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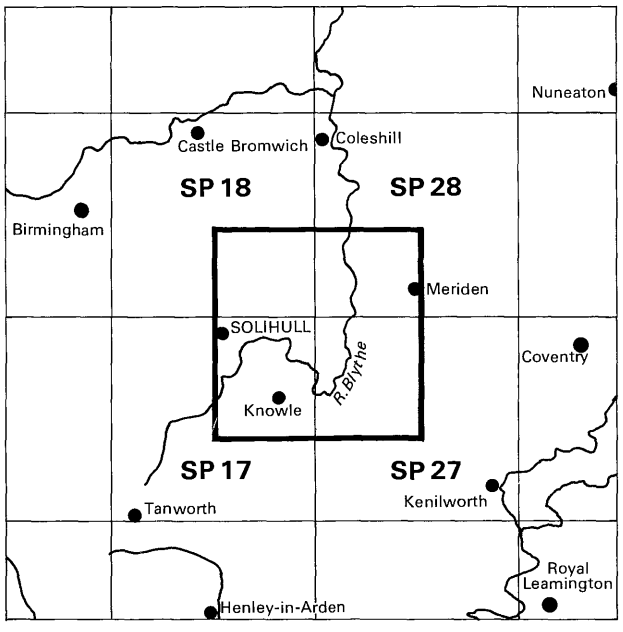

The sand and gravel resources of the country east of Solihull, Warwickshire

Description of part of 1:25 000 sheets SP 17, 18, 27, 28

B. Cannell

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PREFACE

National resources of many industrial minerals may seem so large that stocktaking appears unnecessary, but the demand for minerals and land for all purposes is intensifying and it has become increasingly clear in recent years that regional assessments of the resources of these minerals should be undertaken. The publication of information about the quantity and quality of deposits over large areas is intended to provide a comprehensive factual background against which planning decisions can be made.

Sand and gravel, considered together as naturally occurring aggregate, was selected as the bulk mineral demanding the most urgent attention, initially in the south-east of England, where about half the national output is won and very few sources of alternative aggregates are available. Following a short feasibility project, initiated in 1966 by the Ministry of Land and Natural Resources, the Industrial Minerals Assessment Unit (formerly the Mineral Assessment Unit) began systematic surveys in 1968. The work is now being financed by the Department of the Environment and is being undertaken with the cooperation of the Sand and Gravel Association of Great Britian.

This report describes the resources of sand and gravel of 100 km^2 around Solihull, Warwickshire. The survey was conducted in 1980-81 by B. Cannell and R. G. Crofts. The work is based on a geological survey at 1:10560 in 1913-15 by C. H. Cunnington and T. Eastwood and a re-survey on the 1:10 000 scale by R. A. Old, M. G. Sumbler and K. Ambrose in 1978-81.

J. D. Burnell, ISO, FRICS, Chief Land Agent, was responsible for negotiating access to land for drilling. The ready co-operation of landowners and tenants in this work is gratefully acknowledged.

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The first twelve reports on the assessment of British sand and gravel resources appeared in the Report Series of the Institute of Geological Sciences as a subseries. Report No. 13 and subsequent reports appear as Mineral Assessment Reports of the Institute.

Details of published reports appear at the end of this Report.

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Description of parts of 1:25 000 sheet SP 17, 18, 27, 28

B. CANNELL

SUMMARY

The assessment of the sand and gravel resources in the Solihull area, Warwickshire, is based on the geological maps and borehole records of the Institute of Geological Sciences, records made available by the sand and gravel industry, recent field work and fifty-eight boreholes drilled for the Industrial Minerals Assessment Unit.

All deposits in the area which might be potentially workable for sand and gravel have been investigated geologically and a simple statistical method has been used to estimate the volume. The reliability of the volume estimates is given at the symmetrical 95 per cent probability level.

The district has been divided into three resource blocks containing between 11.3 and 13.1 km^2 of sand and gravel. For these blocks the geology of the deposits is described and the mineral-bearing area, the mean thickness of overburden and mineral, and the mean grading of the mineral are stated. Detailed borehole data are given. The geology, the position of the boreholes and the outlines of the resource blocks are shown on the accompanying map.

Note

National Grid references given in this publication lie within 100 kilometre square SP.

Bibliographical reference

CANNELL, B. 1982. The sand and gravel resources of the country east of Solihull, Warwickshire: description of parts of 1:25 000 sheets SP 17, 18, 27 and 28. **Miner. Assess. Rep. Inst. Geol. Sci.** No. 115

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INTRODUCTION

The survey is concerned with the estimation of resources, which include deposits that are not currently exploitable but have a foreseeable use, rather than reserves, which can only be assessed in the light of current, locally prevailing, economic considerations. Clearly, both the economic and the social factors used to decide whether a deposit may be workable in the future cannot be predicted; they are likely to change with time. Deposits not currently economically workable may be exploited as demand increases, as higher grade or alternative materials become scarce, or as improved processing techniques are applied to them. The improved knowledge of the main physical properties of the resource and their variability which this survey seeks to provide, will add significantly to the factual background against which planning policies can be decided (Archer, 1969; Thurrell, 1971, 1981; Harris and others, 1974).

The survey provided information at the 'indicated' level "for which tonnage and grade are computed partly from specific measurements, samples or production data and partly from projection for a reasonable distance on geological evidence. The sites available for inspection, measurement, and sampling are too widely or otherwise inappropriately spaced to permit the mineral bodies to be outlined completely or the grade established throughout". (Bureau of Mines and Geological Survey, 1948, p. 15).

It follows that the whereabouts of reserves must still be established and their size and quality proved by the customary detailed exploration and evaluation undertaken by the industry. However, the information provided by this survey should assist in the selection of the best targets for such further work. The following arbitrary physical criteria have been adopted:

a The deposit should average at least 1 m in thickness.
b The ratio of overburden to sand and gravel should be no more than 3:1.
c The proportion of fines (particles passing the No. 240 mesh BS sieve, about 1/16 mm) should not exceed 40 per cent.
d The deposit must lie within 25 m of the surface, this being taken as the likely maximum working depth under most circumstances. It follows from the second criterion that boreholes are drilled no deeper than 18 m if no sand and gravel has been proved.

A deposit of sand and gravel which broadly meets these criteria is regarded as 'potentially workable' and is described and assessed as 'mineral' in this report. As the assessment is at the indicated level, parts of such a deposit may not satisfy all the criteria.

For the particular needs of assessing sand and gravel resources, a grain-size classification based on the geometric scale 1/16 mm, 1/4 mm, 1 mm, 4 mm, 16 mm has been adopted. The boundaries between fines (that is, the clay and silt fractions) and sand, and between sand and gravel grade material, are placed at 1/16 mm and 4 mm respectively (see Appendix C).

The volume and other characteristics are assessed within resource blocks, each of which, ideally, contains approximately 10 km^2 of sand and gravel. No account is taken of any factors, for example, roads, villages and high agricultural or landscape value, which might stand

in the way of sand and gravel being exploited, although towns are excluded. The estimated total volume therefore, bears no simple relationship to the amount that could be extracted in practice.

It must be exphasised that the assessment applies to the resource block as a whole. Valid conclusions cannot be drawn about the mineral in parts of a block, except in the immediate vicinity of the sample points.

DESCRIPTION OF THE DISTRICT

The Solihull resource sheet in the West Midlands (Figure 1) covers 100 km^2 east of the town of which 37.3 km^2 is mineral-bearing. Solihull, the major town, has developed as an important industrial and administrative centre as well as a dormitory town for Birmingham. Dorridge and Knowle are the other towns with Hampton in Arden, Meriden and Balsall Common the more important villages (Figure 2). Away from the urban areas the district is given over almost entirely to agriculture with dairying dominant and some arable farming on the lighter sandy soils.

Topography

Generally, the topography of the district consists of a broad valley occupied by the north-flowing River Blythe. The highest ground is on the eastern side of the Blythe valley and rises abruptly to a height of over 160 m north of Meriden [246 826]. To the west of the river, the slope of the valley is more gentle and the highest ground commonly reaches a height of around 135 m near Solihull [151 798]. The floor of the valley falls gently northwards from over 110 m at Barston [2075 7804] to around 80 m at Stonebridge [2137 8312]. The River Blythe follows an incised meandering course eastwards from Solihull before flowing northwards at Barston.

Table 1 Classification of the Solid and Drift deposits.

DRIFT	
Quaternary	
Recent and Pleistocene	Alluvium
	River Terrace Deposits
	Head
	Fluvio-glacial Gravel
	Glacial Sand and Gravel
	Boulder Clay
	Glacial Lake Deposits
SOLID	
Jurassic:-	undivided
Triassic:-	undivided
Carboniferous:-	undivided

Geology

The geology of the northern part of the district has been described by Eastwood and others (1925) and descriptions covering the whole district are given by Old (1981 a, b, c), Sumbler (1981 a, b) and Ambrose (1981). The Solid and Drift deposits are classified as shown in Table 1. A schematic cross-section (A-A^1 on the resource map) showing the generalised Drift geology is shown in Figure 3.

Solid rocks crop out extensively throughout the area. In the eastern part of the district, between Meriden and Berkswell [2462 7914], the bedrock forms the higher ground (over 120 m), but elsewhere, it tends to be confined to ground lying between 115 m and 120 m.

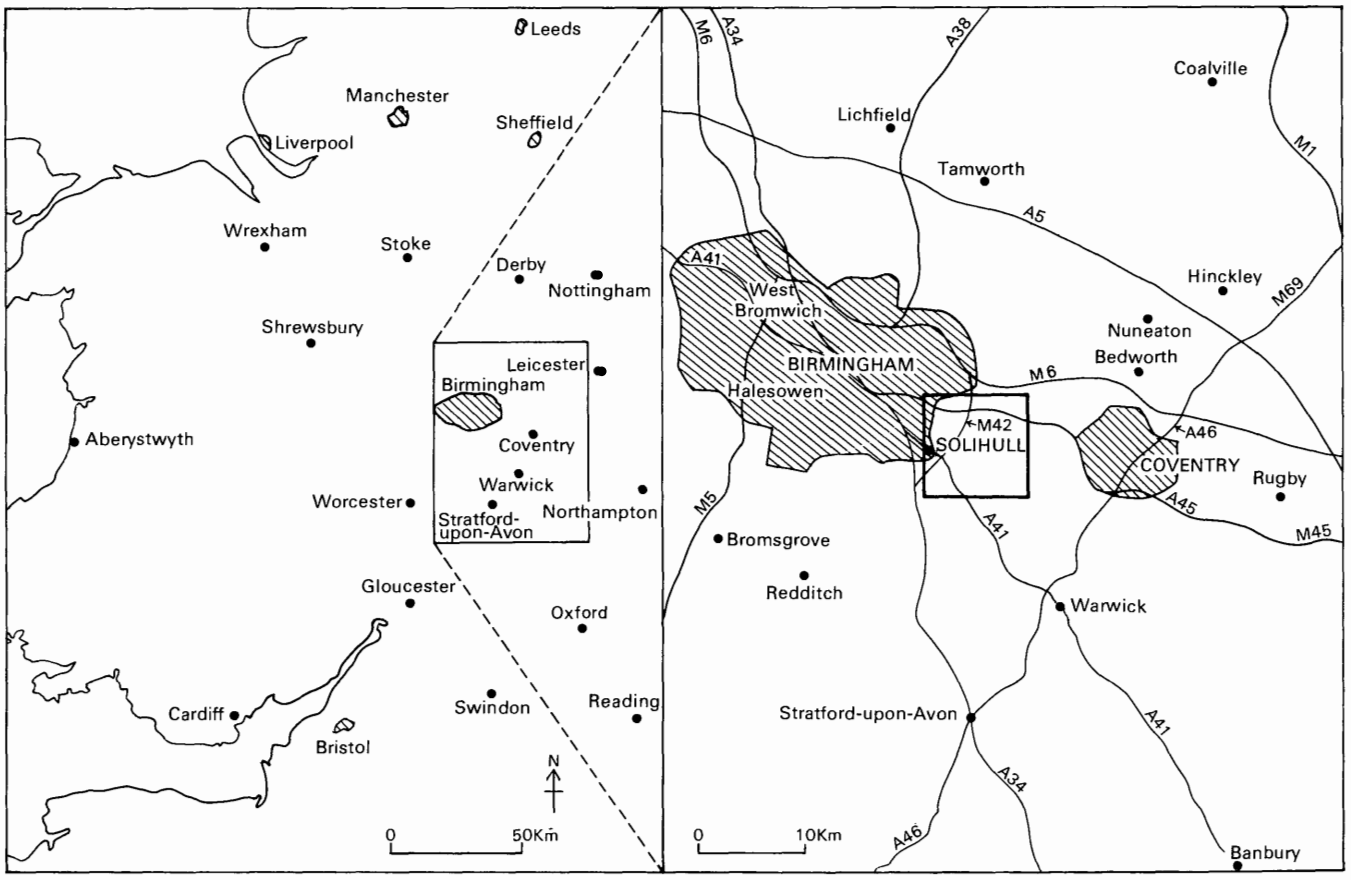


Figure 1 Location of the resource sheet area in the West Midlands.

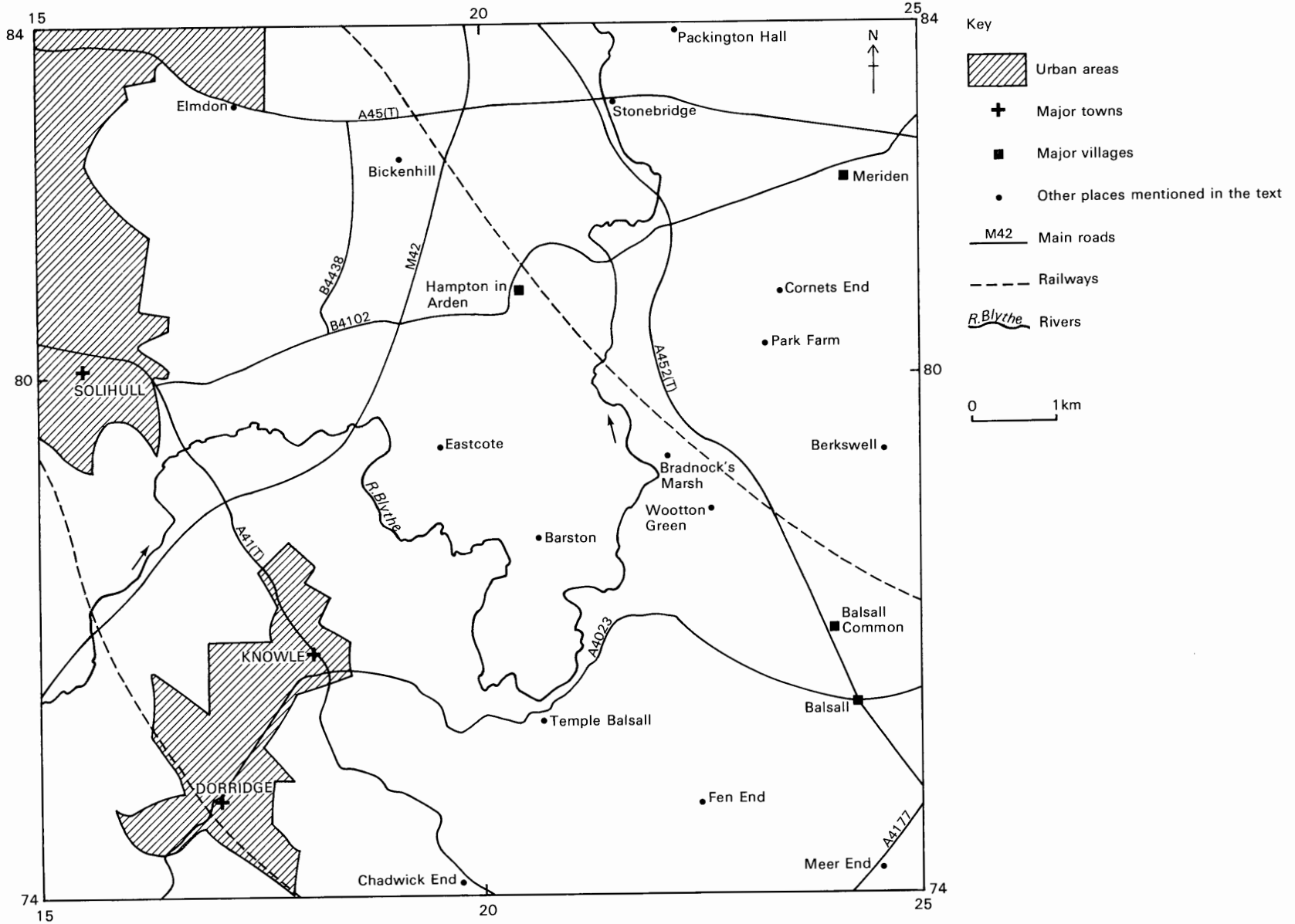
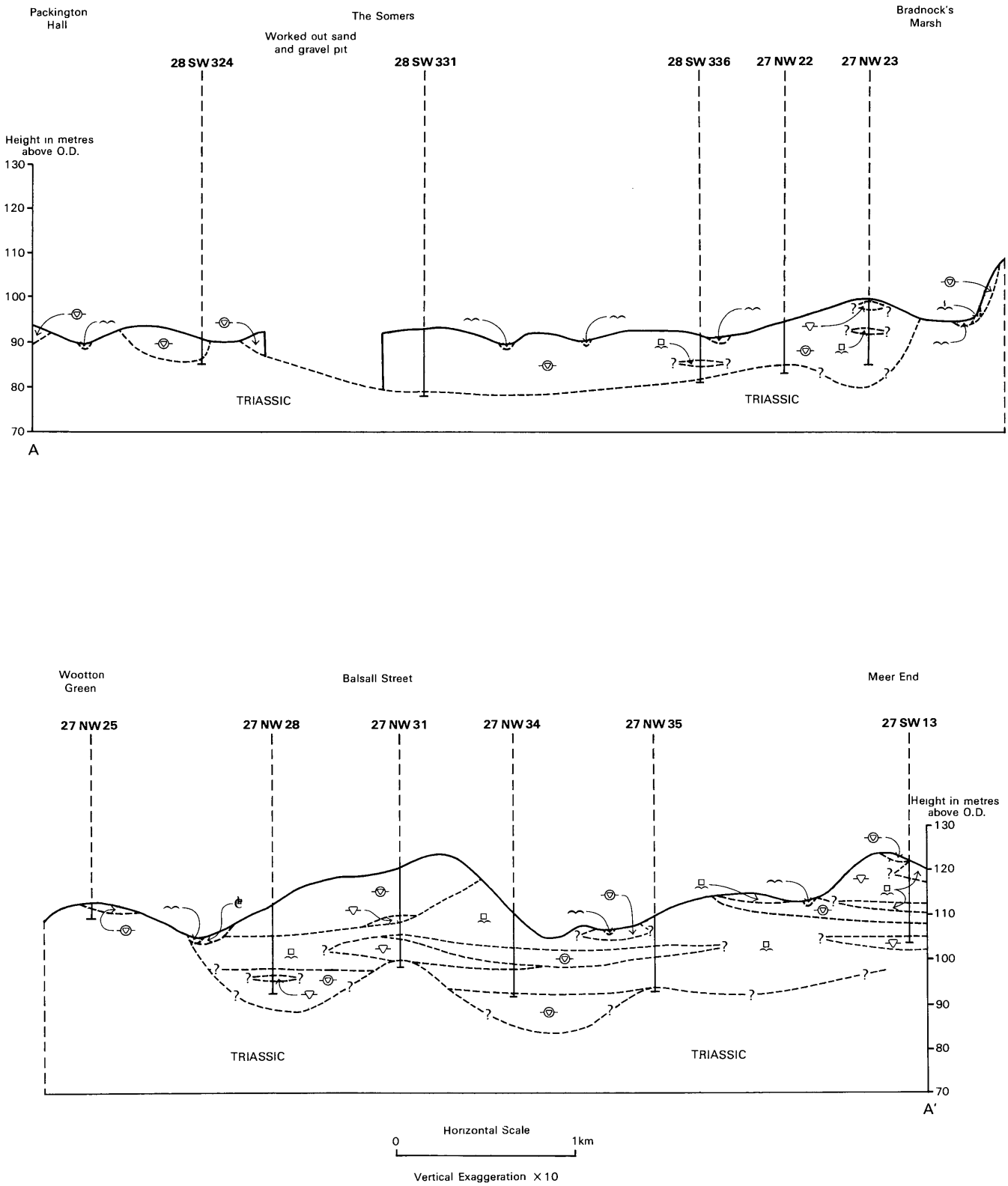


Figure 2 Locality Map.



For legend and symbols see resource map

Figure 3 Cross-section (A-A^1) showing the generalised Drift geology.

Overlying the bedrock are varied thicknesses of Drift comprising Fluvio-glacial Gravel, Glacial Sand and Gravel, Boulder Clay, Glacial Lake Deposits, Head, River Terrace Deposits and Alluvium.

SOLID

Carboniferous Carboniferous strata crop out along the eastern margin of the district where they form a prominent ridge. They comprise red mudstones and sandstones with rare calcareous conglomerate and Spirorbis Limestone beds.

Triassic The Triassic rocks underlie extensive tracts of land throughout much of the area, especially in the north-west from Elmdon [173 830] to Hampton in Arden [205 809]. They consist of red to reddish brown and greenish grey mudstones, siltstones and sandstones.

Jurassic Jurassic rocks form an outlier, west of Barston, surrounded by Triassic beds. They comprise grey mudstones with some bluish grey limestone beds.

DRIFT

An irregular near-surface bedrock topography is present throughout the Solihull district (see Figure 4) and had a considerable control of glacial deposition. Thus, marked lateral variations are common, correlation is difficult, and any interpretation is necessarily simplified (see cross-section A-A^1, Figure 3). A computer generated contour map of the bedrock topography based on IMAU boreholes and topographic information is shown in Figure 5. From this map it can be seen that the north-flowing reach of the River Blythe lies within a distinct bedrock basin bounded to the south by an east-west ridge at Wootton Green [230 784]. The River Blythe does not flow along the axis of this bedrock basin but is confined to its western margin.

