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Lancashire County Council - Sand and Gravel Study

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1 Introduction

ENTEC UK in association with the British Geological Survey were commissioned by Lancashire County Council, in conjunction Blackburn and Darwen Borough Council and Blackpool Borough Council, to assess possible sources of sand within their counties. The role of the British Geological Survey (BGS) in the project was to identify all potential areas for future high quality sand and gravel extraction within Lancashire, Blackburn-with-Darwen and Blackpool. The study will also indicate the areas which might warrant more detailed investigation in a second stage of the study.

2 Sources of information available for the assessment

At the onset of the project, available data sources that would be beneficial in identifying areas of sand and gravel were identified. The majority of data consulted was that either held or published by the British Geological Survey. The following data sets were utilised in the study to identify potential areas of high quality sand and gravel:

2.1 BGS CORPORATE BOREHOLE DATABASE (SOBI)

In excess of two thousand five hundred boreholes were extracted from the corporate database for inclusion in the study. This included a variety of borehole types including site investigation, water and mineral exploration boreholes. The selection of boreholes was primarily restricted to those that occur outside the main urban conurbations within the boundaries of Lancashire County Council, Blackburn and Darwen Borough Council and Blackpool Borough Council.

2.2 BGS PUBLICATIONS

Current published BGS solid and superficial geological maps were obtained for the study area at 1:50 000 scale. Current geological maps were unavailable north of 471500N. The descriptive memoirs that accompanying each sheet were consulted where necessary. The geological sheets/memoirs and the dates of the last update of the geological linework for Lancashire, Blackburn and Darwen, and Blackpool are listed Table 1. In addition to the maps, the 2003 Directory of Mines and Quarries (Cameron *et. al*., 2003) was also referred to indicate areas of current mineral workings.

Sheet Number	Sheet Name	Drift map Last update of linework	Solid map Last update of linework
49	Kirkby Lonsdale	Out of Print; currently being resurveyed	Out of Print; currently being resurveyed
50	Hawes	1997	1997
59	Lancaster	1995	1995
60	Settle	1991	1989
66	Blackpool	1975	1975
67	Garstang	1990	1990
68	Clitheroe	1960	1960
74	Southport	1989	1989
75	Preston	1940	1982
76	Rochdale	1927; new map expected 2004	1927; new map expected 2004
83	Formby	1942	1942
84	Wigan	1935	1935

Table 1. Dates of last update of geological linework in study area

2.3 ARCHIVED MATERIAL

The BGS 1:10 000 scale field slips were consulted to supplement the 1:50 000 map sheet memoirs where further clarification or detail was required.

2.4 OTHER DATA

The detailed Allot and Lomax 'Sand and Gravel Resources of Lancashire' report, commissioned by the Department of the Environment in 1990 was referred to in detail.

3 Areas of potential sand and gravel resources

3.1 BACKGROUND

Sand and gravel are defined on the basis of particle size rather than composition. In current commercial usage, the term 'gravel' is used for material that is coarser than 5 mm, with a maximum size of 40 mm, and the term 'sand' for the material that is finer, but coarser than

0.075 mm. Most sand and gravel is composed of particles that are rich in silica (quartz, quartzite and flint), but other rock types may occur locally.

The principal uses of sand are as fine aggregate in concrete, mortar and asphalt. The main use of gravel is as coarse aggregate in concrete. Unwashed sand and gravel can also be used for constructional fill and as 'hoggin' for surfacing tracks and paths.

Sand and gravel resources occur in a variety of geological environments. In Lancashire, these resources fall into two categories:

- Superficial or 'drift' deposits, subdivided into river sand and gravel, glacial and glaciofluvial sand and gravel and sand in estuarine and foreshore environments;
- Bedrock, or 'solid' deposits not within the scope of this study. However, weathered, unconsolidated Permo-Triassic sandstones have been included.

The rapid desk study involved investigating and integrating all available data sources to further refine the basic resource linework provided by the British Geological Survey. The areas of potential resources highlighted are very much in line with those identified in the study by Allot and Lomax (1990) for the Department of the Environment. The study indicates that there are five main geological scenarios in which sand and gravel occur within the study areas:

1. River valleys
2. Estuaries and foreshores
3. Glaciofuvial/Glacial sand and gravel
4. Areas indicated on geological maps as Till/Boulder Clay concealing Glaciofuvial/Glacial sand and gravel
5. Areas of weathered Permo-Triassic sandstone

Within these geological categories, specific targets have been identified that may warrant further investigations. These investigations are outside the scope of this project. These areas are identified solely on the basis of resource information.

