SOIL RESOURCES AND
AGRICULTURAL USE & QUALITY OF
LAND OF THE PROPOSED
MANCETTER QUARRY EXTENSION

Report 935/1
16th June 2014
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Report 935/1

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16th June 2014
SUMMARY
A study and survey of 27.3 ha of agricultural land to the west of Mancetter Quarry in Warwickshire has shown that the land has a mixture of heavy soils with clay topsoils over slowly permeable subsoils, and loamy soils over sandstone. Seasonal wetness is the principal limitation to agricultural land quality in the heavy land and the majority is of moderate quality in sub-grade 3b. The loamier soils give best and most versatile land in subgrade 3a where the slopes are less steep, but gradient is a limiting factor over some of the site.

Four soil resources have been identified, comprising two topsoils, one heavy and one medium textured, and two subsoils, one heavy and one medium textured.
1.0 Introduction

1.1 This report provides information on the soil resources and agricultural quality and use of 29.9 ha of land to the west of Mancetter Quarry, near Nuneaton in Warwickshire, that is proposed for a quarry extension. The report is based on a soil and agricultural desk study, and a survey of the land in June 2014.

SITE ENVIRONMENT

1.2 The land lies to the south-east of Oldbury Farm, Purley Chase Lane, and is bounded the south and west by the now defunct Purley Chase golf club. The eastern edge runs alongside Oldbury Quarry.

1.3 In the west, the land is nearly level at approximately 170 m AOD, but falls away in a series of strong slopes and knolls to the edge of the present working at approximately 140 m AOD in the east.

AGRICULTURAL USE

1.4 The land in the north is a grass field used for fattening cattle. The southern fields are in arable use, one ploughed and bare ground, and the other growing winter barley. The land is not subject to any agri-environment scheme.

PUBLISHED INFORMATION

1.5 The 1:50,000 BGS geological information shows the basal geology as a series of mudstones, shales, siltstones and sandstones, of which the Oldbury Farm Sandstone is a prominent member. These outcrop on the steep hillsides, but the level ground to the east is covered by Thrussington till.

1.6 The National Soil Map\(^1\) shows the land as Bardsey Association comprising slowly permeable seasonally waterlogged clayey and fine silty soils over soft rock.

1.7 Reconnaissance agricultural land classification (ALC) mapping carried out in the 1970s shows the more level land of the study area as grade 3, and the more steeply sloping land as grade 4. There are no known published modern (post 1988) maps.

2.0 Soils

2.1 National Planning Policy Guidance states that the planning system should protect and enhance valued soils and prevent the adverse effects of unacceptable levels of pollution. This is because soil is an essential finite resource that provides important ecosystem services, for example as a growing medium for food, timber and other crops, as a store for carbon and water, as a reservoir of biodiversity and as a buffer against pollution.

2.2 A detailed soil resource and agricultural quality survey was carried out in June 2014. It was based on observations at intersects of a 100 m grid, giving a sampling density of one observation per hectare. During the survey soils were examined by a combination of pits and augerings to a maximum depth of 1.2 m. A log of the sampling points and a map (Map 3) showing their location is in an appendix to this report.

2.3 The survey shows a mixture of heavy textured soils developed in till, clay and mudstone, and lighter textured soils occurring on sandstone bands.

HEAVY SOILS

2.4 The topsoils are most often heavy clay loam, less often clay, and around 20 cm thick in the grassland and 30 cm thick in the arable land. They have up to 5% stones, mainly drift-derived quartzite and flints. The subsoil is heavy clay loam or clay, often yellowish brown in colour with prominent ochreous mottling indicating seasonal wetness. Locally, reddish brown clay subsoils are found.

2.5 An example profile from near location 17 (Map 3) is described below:

<table>
<thead>
<tr>
<th>Depth Range</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-32 cm</td>
<td>Dark brown (10YR 4/3) clay, 4% small and medium rounded quartzite and subangular flint stones and many very small shale fragments; weakly developed coarse subangular blocky structure; firm; a few medium macro pores; common fine fibrous roots; sharp smooth boundary to:</td>
</tr>
<tr>
<td>32-65 cm</td>
<td>Yellowish brown (10YR 5/6) clay with many grey (10YR 5/1) mottles; weakly developed coarse prismatic structure; firm; 0.1% fine macro pores; common fibrous roots near the top of the layer; merging to:</td>
</tr>
<tr>
<td>65-100+ cm</td>
<td>Grey (N 5/0) stoneless clay, with abundant strong brown (7.5YR 5/8) mottles; structureless, massive; firm; no visible pores; a few fine fibrous roots near the top of the layer; common soft manganiferous concentrations.</td>
</tr>
</tbody>
</table>

2.6 These soils are mainly slowly permeable, and are likely to be affected by winter wetness due to water ponding over the clay layers (wetness class III and IV). They are limited in the range of food and fibre production they can support, being mainly limited to autumn sown crops and grass, and have a poor capacity to absorb excess winter rainfall. They provide moist, neutral habitats.
for plant communities.