Glacial drift covers about half of the district and has an irregular outcrop pattern as a result of dissection by the present drainage network. There are two main types of drift in the district: Glacial Sand and Gravel and Boulder Clay (Eastwood and others 1925; Old, 1981 a, b, c; Sumbler 1981 a, b, and Ambrose 1981). Minor amounts of Fluvio-glacial Gravel and Glacial Lake Deposits are also present. Extensive outcrops of Glacial Sand and Gravel (Shotton's "bedded gravelly drift", 1953, p. 237) occur throughout the district. Boulder Clay is confined, at surface and at depth, largely to the south-west and south-east, around Dorridge [171 752] and Balsall [243 763]. Fluvio-glacial Gravel is present mainly around Meriden, whereas Glacial Lake Deposits tend to be confined to the south-east around Balsall.

Deposition of the entire drift sequence appears to have been associated with a northern or north-western ice sheet (Eastwood and others 1925, Tomlinson 1935). At the onset of glaciation an ice sheet moved southwards along the Blythe valley depositing outwash sands and gravels before being halted for a time by the Wooton Green ridge (Figure 5). The north-flowing drainage of the area was blocked by ice which impounded a lake from Eastcote [195 791] to Meer End [247 743], probably forming part of Shotton's Lake Harrison (1953). The ice sheet continued to move southwards, overriding the ridge and laying down extensive spreads of till at Balsall. Its melt-waters deposited outwash sands and gravels around Solihull and Chadwick End [205 744]. As the ice sheet decayed, further outwash deposits were laid down along the Blythe valley from Park Farm [2332 8030] to Packington Hall [2228 8392].

Post-Glacial rejuvenation of the River Blythe and its tributaries led to significant erosion of the drift and bedrock with the development of a narrow tract of River Terrace Deposits and Alluvium.

Fluvio-glacial Gravel Fluvio-glacial Gravel has been distinguished only along the eastern margin of the Blythe valley, between Berkswell and Meriden. It is thought that these deposits were laid down by melt-waters flowing south from an ice front situated to the north. They consist of poorly sorted 'clayey' sands and gravels with till lenses, 5 m to 9.5 m in recorded thickness, containing Bunter quartzite and quartz with some sandstone, mudstone and igneous rock clasts.

Glacial Sand and Gravel Glacial Sand and Gravel deposits are well exposed in workings at Cornets End Pit [233 811]. The deposits comprise sands with some gravels mainly at the base of the sequence. In the top 4 to 5 m, the sands are level bedded below which uneven bedding with large- and small-scale cross-bedding of the fluvial type are common. Thin (1 to 2 m) sub-horizontal lenses of till are commonly present in their upper part.

Broadly, the sands and gravels of the district show the same sequence as that seen in the Cornets End Pit. Glacial Sand and Gravel crops out continuously along the Blythe valley from Bradnock's Marsh to Packington Hall. Elswhere, from Solihull to Dorridge and around Balsall, the Glacial Sand and Gravel has an irregular distribution. The deposits were probably laid down either as outwash in front of an ice sheet or in subglacial channels. The thickest deposits of sand and gravel are seen along the Blythe valley, at Solihull and around Balsall, where they range in recorded thickness from 6.0 m to more than 17.0 m. Over the rest of the area, the deposits are thinner, generally less than 5 m.

Throughout the Solihull district the gravel clasts comprise Bunter quartzite and quartz with minor amounts of sandstone, mudstone and igneous rock set in a matrix of fine to coarse-grained sand.

The sands have the same lithological constituents as the gravels with the lithic component only common in the coarser sands. Most of the medium and fine grains are coated with iron oxides which impart a reddish or yellowish brown colour to the deposits. The coarser grains are more rounded than the medium-sized particles.

Minor amounts of silts and clays are intercalated with the sands and gravels and probably reflect deposition in quiet water away from the main channel areas.

Boulder Clay Outcrops of Boulder Clay (till) are restricted to the southern part of the district where they form extensive, discontinuous spreads of stony clay. Boulder Clay is rarely developed outside this restricted area, (even at depth), but isolated pockets are present, notably to the north of Meriden [2351 8323]. The main deposits of these stony clays are believed to be lodgement till. The thickness of till commonly ranges between 1 m and 7 m, except at Fen End [225 750] where over 11 m has been proved.

The till consists of a stiff, reddish brown, pebbly sandy clay. The sand fraction is generally fine to medium-grained and the gravel fraction has a similar composition to that of the outwash gravels.

Glacial Lake Deposits Glacial Lake Deposits are found mainly in the south-east of the district. Their outcrop trends south-east from Eastcote to Meer End. The deposit thickens eastwards from about 1.5 to 10 m. Isolated deposits have also been proved north-east of Bradnock's Marsh and west of Dorridge.

Glacial Lake Deposits consist of soft, reddish brown stone-free, laminated clays and silts.

Head Outcrops of head are restricted to the south of the district, around Temple Balsall [207 760] and north-west of Balsall. The deposits form elongated lenses bordering the River Blythe and its tributaries. They comprise pebbly clay and silt and contain a clast composition reflecting that of Glacial Sand and Gravel from which they are probably derived.

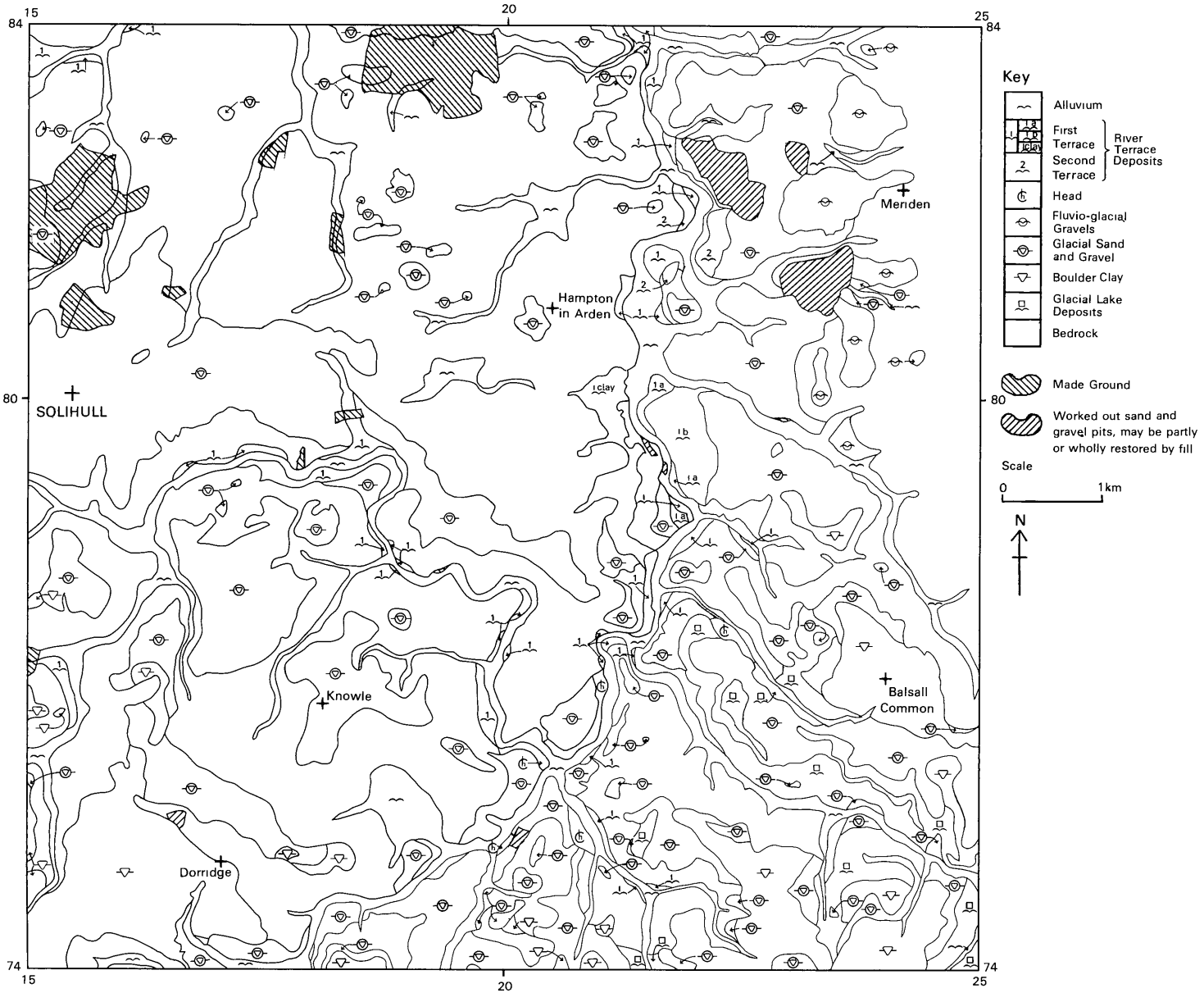


Figure 4 Drift geology map.

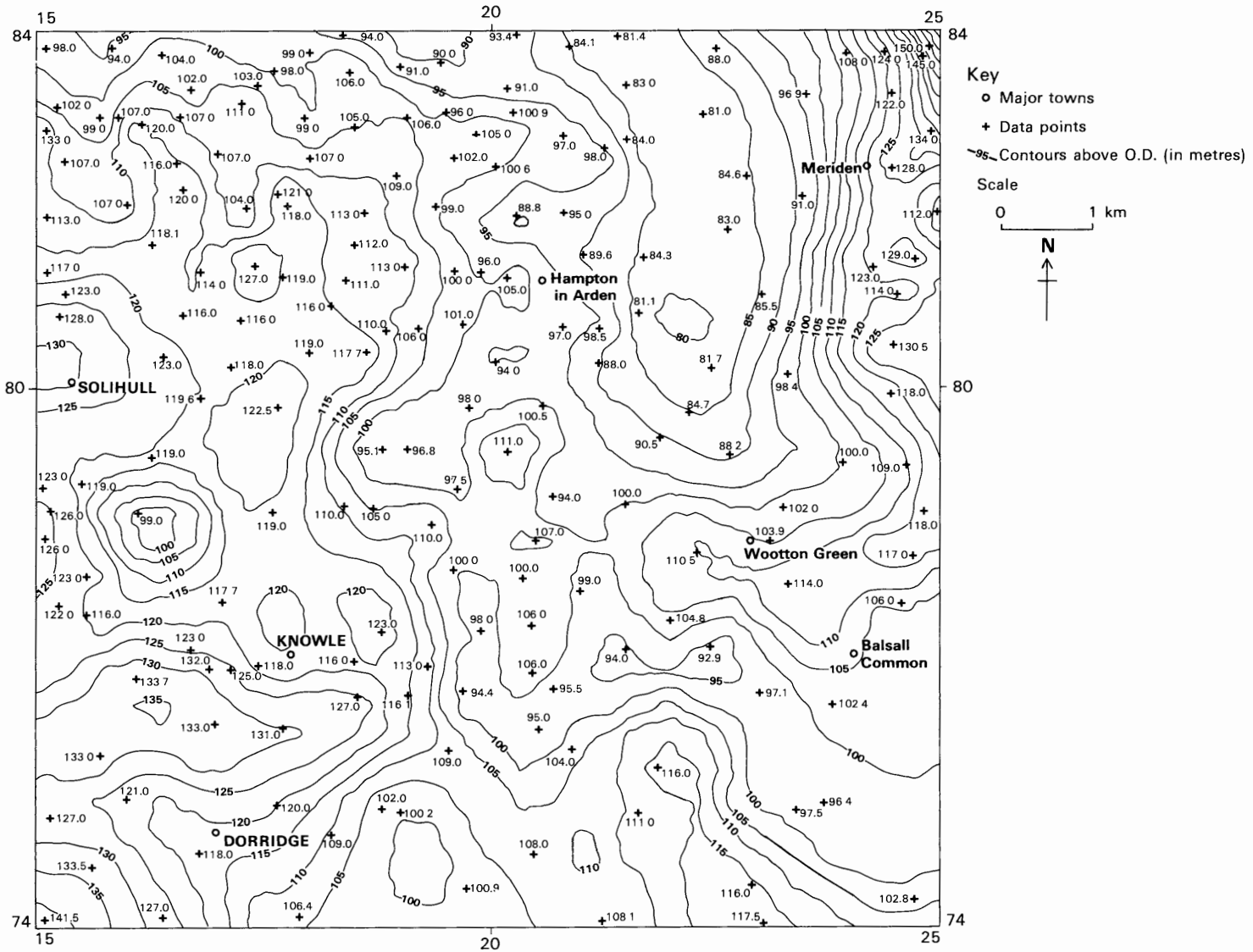


Figure 5 Computer generated contour map of the bedrock surface (heights in metres above O.D.).

River Terrace Deposits The First Terrace deposits can be traced downstream from Solihull and are less than 4 m thick. The comprise mainly sand and gravel, though a clay deposit has been recognised south-east of Hampton in Arden.

Second Terrace deposits have been recognised to the east of Hampton in Arden and consist of mainly 'clayey' pebbly sand.

The gravels of the terrace deposits are fine and coarse-grained with a clast composition similar to that of the glacial deposits. The sand fraction is mainly fine and medium-grained and has the same lithological constituents as the gravels.

Alluvium Alluvium comprising humic silts and clays, gravels and sands occurs as a continuous deposit on the floor of the valleys. Its recorded thickness along the River Blythe ranges from 3.0 to 4.5 m but is thinner in the tributary valleys.

Composition of the sand and gravel deposits

Five potentially workable sand and gravel deposits occur within the resource sheet area: Alluvium, River Terrace Deposits, Head, Fluvio-glacial Gravel and Glacial Sand and Gravel. For the small area of Head, no grading or compositional data are available and although the Head sands and gravels are considered to be potentially workable they will not be considered further in this section. The mean gradings and pebble compositions for the other deposits are shown in Table 2.

Alluvium The flood-plain deposits of the River Blythe comprise sandy or silty clay with some gravel and those of the tributaries are predominantly silty clay. The sand is fine to coarse-grained and consists mainly of subangular to well-rounded quartzite and quartz clasts. The gravel is fine and coarse with a few cobbles and consists largely of well-rounded quartzite (79 per cent) with some quartz and minor amounts of sandstone and igneous rock. The mean grading for the deposit is fines 5 per cent, sand 27 per cent, gravel 68 per cent.

River Terrace Deposits The deposits range from gravel to 'very clayey' sandy gravel with a mean grading of fines 9 per cent, sand 58 per cent and gravel 33 per cent. The sand is fine and medium-grained and composed mainly of angular to rounded quartzite and quartz. The gravel is fine and coarse with rounded to well-rounded quartzite clasts dominant.

Fluvio-glacial Gravel Ranging from gravel to 'clayey' sand, the deposit has a mean grading of fines 9 per cent, sand 58 per cent and gravel 33 per cent. No mineral was proved in two boreholes (28 SW 325 and 28 SW 332). The sand is fine and medium-grained, composed of angular to rounded quartzite and quartz. The gravel is fine and coarse with a composition similar to the River Terrace Deposits.

Glacial Sand and Gravel This formation contains the principal deposits of potentially workable sand and gravel in the district. Although the mean grading of the deposit is fines 12 per cent, sand 63 per cent and gravel 25 per cent, there is considerable vertical and lateral variability from pebble-free sand to gravel. The sand fraction is predominantly of fine and medium grade and is composed of angular to rounded quartzite and quartz. The gravel fraction is fine and coarse with some cobbles, comprising for the most part, rounded to well-rounded quartzite with some quartz, sandstone, mudstone and igneous rock clasts.

The Map

The sand and gravel resource map is folded into the pocket at the end of this report. The map base with contours is the Ordnance Survey 1:25 000 Outline Edition in grey, on which the geological data are shown in black and the mineral resource information in shades of red.

Geological data The geological boundary lines are taken from the Birmingham (Sheet 168), Coventry (Sheet 169), Redditch (Sheet 183) and Warwick (Sheet 184) geological maps which were surveyed at scales of 1:10 560 and 1:10 000. Borehole data, which include the stratigraphic relations and mean particle size distribution of the sand and gravel samples collected during the assessment survey are also shown.

The geological boundaries are based on the information available at the time of the original survey.

Mineral resource information The mineral-bearing ground is divided into three resource blocks (see Appendix A). The mineral is identified as 'exposed' where the thickness of overburden, commonly consisting only of soil and subsoil, averages less than 1.0 m.

Areas where bedrock crops out are uncoloured on the map. Areas of unassessed sand and gravel, for example, in built-up areas, are indicated by a red stipple.

The area of the exposed sand and gravel is measured from the mapped geological boundary lines. The whole of this area is considered as mineral, although it may include small areas where sand and gravel is not present or is not potentially workable.

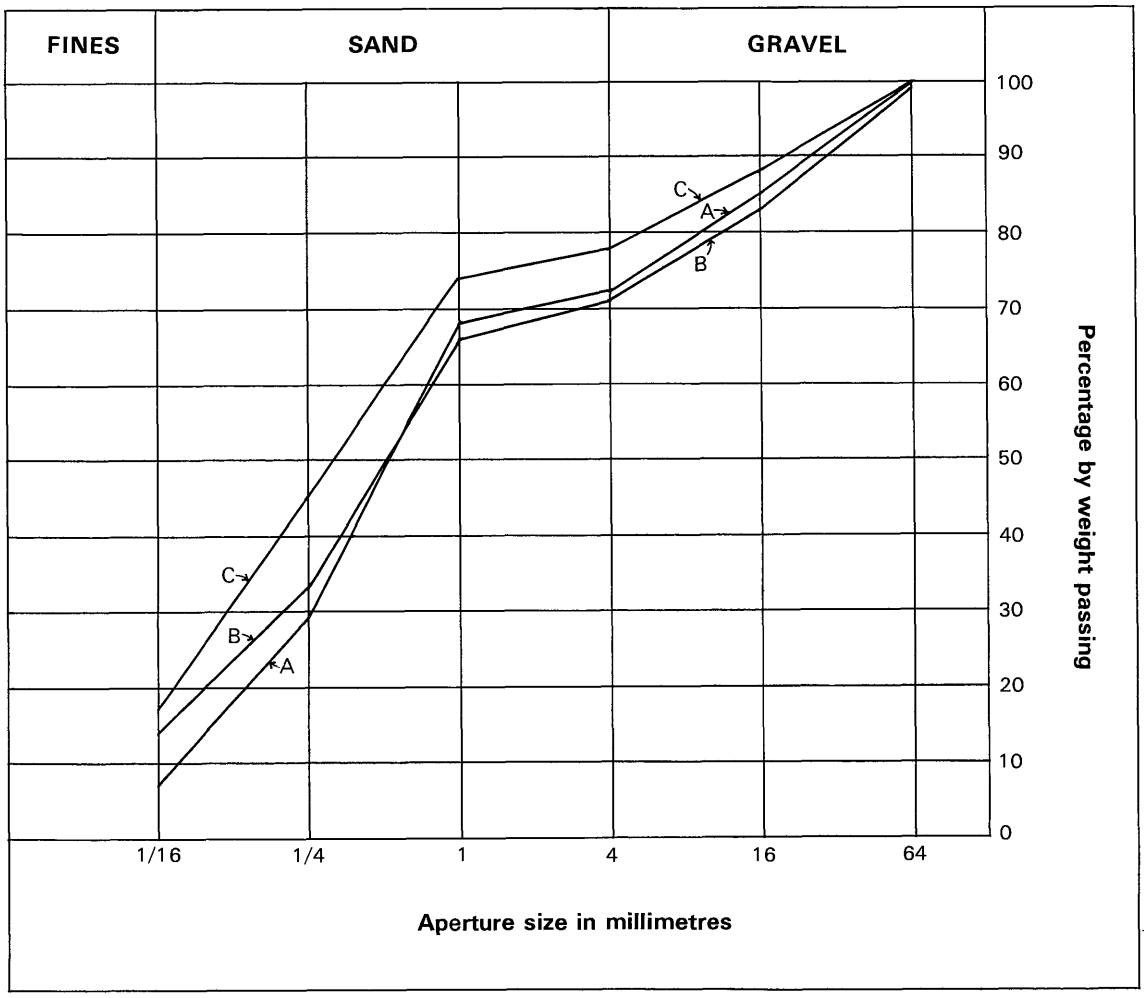
Results

The statistical results are summarised in Table 3. More complete grading particulars are shown in Figure 6.

Accuracy of the results For the three resource blocks the accuracy of the results ranges between 25 and 49 per

Table 2 Mean grading and composition of the sand and gravel deposits (based on IMAU boreholes).

Deposit Type	Mean grading %			Composition, % by weight in gravel fraction (+8 mm)					
	Fines	Sand	Gravel	Quartzite	Quartz	Sandstone	Mudstone	Igneous rock	
								Volcanic	Intrusive
Alluvium	5	27	68	79	19	1	trace	-	1
River Terrace Deposits	9	58	33	73	25	1	-	-	1
Fluvio-glacial Gravel	9	58	33	74	25	1	-	-	-
Glacial Sand and Gravel	12	63	25	74	20	4	1	trace	1



Block	Percentage by weight passing					
	$\frac{1}{16}$ mm	$\frac{1}{4}$ mm	1 mm	4 mm	16 mm	64 mm
A	7	29	68	72	85	100
B	14	33	66	71	83	99
C	17	45	74	78	88	100

Figure 6 Particle size distribution for the assessed thickness of mineral in resource blocks A to C.

cent at the symmetrical 95 per cent probability level (that is, it is probable that 19 times out of 20 the true volume present lies within these limits). However, the true values are more likely to be nearer the figures estimated than the limits. Moreover, it is probable that in each block roughly the same percentage limits would apply for the estimate of volume of a very much smaller parcel of ground (say, 100 hectares) containing similar sand and gravel deposits if the results from the same number of sample points (as provided by, say, 10 boreholes) were used in the calculation. Thus, if closer limits are neeeded for the quotation of reserves of part of a block it can be expected that data from more than 10 sample points will be required, even if the area is quite small. This point can be illustrated by considering the whole of the potentially workable sand and gravel on this sheet. The volume (171.5 million m^3) can be esimated to limits of ± 18 per cent at the 95 per cent probability level (Table 3), by a calculation based on the data from 58 sample points spread across the three resource blocks.