Generally, only exposed sand and gravel is defined in the 1:50,000 geological linework, although sub-alluvial inferred resources of sand and gravel occurring beneath modern river flood plains may be extensive in some places. Narrow (<200 m) spreads of sub-alluvial deposits are mainly excluded from the map. Their limited width is likely to preclude economic working of any sand and gravel present. BGS IMAU resource surveys have not been carried out in the area limiting detailed information on the quality and nature and workability of these deposits. Without the availability of such information it is not possible to indicate whether or not areas of potential deposits are in fact economic.

The areas that warrant further investigation are provided digitally and have been outlined by a rectangular polygon. The digital polygonal areas are centred on borehole intersection information and further detailed site investigation work would be required to determine the extent of the resource intersected. In some instances the polygons do not occur over areas of

resources outlined in the BGS resource linework, a result of the additional borehole information included in this study.

Planning considerations such as the presence of environmental designations, access to transport networks and land use have not been taken into account.

3.2 RIVER VALLEYS

River terrace deposits occur at several levels in most of the major valleys in the county flanking the present floodplain. Terrace deposits are commonly dry in their upper parts and saturated to the base. The river valleys identified to contain sand and gravel deposits in the county are the Wyre, Ribble, Codner, Cocker, Catterall Calder, Brock, Burnley Calder and Douglas. These valleys broadly comprise older, raised river terrace sequences (formerly called 'Plateau Gravels') and younger, terraces adjacent to and beneath the present day alluvium. The terraces of each river system are compositionally distinguishable reflecting their source material.

Sub-alluvial gravels are encountered beneath the alluvium of the major valleys in the county and are compositionally similar to the adjacent river terraces deposits. The deposits rest on an irregular channelled surface and are thus of very variable thickness. The deposits are saturated and would require wet working if they were exploited. Many minor areas of sub-alluvial gravel have been excluded from the map since their size would preclude economic extraction.

Old workings exist along many of the river valleys for example on the Wyre at Scorton. Current workings exist at Brockholes on the Ribble. The river valley deposits in Lancashire predominantly comprise both sand and gravel. Based on available information the following targets were identified as potential high-grade sand and gravel resources. The reference codes below relate to the digital dataset called **river valleys.shp** accompanying this report.

1A	Wyre Valley:	Railway crossing [4990 4830] to Garstang [4975 4575]
1B	Conder Valley:	Banton House Farm [4940 5700] to Conder Green [4600 5570]
1C	Cocker Valley:	East of Crookhey Hall [4710 5130]
1D	Cocker Valley:	Hay Carr [4830 5300]
1E	Brock/Wyre:	Confluence – [4700 4415]
1F	Brock:	Brock [5120 4060] to Walmsley Bridge [5340 4150]
1G	Catterall Calder:	around Sandholme Mill [5080 4350]
1H	Ribble Valley:	Salmansbury [5900 3100] to Winckley Hall [7100 3840]
1J	Burnley Calder:	Martholme[7550 3400] to Padiham [7900 3325]
1K	Burnley Calder:	Padiham[8000 3400] to Burnley [8300 3500]
1L	Douglas Valley:	Mawdesley [4670 1550] to Parbold [4850 1100]

3.3 ESTUARIES AND FORESHORES

Expanses of sand are associated with the Kent, Lune and Ribble estuaries and the foreshores of Morecambe Bay and those off Blackpool. Boreholes indicate up to 15 m of sand in the Hesketh Bank **(2A)** and Clifton Marsh **(2B)** areas of the Ribble estuary. However, most of these areas will have high water tables and suffer periodic tidal flooding. Sand is currently extracted from the foreshore at St Annes. The reference codes above relate to the digital dataset called **estuaries&foreshores.shp** accompanying this report

3.4 FLUVIOGLACIAL AND GLACIAL SAND AND GRAVEL

Fluvioglacial sand and gravel are deposited by glacial meltwaters. On more recent BGS maps they are now more commonly described as glaciofluvial and fluvioglacial deposits, a more accurate description of their origin. The sequence of these deposits is complex, with mappable units commonly exhibiting intricate relationships. Bodies of sand and gravel may occur as sheet or delta-like layers above till deposits or as elongate, irregular lenses within the till sequence. Areas of wholly concealed, and thus unknown, bodies of sand and gravel may occur under spreads of till (boulder clay) and other drift deposits.

