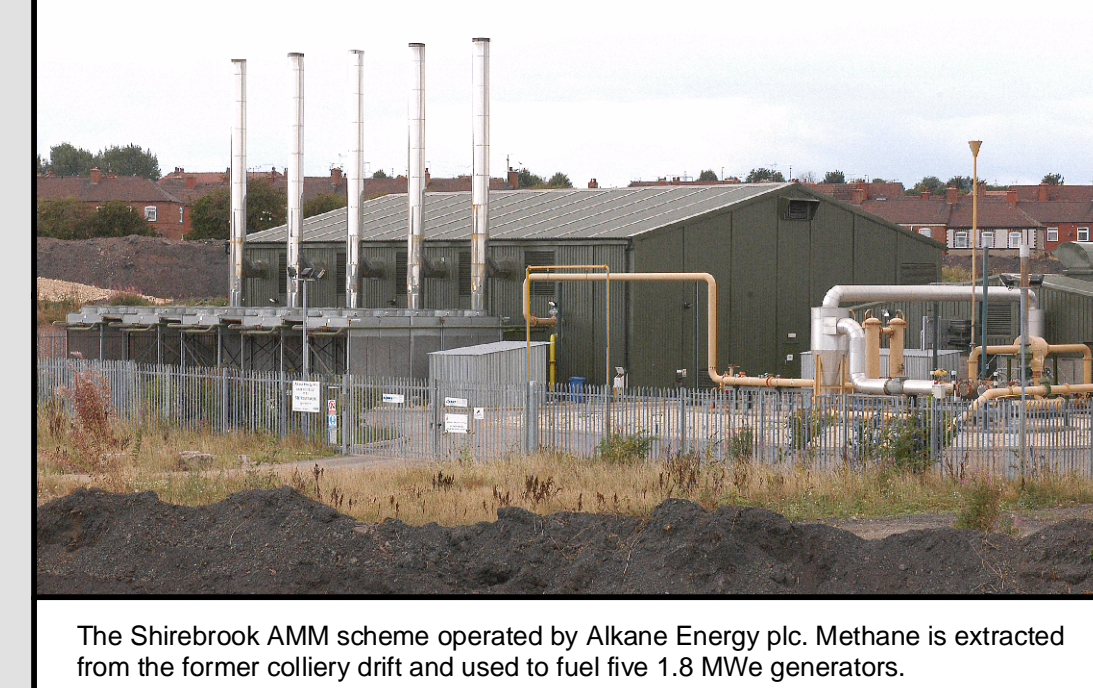


SOUTH WALES MINING TECHNOLOGIES
Most of the coalfield has been extensively worked by underground mining techniques. The main potential for further large scale underground mining is in the north-west of the coalfield. Opencast mining has occurred on a smaller scale, particularly on the northern margins of the coalfield, and potential still exists on both the northern and southern margins. AMM prospects are low but there is some CMM potential, associated with the two working mines on the north side of the coalfield.

- Legend to Mining Technologies maps**
- Large working coal mines
 - Present Opencast Licences* (shown on inset maps only)
 - Past opencast workings*
 - Theoretical potential for opencast workings** (shown on inset maps only)
 - Extent of underground workings with 500m buffer zone*
 - Underground mining exploration prospects (shown on inset maps only)
 - Resource area for coal mine methane (CMM)
 - Good prospects for abandoned mine methane (AMM) (Mine workings not recovered)**
 - Lignite at surface
 - Coal bearing strata at surface
 - Concealed coal bearing strata < 1200m from surface datum
 - Concealed coal bearing strata > 1200m from surface datum
- * Source Coal Authority, May 2002
** Source Coal Resource Map of Great Britain BGS/Coal Authority 1999
*** A recovered mine is one in which the ground water has generally returned to the pre-mining condition



The former High Lane opencast site, North Staffordshire Coalfield.



The Shirebrook AMM scheme operated by Alkane Energy plc. Methane is extracted from the former colliery drift and used to fuel five 1.8 MWe generators.

TECHNOLOGIES CONSIDERED ON THIS MAP

Underground Coal Mining
Many areas of the UK coalfields are technically amenable to underground mining. In broad terms, the current requirements are concealed coal seams more than approximately 1.5m thick at depths above 1200m, subject to coal quality and suitable geological and engineering conditions.

Much of the potential resource area has been investigated in detail by the mining industry and favourable areas were identified in British Coal's 'Plan 2000'. These broad areas are identified on the map.

Opencast Coal Mining
Areas suitable for opencast coal mining occur at or near the outcrop of productive Coal Measures, where coal seams occur at depths of 0 to 200m and are associated with less than 50m overburden (overburden is defined as any barren rocks or superficial deposits overlying the coal-bearing strata). The licensed opencast mining areas are identified from Coal Authority data (May 2002) and the resource areas are taken from the 'Coal Resources Map of Britain', BGS/Coal Authority 1999. No consideration has been given to topographic or planning issues in the definition of resource areas. No data was available about the extent of the lignite workings.

Abandoned Mine Methane (AMM)
This resource comprises the methane-rich gas that is adsorbed on to the coal in the zone of enhanced permeability that occurs in the strata surrounding seams mined by total extraction methods. This zone is considered to extend approximately 40m below and 150m above a typical mined seam of 2m thickness.

Most abandoned mines are technically amenable to this technology, providing that excessive air ingress does not take place, and that mine water in the workings has not recovered. However, mines in which the initial methane content of the coal was very low (i.e. < 1m³/tonne) are unsuitable and may emit mixtures of de-oxygenated air and carbon dioxide (blackdamp). Minewater recovery of abandoned coal workings is the major risk in exploitation of abandoned mine methane resources in many UK coalfields. Other risks include air ingress, width of the distressed zone and the viability of access boreholes.

Coal Mine Methane (CMM)
Coal mine methane is the name applied here to methane-rich gas drained from working mines to enhance the safety and efficiency of mining, and which subsequently can be used as a fuel. The resource area for this technology is considered to be the mining licence area. The main perceived risks to CMM exploitation are early closure of the mine and viability of methane extraction and capture under the prevailing mining conditions.

MINING TECHNOLOGIES MAP