However, it must be emphasised that the quoted volume of sand and gravel has no simple relationship with the amount that could be extracted in practice, as no allowance has been made in the calculations for any restraints (such as existing buildings and roads) on the use of the land for mineral working.

Notes on the resource blocks

The area is divided into three resource blocks in which the area of mineral ranges from 11.3 km^2 to 13.1 km^2 (Table 3). As far as possible the block boundaries are determined by geological considerations. The mineral components within the district consist of Alluvium, River Terrace Deposits, Head, Fluvio-glacial Gravel and Glacial Sand and Gravel.

Block A

Block A extends over the north-eastern part of the sheet and covers an area of 38.0 km^2 of which 11.3 km^2 is mineral-bearing.

Table 3 The sand and gravel resources of the Solihull district: summary of statistical results.

Resource block	Area		Mean thickness		Volume of sand and gravel			Mean grading percentage		
	Block	Mineral	Over-burden	Mineral		Limits at the 95% probability level		Fines $-\frac{1}{16}$ mm	Sand $+\frac{1}{16}$ -4 mm	Gravel +4 mm
	km^2	km^2	m	m	$m^3 \times 10^6$	± %	± $m^3 \times 10^6$			
A	38.0	11.3	1.2	6.3	71.1	25	17.7	7	65	28
B	31.9	12.9	0.7	4.2	54.1	28	15.1	14	57	29
C	20.4	13.1	1.4	3.0	39.3	49	19.2	17	61	22
A to C	90.3	37.3	1.0	4.6	171.5	18	30.8	12	61	27
Urban district of Solihull, Knowle and Dorridge										
	9.7	- not assessed (see text)								

The potentially workable sand and gravel is confined largely to the Blythe valley and comprises Alluvium, River Terace Deposits, Fluvio-glacial Gravel and Glacial Sand and Gravel. Elsewhere, the area is generally barren, consisting of Carboniferous and Triassic bedrock, although small isolated pockets of Glacial Sand and Gravel are present.

The pre-Glacial Blythe valley contains thick outwash deposits of Glacial Sand and Gravel (over 17.0 m in places). The mineral thins towards the valley sides notably on the western flank, where the sand and gravel is less than 3.9 m thick. Thin deposits (less than 4.6 m) of sand and gravel occur in isolated pockets around Bickenhill [189 823]. The mean thickness of mineral for the block is 6.3 m; the range is from 2.1 m to over 17.0 m but mineral was absent in boreholes 28 SW 325 and 28 SW 332. The estimated volume of mineral is 17.1 million m^3 ±25 per cent. The overburden, which usually consists of silt and pebbly, sandy clay, ranges in thickness from 0.2 m to 6.0 m and has a mean of 1.2 m.

The grading results are shown in Figure 7 and Table 4. The fines content is commonly less than 8 per cent but it is as high as 19 per cent in borehole 18 SE 461. The content of sand, which is dominantly medium-grained, varies between 29 and 92 per cent. The gravel content is very variable, ranging from 1 to 67 per cent. The mean grading for the resource block is fines 7 per cent, sand 65 per cent and gravel 28 per cent.

Block B

Block B covers 31.9 km^2, of which 12.9 km^2 is mineral-bearing; it extends over the western half of the sheet but does not include the urban areas of Solihull, Knowle and Dorridge.

Within the area much of the mineral is exposed except for small patches which lie beneath Alluvium and Boulder Clay around Dorridge. The mineral comprises Glacial Sand and Gravel together with a narrow tract of Alluvium and River Terrace Deposits along the River Blythe.

The greatest mineral thickness is found within the Glacial Sand and Gravel around Barston and Eastcote, where up to 12.6 m has been proved. Elsewhere, the sand and gravel is less than 2.1 m thick apart from the south-west where 8.3 m and 6.2 m of mineral were proved in boreholes 17 NE 192 and 17 NE 198 respectively. The mean thickness of mineral for the block is 4.2 m, the range from 1.1 m to 12.6 m; it was absent from boreholes 17 NE 194, 17 NE 196 and 18 SE 465. The estimated volume of mineral is 54.1 million m^3 ± 28 per cent. The overburden ranges in thickness from 0.3 m to 5.0 m and has a mean of 0.7 m. It consists of gravelly soil, silt and sandy clay.

The grading results are shown in Figure 8 and Table 5. The fines content varies from 3 to 25 per cent. The sand content commonly varies between 47 and 67 per cent, although in borehole 17 NE 186 it is as high as

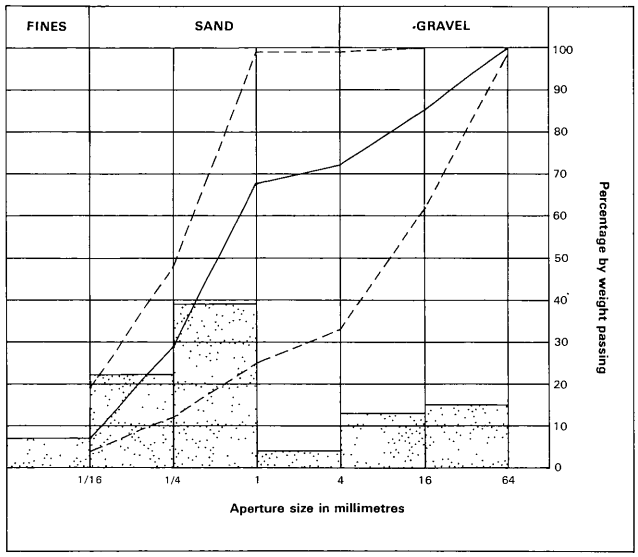


Figure 7 Grading characteristics of the mineral in Block A.

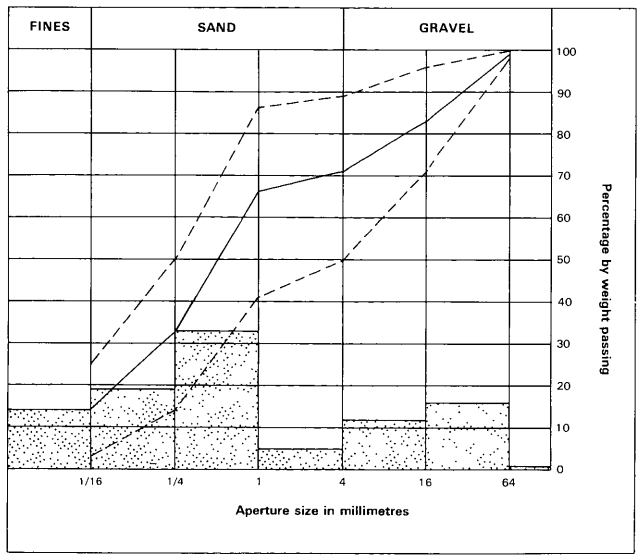


Figure 8 Grading characteristics of the mineral in Block B.

Table 4 Data from IMAU boreholes: Block A.

Borehole	Recorded thickness (m)		Mean grading percentage						
	Over-burden	Mineral	Fines $-\frac{1}{16}$ mm	Fine sand $+\frac{1}{16}-\frac{1}{4}$ mm	Medium sand $+\frac{1}{4}$ -1 mm	Coarse sand +1 -4 mm	Fine gravel +4 -16 mm	Coarse gravel +16 -64 mm	Cobbles +64 mm
SP 18									
SE 460	0.6	7.4	7	20	72	1	0	0	
SE 461	1.4	4.6	19	20	40	3	9	8	1
SP 27									
NW 21	0.7 m of sand proved beneath 0.8 m of overburden								
NW 22	0.8	9.2	4	16	21	5	23	29	2
NW 23*	2.5	11.2+†	6	39	38	3	6	8	0
NW 26*	0.5	4.6	8	31	50	3	3	5	0
SP 28									
SW 320	0.5	5.0	8	26	46	1	6	13	0
SW 321	0.4	10.4	7	7	23	6	21	35	1
SW 322	0.8 m of sand proved beneath 0.3 m of overburden								
SW 323	0.9 m of sand proved beneath 0.6 m of overburden								
SW 324	0.5	4.4	5	10	17	7	28	31	2
SW 325		absent							
SW 327	0.4	3.6	16	26	52	1	3	2	0
SW 328	0.6	10.0	11	18	33	4	14	20	0
SW 329	6.0	17.0+	5	27	40	5	13	10	0
SW 330	0.3	3.4	11	37	38	5	5	4	0
SW 331	0.5	13.5	5	25	44	3	10	13	0
SW 332		absent							
SW 333	0.6	3.9	4	8	13	8	29	37	1
SW 334	3.2	10.3	5	31	60	1	2	1	0
SW 335	0.4	2.1	7	12	16	9	32	24	0
SW 336*	0.2	8.5	7	13	39	4	16	21	0
Block mean grading			**7**	**22**	**39**	**4**	**13**	**15**	**0**

* Excludes waste partings
† The + sign indicates that the base of the deposit was not reached

84 per cent. The sand is predominantly medium-grained. The gravel content varies from 11 to 50 per cent. The mean grading for the block is fines 14 per cent, sand 57 per cent and gravel 29 per cent.

Block C

Block C extends over the south-eastern part of the sheet and covers an area of 20.4 km^2, of which 13.1 km^2 is mineral-bearing.

Along the western margin of the block a thin Glacial sequence overlies bedrock; here the mineral is largely 'exposed' and comprises Alluvium, River Terrace Deposits, Head and Glacial Sand and Gravel. Further east, the deposits although thicker (over 10 m in places) are mainly concealed beneath varying thicknesses of Boulder Clay and Glacial Lake Deposits.

The mean thickness of mineral for the block is 3.0 m and the recorded range from 1.1 m to 12.8 m. Boreholes 27 NW 27, 27 NW 29 and 27 NW 33 proved no mineral. The estimated volume of mineral is 39.3 million m^3 $\pm$ 49 per cent. The overburden, comprising silt, sandy clay and laminated clay, ranges in recorded thickness from 0.2 m to 1.5 m and has a mean of 1.4 m.

The grading results are shown in Figure 9 and Table 6. The fines content commonly varies between 12 and 25 per cent but is as low as 2 per cent in borehole 27 NW 30. The sand content is usually between 55 per cent and 83 per cent, although, exceptionally, in boreholes 27 NW 30 and 27 SW 11 it is 27 per cent and 33 per cent respectively. The sand is predominantly fine and medium-grained. The gravel content commonly varies between 4 and 28 per cent, but reaches a maximum of 71 per cent in borehole 27 NW 30. The mean grading for the block is fines 17 per cent, sand 61 per cent and gravel 22 per cent.

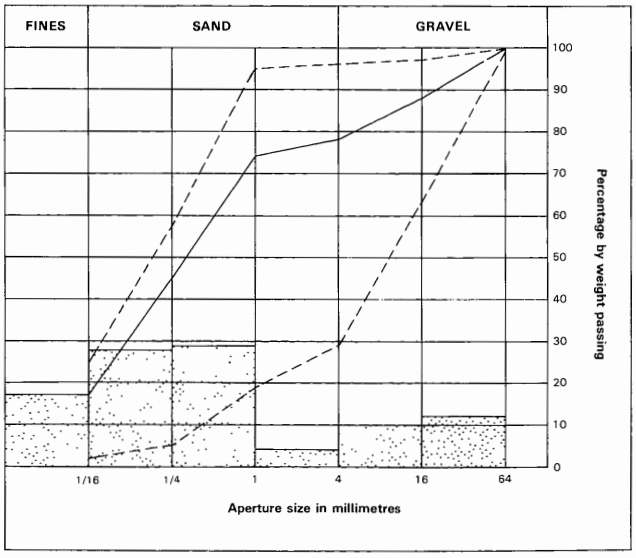


Figure 9 Grading characteristics of the mineral in Block C.

Table 5 Data from IMAU boreholes: Block B.

Borehole	Recorded thickness (m)		Mean grading percentage						
	Over-burden	Mineral	Fines $-\frac{1}{16}$ mm	Fine sand $+\frac{1}{16}-\frac{1}{4}$ mm	Medium sand $+\frac{1}{4}-1$ mm	Coarse sand +1 -4 mm	Fine gravel +4 -16 mm	Coarse gravel +16 -64 mm	Cobbles +64 mm
SP 17									
NE 185*	0.3	7.8	13	16	33	6	13	18	1
NE 186	0.4	1.1	5	22	59	3	7	4	0
NE 187	1.0	6.9	3	11	27	9	21	29	0
NE 188	5.0	6.2	4	22	32	5	17	20	0
NE 189	0.8 m of sand proved beneath 0.6 m of overburden								
NE 190	0.9	2.1	23	13	47	5	7	5	0
NE 191*	0.4	12.6	16	32	31	4	9	8	0
NE 192*	0.3	8.3	25	17	36	3	9	8	2
NE 193	0.5 m of sand proved beneath 2.8 m of overburden								
NE 194		absent							
NE 195	0.5	1.5	21	9	18	9	25	18	0
NE 196		absent							
NE 197	0.5 m of sand proved beneath 1.0 m of overburden								
NE 198*	1.5	6.2	12	11	32	4	15	26	0
SP 18									
SE 462	0.5	2.4	21	29	28	3	6	11	2
SE 463	0.5	4.5	18	21	32	4	11	14	0
SE 464	0.6	12.6	11	12	37	5	14	20	1
SE 465		absent							
SP 27									
NW 24	0.5	8.8	22	22	32	4	9	11	0
Block mean grading			**14**	**19**	**33**	**5**	**12**	**16**	**1**

* Excludes waste partings

Table 6 Data from IMAU boreholes: Block C.

Borehole	Recorded thickness (m)		Mean grading percentage						
	Over-burden	Mineral	Fines $-\frac{1}{16}$ mm	Fine sand $+\frac{1}{16}-\frac{1}{4}$ mm	Medium sand $+\frac{1}{4}-1$ mm	Coarse sand +1 -4 mm	Fine gravel +4 -16 mm	Coarse gravel +16 -64 mm	Cobbles +64 mm
SP 17									
NE 199	0.8 m of sand proved beneath 2.0 m of overburden								
SE 64	1.5	6.2	13	44	38	1	1	2	1
SP 27									
NW 25	0.4	1.1	14	11	55	4	8	8	0
NW 27		absent							
NW 28*	0.4	5.3	13	27	44	3	8	5	0
NW 29		absent							
NW 30	1.0	2.5	2	3	14	10	34	37	0
NW 31	0.4	10.3	18	23	27	5	12	15	0
NW 32*	0.4	12.8	23	27	38	2	3	6	1
NW 33		absent							
NW 34*	0.2	8.4	12	35	22	3	11	17	0
NW 35	excessive overburden								
SW 11	0.4	3.6	25	10	16	7	20	22	0
SW 12	excessive overburden								
SW 13	excessive overburden								
SW 15	excessive overburden								
Block mean grading			**17**	**28**	**29**	**4**	**10**	**12**	**0**

* Excludes waste partings

Notes on the sand and gravel workings of the area

Sand and gravel has been extracted from both the Fluvio-glacial Gravel and Glacial Sand and Gravel, mainly in the north-east of district near Meriden. To date all the workings cover a total area of 0.81 km^2 and an estimated 9.7 million m^3 of material has been removed. The mineral has been used to provide a wide range of products, including moulding sand and building sand. Several of the pits are now disused and have been partially or wholly restored.

The active and disused workings in the district are as follows:

Location and Grid Reference		Deposit worked
Active workings		
Cornets End	232 813	Fluvio-glacial Gravel and Glacial Sand and Gravel
Brown's Lane	165 768	Glacial Sand and Gravel
Ryton End	215 795	Terrace 1
Disused workings		
Rileys Pit	201 753	Glacial Sand and Gravel
Sibleys Pit	224 792	Glacial Sand and Gravel
The Somers	223 824	Glacial Sand and Gravel

Note: There is a small, now restored pit to the east of the Somers (230 827).

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WP/KW/LKW

APPENDIX A

FIELD AND LABORATORY PROCEDURES

Trial and error during initial studies of the complex and variable glacial deposits of East Anglia and Essex showed that an absolute minimum of five sample points evenly distributed across the sand and gravel are needed to provide a worthwhile statistical assessment, but that, where possible, there should be not less than ten. Sample points are any points for which adequate information exists about the nature and thickness of the deposit and may include boreholes other than those drilled during the survey and exposures. In particular, the cooperation of sand and gravel operators ensures that boreholes are not drilled where reliable information is already available; although this may be used in the calculations, it is held confidentially by the Institute and cannot be disclosed.

The mineral shown on each 1:25 000 sheet is divided into resource blocks. The arbitrary size selected is a compromise to meet the aims of the survey by providing sufficient sample points in each block. As far as possible the block boundaries are determined by geological boundaries so that, for example, glacial and river terrace gravels are separated. Otherwise division is by arbitrary lines, which may bear no relationship to the geology. The blocks are drawn provisionally before drilling begins.

A reconnaissance of the ground is carried out to record any exposures and inquiries are made to ascertain what borehole information is available. Borehole sites are then selected to provide an even pattern of sample points at a density of approximately one per square kilometre. However, because broad trends are independently overlain by smaller-scale characteristically random variations, it is unnecessary to adhere to a square grid pattern. Thus such factors as ease of access and the need to minimise disturbance to land and the public are taken into account in siting the holes; at the same time it is necessary to guard against the possibility that ease of access (that is, the positions of roads and farms) may reflect particular geological conditions, which may bias the drilling results.

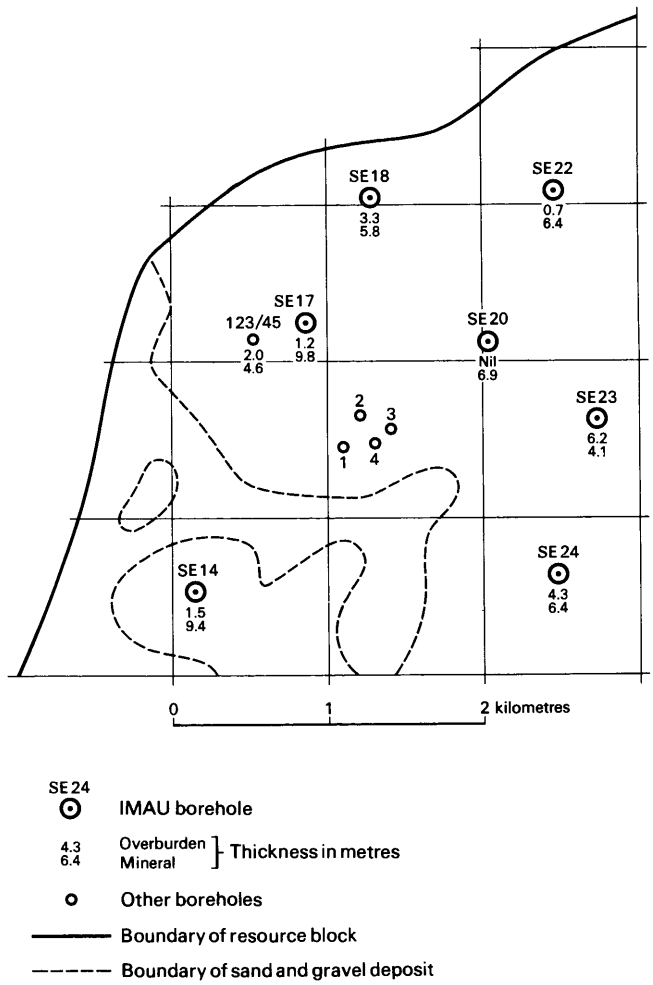
The drilling machine employed should be capable of providing a continuous sample representative of all unconsolidated deposits, so that the in-situ grading can be determined, if necessary, to a depth of 30 m (100 ft) at a diameter of about 200 mm (8 in), beneath different types of overburden. It should be reliable, quiet, mobile and relatively small (so that it can be moved to sites of difficult access). Shell and auger rigs have proved to be almost ideal.

The rigs are modified to enable deposits above the water table to be drilled 'dry', instead of with water added to facilitate the drilling, to minimise the amount of material drawn in from outside the limits of the hole. The samples thus obtained are representative of the in-situ grading, and satisfy one of the most important aims of the survey. Below the water table the rigs are used conventionally, although this may result in the loss of some of the fines fraction and the pumping action of the bailer tends to draw unwanted material into the hole from the sides or the bottom.

A continuous series of bulk samples is taken throughout the sand and gravel. Ideally samples are composed exclusively of the whole of the material encountered in the borehole between stated depths. However, care is taken to discard, as far as possible, material which has caved or has been pumped from the bottom of the hole. A new sample is commenced whenever there is an appreciable lithological change within the sand and gravel, or at every 1 m (3.3 ft) depth. The samples, each weighing between 25 and 45 kg (55 and 100 lb), are despatched in heavy-duty polythene bags to a laboratory for grading. The grading procedure is based on B.S. 1337 (British Standards Institution, 1967). Random checks of the accuracy of the grading are made in the Institute's laboratories.

All data, including mean grading analysis figures calculated for the total thickness of the mineral, are entered on standard record sheets, abbreviated copies of which are reproduced in Appendix E.

Detailed records may be consulted at the appropriate offices of the Institute, upon application to the Head, Industrial Minerals Assessment Unit.