In Lancashire, many of these "outcrops" are small in area. Other more extensive bodies are sterilized by urban development e.g. Central Preston, Rishton, Darwen and Rawtenstall/Helmshore. There are current workings at Bradleys Sandpit, Fullwood and Lydiate Lane, Cuerden (see also 3.5. below). Boreholes indicate that the areas below may warrant further investigation. The complex nature of glacial deposits suggests that these outcrops may continue as concealed deposits of sand and gravel (see 3.5. below) and may be more extensive than maps indicate. Records show these deposits to be mainly sand. Based on available information the following targets were identified as potential high-grade sand and resources. The reference codes below relate to the digital dataset called **Expfluvioglacial.shp** accompanying this report.

3A	Holland Lees:	[5180 0865]
3B	Chapeltown:	[7330 1600]
3C	Coppull-Standish:	[5650 1175]
3D	Euxton:	[5475 2000] (see also 4. below)
3E	Hoddlesden:	[7130 2325]
3F	Duckworth Hall:	[7225 2660]
3G	Bateson's Farm:	[6035 2450]
3H	Elswick:	[4070 3800] to Inskip [4650 3800]
3J	Cleveley Bank :	[4980 5070]
3K	Caton-Quernmore:	[5300 6400] to [5200 6250]

3.5 CONCEALED GLACIAL AND/OR FLUVIOGLACIAL SAND AND GRAVEL

Part of the current workings at Bradleys Sandpit, Fullwood and Lydiate Lane, Cuerden are in areas shown as partly concealed. Former workings exist at Headnook Farm, Bilsborrow. Records show these deposits to be mainly sand. Based on borehole intersections further concealed deposits are listed below. The extent of these deposits is impossible to predict without detailed site investigation. The following targets were identified as potential high-grade sand resources. The reference code relates to the digital dataset called **Con_fluvioglacial.shp** accompanying this report.

4A	West of Coppull:	[5490 1350]
4B	Euxton:	[5475 2000]: (see also 3. above)
4C	Hardhorn-Staining:	[3565 3850] to [3520 3550]
4D	Esprick - Wesham:	[4120 3645] to [4250 3350]
4E	Woodplumpton:	[5050 3450] to Cow Hill [5700 3380]

3.6 AREAS OF WEATHERED PERMO-TRIASSIC SANDSTONE AT OR CLOSE TO SURFACE

An extensive area of Permo-Triassic sandstone at relatively shallow depth underlies the area around Ormskirk. These sandstones often weathered to a loose sand to a depth of 2-3 m. These weathered sands are medium grained and may potentially have problems with elevated iron content, although this would have to be analysed and tested. Additionally, these sandstones also represent a regional groundwater aquifer which may necessitate special measures being in place to prevent aquifer contamination. The following targets were identified as potential high-grade sand resources. The reference codes below relate to the digital dataset called **permo-triassic.shp** accompanying this report.

5A	Ormskirk Golf Course:	[4450 0900]
5B	South-east of Ormskirk/Scarth Hill:	[4300 0670]
5C	South-west of Ormskirk:	[4000 0710]
5D	Barton:	[3530 0920]
5E	Hill House:	[3425 0615]

4 Conclusions and recommendations for further work

- The potential areas for high quality sand identified are based on borehole intersections and the extent of these deposits is untested. The areas identified have sufficient resource intersections and overburden thickness to allow economic extraction. Detailed information on the quality of these sands such as grading curves is limited and the selection of the potential areas is based on the geologist's expert opinion and general knowledge of the deposits in the region.

- Planning considerations such as the presence of environmental designations, access to transport networks and land use have not been taken into account. The areas of potential high sand that lie outside these constraints would require detailed follow field investigations and drilling to confirm their extent and thickness.
- Within the areas where concealed sand and gravel resources have been identified from borehole records, it is recommended that isopachytes of overburden thickness be constructed. The thickness of overburden is a critical economic consideration in the viability of concealed deposits.
- The extent of the weathered Permo-Triassic sandstone needs to be defined in further detail. In addition, similar to the concealed sand and gravel deposits, the thickness of overburden overlying these weathered deposits needs to be quantified. Additional analysis would be required to determine their iron content. These deposits are currently exploited in Cheshire.
- Sand can be manufactured by the crushing and processing of consolidated rocks, particularly the softer sandstones. Indeed, such crushed rock sands are a major source of fine aggregates in certain parts of Britain. It is likely that certain sandstones units in Lancashire could be potential sources of crushed rock sand. A reconnaissance survey is needed to evaluate local resources of sandstones for fine aggregate. BGS has recent experience of this type of exercise in South Wales and recommends that a similar reconnaissance study be carried out in Lancashire.

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