Example of resource block assessment: map of a fictitious block

APPENDIX B

STATISTICAL PROCEDURE

Statistical assessment

1 A statistical assessment is made of an area of mineral greater than 2 km^2, if there are at least five evenly spaced boreholes in the resource block (for smaller areas, see Paragraph 12 below).

2 The simple methods used in the calculations are consistent with the amount of data provided by the survey (Hull, 1981). Conventional symmetrical confidence limits are calculated for the 95 per cent probability level, that is, on average nineteen out of every twenty sets of limits constructed in this way contain the true value for the volume of mineral.

3 The volume estimate (V) for the mineral in a given block is the product of two variables, the sampled areas (A) and the mean thickness ($\bar{l}_m$) calculated from the individual thicknesses at the sample points. The standard deviations for these variables are related such that

$$S_V = \sqrt{(S_A^2 + S_{\bar{l}_m}^2)} \qquad [1]$$

4 The above relationship may be transposed such that

$$S_V = S_{\bar{l}_m} \sqrt{(1 + S_A^2 / S_{\bar{l}_m}^2)} \qquad [2]$$

From this it can be seen that as $S_A^2 / S_{\bar{l}_m}^2$ tends to 0, S_V tends to $S_{\bar{l}_m}$.

If, therefore, the standard deviation for area is small with respect to that for thickness, the standard deviation for volume approximates to that for mean thickness.

5 Given that the number of approximately evenly spaced sample points in the sampled area is n with mineral thickness measurements $l_{m_1}, l_{m_2}, \ldots l_{m_n}$, then the best estimate of mean thickness, $\bar{l}_m$, is given by

$$\Sigma (l_{m_1} + l_{m_2} \ldots l_{m_n}) / n .$$

For groups of closely spaced boreholes a discretionary weighting factor may be applied to avoid bias (see note on weighting below). The standard deviation for mean thickness $S_{\bar{l}_m}$, expressed as a proportion of the mean thickness, is given by

$$S_{\bar{l}_m} = (1/\bar{l}_m) \sqrt{[\Sigma (l_m - \bar{l}_m)^2/(n-1)]}$$

where l_m is any value in the series l_{m_1} to l_{m_n}.

6 The sampled area in each resource block is coloured pink on the map. Wherever possible, calculations relate to the mineral within mapped geological boundaries (which may not necessarily correspond to the limits of a deposit). Where the area is not defined by a mapped boundary, that is, where the boundary is inferred, a distinctive symbol is used. Experience suggests that the errors in determining area are small relative to those in thickness. The relationship $S_A / S_{\bar{l}_m} \leqq 0.\dot{3}$ is assumed in all cases. It follows from Equation [2] that

$$S_{\bar{l}_m} \leqq S_V \leqq 1.05\, S_{\bar{l}_m} \qquad [3]$$

7 The limits on the estimate of mean thickness of mineral, $L_{\bar{l}_m}$, may be expressed in absolute units

$\pm (t/\sqrt{n}) \times S_{\bar{l}_m}$ or as a percentage

$\pm (t/\sqrt{n}) \times S_{\bar{l}_m} \times (100/\bar{l}_m)$ per cent, where t is Student's t at the 95 per cent probability level for $(n-1)$ degrees of freedom, evaluated by reference to statistical tables. (In applying Student's t it is assumed that the measurements are distributed normally).

8 Values of t at the 95 per cent probability level for values of n up to 20 are as follows:

n	t	n	t
1	infinity	11	2.228
2	12.706	12	2.201
3	4.303	13	2.179
4	3.182	14	2.160
5	2.776	15	2.145
6	2.571	16	2.131
7	2.447	17	2.120
8	2.365	18	2.110
9	2.306	19	2.101
10	2.262	20	2.093

(from Table 12 in *Biometrika Tables for Statisticians*, Volume 1, Second Edition, Cambridge University Press, 1962). When n is greater than 20, 1.96 is used (the value of t when n is infinity).

9 In calculating confidence limits for volume, L_V, the following inequality, corresponding to Equation [3], is applied:

$$L_{\bar{l}_m} \leqq L_V \leqq 1.05\, L_{\bar{l}_m}.$$

10 In summary, for values of n between 5 and 20, L_V is calculated as

$$[(1.05 \times t)/\bar{l}_m] \times [\sqrt{\Sigma (l_m - \bar{l}_m)^2/n\ (n-1)}] \times 100$$

per cent,

and when n is greater than 20, as

$$[(1.05 \times 1.96)/\bar{l}_m] \times [\sqrt{\Sigma (l_m - \bar{l}_m)^2/n\ (n-1)}] \times 100$$

per cent.

11 The application of this procedure to a fictitious area is illustrated in the accompanying Figure and example of a block calculation.

Inferred assessment

12 If the sampled area of mineral in a resource block is between 0.25 km^2 and 2 km^2, an assessment is inferred on the basis of geological and topographical information, usually supported by the data from one or two boreholes. The volume of mineral is calculated as the product of the area, measured from field data, and the estimated thickness. Confidence limits are not calculated.

13 In some cases a resource block may include an area left uncoloured on the map, within which mineral (as defined) is interpreted to be generally absent. If there is reason to believe that some mineral may be present, an inferred assessment may be made.

14 No assessment is attempted for an isolated area of mineral less than 0.25 km^2.

15 Note on weighting The thickness of a deposit at any point may be governed solely by the position of the point in relation to a broad trend. However, most sand and gravel deposits also exhibit a random pattern of local, and sometimes considerable, variation in thickness. Thus the distribution of sample points needs to be only approximately regular and in estimating the mean thickness only simple weighting is necessary. In practice, equal weighting can often be applied to thicknesses at all sample points. If, however, there is a distinctly unequal distribution of points, bias is avoided by dividing the sampled area into broad zones, to each of which a value roughly proportional to its area is assigned. This value is then shared between the data points with the zone as the weighting factor.

Block calculation

Scale: 1:25 000
Block: Fictitious

Area
Block: 11.08 km²
Mineral: 8.32 km²

Mean thickness
Overburden: 2.5 m
Mineral: 6.5 m

Volume
Overburden: 21 million m³
Mineral: 54 million m³

Confidence limits of the estimate of mineral volume at the 95 per cent probability level: ± 20 per cent
That is, the volume of mineral (with 95 per cent probability): 54 ± 11 million m³

Thickness estimate (measurements in metres)
l_o= overburden thickness l_m = mineral thickness

Sample point	Weighting w	Overburden l_o	Overburden wl_o	Mineral l_m	Mineral wl_m	Remarks
SE 14	1	1.5	1.5	9.4	9.4	IMAU boreholes
SE 18	1	3.3	3.3	5.8	5.8	
SE 20	1	nil	-	6.9	6.9	
SE 22	1	0.7	0.7	6.4	6.4	
SE 23	1	6.2	6.2	4.1	4.1	
SE 24	1	4.3	4.3	6.4	6.4	
SE 17	½	1.2	1.6	9.8	7.2	Hydrogeology Unit record
123/45	½	2.0		4.6		
1	¼	2.7	2.6	7.3	5.8	Close group of four boreholes (commercial)
2	¼	4.5		3.2		
3	¼	0.4		6.8		
4	¼	2.8		5.9		
Totals	$\Sigma w = 8$	$\Sigma wl_o = 20.2$		$\Sigma wl_m = 52.0$		
Means		$\overline{wl}_o = 2.5$		$\overline{wl}_m = 6.5$		

Calculation of confidence limits

wl_m	$\lvert(wl_m - \overline{wl}_m)\rvert$	$(wl_m - \overline{wl}_m)^2$
9.4	2.9	8.41
5.8	0.7	0.49
6.9	0.4	0.16
6.4	0.1	0.01
4.1	2.4	5.76
6.4	0.1	0.01
7.2	0.7	0.49
5.8	0.7	0.49

$\Sigma(wl_m - \overline{wl}_m)^2 = 15.82$

$n = 8$

$t = 2.365$

L_V is calculated as

$1.05\,(t/\overline{wl}_m)\,\sqrt{[\Sigma(wl_m - \overline{wl}_m)^2/\,n(n-1)]} \times 100$

$= 1.05 \times (2.365/6.5)\,\sqrt{[15.82/(8 \times 7)]} \times 100$

$= 20.3$

$\simeq 20$ per cent.

APPENDIX C

CLASSIFICATION AND DESCRIPTION OF SAND AND GRAVEL

For the purposes of assessing resources of sand and gravel a classification should take account of economically important characteristics of the deposit, in particular the absolute content of fines and the ratio of sand to gravel.

The terminology commonly used by geologists when describing sedimentary rocks (Wentworth, 1922) is not entirely satisfactory for this purpose. For example, Wentworth proposed that a deposit should be described as a 'gravelly sand' when it contains more sand than gravel and there is at least 10 per cent of gravel, provided that there is less than 10 per cent of material finer than sand (< $\frac{1}{16}$ mm) and coarser than pebbles (> 64 mm in diameter). Because deposits containing more than 10 per cent fines are not embraced by this system, a modified binary classification based on Willman (1942) has been adopted.

When the fines content exceeds 40 per cent the material is considered to be not potentially workable and falls outside the definition of mineral. Deposits which contain 40 per cent fines or less are classified primarily on the ratio of sand to gravel but qualified in the light of the fines content, as follows: less than 10 per cent fines - no qualification; 10 per cent or more but less than 20 per cent fines - 'clayey'; 20 to 40 per cent fines - 'very clayey'.

The term 'clay' (as written, with single quote marks) is used to describe all material passing $\frac{1}{16}$ mm. Thus it has no mineralogical significance and includes particles falling within the size range of silt. The normal meaning applies to the term clay where it does not appear in single quotation marks.

The ratio of sand to gravel defines the boundaries between sand, pebbly sand, sandy gravel and gravel (at 19:1, 3:1 and 1:1).

Thus it is possible to classify the mineral into one of twelve descriptive categories (see the accompanying Figure). The procedure is as follows:

1 Classify according to the ratio of sand to gravel.
2 Describe the fines.

For example, a deposit grading 11 per cent gravel, 70 per cent sand and 19 per cent fines is classified as 'clayey' pebbly sand. This short description is included in the borehole log (see Appendix D)

Many differing proposals have been made for the classification of the grain size of sediments (Atterberg, 1905; Udden, 1914; Wentworth, 1922; Wentworth, 1935; Allen, 1936; Twenhofel, 1937; Lane and others, 1947). As Archer (1970a, b) has emphasised, there is a pressing need for a simple metric scale acceptable to both scientific and engineering interests, for which the class limit sizes correspond closely with certain marked changes in the natural properties of mineral particles. For example, there is an important change in the degree of cohesion between particles at about the $\frac{1}{16}$-mm size, which approximates to the generally accepted boundary between silt and sand. These and other requirements are met by a system based on Udden's geometric scale and a simplified form of Wentworth's terminology (see the accompanying table), which is used in the Report.

The fairly wide intervals in the scale are consistent with the general level of accuracy of the qualitative assessments of the resource blocks. Three sizes of sand are recognised, fine ($+\frac{1}{16}$ -$\frac{1}{4}$ mm), medium ($+\frac{1}{4}$ -1 mm) and coarse (+1 -4 mm). The boundary at 16 mm distinguishes a range of finer gravel (+4 -16 mm), often characterised by abundance of worn tough pebbles of vein quartz, from larger pebbles, often of notably different materials. The boundary at 64 mm distinguishes pebbles from cobbles. The term 'gravel' is used loosely to denote both pebble-sized and cobble-sized material.

The size distribution of borehole samples is determined by sieve analysis, which is presented by the laboratory as logarithmic cumulative curves (see, for example, British Standards Institution, 1967). In this report the grading is tabulated on the borehole record sheets (Appendix E), the intercepts corresponding with the simple geometric scale $\frac{1}{16}$ mm, $\frac{1}{4}$ mm, 1 mm, 4 mm, 16 mm and so on as required. Original sample grading curves are available for reference at the appropriate office of the Institute.

Each bulk sample is described, subjectively, by a geologist at the borehole site. Being based on visual examination, the description of the grading is inexact, the accuracy depending on the experience of the observer. The descriptions recorded are modified, as necessary, when the laboratory results become available.

The relative proportions of the rock types present in the gravel fraction are indicated by the use of the words 'and' or 'with'. For example, 'flint and quartz' indicates roughly equal proportions with neither constituent accounting for less than about 25 per cent of the whole; 'flint with quartz' indicates that flint is dominant and quartz, the principal accessory rock type, comprises 5 to 25 per cent of the whole. Where the accessory material accounts for less than 5 per cent of the whole, but is still readily apparent, the phrase 'with some' has been used. Rare constitutents are referred to as 'trace'.

The terms used in the field to describe the degree of rounding of particles, which is concerned with the sharpness of the edges and corners of a clastic fragment and not the shape (after Pettijohn, 1975), are as follows.

Angular: showing little or no evidence of wear; sharp edges and corners.

Subangular: showing definite effects of wear. Fragments still have their original form but edges and corners begin to be rounded off.

Subrounded: showing considerable wear. The edges and corners are rounded off to smooth curves. Original grain shape is still distinct.

Rounded: original faces almost completely destroyed, but some comparatively flat surfaces may still remain. All original edges and corners have been smoothed off to rather broad curves. Original shape is still apparent.

Well rounded: not original faces, edges or corners left. The entire surface consists of broad curves; flat areas are absent. The original shape is suggested by the present form of the grain.

Classification of gravel, sand and fines

Size limits	Grain-size description	Qualification	Primary classification
	Cobble		
64 mm			
		Coarse	Gravel
16 mm	Pebble		
		Fine	
4 mm			
		Coarse	
1 mm			
	Sand	Medium	Sand
$\frac{1}{4}$ mm			
		Fine	
$\frac{1}{16}$ mm			
	Fines (silt and clay)		Fines

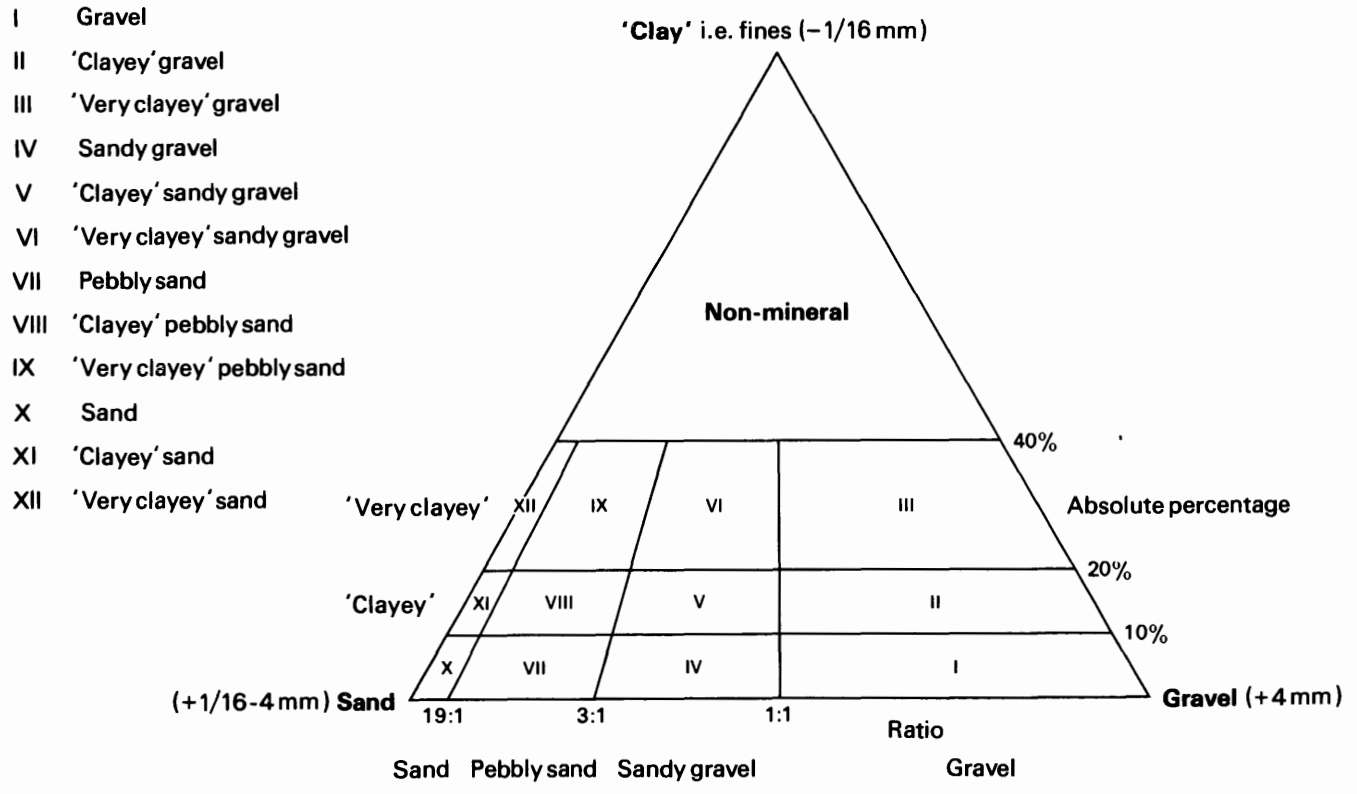


Diagram showing the descriptive categories used in the classification of sand and gravel

APPENDIX D

EXPLANATION OF THE BOREHOLE RECORDS

Annotated fictitious example

CK 66 NW 5[1] **6191 6962**[2] **Northfields**[3] **Block B**

Surface level +49.7 m [4]
Water struck at +45.9 m[5]
October 1972[6]

Overburden [7] 2.8 m
Mineral 5.4 m
Waste 1.1 m
Mineral 1.4 m
Bedrock 0.7 m+[8]

LOG

Geological classification	Lithology[9]	Thickness m	Depth m
	Soil	0.2	0.2
Alluvium	Clay, silty, dark brown	2.6	2.8
River Terrace Deposits	**a** Gravel Gravel: fine to coarse, with cobbles towards base, angular to rounded flint and limestone with ironstone and some quartz and chalk Sand: medium with coarse and some fine, quartz and limestone	5.4	8.2
Boulder Clay	Clay, sandy and pebbly, red-brown	1.1	9.3
Glacial Sand and Gravel	**b** Sand, 'clayey' in part: fine, subangular to rounded, quartz with some coal	1.4	10.7
Lias	Mudstone, blue-grey, fossiliferous	0.7+	11.4

GRADING[10]

	Mean for deposit percentages			Depth below[11] surface (m)	percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
a	5	46	49	2.8-3.9	20	14	62	2	2	0	0
				3.8-4.8	2	2	12	18	42	24	0
				4.8-5.8	1	3	24	13	35	24	0
				5.8-6.8	0	4	21	20	26	29	0
				6.8-8.2	4	3	23	10	23	30	7
				Mean	**5**	**5**	**28**	**13**	**25**	**22**	**2**
b	5	95	0	9.3-10.3	3	73	23	1	0	0	0
				10.3-10.7	9	85	5	1	0	0	0
				Mean	**5**	**77**	**17**	**1**	**0**	**0**	**0**
a+b	**5**	**56**	**39**	**Mean**	**5**	**20**	**26**	**10**	**20**	**17**	**2**

COMPOSITION[12]

Depth below surface (m)	percentages by weight in the +8-16 mm fraction				
	Flint	Quartz	Limestone	Chalk	Ironstone
3.8-4.8	41	5	50	1	3
4.8-5.8	39	3	45	5	8
5.8-6.8	45	2	42	5	6
6.8-8.2	19	6	61	3	11
Mean	**35**	**4**	**51**	**3**	**7**

The numbered paragraphs below correspond with the annotations given on the specimen record opposite.

1 Borehole Registration Number
Each Industrial Minerals Assessment Unit (IMAU) borehole is identified by a Registration Number. This consists of two statements.

a The number of the 1:25 000 sheet on which the borehole lies, here CK 66.
b The quarter of the 1:25 000 sheet on which the borehole lies and the number of the borehole in a series for that quarter, here NW 5.

Thus the full Registration Number is CK 66 NW 5.

2 National Grid Reference
All National Grid References fall in the 100 km square identified by the first two letters of the Registration Number. Grid references are given to eight figures, accurate to within 10 m.

3 Location
The position of the borehole is generally referred to the nearest named locality on the 1:25 000 base map and the resource block in which the borehole lies is stated.

4 Surface level
The surface level at the borehole site is given in metres above Ordnance Datum.

5 Groundwater conditions
If groundwater was present the level at which it was encountered is normally given (in metres relative to Ordnance Datum).

6 Type of drill and date of drilling
Unless otherwise stated the borehole was drilled by a shell and auger rig using 152 mm diameter casing. The month and year of completion of drilling are stated.

7 Overburden, mineral, waste and bedrock
Mineral is sand and gravel which, as part of a deposit, falls within the arbitrary definition of potentially workable material (see p. 1). Bedrock is the 'formation', 'country rock' or 'rock head' below which potentially workable sand and gravel will not be found. Waste is any material other than bedrock or mineral. Where waste occurs between the surface and mineral it is classified as overburden.

8 The plus sign (+) indicated that the base of the deposit was not reached during drilling.

9 Lithological description
When sand and gravel is recorded a general description based on the grading characteristics (for details see Appendix C) is followed by more detailed particulars of the gravel and/or sand fraction. Where more than one bed of mineral is recognised each is designated by a letter, e.g. **a, b,** etc. The description of other deposits is based on visual examination in the field.

10 Grading data
A continuous series of bulk samples is taken throughout the thickness of sand and gravel. A new sample is commenced whenever there is an appreciable lithological change or at every 1 m of depth.

For each bulk sample the percentages of fines (-$\frac{1}{16}$ mm), fine sand (+$\frac{1}{16}$-$\frac{1}{4}$ mm), medium sand (+$\frac{1}{4}$-1 mm), coarse sand (+1-4 mm), fine gravel (+4-16 mm) and coarse and cobble gravel (+16 mm) are stated.

The mean grading of groups of samples making up an identified bed of mineral are also given in detail and in summary. Where more than one bed is recognised the mean grading for the whole of the mineral in the borehole may be given. Where necessary, in calculating mean gradings, data for individual samples are weighted by the thickness represented.

Fully representative sampling of sand and gravel is difficult to achieve, particularly where groundwater levels are high. Comparison between boreholes and adjacent exposures commonly suggests that in borehole samples the proportion of sand may be higher and the proportion of fines and coarse gravel may be lower.

11 Sampling
A continuous series of bulk samples is taken throughout the thickness of sand and gravel. A new sample is taken wherever there is an appreciable lithological change within the sand and gravel or at every 1 m of depth. Samples obtained by bailing are indicated by an asterisk (*).

12 Composition
Details of the composition of selected samples or groups of samples may be given. Where appropriate the calculated weighted mean composition of groups of samples may be quoted. The categories recognised in this report were:

Quartzite Durable, recrystallised or granular in texture, varying in colour from buff to dark grey, derived largely from Bunter outcrops.

Quartz Durable component, commonly found in gravel fraction.

Sandstone Medium grained, poorly cemented, varying in colour from yellow to red-brown, mostly Triassic sandstone.

Mudstone Mechanically weak, red and green in colour, mainly derived from the Triassic.

Igneous rock Intrusive - dark grey intermediate to basic rocks, mainly dolerites; and rare, light-coloured tuffs.

'Trace' amounts of volcanic rock, coal, flint and chert were also identified. 'Trace' means less than 0.5 per cent (0.5 and above rounds up to 1).

APPENDIX E
INDUSTRIAL MINERALS ASSESSMENT UNIT BOREHOLE RECORDS

SP17 NE 185 **1677 7989** **The Rookery** **Block B**

Surface level +129 m
Water struck at +122.5 m
152 mm shell
January 1981

Overburden	0.3 m
Mineral	6.9 m
Waste	1.3 m
Mineral	0.9 m
Bedrock	0.1 m+

LOG

Geological classification	Lithology	Thickness	Depth
	Soil	0.3	0.3
Glacial Sand and Gravel	**a** 'Clayey' sand with a few pebbles, red-brown; mainly medium, subangular to subrounded	2.7	3.0
	b 'Clayey' Gravel Gravel: fine and coarse with some cobbles, subrounded to well-rounded, quartzite with quartz and some sandstone and mudstone Sand: fine to coarse, subangular to subrounded	2.0	5.0
	c 'Very clayey' pebbly sand Gravel: fine, mainly quartzite with quartz Sand: medium, subangular to subrounded	1.2	6.2
	d Gravel Gravel: mainly coarse, rounded to well-rounded, quartzite with quartz and some sandstone Sand: fine to coarse, angular to subrounded	1.0	7.2
	Silt, sandy, red-brown; rare rounded quartz pebbles	1.3	8.5
	e Gravel Gravel: fine and coarse, rounded to well-rounded, quartzite with quartz and some sandstone Sand: medium and coarse, subangular to subrounded	0.9	9.4
Triassic	Mudstone, red-brown with green spots	0.1+	9.5

GRADING

	Mean for deposit percentages			Depth below surface (m)	percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16-64$	$+64$ mm
a	12	86	2	0.3-1.3	13	20	61	1	0	5	0
				1.3-3.0	12	33	53	2	0	0	0
				Mean	**12**	**28**	**56**	**2**	**0**	**2**	**0**
b	13	31	56	3.0-4.0	13	7	16	6	20	33	5
				4.0-5.0	13	9	17	7	24	30	0
				Mean	**13**	**8**	**17**	**6**	**22**	**31**	**3**
c	21	72	7	5.0-6.2	21	18	46	8	6	1	0
d	9	22	69	6.2-7.2	9	6	10	6	24	45	0
e	6	32	62	8.5-9.4	6	3	15	14	32	30	0
a-d	**14**	**58**	**28**	**Mean**	**14**	**17**	**36**	**5**	**11**	**16**	**1**
a-e	**13**	**55**	**32**	**Mean**	**13**	**16**	**33**	**6**	**13**	**18**	**1**

COMPOSITION

	Depth below surface (m)	percentages by weight in +8 mm fraction						
		Quartzite	Quartz	Sandstone	Mudstone	Flint	Igneous rock Volcanic	Igneous rock Intrusive
b	3.0-5.0	80	18	1	1	0	trace	trace
e	8.5-9.4	73	25	2	trace	0	0	0

SP 17 NE 186 1765 7979 Bogay Hall **Block B**

Surface level +124 m
Water not encountered
203 mm shell
January 1981

Overburden 0.4 m
Mineral 1.1 m
Bedrock 1.5 m+

LOG

Geological classification	Lithology	Thickness	Depth
	Soil	0.4	0.4
Glacial Sand and Gravel	Pebbly sand Gravel: mainly fine, subrounded to well-rounded, quartzite with quartz Sand: medium, subangular to subrounded	1.1	1.5
Triassic	Mudstone, red-brown with green spots	1.5+	3.0

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
5	84	11	0.4-1.5	5	22	59	3	7	4	0

SP 17 NE 187 1880 7933 Eastcote Hall **Block B**

Surface level +103 m
Water struck at +101.5 m
152 mm shell
January 1981

Overburden 1.0 m
Mineral 6.9 m
Bedrock 0.6 m+

LOG

Geological classification	Lithology	Thickness	Depth
	Made ground	1.0	1.0
Terrace 1	**a** Gravel Gravel: fine and coarse, subrounded to well-rounded, quartzite with quartz and some igneous rock Sand: mainly medium, angular to subrounded	1.8	2.8
?Glacial Sand and Gravel	**b** Pebbly sand Gravel: mainly coarse, subrounded to well-rounded, quartzite with quartz Sand: mainly medium, angular to subrounded	1.4	4.2
	c Gravel Gravel: fine and coarse, rounded to well-rounded, quartzite with quartz and some igneous rock and sandstone Sand: medium and coarse, angular to subrounded	3.7	7.9
Triassic	Mudstone, red-brown with green spots	0.6+	8.5

GRADING

	Mean for deposit percentages			Depth below surface (m)	percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
a	4	48	48	1.0-1.8	2	4	14	18	35	27	0
				1.8-2.8	5	19	35	5	15	21	0
				Mean	**4**	**12**	**25**	**11**	**24**	**24**	**0**
b	5	80	15	2.8-4.2	5	25	51	4	5	10	0
c	2	36	62	4.2-4.8	2	9	16	4	22	47	0
				4.8-5.8	2	7	28	13	23	27	0
				5.8-6.8	2	4	13	13	26	42	0
				6.8-7.9	2	5	17	11	30	35	0
				Mean	**2**	**6**	**19**	**11**	**26**	**36**	**0**
b+c	**3**	**48**	**49**	**Mean**	**3**	**11**	**28**	**9**	**20**	**29**	**0**
a-c	**3**	**47**	**50**	**Mean**	**3**	**11**	**27**	**9**	**21**	**29**	**0**

COMPOSITION

	Depth below surface (m)	percentages by weight in +8 mm fraction						
		Quartzite	Quartz	Sandstone	Mudstone	Flint	Igneous rock Volcanic	Igneous rock Intrusive
a	1.0-1.8	71	27	trace	0	0	0	2
c	4.8-6.8	77	18	1	0	0	0	4

SP 17 NE 188 **1906 7936** **Eastcote Hall** **Block B**

Surface level +108 m
Water struck at +103 m
152 mm shell
January 1981

Overburden 5.0 m
Mineral 6.2 m
Bedrock 0.3 m+

LOG

Geological classification	Lithology	Thickness	Depth
	Soil	0.3	0.3
Glacial Sand and Gravel	Clay, sandy, mottled yellow-brown to grey-blue becoming red-brown below 1.0 m; scattered quartzite and quartz pebbles	1.4	1.7
Glacial Lake Deposits	Clay, silty, stonefree, red-brown	3.3	5.0
Glacial Sand and Gravel	**a** Sand with a few pebbles, red; fine and medium, subangular to subrounded	2.4	7.4
	b Gravel Gravel: fine and coarse, rounded to well-rounded, mainly quartzite with quartz Sand: fine and medium, angular to subrounded	3.8	11.2
Triassic	Mudstone, red-brown with green spots	0.3+	11.5

GRADING

	Mean for deposit percentages			Depth below surface (m)	percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
a	8	91	1	5.0-6.0	10	38	52	0	0	0	0
				6.0-7.0	6	36	51	4	3	0	0
				7.0-7.4	8	43	49	0	0	0	0
				Mean	**8**	**38**	**51**	**2**	**1**	**0**	**0**
b	2	37	61	7.4-8.4	3	14	17	3	25	38	0
				8.4-9.4	3	17	19	5	28	28	0
				9.4-10.4	1	8	17	10	31	33	0
				10.4-11.2	2	5	22	11	25	35	0
				Mean	**2**	**11**	**19**	**7**	**27**	**34**	**0**
a+b	**4**	**59**	**37**	**Mean**	**4**	**22**	**32**	**5**	**17**	**20**	**0**

SP 17 NE 189 **1611 7863** **Malvern Park** **Block B**

Surface level +102 m
Water not encountered
203 m shell
December 1980

Waste 3.0 m
Bedrock 1.0 m+

LOG

Geological classification	Lithology	Thickness	Depth
	Soil	0.6	0.6
Alluvium	Gravel Gravel: mainly coarse with cobbles, subangular to well-rounded, quartzite with quartz and some sandstone Sand: fine to coarse, angular to subangular	0.8	1.4
	Clay, silty, pebbly, grey	1.6	3.0
Triassic	Mudstone, red and green	1.0+	4.0

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
7	19	74	0.6-1.4	7	4	6	9	24	41	9

COMPOSITION

Depth below surface (m)	percentages by weight in +8 mm fraction						
						Igneous rock	
	Quartzite	Quartz	Sandstone	Mudstone	Flint	Volcanic	Intrusive
0.6-1.4	88	11	1	0	0	0	trace

SP 17 NE 190 **1762 7863** **Copt Heath** **Block B**

Surface level +122 m
Water not encountered
203 mm shell
December 1980

Overburden 0.9 m
Mineral 2.1 m
Bedrock 4.5 m+

LOG

Geological classification	Lithology	Thickness	Depth
	Made ground	0.9	0.9
Glacial Sand and Gravel	'Very clayey' pebbly sand Gravel: fine and coarse, subangular to well-rounded, mainly quartzite with quartz Sand: medium	2.1	3.0
Triassic	Mudstone, red and green	4.5+	7.5

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
23	65	12	0.9-2.2	25	16	46	4	6	3	0
			2.2-3.0	20	8	50	6	8	8	0
			Mean	**23**	**13**	**47**	**5**	**7**	**5**	**0**

SP 17 NE 191 **1963 7891** **Eastcote** **Block B**

Surface level +117 m
Water struck at +111.8 m and +106.8 m
152 mm shell
January 1981

Overburden 0.4 m
Mineral 1.3 m
Waste 3.5 m
Mineral 2.0 m
Waste 3.0 m
Mineral 9.3 m
Bedrock 0.5 m+

LOG

Geological classification	Lithology	Thickness	Depth
	Soil	0.4	0.4
Glacial Sand and Gravel	**a** 'Very clayey' sandy gravel Gravel: fine and coarse, mainly quartzite with quartz Sand: fine and medium	1.3	1.7
	Clay, stony, red-brown; scattered rounded to well-rounded quartzite, quartz and sandstone pebbles	3.5	5.2
	b 'Very clayey' sand; fine and medium, subangular to subrounded	2.0	7.2
Glacial Lake Deposits	Silt, sandy, red-brown	1.4	8.6
	Clay, silty, stonefree, laminated, red-brown	1.6	10.2
Glacial Sand and Gravel	**c** 'Very clayey' sand, silt lenses, red-brown; mainly fine	5.3	15.5
	d Sandy gravel Gravel: fine and coarse with some cobbles, rounded to well-rounded, mainly quartzite with quartz Sand: mainly medium	4.0	19.5
Triassic	Mudstone, reddish brown with green spots	0.5+	20.0

GRADING

	Mean for deposit percentages			Depth below surface (m)	percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}$ -1	+1 -4	+4 -16	+16 -64	+64 mm
a	21	58	21	0.4-1.7	21	25	30	3	11	10	0
b	21	79	0	5.2-6.2	25	33	41	1	0	0	0
				6.2-7.2	17	32	50	1	0	0	0
				Mean	**21**	**33**	**45**	**1**	**0**	**0**	**0**
c	23	76	1	10.2-11.2	20	53	25	0	2	0	0
				11.2-12.2	23	43	30	1	1	2	0
				12.2-13.2	25	45	29	1	0	0	0
				13.2-14.2	25	45	29	1	0	0	0
				14.2-15.5	22	50	26	1	1	0	0
				Mean	**23**	**47**	**28**	**1**	**1**	**0**	**0**
d	3	51	46	15.5-16.5	3	19	35	4	17	22	0
				16.5-17.5	3	17	26	7	24	23	0
				17.5-18.5	2	11	21	11	28	21	6
				18.5-19.5	4	10	28	15	28	15	0
				Mean	**3**	**14**	**28**	**9**	**24**	**20**	**2**
c+d	**14**	**65**	**21**	**Mean**	**14**	**33**	**28**	**4**	**11**	**9**	**1**
a-d	**16**	**67**	**17**	**Mean**	**16**	**32**	**31**	**4**	**9**	**8**	**0**

SP 17 NE 192 **1557 7793** **Widney Manor Station** **Block B**

Surface level +133 m
Water struck at +126 m
203 m shell
December 1980

Overburden	0.3 m
Mineral	3.7 m
Waste	1.4 m
Mineral	4.6 m
Bedrock	0.5 m+

LOG

Geological classification	Lithology	Thickness	Depth
	Soil	0.3	0.3
Glacial Sand and Gravel	**a** 'Very clayey' pebbly sand Gravel: fine, subangular to well-rounded, mainly quartzite with quartz Sand: fine and medium	3.7	4.0
	Silt, sandy, stonefree, brown	1.4	5.4
	b 'Very clayey' pebbly sand Gravel: fine and coarse, subangular to well-rounded, mainly quartzite with quartz Sand: medium	3.1	8.5
	c Gravel Gravel: fine and coarse with cobbles, subangular to well-rounded, quartzite with quartz and some sandstone Sand: medium and coarse	1.5	10.0
Triassic	Mudstone, reddish brown with green sandstone	0.5+	10.5

GRADING

	Mean for deposit percentages			Depth below surface (m)	percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
a	29	67	4	0.3-2.0	34	19	42	2	3	0	0
				2.0-3.0	23	28	33	4	11	1	0
				3.0-4.0	26	39	35	0	0	0	0
				Mean	**29**	**27**	**38**	**2**	**4**	**0**	**0**
b	27	63	10	5.4-7.0	21	9	53	3	9	5	0
				7.0-8.5	34	18	42	2	2	2	0
				Mean	**27**	**13**	**47**	**3**	**6**	**4**	**0**
c	8	18	74	8.5-10.0	8	3	8	7	27	34	13
b+c	**21**	**49**	**30**	**Mean**	**21**	**10**	**35**	**4**	**13**	**13**	**4**
a-c	**25**	**56**	**19**	**Mean**	**25**	**17**	**36**	**3**	**9**	**8**	**2**

SP 17 NE 193 **1706 7767** **Longdon Hall** **Block B**

Surface level +121 m
Water struck at +120.9 m
203 mm shell
December 1980

Waste 3.3 m
Bedrock 2.2 m+

LOG

Geological classification	Lithology	Thickness	Depth
	Soil	0.1	0.1
Glacial Sand and Gravel	Clay, sandy, yellow-brown with blue-grey gleying; rare subrounded to well-rounded pebbles, mainly quartzite and quartz	2.7	2.8
	'Very clayey' sand with a few pebbles, brown; mainly medium	0.5	3.3
Triassic	Mudstone, red-brown with green sandstone	2.2+	5.5

GRADING

	Mean for deposit percentages			Depth below surface (m)	percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
	22	77	1	2.8-3.3	22	27	48	2	1	0	0

SP 17 NE 194 **1613 7682** **Widney Cottage** **Block B**

Surface level +135.0 m
Water not encountered
203 mm shell
December 1980

Waste 1.8 m
Bedrock 2.7 m+

LOG

Geological classification	Lithology	Thickness	Depth
	Soil	0.4	0.4
Glacial Sand and Gravel	Clay, sandy, stony, mottled grey to reddish brown; scattered, subangular to well-rounded pebbles, mainly quartzite and quartz	1.4	1.8
Triassic	Mudstone, red-brown with green sandstone	2.7+	4.5

SP 17 NE 195 **1851 7701** **Kixley Wharf** **Block B**

Surface level +119 m
Water struck at +117 m
203 mm shell
December 1980

Overburden 0.5 m
Mineral 1.5 m
Bedrock 3.5 m+

LOG

Geological classification	Lithology	Thickness	Depth
	Soil	0.5	0.5
Glacial Sand and Gravel	'Very clayey' gravel Gravel: fine and coarse, subangular to well-rounded, mainly quartzite with quartz Sand: mainly medium	1.5	2.0
Triassic	Mudstone, red and green	3.5+	5.5

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16-64$	$+64$ mm
21	36	43	0.5-1.5	24	11	15	11	28	11	0
			1.5-2.0	16	5	24	6	18	31	0
			Mean	**21**	**9**	**18**	**9**	**25**	**18**	**0**

SP 17 NE 196 **1918 7662** **Elvers Green Farm** **Block B**

Surface level +119 m
Water not encountered
203 mm shell
December 1980

Waste 2.9 m
Bedrock 1.1 m+

LOG

Geological classification	Lithology	Thickness	Depth
	Soil	0.5	0.5
Glacial Sand and Gravel	Clay, sandy, stony, mottled reddish brown to grey-green; scattered subrounded to well-rounded pebbles, mainly quartzite with quartz	2.4	2.9
Triassic	Mudstone, red-brown with green sandstone	1.1+	4.0

SP 17 NE 197 **1970 7665** **Hall Farm** **Block B**

Surface level +98 m
Water not encountered
203 mm shell
December 1980

Waste 3.6 m
Bedrock 0.9 m+

LOG

Geological classification	Lithology	Thickness	Depth
	Made ground	0.4	0.4
Terrace 1	Clay, stony, mottled yellow-brown to grey-brown; scattered subangular to well-rounded pebbles, mainly quartzite and quartz	0.6	1.0
	'Very clayey' sandy gravel Gravel: fine and coarse with cobbles, subrounded to well-rounded, mainly quartzite with quartz Sand: fine and medium	0.5	1.5
	Clay, silty, blue-grey becoming brown with depth; rare well-rounded quartzite pebbles	1.5	3.0
	Clay, silty, black; scattered subrounded to well-rounded pebbles, mainly quartzite and quartz	0.6	3.6
Triassic	Mudstone, red-brown with green sandstone	0.9+	4.5

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
23	54	23	1.0-1.5	23	21	31	2	6	6	11

SP 17 NE 198 **1596 7543** **Four Ash Cottage** **Block B**

Surface level +133 m
Water struck at +126.7 m
203 mm shell
December 1980

Overburden	1.5 m
Mineral	1.3 m
Waste	3.5 m
Mineral	4.9 m
Bedrock	1.3 m+

LOG

Geological classification	Lithology	Thickness	Depth
	Soil	0.5	0.5
Till	Clay, sandy, mottled yellow-brown to reddish brown; scattered subangular to well-rounded pebbles, mainly quartzite	1.0	1.5
	a 'Very clayey' sand with a few pebbles, reddish brown; medium	1.3	2.8
	Clay, sandy, yellowish brown to brown; rare subangular to well-rounded pebbles, mainly quartzite	1.3	4.1
?Glacial Lake Deposits	Clay, silty, sand lenses, stonefree, red-brown	2.2	6.3
Glacial Sand and Gravel	**b** Gravel Gravel: fine and coarse, subangular to well-rounded, quartzite with quartz and some mudstone, sandstone igneous rock Sand: medium	4.9	11.2
Triassic	Mudstone, red-brown with green sandstone	1.3+	12.5

GRADING

	Mean for deposit percentages			Depth below surface (m)	percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
a	23	75	2	1.5-2.8	23	16	59	0	2	0	0
b	9	39	52	6.3-7.5	12	5	19	3	18	43	0
				7.5-8.5	2	1	6	5	31	55	0
				8.5-11.2	11	14	34	5	15	21	0
				Mean	**9**	**9**	**25**	**5**	**19**	**33**	**0**
a+b	**12**	**47**	**41**	**Mean**	**12**	**11**	**32**	**4**	**15**	**26**	**0**

COMPOSITION

	Depth below surface (m)	percentages by weight in +8 mm fraction						
							Igneous rock	
		Quartzite	Quartz	Sandstone	Mudstone	Flint	Volcanic	Intrusive
b	6.3-11.2	75	21	1	2	0	0	1

SP 17 NE 199 **1900 7529** **Pear Tree Farm** **Block C**

Surface level +104 m
Water struck at +99.2 m
203 mm shell
December 1980

Waste 3.8 m
Bedrock 4.2 m+

LOG

Geological classification	Lithology	Thickness	Depth
	Made ground	2.0	2.0
Glacial Sand and Gravel	'Clayey' gravel Gravel: mainly fine, subangular to well-rounded, mainly quartzite with quartz Sand: fine to coarse, angular to well-rounded	0.8	2.8
	Clay, silty, stony, mottled reddish brown to grey; scattered subangular to well-rounded pebbles, mainly quartzite	1.0	3.8
Triassic	Mudstone, sandy to 7.0 m, reddish brown with green sandstone	4.2+	8.0

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
17	33	50	2.0-2.8	17	8	15	10	33	17	0

SP 17 SE 64 **1974 7444** **Heronfield House** **Block C**

Surface level +108.6 m
Water not encountered
203 mm shell
December 1980

Overburden 1.5 m
Mineral 6.2 m
Bedrock 0.8 m+

LOG

Geological classification	Lithology	Thickness	Depth
	Soil	0.5	0.5
Glacial Sand and Gravel	Silt, sandy, pebbly, brown; subangular to well-rounded quartzite and quartz clasts	1.0	1.5
	a 'Clayey' sand, brown; fine and medium, angular to well-rounded	5.8	7.3
	b Gravel Gravel: mainly coarse with cobbles, subangular to well-rounded, quartzite with quartz Sand: fine	0.4	7.7
Triassic	Mudstone, red-brown with green sandstone	0.8+	8.5

GRADING

	Mean for deposit percentages			Depth below surface (m)	percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
a	14	86	0	1.5-3.0	17	49	32	1	0	0	0
				3.0-5.0	14	45	40	1	0	0	0
				5.0-7.3	11	42	46	1	0	0	0
				Mean	**14**	**45**	**40**	**1**	**0**	**0**	**0**
b	7	46	47	7.3-7.7	7	29	9	8	11	28	8
a+b	**13**	**83**	**4**	**Mean**	**13**	**44**	**38**	**1**	**1**	**2**	**1**

SP 18 SE 460 **1835 8399** **Bickenhill** **Block A**

Surface level +102 m
Water not encountered
203 mm shell
January 1981

Overburden 0.6 m
Mineral 7.4 m
Bedrock 0.5 m+

LOG

Geological classification	Lithology	Thickness	Depth
	Soil	0.6	0.6
Glacial Sand and Gravel	Sand, part 'clayey', brown; medium, angular to well-rounded	7.4	8.0
Triassic	Mudstone, reddish brown with green sandstone	0.5+	8.5

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
7	92	1	0.6-2.0	15	25	57	1	0	2	0
			2.0-4.0	9	31	58	1	1	0	0
			4.0-6.0	3	16	81	0	0	0	0
			6.0-8.0	4	8	87	0	1	0	0
			Mean	**7**	**20**	**72**	**0**	**1**	**0**	**0**

SP 18 SE 461 **1897 8234** **Bickenhill** **Block A**

Surface level +115 m
Water struck at +110.5 m
152 mm shell
January 1981

Overburden 1.4 m
Mineral 4.6 m
Bedrock 1.3 m+

LOG

Geological classification	Lithology	Thickness	Depth
	Soil	0.3	0.3
Glacial Sand and Gravel	Clay, sandy, red-brown with orange-red lenses, scattered rounded to well-rounded quartzite and quartz pebbles	1.1	1.4
	a 'Clayey' sandy gravel Gravel: fine and coarse with some cobbles, rounded to well-rounded, mainly quartzite and quartz Sand: fine and medium, angular to subrounded	3.4	4.8
	b 'Very clayey' sand with a few pebbles; medium	1.2	6.0
Triassic	Mudstone, red with green spots	1.3+	7.3

GRADING

	Mean for deposit percentages			Depth below surface (m)	percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16-64$	$+64$ mm
a	16	61	23	1.4-2.4	21	40	21	3	13	2	0
				2.4-3.4	16	16	46	3	9	10	0
				3.4-4.2	9	13	46	3	13	16	0
				4.2-4.8	17	11	32	6	10	20	4
				Mean	**16**	**21**	**36**	**4**	**11**	**11**	**1**
b	29	70	1	4.8-6.0	29	17	52	1	1	0	0
a+b	**19**	**63**	**18**	**Mean**	**19**	**20**	**40**	**3**	**9**	**8**	**1**

SP 18 SE 462 **1624 8162** **Elmdon Coppice** **Block B**

Surface level +121 m
Water not encountered
203 mm shell
January 1981

Overburden 0.5 m
Mineral 2.4 m
Bedrock 0.6 m+

LOG

Geological classification	Lithology	Thickness	Depth
	Soil	0.5	0.5
Glacial Sand and Gravel	'Very clayey' pebbly sand Gravel: mainly coarse with cobbles, subrounded to well-rounded, quartzite and quartz Sand: fine and medium	2.4	2.9
Triassic	Mudstone, reddish brown with green sandstone	0.6+	3.5

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
21	60	19	0.5-2.0	24	39	28	1	2	6	0
			2.0-2.9	16	11	29	6	13	19	6
			Mean	**21**	**29**	**28**	**3**	**6**	**11**	**2**

SP 18 SE 463 **1639 8035** **Elmdon Heath** **Block B**

Surface level +128 m
Water struck at +125.2 m
203 mm shell
January 1981

Overburden 0.5 m
Mineral 4.5 m
Bedrock 1.0 m+

LOG

Geological classification	Lithology	Thickness	Depth
	Soil	0.5	0.5
Glacial Sand and Gravel	'Clayey' sandy gravel, part 'very clayey' Gravel: fine and coarse, subangular to well-rounded, mainly quartzite and quartz Sand: fine and medium	4.5	5.0
Triassic	Mudstone, sandy to 5.7 m, reddish brown with green sandstone	1.0+	6.0

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
18	57	25	0.5-1.3	16	27	32	5	9	11	0
			1.3-2.5	23	8	25	6	19	19	0
			2.5-4.0	11	35	28	3	10	13	0
			4.0-5.0	22	11	44	4	6	13	0
			Mean	**18**	**21**	**32**	**4**	**11**	**14**	**0**

SP 18 SE 464 **1715 8027** **Catherine de Barnes Heath** **Block B**

Surface level +132 m
Water struck at +124.5 m
203 mm shell
January 1981

Overburden 0.6 m
Mineral 12.6 m
Bedrock 0.8 m+

LOG

Geological classification	Lithology	Thickness	Depth
	Soil	0.6	0.6
Glacial Sand and Gravel	**a** 'Clayey' pebbly sand Gravel: fine and coarse, subangular to well-rounded, mainly quartzite and quartz Sand: medium, angular to subrounded	7.9	8.5
	b Gravel Gravel: fine and coarse with a few cobbles, subangular to well-rounded, quartzite with quartz and some sandstone, mudstone and igneous rock Sand: medium, angular to subrounded	4.7	13.2
Triassic	Clay, red and green	0.8+	14.0

GRADING

	Mean for deposit percentages			Depth below surface (m)	percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
a	13	66	21	0.6-2.0	13	25	38	2	9	13	0
				2.0-3.0	13	20	38	1	8	20	0
				3.0-4.5	15	17	49	2	6	11	0
				4.5-6.0	13	11	50	5	10	11	0
				6.0-8.5	13	14	48	6	10	9	0
				Mean	**13**	**17**	**45**	**4**	**9**	**12**	**0**
b	6	36	58	8.5-10.00	9	5	34	7	18	27	0
				10.0-11.0	7	6	23	8	31	25	0
				11.0-12.5	4	4	15	5	21	45	6
				12.5-13.2	4	6	25	12	17	36	0
				Mean	**6**	**5**	**24**	**7**	**22**	**34**	**2**
a+b	**11**	**54**	**35**	**Mean**	**11**	**12**	**37**	**5**	**14**	**20**	**1**

COMPOSITION

	Depth below surface (m)	percentages by weight in +8 mm fraction						
		Quartzite	Quartz	Sandstone	Mudstone	Flint	Igneous rock Volcanic	Igneous rock Intrusive
b	8.5-10.0	80	17	1	1	0	trace	1
	11.0-12.5	79	18	2	trace	0	1	trace

SP 18 SE 465 **1863 8040** **Walford Hall Farm** **Block B**

Surface level +118 m
Water not encountered
152 mm shell
January 1981

Waste 1.7 m
Bedrock 0.8 m+

LOG

Geological classification	Lithology	Thickness	Depth
	Soil	0.3	0.3
Glacial Sand and Gravel	Clay, sandy, red-brown with vertical, grey-green gleyed veins; rare quartzite and quartz pebbles	1.4	1.7
Triassic	Mudstone, red and green	0.8+	2.5

SP 27 NW 21 **2188 7944** **Marsh House Farm** **Block A**

Surface level +92.0 m
Water struck at +90.8 m
203 mm shell
December 1980

Waste 1.5 m
Bedrock 1.0 m+

LOG

Geological classification	Lithology	Thickness	Depth
	Soil	0.8	0.8
Terrace 1	Gravel Gravel: fine and coarse, rounded to well-rounded, quartzite with quartz Sand: medium, angular to subrounded	0.7	1.5
Triassic	Mudstone, red-brown and green	1.0+	2.5

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
2	20	78	0.8-1.5	2	3	13	4	38	40	0

COMPOSITION

Depth below surface (m)	percentages by weight in +8 mm fraction						
	Quartzite	Quartz	Sandstone	Mudstone	Flint	Igneous rock Volcanic	Igneous rock Intrusive
0.8-1.5	68	32	trace	0	0	0	0

SP 27 NW 22 **2219 7974** **Marsh Farm** **Block A**

Surface level +94.7 m
Water struck at +89 m
203 mm shell
December 1980

Overburden 0.8 m
Mineral 9.2 m
Bedrock 1.5 m+

LOG

Geological classification	Lithology	Thickness	Depth
	Soil	0.8	0.8
Glacial Sand and Gravel	**a** Gravel Gravel: mainly coarse with cobbles, rounded to well-rounded, quartzite with quartz and some sandstone Sand: medium and coarse, subangular to subrounded	2.2	3.0
	b Sand; fine and medium, subangular to subrounded	2.2	5.2
	c Gravel Gravel: fine and coarse, rounded to well-rounded, quartzite with quartz and some igneous rock, sandstone, mudstone and flint Sand: mainly medium, subangular to subrounded	4.8	10.0
Triassic	Mudstone, red and green	1.5+	11.5

GRADING

	Mean for deposit percentages			Depth below surface (m)	percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
a	1	20	79	0.8-1.8	1	6	12	9	30	42	0
				1.8-3.0	0	3	7	5	26	42	17
				Mean	**1**	**4**	**9**	**7**	**28**	**42**	**9**
b	7	93	0	3.0-5.2	7	47	45	1	0	0	0
c	5	30	65	5.2-7.0	5	11	21	5	31	27	0
				7.0-8.0	5	4	12	7	31	41	0
				8.0-9.5	4	5	15	9	36	31	0
				9.5-10.0	4	2	7	5	25	57	0
				Mean	**5**	**7**	**16**	**7**	**32**	**33**	**0**
a-c	**4**	**42**	**54**	**Mean**	**4**	**16**	**21**	**5**	**23**	**29**	**2**

COMPOSITION

	Depth below surface (m)	percentages by weight in +8 mm fraction						
		Quartzite	Quartz	Sandstone	Mudstone	Flint	Igneous rock Volcanic	Igneous rock Intrusive
a	0.8-1.8	71	23	5	0	trace	1	0
	1.8-3.0	77	22	1	0	trace	trace	0
	Mean	**75**	**22**	**3**	**0**	**0**	**trace**	**0**
c	7.0-8.0	75	22	1	trace	1	1	0
	9.5-10.0	80	14	1	1	0	4	0

SP 27 NW 23 **2262 7928** **Bradnock's Marsh** **Block A**

Surface level +104.2 m
Water struck at +99.2 m and +93.8 m
203 mm shell
December 1980

Overburden	2.5 m
Mineral	4.0 m
Waste	1.3 m
Mineral	7.2 m+

LOG

Geological classification	Lithology	Thickness	Depth
	Soil	0.2	0.2
Glacial Sand and Gravel	Clay, sandy, stony, red-brown; scattered quartzite and quartz pebbles; minor amounts of sandstone and flint	2.3	2.5
	a Gravel Gravel: fine and coarse, rounded to well-rounded, mainly quartzite with quartz Sand: fine and medium, subangular to subrounded	1.7	4.2
	b Pebbly sand Gravel: fine and coarse, rounded to well-rounded, mainly quartzite with quartz Sand: mainly medium, subangular to subrounded	2.3	6.5
?Glacial Lake Deposits	Clay, silty, red-brown; rare rounded quartzite pebbles	1.3	7.8
Glacial Sand and Gravel	**c** Sand; fine and medium, subangular to subrounded	7.2+	15.0
	Hole abandoned due to rising sand		

GRADING

	Mean for deposit percentages			Depth below surface (m)	percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16-64$	$+64$ mm
a	1	39	60	2.5-3.5	1	9	19	7	24	40	0
				3.5-4.2	1	22	18	4	22	33	0
				Mean	**1**	**14**	**19**	**6**	**23**	**37**	**0**
b	6	74	20	4.2-5.3	2	31	50	8	7	2	0
				5.3-6.5	10	24	33	4	12	17	0
				Mean	**6**	**27**	**41**	**6**	**10**	**10**	**0**
c	7	92	1	7.8-8.8	4	76	20	0	0	0	0
				8.8-9.8	11	66	21	1	1	0	0
				9.8-10.8	14	53	33	0	0	0	0
				10.8-11.8	8	30	60	1	1	0	0
				11.8-12.8	8	17	68	5	2	0	0
				12.8-13.8	2	55	41	0	0	2	0
				13.8-15.0	3	44	51	1	0	1	0
				Mean	**7**	**49**	**42**	**1**	**1**	**0**	**0**
a+b	**4**	**60**	**36**	**Mean**	**4**	**22**	**32**	**6**	**15**	**21**	**0**
a–c	**6**	**80**	**14**	**Mean**	**6**	**39**	**38**	**3**	**6**	**8**	**0**

SP 27 NW 24 **2048 7832** **Barston** **Block B**

Surface level +118.4 m
Water struck at +114.4 m
203 mm shell
December 1980

Overburden	0.5 m
Mineral	8.8 m
Waste	2.1 m
Bedrock	0.6 m+

LOG

Geological classification	Lithology	Thickness	Depth
	Soil	0.5	0.5
Glacial Sand and Gravel	**a** 'Very clayey' sand; fine and medium	1.0	1.5
	b 'Clayey' gravel Gravel: fine and coarse with some cobbles, rounded to well-rounded, mainly quartzite with quartz Sand: fine to coarse	2.7	4.2
	c 'Very clayey' sand with a few pebbles, red-brown; fine and medium	5.1	9.3
Glacial Lake Deposits	Silt, stonefree, red-brown	0.7	10.0
	Clay, laminated, red-brown becoming grey-green below 11.0 m	1.4	11.4
Jurassic	Mudstone, yellow-green	0.6+	12.0

GRADING

	Mean for deposit percentages			Depth below surface (m)	percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
a	23	75	2	0.5-1.5	23	33	41	1	1	1	0
b	10	28	62	1.5-2.5	5	4	12	5	30	44	0
				2.5-3.5	11	6	16	7	27	30	3
				3.5-4.2	16	9	21	7	17	30	0
				Mean	**10**	**6**	**16**	**6**	**26**	**35**	**1**
c	28	69	3	4.2-5.2	30	14	49	4	3	0	0
				5.2-6.2	25	11	56	4	4	0	0
				6.2-7.2	31	7	49	8	5	0	0
				7.2-8.2	26	60	13	1	0	0	0
				8.2-9.3	29	47	21	2	1	0	0
				Mean	**28**	**28**	**37**	**4**	**3**	**0**	**0**
a-c	**22**	**58**	**20**	**Mean**	**22**	**22**	**32**	**4**	**9**	**11**	**0**

SP 27 NW 25 **2232 7819** **Brooklands Farm** **Block C**

Surface level +112 m
Water not encountered
152 mm shell
January 1981

Overburden 0.4 m
Mineral 1.1 m
Bedrock 1.5 m+

LOG

Geological classification	Lithology	Thickness	Depth
	Soil	0.4	0.4
Glacial Sand and Gravel	'Clayey' pebbly sand Gravel: fine and coarse, rounded to well-rounded, mainly quartzite with quartz Sand: medium, subangular to subrounded	1.1	1.5
Triassic	Mudstone, red-brown with green spots	1.5+	3.0

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16-64$	$+64$ mm
14	70	16	0.4-1.5	14	11	55	4	8	8	0

SP 27 NW 26 **2318 7833** **Wootton Green** **Block A**

Surface level +113.1 m
Water stuck at +109.6 m
152 mm shell
December 1980

Overburden 0.5 m
Mineral 1.3 m
Waste 1.7 m
Mineral 3.3 m
Waste 2.4 m
Bedrock 0.8 m+

LOG

Geological classification	Lithology	Thickness	Depth
	Soil	0.5	0.5
Glacial Sand and Gravel	**a** 'Clayey' sandy gravel Gravel: fine and coarse, rounded to well-rounded, mainly quartzite with quartz Sand: mainly medium, subangular to subrounded	1.3	1.8
	Clay, red; rare quartzite, quartz and mudstone pebbles	1.7	3.5
	b Sand; fine and medium, subangular to subrounded	3.3	6.8
	Clay, sandy, stony, red-brown; scattered pebbles, mainly quartzite	1.2	8.0
Glacial Lake Deposits	Clay, silty, stonefree, laminated, red-brown	1.2	9.2
Triassic	Mudstone, red-brown with green spots	0.8+	10.0

GRADING

	Mean for deposit percentages			Depth below surface (m)	percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
a	11	60	29	0.5-1.8	11	19	35	6	12	17	0
b	7	93	0	3.5-4.5	9	31	55	5	0	0	0
				4.5-5.5	7	39	54	0	0	0	0
				5.5-6.8	6	38	56	0	0	0	0
				Mean	**7**	**36**	**55**	**2**	**0**	**0**	**0**
a+b	**8**	**84**	**8**	**Mean**	**8**	**31**	**50**	**3**	**3**	**5**	**0**

SP 27 NW 27 **2198 7743** **The Elms** **Block C**

Surface level +107 m
Water not encountered
January 1981

Waste 2.2 m
Bedrock 1.3 m+

LOG

Geological classification	Lithology	Thickness	Depth
	Made ground	1.0	1.0
Glacial Sand and Gravel	Clay, stony, red-brown; scattered rounded to well-rounded quartzite and quartz pebbles	1.2	2.2
Triassic	Mudstone, red-brown with green spots	1.3+	3.5

SP 27 NW 28 **2246 7716** **The Elms** **Block C**

Surface level +111.4 m
Water struck at +105.9 m
203 mm shell
December 1980

Overburden 0.4 m
Mineral 4.2 m
Waste 0.6 m
Mineral 1.1 m
Waste 12.2 m+

LOG

Geological classification	Lithology	Thickness	Depth
	Soil	0.4	0.4
Glacial Sand and Gravel	**a** 'Very clayey' pebbly sand Gravel: fine and coarse, rounded to well-rounded, mainly quartzite with quartz Sand: fine and medium, subangular to subrounded	4.2	4.6
	Silt, sandy, red-brown	0.6	5.2
	b 'Clayey' gravel Gravel: fine and coarse, rounded to well-rounded, mainly quartzite with quartz Sand: mainly medium, subangular to subrounded	1.1	6.3
Glacial Lake Deposits	Clay, sandy, stonefree below 12.5 m, red-brown	7.4	13.7

Glacial Sand and Gravel	**c** Sand with a few pebbles; mainly medium, subangular to subrounded	1.3	15.0
	Clay, silty, stonefree below 15.3 m, brown	0.8	15.8
	d Sand with a few pebbles; mainly medium, subangular to subrounded	2.7+	18.5
	Hole abandoned due to rising sand		

GRADING

	Mean for deposit percentages			Depth below surface (m)	percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
a	24	65	11	0.4-1.4	24	29	34	3	5	5	0
				1.4-2.4	21	19	40	4	8	8	0
				2.4-3.4	22	22	43	2	7	4	0
				3.4-4.6	29	28	31	3	6	3	0
				Mean	**24**	**25**	**37**	**3**	**6**	**5**	**0**
b	10	29	61	5.2-6.3	10	6	15	8	38	23	0
c	4	94	2	13.7-15.0	4	32	59	3	2	0	0
d	2	96	2	15.8-16.8	5	39	55	1	0	0	0
				16.8-18.5	1	35	59	2	2	1	0
				Mean	**2**	**36**	**58**	**2**	**1**	**1**	**0**
a-d	**13**	**74**	**13**	**Mean**	**13**	**27**	**44**	**3**	**8**	**5**	**0**

SP 27 NW 29 **2330 7784** **Balsall Common** **Block C**

Surface level +117 m
Water not encountered
152 mm shell
December 1980

Waste 3.0 m
Bedrock 1.0 m+

LOG

Geological classification	Lithology	Thickness	Depth
	Made ground and soil	0.8	0.8
Glacial Sand and Gravel	Clay, sandy, stony, yellow-brown becoming red-brown below 1.5 m; scattered rounded to well-rounded pebbles, mainly quartzite	2.2	3.0
Triassic	Mudstone, red-brown with green spots	1.0+	4.0

SP 27 NW 30 **2068 7667** **Piercil End** **Block C**

Surface level +99 m
Water stuck at +97.8 m
152 mm shell
January 1981

Overburden 1.0 m
Mineral 2.5 m
Bedrock 2.5 m+

LOG

Geological classification	Lithology	Thickness	Depth
	Soil and sandy clay	1.0	1.0
Glacial Sand and Gravel	Gravel Gravel: fine and coarse, rounded to well-rounded, quartzite with quartz and some sandstone Sand: medium and coarse, subangular to subrounded	2.5	3.5
Triassic	Mudstone, red and green	2.5+	6.0

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
2	27	71	1.0-2.0	2	2	10	9	36	41	0
			2.0-3.5	2	4	16	11	32	35	0
			Mean	**2**	**3**	**14**	**10**	**34**	**37**	**0**

COMPOSITION

Depth below surface (m)	percentages by weight in +8 mm fraction						
						Igneous rock	
	Quartzite	Quartz	Sandstone	Mudstone	Flint	Volcanic	Intrusive
1.0-3.5	68	31	1	trace	0	0	0

SP 27 NW 31 **2297 7666** **Balsall Street** **Block C**

Surface level +117.4 m
Water stuck at +114.2 and +102.8 m
203 mm shell
November 1980

Overburden	0.4 m
Mineral	10.3 m
Waste	9.6 m
Bedrock	1.2 m+

LOG

Geological classification	Lithology	Thickness	Depth
	Soil	0.4	0.4
Glacial Sand and Gravel	**a** 'Very clayey' pebbly sand Gravel: fine and coarse, subangular to well-rounded, mainly quartzite Sand: fine and medium	2.1	2.5
	b 'Clayey' sandy gravel, part gravel Gravel: fine and coarse, subrounded to well-rounded, quartzite with quartz and some sandstone and mudstone	7.0	9.5
	c 'Very clayey' pebbly sand Gravel: fine, subrounded to well-rounded, mainly quartzite Sand: fine	1.2	10.7
Till	Clay, sandy, stony, reddish brown; scattered subangular to well-rounded pebbles, mainly quartzite with quartz	0.8	11.5
Glacial Lake Deposits	Clay, silty, laminated, brown; rare subrounded quartzite pebbles	3.1	14.6
Glacial Sand and Gravel	**d** 'Very clayey' sandy gravel Gravel: fine and coarse, subrounded to well-rounded, mainly quartzite Sand: fine and medium	1.0	15.6
Till	Clay, sandy, stony, reddish brown; scattered subangular to well-rounded pebbles, mainly quartzite and quartz	4.7	20.3
Triassic	Clay, silty, red-brown	1.2+	21.5

GRADING

	Mean for deposit percentages			Depth below surface (m)	percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
a	27	63	10	0.4-1.3	25	16	44	2	5	8	0
				1.3-2.5	28	37	26	2	3	4	0
				Mean	**27**	**28**	**33**	**2**	**4**	**6**	**0**
b	15	49	36	2.5-3.5	16	9	38	5	18	14	0
				3.5-5.0	9	7	22	7	20	35	0
				5.0-6.5	11	12	30	7	18	22	0
				6.5-8.0	25	13	29	5	15	13	0
				8.0-9.5	13	22	38	7	8	12	0
				Mean	**15**	**13**	**30**	**6**	**16**	**20**	**0**
c	23	73	4	9.5-10.7	23	67	4	2	3	1	0
d	16	56	28	14.6-15.6	16	29	23	4	11	17	0
a+b+c	**18**	**55**	**27**	**Mean**	**18**	**22**	**28**	**5**	**12**	**15**	**0**
a-d	**18**	**55**	**27**	**Mean**	**18**	**23**	**27**	**5**	**12**	**15**	**0**

COMPOSITION

	Depth below surface (m)	percentages by weight in +8 mm fraction						
		Quartzite	Quartz	Sandstone	Mudstone	Flint	Igneous rock Volcanic	Igneous rock Intrusive
b	3.5-5.0	72	26	1	1	0	0	0

SP 27 NW 32 **2380 7651** **Yew Tree Farm** **Block C**

Surface level +119.4 m
Water struck at +116.6 m and +106.4 m
203 mm shell
December 1980

Overburden	0.4 m
Mineral	9.3 m
Waste	3.3 m
Mineral	3.5 m
Waste	0.5 m
Bedrock	0.5 m+

LOG

Geological classification	Lithology	Thickness	Depth
	Soil	0.4	0.4
Glacial Sand and Gravel	**a** 'Clayey' gravel Gravel: mainly coarse with cobbles, subrounded to well-rounded, quartzite with quartz Sand: fine and medium	2.4	2.8
	b 'Very clayey' sand with a few pebbles; mainly medium	6.9	9.7
Till	Clay, sandy, stony, brown; scattered subangular to well-rounded pebbles, mainly quartzite and quartz	3.3	13.0
Glacial Sand and Gravel	**c** 'Clayey' sand, brown; fine and medium	3.5	16.5
Glacial Lake Deposits	Silt, sand lenses, stonefree, yellow-brown	0.5	17.0
Triassic	Mudstone, reddish brown	0.5+	17.5

GRADING

	Mean for deposit percentages			Depth below surface (m)	percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
a	10	44	46	0.4-1.5	14	13	11	2	4	46	10
				1.5-2.8	7	27	26	5	17	18	0
				Mean	**10**	**21**	**19**	**4**	**11**	**30**	**5**
b	31	66	3	2.8-4.5	29	15	47	1	5	3	0
				4.5-6.5	26	19	52	2	1	0	0
				6.5-8.5	34	28	33	2	2	1	0
				8.5-9.7	36	41	22	1	0	0	0
				Mean	**31**	**24**	**40**	**2**	**2**	**1**	**0**
c	15	85	0	13.0-16.5	15	37	46	2	0	0	0
a+b	**25**	**61**	**14**	**Mean**	**25**	**23**	**36**	**2**	**4**	**9**	**1**
a-c	**23**	**67**	**10**	**Mean**	**23**	**27**	**38**	**2**	**3**	**6**	**1**

COMPOSITION

	Depth below surface (m)	percentages by weight in +8 mm fraction						
		Quartzite	Quartz	Sandstone	Mudstone	Flint	Igneous rock Volcanic	Igneous rock Intrusive
a	0.4-2.8	78	21	1	trace	0	0	0

SP 27 NW 33 2165 7532 Balsall Lodge Farm **Block C**

Surface level +118 m
Water not encountered
152 mm shell
January 1981

Waste	7.0 m
Bedrock	0.5 m+

LOG

Geological classification	Lithology	Thickness	Depth
	Soil	0.2	0.2
Glacial Sand and Gravel	Clay, sandy, red-brown to yellow-brown; rare quartzite and quartz pebbles	1.6	1.8
Till	Clay, stony, red-brown; scattered quartzite, quartz, sandstone and mudstone pebbles	5.2	7.0
Triassic	Mudstone, greyish green	0.5+	7.5

SP 27 NW 34 2341 7621 Balsall Street **Block C**

Surface level +116 m
Water struck at +113 m
203 mm shell
November 1980

Overburden	0.2 m
Mineral	1.3 m
Waste	1.5 m
Mineral	2.9 m
Waste	1.4 m
Mineral	4.2 m
Waste	7.0 m+

LOG

Geological classification	Lithology	Thickness	Depth
	Soil	0.2	0.2
?Glacial Sand and Gravel	**a** 'Very clayey' pebbly sand Gravel: fine, subrounded to well-rounded, mainly quartzite with quartz Sand: fine and medium	1.3	1.5
	Silt, clay lenses, sandy, reddish brown	1.5	3.0
	b 'Clayey' sand, reddish brown; mainly fine	2.9	5.9
Glacial Lake Deposits	Clay, silty, stonefree, laminated, brown	1.4	7.3
Glacial Sand and Gravel	**c** Gravel, part 'clayey', part pebbly sand Gravel: fine and coarse, subangular to well-rounded, quartzite with quartz, mudstone and some sandstone Sand: fine and medium, subangular to well-rounded	4.2	11.5

?Till	Clay, stony, reddish brown; scattered subrounded to well-rounded pebbles, mainly quartzite and quartz	0.8	12.3
Glacial Lake Deposits	Clay, silty, sandy lenses, stonefree, laminated, brown	5.6	17.9
Glacial Sand and Gravel	**d** Sand, brown; fine	0.6+	18.5
	Hole abandoned due to rising sand		

GRADING

	Mean for deposit percentages			Depth below surface (m)	percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
a	24	65	11	0.2-1.5	24	38	25	2	8	3	0
b	15	85	0	3.0-4.5	15	64	21	0	0	0	0
				4.5-5.9	14	52	34	0	0	0	0
				Mean	**15**	**58**	**27**	**0**	**0**	**0**	**0**
c	7	37	56	7.3-8.5	4	5	8	3	26	54	0
				8.5-9.5	4	9	13	5	24	45	0
				9.5-10.5	10	11	21	7	21	30	0
				10.5-11.5	9	30	34	10	11	6	0
				Mean	**7**	**13**	**18**	**6**	**21**	**35**	**0**
d	9	88	3	17.9-18.5	9	62	24	2	3	0	0
a-d	**12**	**60**	**28**	**Mean**	**12**	**35**	**22**	**3**	**11**	**17**	**0**

COMPOSITION

	Depth below surface (m)	percentages by weight in +8 mm fraction						
		Quartzite	Quartz	Sandstone	Mudstone	Flint	Igneous rock Volcanic	Igneous rock Intrusive
c	7.3-10.5	71	20	4	5	0	trace	trace

SP 27 NW 35 **2363 7535** **Holly Grange Farm** **Block C**

Surface level +112 m
Water struck at +107 m
152 mm shell
January 1981

Waste 15.6 m
Bedrock 0.4 m+

LOG

Geological classification	Lithology	Thickness	Depth
	Soil	0.3	0.3
Glacial Lake Deposits	Clay, sandy, red-brown; rare quartzite, quartz and mudstone pebbles	2.7	3.0
	Clay, silty, laminated, red-brown; rare quartzite and quartz pebbles	3.0	6.0
Glacial Sand and Gravel	'Clayey' sand, red-brown; fine and medium	2.6	8.6
Glacial Lake Deposits	Clay, silty, sand lenses to 10.3 m, stonefree, laminated, red-brown; intercalations of yellow-brown silt below 11.5 m	7.0	15.6
Triassic	Mudstone, red-brown and grey-green	0.4+	16.0

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
14	86	0	6.0–7.0	18	40	42	0	0	0	0
			7.0–8.6	12	50	37	1	0	0	0
			Mean	**14**	**46**	**39**	**1**	**0**	**0**	**0**

SP 27 SW 11 **2124 7412** **Oldwich Lane** **Block C**

Surface level +112.1 m
Water not encountered
203 mm shell
December 1980

Overburden 0.4 m
Mineral 3.6 m
Bedrock 1.5 m+

LOG

Geological classification	Lithology	Thickness	Depth
	Soil	0.4	0.4
Glacial Sand and Gravel	'Very clayey' gravel Gravel: fine and coarse, subangular to well-rounded, mainly quartzite with quartz Sand: fine and medium	3.6	4.0
Triassic	Mudstone, red-brown with green sandstone	1.5+	5.5

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
25	33	42	0.4–1.5	24	21	27	2	9	17	0
			1.5–3.0	17	4	13	10	30	26	0
			3.0–4.0	40	6	9	7	18	20	0
			Mean	**25**	**10**	**16**	**7**	**20**	**22**	**0**

SP 27 SW 12 **2288 7448** **Frogmore Wood** **Block C**

Surface level +127 m
Water not encountered
152 mm shell
January 1981

Waste 11.0 m
Bedrock 0.5 m+

LOG

Geological classification	Lithology	Thickness	Depth
	Soil	0.3	0.3
Till	Clay, silty, stony, red-brown with blue-grey gleying to 2.0 m; scattered subangular to well-rounded quartzite, quartz, sandstone and mudstone pebbles	9.9	10.2
	Gravel lens; fine and coarse, subrounded to well-rounded quartzite, quartz and sandstone clasts	0.8	11.0
Triassic	Mudstone, greyish green	0.5+	11.5

SP 27 SW 13 **2469 7435** **Mere End Farm** **Block C**

Surface level +121.4 m
Water struck at +117.9 m and +111.8 m
203 mm shell
November 1980

Waste 18.6 m+

LOG

Geological classification	Lithology	Thickness	Depth
	Soil	0.2	0.2
Glacial Lake Deposits	Clay, silty, sandier with depth, reddish brown with white gleying	3.3	3.5
	Silt, sandy, stonefree, brown	0.5	4.0
Till	Clay, stony, reddish brown; scattered subangular to well-rounded, quartzite, quartz, sandstone and mudstone pebbles	5.6	9.6
Glacial Lake Deposits	Silt, sandy, stonefree, brown	2.0	11.6
	'Very clayey' sand with a few pebbles, silt lenses, brown; fine	2.5	14.1
	Silt, clayey, stonefree, brown	3.2	17.3
Till	Clay, stony, reddish brown; scattered subrounded to to well-rounded quartzite, quartz, sandstone and mudstone pebbles	1.3+	18.6
	Hole abandoned - no recovery		

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages							
Fines	Sand	Gravel		Fines	Sand			Gravel			
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16-64$	$+64$ mm	
28	68	4	11.6-14.1	28	63	3	2	2	2	0	

SP 27 SW 15 **2306 7408** **South of Frogmore Wood** **Block C**

Surface level +131.7 m
Water struck at +123.7 m and +120.2 m
152 mm shell
January 1981

Waste 14.2 m
Bedrock 0.3 m+

LOG

Geological classification	Lithology	Thickness	Depth
	Soil	0.4	0.4
Glacial Sand and Gravel ?	Clay, sand lenses, red-brown; scattered quartzite and quartz pebbles	3.8	4.2
Till	Clay, stony, brown; scattered subrounded to well-rounded quartzite, quartz, sandstone and mudstone pebbles	3.1	7.3
Glacial Lake Deposits	Clay, silt lenses, stonefree, laminated, red-brown	4.2	11.5

Glacial Sand and Gravel	Gravel Gravel: fine and coarse with some cobbles, rounded to well-rounded, mainly quartzite with quartz Sand: medium, angular to subrounded	2.7	14.2
Triassic	Mudstone, red-brown and green	0.3+	14.5

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
4	29	67	11.5-12.5	3	3	18	11	30	34	1
			12.5-14.2	4	4	16	6	32	38	0
			Mean	**4**	**4**	**17**	**8**	**31**	**36**	**0**

SP 28 SW 320 **2027 8395** **Middle Bickenhill** **Block A**

Surface level +98.9 m
Water level not recorded
203 mm shell
January 1981

Overburden 0.5 m
Mineral 5.0 m
Bedrock 0.5 m+

LOG

Geological classification	Lithology	Thickness	Depth
	Soil	0.5	0.5
Glacial Sand and Gravel	**a** Sandy gravel Gravel: mainly coarse, subangular to well-rounded, quartzite with quartz Sand: mainly medium	3.5	4.0
	b Sand, brown; fine and medium	1.5	5.5
Triassic	Mudstone, red-brown with green spots	0.5+	6.0

GRADING

	Mean for deposit percentages			Depth below surface (m)	percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
a	9	63	28	0.5-2.0	11	19	30	2	11	27	0
				2.0-4.0	7	21	51	1	7	13	0
				Mean	**9**	**20**	**42**	**1**	**9**	**19**	**0**
b	5	95	0	4.0-5.5	5	39	55	1	0	0	0
a+b	**8**	**73**	**19**	**Mean**	**8**	**26**	**46**	**1**	**6**	**13**	**0**

SP 28 SW 321 **2086 8378** **Siding Wood** **Block A**

Surface level +94.9 m
Water not encountered
203 mm shell
January 1981

Overburden 0.4 m
Mineral 10.4 m
Bedrock 0.7 m+

LOG

Geological classification	Lithology	Thickness	Depth
	Soil	0.4	0.4
Glacial Sand and Gravel	Gravel, part 'clayey' sandy gravel Gravel: fine and coarse with some cobbles, subangular to well-rounded, quartzite with quartz and some sandstone and mudstone Sand: medium	10.4	10.8
Triassic	Mudstone, red-brown with green spots	0.7+	11.5

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
7	36	57	0.4-1.5	15	11	37	2	9	26	0
			1.5-3.0	6	10	29	5	18	32	0
			3.0-5.0	7	6	24	5	15	40	3
			5.0-7.0	6	6	19	6	18	42	3
			7.0-8.5	10	10	24	6	22	28	0
			8.5-9.5	3	2	8	8	26	53	0
			9.5-10.8	2	3	19	9	41	26	0
			Mean	**7**	**7**	**23**	**6**	**21**	**35**	**1**

COMPOSITION

Depth below surface (m)	percentages by weight in +8 mm fraction						
						Igneous rock	
	Quartzite	Quartz	Sandstone	Mudstone	Flint	Volcanic	Intrusive
0.4-10.8	79	18	2	1	0	trace	trace

SP 28 SW 322 **2024 8306** **Middle Bickenhill** **Block A**

Surface level +102 m
Water not encountered
152 mm shell
December 1980

Waste 1.1 m
Bedrock 0.9 m+

LOG

Geological classification	Lithology	Thickness	Depth
	Soil	0.3	0.3
Glacial Sand and Gravel	'Very clayey' pebbly sand Gravel: fine, subangular to subrounded, mainly quartz Sand: fine and medium	0.8	1.1
Triassic	Mudstone, sandy in upper 0.5 m, red-brown with black and some grey-green lenses	0.9+	2.0

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
29	64	7	0.3-1.1	29	26	35	3	5	2	0

SP 28 SW 323 **2148 8338** **Stonebridge** **Block A**

Surface level +84.5 m
Water not encountered
203 mm shell
January 1981

Waste 1.5 m
Bedrock 0.5 m+

LOG

Geological classification	Lithology	Thickness	Depth
	Soil	0.6	0.6
Terrace 1	'Clayey' gravel Gravel: mainly coarse, subangular to well-rounded, quartzite with quartz and some sandstone and igneous rock Sand: fine and medium	0.9	1.5
Triassic	Clay, reddish brown	0.5+	2.0

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
12	33	53	0.6-1.5	12	11	17	5	19	36	0

COMPOSITION

Depth below surface (m)	percentages by weight in +8 mm fraction						
	Quartzite	Quartz	Sandstone	Mudstone	Flint	Igneous rock Volcanic	Igneous rock Intrusive
0.6-1.5	81	16	2	0	0	0	1

SP 28 SW 324 **2234 8304** **Geary's Heath** **Block A**

Surface level +85.9 m
Water struck at +83.9 m
203 mm shell
January 1981

Overburden 0.5 m
Mineral 4.4 m
Bedrock 1.1 m+

LOG

Geological classification	Lithology	Thickness	Depth
	Soil	0.5	0.5
Glacial Sand and Gravel	Gravel Gravel: fine and coarse with some cobbles, subangular to well-rounded, quartzite with quartz and some sandstone and igneous rock Sand: mainly medium	4.4	4.9
Triassic	Mudstone, red-brown with green spots	1.1+	6.0

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16-64$	$+64$ mm
5	34	61	0.5-1.7	6	9	14	4	30	37	0
			1.7-3.0	5	15	18	5	22	35	0
			3.0-4.0	6	9	19	9	15	34	8
			4.0-4.9	3	3	19	10	47	18	0
			Mean	**5**	**10**	**17**	**7**	**28**	**31**	**2**

COMPOSITION

Depth below surface (m)	percentages by weight in +8 mm fraction						
						Igneous rock	
	Quartzite	Quartz	Sandstone	Mudstone	Flint	Volcanic	Intrusive
0.5-4.9	80	18	1	0	0	0	1

SP 28 SW 325 **2351 8323** **Harding's Wood** **Block A**

Surface level +110.5 m
Water not encountered
203 mm shell
January 1981

Waste 13.6 m
Bedrock 2.4 m+

LOG

Geological classification	Lithology	Thickness	Depth
	Soil	0.5	0.5
Fluvio-glacial Gravel	Clay, sandy becoming silty with depth, reddish brown; scattered subangular to well-rounded pebbles, mainly quartzite	2.5	3.0
	Silt, sandy, brown; rare subangular to well-rounded pebbles	2.0	5.0
?Till	Clay, stony, reddish brown; scattered subangular to well-rounded pebbles, mainly quartzite and quartz Bunter quartzite cobble at 5.2 m	8.6	13.6
Triassic	Mudstone, sandy to 15.7 m, red-brown with green sandstone	2.4+	16.0

SP 28 SW 326 **2032 8187** **Hampton-in-Arden** **Block A**

Surface level +91.0 m
Water not encountered
203 mm shell
January 1981

Waste 2.2 m
Bedrock 0.8 m+

LOG

Geological classification	Lithology	Thickness	Depth
	Soil	0.3	0.3
Alluvium	Clay,stony, grey-brown; scattered subangular to well-rounded pebbles, mainly quartzite	1.9	2.2
Triassic	Clay, silty, reddish brown with green sandstone clasts	0.8+	3.0

SP 28 SW 327 **2081 8280** **Pasture Farm** **Block A**

Surface level +101 m
Water struck at +98.5 m
152 mm shell
January 1981

Overburden 0.4 m
Mineral 3.6 m
Bedrock 1.0 m+

LOG

Geological classification	Lithology	Thickness	Depth
	Soil	0.4	0.4
Glacial Sand and Gravel	'Clayey' pebbly sand, part 'clayey' sand Gravel: fine and coarse, rounded to well-rounded, quartzite with quartz and some sandstone Sand: mainly medium, subangular to subrounded	3.6	4.0
Triassic	Mudstone, red-brown with green spots	1.0+	5.0

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
16	79	5	0.4-1.3	13	14	63	2	5	3	0
			1.3-2.0	18	14	53	1	8	6	0
			2.0-3.0	16	40	44	0	0	0	0
			3.0-4.0	16	30	52	2	0	0	0
			Mean	**16**	**26**	**52**	**1**	**3**	**2**	**0**

SP 28 SW 328 **2284 8236** **The Somers** **Block A**

Surface level +95.2 m
Water struck at +90.2 m
203 mm shell
January 1981

Overburden 0.6 m
Mineral 10.0 m
Bedrock 0.9 m+

LOG

Geological classification	Lithology	Thickness	Depth
	Soil	0.6	0.6
Glacial Sand and Gravel	**a** 'Very clayey' pebbly sand Gravel: fine, subangular to well-rounded, mainly quartzite with quartz Sand: fine and medium	0.9	1.5
	b 'Very clayey' sand, part sand, reddish brown; fine and medium	3.5	5.0
	c Gravel Gravel: fine and coarse, subangualr to well-rounded, quartzite with quartz and some sandstone Sand: mainly medium	5.6	10.6
Triassic	Clay, reddish brown with green spots	0.9+	11.5

GRADING

	Mean for deposit percentages			Depth below surface (m)	percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
a	27	56	17	0.6-1.5	27	24	30	2	12	5	0
b	21	78	1	1.5-3.5	7	46	47	0	0	0	0
				3.5-5.0	40	23	34	0	1	2	0
				Mean	**21**	**36**	**42**	**0**	**0**	**1**	**0**
c	2	41	57	5.0-6.5	3	6	26	7	27	31	0
				6.5-8.0	2	4	20	7	24	43	0
				8.0-10.6	2	7	34	7	20	30	0
				Mean	**2**	**6**	**28**	**7**	**23**	**34**	**0**
a+b+c	**11**	**55**	**34**	**Mean**	**11**	**18**	**33**	**4**	**14**	**20**	**0**

COMPOSITION

	Depth below surface (m)	percentages by weight in +8 mm fraction						
							Igneous rock	
		Quartzite	Quartz	Sandstone	Mudstone	Flint	Volcanic	Intrusive
c	5.0-10.6	77	22	1	trace	0	trace	trace

SP 28 SW 329 **2346 8216** **Meriden** **Block A**

Surface level +114.0 m
Water struck at +108 m
203 mm shell
January 1981

Overburden 6.0 m
Mineral 17.0 m+

LOG

Geological classification	Lithology	Thickness	Depth
	Soil	0.5	0.5
Fluvio-glacial Gravel	Clay, sandy, reddish brown; scattered subangular to well-rounded pebbles, mainly quartzite and quartz	5.5	6.0
	a 'Clayey' pebbly sand Gravel: fine and coarse, subangular to well-rounded, mainly quartzite and quartz Sand: mainly medium	3.5	9.5
?Glacial Sand and Gravel	**b** Gravel Gravel: mainly fine, subangular to well-rounded, quartzite with sandstone, quartz, mudstone and some igneous rock Sand: medium	4.0	13.5
	c Sand with a few pebbles, reddish brown; fine and medium	5.2	18.7
	d Sandy gravel Gravel: fine and coarse, subangular to well-rounded, quartzite and sandstone with quartz and mudstone Sand: mainly medium	1.3	20.0
	e Sand, reddish brown; mainly medium	2.0	22.0
	f Gravel Gravel: fine and coarse, subangular to well-rounded, quartzite with quartz and some sandstone and mudstone Sand: mainly medium	1.0+	23.0
	Hole abandoned - no penetration through gravel		

GRADING

	Mean for deposit percentages			Depth below surface (m)	percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
a	11	70	19	6.0-6.5	28	23	35	5	4	5	0
				6.5-8.0	6	20	43	5	13	13	0
				8.0-9.5	11	23	46	4	7	9	0
				Mean	**11**	**23**	**43**	**4**	**9**	**10**	**0**
b	4	44	52	9.5-11.5	3	16	30	8	26	17	0
				11.5-13.5	4	5	14	15	42	20	0
				Mean	**4**	**11**	**22**	**11**	**34**	**18**	**0**
c	4	94	2	13.5-15.5	6	67	21	3	3	0	0
				15.5-18.7	2	32	64	1	1	0	0
				Mean	**4**	**45**	**47**	**2**	**2**	**0**	**0**
d	2	68	30	18.7-20.0	2	18	44	6	11	19	0
e	1	98	1	20.0-22.0	1	33	64	1	1	0	0
f	5	30	65	22.0-23.0	5	8	16	6	34	31	0
b-f	**3**	**73**	**24**	**Mean**	**3**	**28**	**40**	**5**	**14**	**10**	**0**
a-f	**5**	**72**	**23**	**Mean**	**5**	**27**	**40**	**5**	**13**	**10**	**0**

COMPOSITION

	Depth below surface (m)	percentages by weight in +8 mm fraction						
		Quartzite	Quartz	Sandstone	Mudstone	Flint	Igneous rock Volcanic	Igneous rock Intrusive
b	9.5-13.5	52	13	25	9	0	0	1
d	18.7-20.0	59	5	31	5	trace	0	0
f	22.0-23.0	78	20	1	1	trace	0	trace

SP 28 SW 330 **2168 8146** **Patrick Farm** **Block A**

Surface level +88.0 m
Water struck at +86.0 m
152 mm shell
January 1981

Overburden 0.3 m
Mineral 3.4 m
Bedrock 1.3 m+

LOG

Geological classification	Lithology	Thickness	Depth
	Soil	0.3	0.3
Terrace 2	'Clayey' pebbly sand Gravel: fine and coarse, rounded to well-rounded, mainly quartzite with quartz Sand: fine and medium, subangular to subrounded	3.4	3.7
Triassic	Mudstone, red with green sandstone	1.3+	5.0

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
11	80	9	0.3-1.3	12	33	28	6	12	9	0
			1.3-2.3	9	24	53	7	4	3	0
			2.3-3.7	11	49	37	3	0	0	0
			Mean	**11**	**37**	**38**	**5**	**5**	**4**	**0**

SP 28 SW 331 **2262 8178** **North Warwickshire Golf Course** **Block A**

Surface level +97.0 m
Water struck at +90 m
152 mm shell
December 1980

Overburden 0.5 m
Mineral 13.5 m
Bedrock 0.5 m+

LOG

Geological classification	Lithology	Thickness	Depth
	Soil	0.5	0.5
Glacial Sand and Gravel	**a** 'Clayey' pebbly sand Gravel: fine and coarse, rounded to well-rounded, mainly quartzite with quartz Sand: fine	2.2	2.7
	b Pebbly sand, part sandy gravel Gravel: fine and coarse, rounded to well-rounded, mainly quartzite with quartz Sand: medium, subangular to subrounded	7.5	10.2
	c Gravel Gravel: fine and coarse, rounded to well-rounded, mainly quartzite with quartz Sand: medium, subangular to subrounded	3.8	14.0
Triassic	Mudstone, red-brown with green spots	0.5+	14.5

GRADING

	Mean for deposit percentages			Depth below surface (m)	percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
a	12	76	12	0.5-1.5	15	42	22	4	9	8	0
				1.5-2.7	10	59	20	3	5	3	0
				Mean	**12**	**52**	**21**	**3**	**7**	**5**	**0**
b	3	87	10	2.7-3.5	6	31	61	1	1	0	0
				3.5-4.5	5	12	57	3	11	12	0
				4.5-5.5	3	23	73	0	1	0	0
				5.5-6.5	2	27	67	1	1	2	0
				6.5-7.5	3	28	67	1	1	0	0
				7.5-8.5	2	23	30	3	20	22	0
				8.5-9.5	4	36	56	1	3	0	0
				9.5-10.2	3	28	61	1	3	4	0
				Mean	**3**	**26**	**60**	**1**	**5**	**5**	**0**
c	4	41	55	10.2-11.2	2	14	25	3	21	35	0
				11.2-12.4	3	5	23	5	27	37	0
				12.4-14.0	5	5	36	6	16	32	0
				Mean	**4**	**7**	**29**	**5**	**21**	**34**	**0**
a+b+c	**5**	**72**	**23**	**Mean**	**5**	**25**	**44**	**3**	**10**	**13**	**0**

SP 28 SW 332 **2425 8136** **South of Meriden** **Block A**

Surface level +124.5 m
Water not encountered
203 mm shell
January 1981

Waste 1.5 m
Bedrock 1.5 m+

LOG

Geological classification	Lithology	Thickness	Depth
	Soil	0.2	0.2
Fluvio-glacial Gravel	Clay, sandy, red-brown; rare subrounded to well-rounded quartzite pebbles	1.3	1.5
Carboniferous	Mudstone, red-brown	1.5+	3.0

SP 28 SW 333 **2167 8083** **East of Siden Hill Wood** **Block A**

Surface level +84.6 m
Water struck at +83.1 m
152 mm shell
January 1981

Overburden 0.6 m
Mineral 3.9 m
Bedrock 1.5 m+

LOG

Geological classification	Lithology	Thickness	Depth
	Soil	0.6	0.6
?Alluvium	Gravel, part 'clayey sandy gravel Gravel: fine and coarse with some cobbles, subangular to well-rounded, quartzite with quartz and some sandstone and igneous rock Sand: fine to coarse, angular to subrounded	3.9	4.5
Triassic	Mudstone, red with green spots	1.5+	6.0

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
				Fines	Sand			Gravel		
Fines	Sand	Gravel		$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
4	29	67	0.6-2.0	10	20	21	8	19	22	0
			2.0-3.0	1	2	10	8	37	42	0
			3.0-4.5	1	2	8	7	32	47	3
			Mean	**4**	**8**	**13**	**8**	**29**	**37**	**1**

COMPOSITION

Depth below surface (m)	percentages by weight in +8 mm fraction						
						Igneous rock	
	Quartzite	Quartz	Sandstone	Mudstone	Flint	Volcanic	Intrusive
0.6-4.5	77	21	1	trace	0	0	1

SP 28 SW 334 **2298 8107** **Keeper's Cottage** **Block A**

Surface level +99.0 m
Water struck at +93.5 m
152 mm shell
December 1980

Overburden 3.2 m
Mineral 10.3 m
Bedrock 0.5 m+

LOG

Geological classification	Lithology	Thickness	Depth
	Made ground	3.2	3.2
Glacial Sand and Gravel	Sand; mainly medium, subangular to subrounded, quartzite and quartz	10.3	13.5
Triassic	Mudstone, red-brown and green	0.5+	14.0

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
5	92	3	3.2-4.2	16	10	67	1	4	2	0
			4.2-5.2	3	24	71	1	0	1	0
			5.2-6.2	5	50	44	1	0	0	0
			6.2-7.2	3	48	46	1	2	0	0
			7.2-8.2	5	39	56	0	0	0	0
			8.2-9.2	2	33	60	0	4	1	0
			9.2-10.2	4	35	60	0	1	0	0
			10.2-11.2	2	32	61	2	2	1	0
			11.2-12.2	3	22	58	4	6	7	0
			12.2-13.5	5	19	70	4	2	0	0
			Mean	**5**	**31**	**60**	**1**	**2**	**1**	**0**

SP 28 SW 335 **2328 8016** **Park Farm** **Block A**

Surface level +105.6 m
Water not encountered
203 mm shell
January 1981

Overburden 0.4 m
Mineral 2.1 m
Waste 4.9 m
Bedrock 0.6 m+

LOG

Geological classification	Lithology	Thickness	Depth
	Soil	0.4	0.4
Fluvio-glacial Gravel	Gravel Gravel: fine and coarse, subangular to well-rounded, quartzite with quartz and some sandstone Sand: fine to coarse	2.1	2.5
	Clay, stony, red-brown; scattered subangular to well-rounded quartzite, quartz and green sandstone clasts	4.9	7.4
Triassic	Mudstone, reddish brown	0.6+	8.0

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
7	37	56	0.4-2.5	7	12	16	9	32	24	0

COMPOSITION

Depth below surface (m)	percentages by weight in +8 mm fraction						
						Igneous rock	
	Quartzite	Quartz	Sandstone	Mudstone	Flint	Volcanic	Intrusive
0.4-2.5	74	25	1	0	0	0	0

SP 28 SW 336 2245 8022 **Coronation Spinney** **Block A**

Surface level +91.3 m
Water level not recorded
203 mm shell
February 1981

Overburden	0.2 m
Mineral	5.4 m
Waste	0.9 m
Mineral	3.1 m
Bedrock	0.4 m+

LOG

Geological classification	Lithology	Thickness	Depth
	Soil	0.2	0.2
Glacial Sand and Gravel	**a** Gravel Gravel: fine and coarse, subangular to well-rounded, mainly quartzite and quartz with some sandstone Sand: medium	1.3	1.5
	b Pebbly sand Gravel: fine and coarse, subangular to well-rounded, mainly quartzite with quartz Sand: medium	4.1	5.6
Glacial Lake Deposits	Clay, silty, laminated, brown	0.9	6.5
Glacial Sand and Gravel	**c** Gravel Gravel: fine and coarse, subangular to well-rounded, quartzite with quartz and some sandstone and igneous rock Sand: mainly medium	3.1	9.6
Triassic	Mudstone, reddish brown with green sandstone	0.4+	10.0

GRADING

	Mean for deposit percentages			Depth below surface (m)	percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
a	3	44	53	0.2-1.5	3	10	26	8	25	28	0
b	8	83	9	1.5-3.0	8	13	55	3	10	11	0
				3.0-5.6	8	22	67	1	1	1	0
				Mean	**8**	**19**	**62**	**2**	**4**	**5**	**0**
c	7	25	68	6.5-8.0	12	7	17	4	23	37	0
				8.0-9.6	2	6	14	4	34	40	
				Mean	**7**	**6**	**15**	**4**	**29**	**39**	**0**
a-c	**7**	**56**	**37**	**Mean**	**7**	**13**	**39**	**4**	**16**	**21**	**0**

COMPOSITION

	Depth below surface (m)	percentages by weight in +8 mm fraction						
							Igneous rock	
		Quartzite	Quartz	Sandstone	Mudstone	Flint	Volcanic	Intrusive
c	6.5-8.0	77	21	1	trace	0	0	1

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INSTITUTE OF GEOLOGICAL SCIENCES

INDUSTRIAL MINERALS ASSESSMENT UNIT

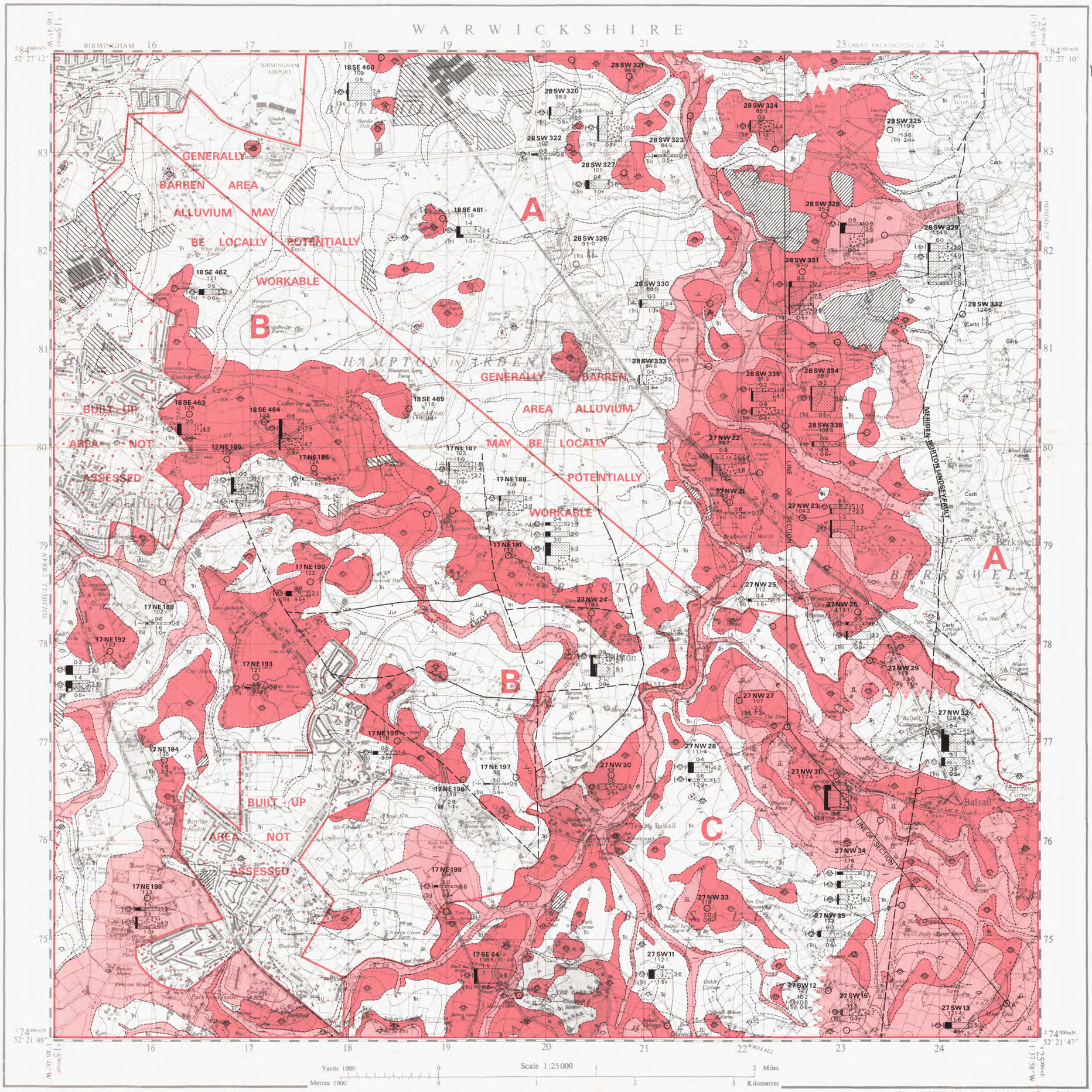
THE SAND AND GRAVEL RESOURCES OF THE COUNTRY EAST OF SOLIHULL, WARWICKSHIRE

Scale 1:25 000 or about 2½ Inches to 1 Mile

ORDNANCE SURVEY
PARTS OF SHEETS SP17, 18, 27 & 28
PROVISIONAL EDITION

115

This map should be read in conjunction with the accompanying Report which contains details of the assessment of resources.



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Heights are in feet above Mean Sea Level at Newlyn.
Contour values are in feet.
1 square inch on this map represents 99·839 acres on the ground.

Original survey north of grid line 764 on the 1:10 560 scale by C.H. Cunnington, T. Eastwood in 1913-15. Revised and primary survey of remainder on the 1:10 000 scale by R.A. Old, M.G. Sumbler and K. Ambrose in 1978-81. G.W. Green, District Geologist.

Sand and Gravel survey by B. Cannell and R.G. Crofts in 1980-81. R.G. Thurrell, Head, Industrial Minerals Assessment Unit.

1:25 000 Sand and Gravel Resource Sheet published 1982.
G.M. Brown, D.Sc., F.R.S., *Director, Institute of Geological Sciences.*

Data quoted for an individual borehole refer strictly to that site; reliable conclusions cannot be drawn about the thickness and grading elsewhere in the deposit, particularly in material as variable as sand and gravel. However, estimates of the volume and mean grading of the mineral as a whole in each Resource Block are given in the Report.

Compiled from 6" sheets last fully revised 1902-74.
Other partial systematic revision 1937-77 has been incorporated.
Major roads revised 1969-77.

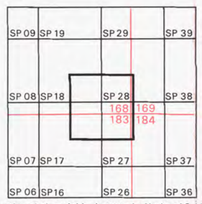


Diagram showing the relation of this sheet to the National Grid 1:25 000 sheets and the 1:50 000 Geological sheets 168, 169, 183 and 184.

EXPLANATION OF SYMBOLS AND ABBREVIATIONS

DRIFT

RECENT AND PLEISTOCENE (QUATERNARY)

- **Alluvium** – mainly grey loam, commonly underlain by gravel — A-69
- **First Terrace Deposits** – silt, sand and gravel, clay shown separately on map — 1T-38, 1T-40, 1T-39, 1T-41
- **Second Terrace Deposits** – mainly sand and gravel — 2T-10
- **Head** – pebbly sandy clay and silt — H-47
- **Fluvio-glacial Gravel** – poorly sorted 'clayey' sand and gravel with clay lenses — FL-21
- **Glacial Sand and Gravel** – variable sand and gravel with some layers of clay and silt — GS-75
- **Boulder Clay** – brown silty clay with Bunter quartzite and rare flint pebbles — BC-44
- **Glacial Lake Deposits** – laminated clay and silt — GL-7

SOLID

- Jur — **Jurassic** – undivided; grey mudstone with thin blue-grey limestone
- Tri — **Triassic** – undivided; red, red-brown and green mudstones with grey-green siltstones and sandstones
- Carb — **Carboniferous** – undivided; red mudstones with red and grey sandstones, conglomerate and Spirorbis Limestone
- **Made ground** — MG-2
- **Worked out sand and gravel pits, may be partly or wholly restored by fill** — WO-24

BOUNDARY LINES

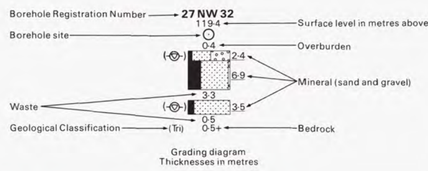
- Geological boundary, Drift (pecked line denotes uncertainty)
- Fault, crossmark denotes downthrow side
- Inferred boundary between recognised categories of deposits
- Resource Block boundary

BOREHOLE DATA

SITE LOCATIONS

- ○ Industrial Minerals Assessment Unit (I.M.A.U.) Boreholes

I.M.A.U. BOREHOLES



Grading diagram
Thicknesses in metres

Notes:–
(i) Figures underlined denote thicknesses used in the assessment of resources.
(ii) The + sign indicates that the base of the deposit was not reached.
(iii) The Geological Classification is given only for mineral and bedrock.

Borehole Registration Number
Each I.M.A.U. borehole is identified by a Registration Number, e.g. **27 NW 32.** The first number and letters refer to the quarter sheet and the second number to the I.G.S. serial number for that quarter. The unique designation for borehole **27 NW 32** is **SP 27 NW 32.**

Grading diagrams
Each grading diagram shows the mean particle size distribution of a distinct deposit of mineral.

The height of the diagram is proportional to the mineral thickness. The widths of the divisions show the proportions of **Fines, Sand** and **Gravel** but small amounts of gravel may be omitted or exaggerated.

CATEGORIES OF DEPOSITS

- **Exposed mineral** — CAT-E6
- **Continuous or almost continuous spreads of mineral beneath overburden** — CAT-C1
- **Sand and gravel either not potentially workable (see Report) or absent** — CAT-A2
- **Sand and gravel not assessed** — CAT-N1

RESOURCE BLOCKS

For the purpose of assessment, the mineral is divided into Resource Blocks (see Report). Each is designated by a letter.

A horizontal section showing the general relationship of the drift deposits along the line of section (A-A¹), constitutes Figure 4 of the Report.

Detailed records may be consulted on application to the Head, Industrial Minerals Assessment Unit, Institute of Geological Sciences, Keyworth, Nottingham, NG12 5GG.

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