**LOAMY SOILS**

2.7 These soils are more common on strongly sloping ground. The topsoil is sandy clay loam and brown in colour. Some are stony with tabular sandstone fragments, particularly where the soils are shallow over sandstone. The upper subsoil is brown permeable sandy clay loam, stony in some localities. The lower subsoil is either soft or hard sandstone, or reddish clay.

2.8 An example profile from near location 16 (Map 3) is described below:

<table>
<thead>
<tr>
<th>Depth (cm)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-28 cm</td>
<td>Dark brown (7.5YR 4/3) sandy clay loam, 4% small and medium rounded quartzite and subangular sandstone stones; moderately developed medium subangular blocky structure; friable; 2% medium macropores; common fine fibrous mostly dead roots; sharp smooth boundary to:</td>
</tr>
<tr>
<td>28-52 cm</td>
<td>Reddish brown (5YR 4/4) sandy clay loam; a few small tabular sandstone stones with some medium flaggy sandstone at the base of the layer; weakly developed medium angular blocky structure; friable; a few coarse macropores; rare roots; clear smooth boundary to:</td>
</tr>
<tr>
<td>52-100+ cm</td>
<td>Reddish grey (5YR 5/2), reddish brown (5YR 5/4) and grey (5BG 6/1) clay; a few small skerry sandstone fragments; moderately developed coarse prismatic structure becoming structureless, massive at depth; firm; 0.1% fine pores; no visible roots.</td>
</tr>
</tbody>
</table>

2.9 These soils are mainly permeable in their upper layers, and where over sandstone drain freely (wetness class I). Over slowly permeable clay water drains quickly laterally on the steep slopes, and the soils suffer only minor winter wetness (wetness class II). They can potentially support a fairly wide range of food and fibre production, but very steep slopes make cultivation difficult. They provide moist, neutral habitats for plant communities.

2.10 The soil resources are shown on Map 1.
3.0 Agricultural Quality

3.1 To assist in assessing land quality, the Ministry of Agriculture, Fisheries and Food (MAFF) developed a method for classifying agricultural land by grade according to the extent to which physical or chemical characteristics impose long-term limitations on agricultural use for food production. The MAFF Agricultural Land Classification (ALC) system classifies land into five grades numbered 1 to 5, with grade 3 divided into two sub-grades (3a and 3b). The system was devised and introduced in the 1960s and revised in 1988.

3.2 The agricultural climate is an important factor in assessing the agricultural quality of land and has been calculated using the Climatological Data for Agricultural Land Classification\(^2\). The relevant site data for an average elevation of 155 m is given below.

- Average annual rainfall: 699 mm
- January-June accumulated temperature >0°C 1302 day°
- Field capacity period (when the soils are fully replete with water) mid Nov – mid April 155 days
- Summer moisture deficits for:
  - wheat: 92 mm
  - potatoes: 79 mm

3.3 The survey described in the previous section was used in conjunction with the agroclimatic data above to classify the site using the revised guidelines for agricultural land classification issued in 1988 by the Ministry of Agriculture, Fisheries and Food\(^3\).

SURVEY RESULTS

3.4 The agricultural quality in the survey area is determined partly by wetness caused by slow drainage over slowly permeable subsoils where the soils are heavier, and partly by droughtiness limitation where the soils are over sandstone. Slope is also an important factor. Land of grades 3 and 4 agricultural quality exists on the site.

\(^2\) Climatological Data for Agricultural Land Classification. Meteorological Office, 1989
\(^3\) Agricultural Land Classification for England and Wales: Guidelines and Criteria for Grading the Quality of Agricultural Land. MAFF, 1988.
Sub-grade 3a
3.5 There are 4 ha of sub-grade 3a land on gently sloping land with loamier soils similar to those described in paragraphs 2.7 - 2.9. Soils with sandstone at depth are freely draining but have limited rooting depth and the land is thus slightly droughty. Over clay, there is some winter wetness (wetness class II) which limits cultivation in autumn and spring.

Sub-grade 3b
3.6 This sub-grade accounts for 75% of the agricultural land (15.9 ha), mostly on land with soils similar to those described in paragraphs 2.4 - 2.6 with heavy topsoils over clay subsoils. Seasonal wetness is the agricultural limitation. Also included are loamier soils on slopes steeper than 7 degrees.

Grade 4
3.7 Grade 4 land is mapped on land with slopes steeper than 11 degrees which limit the safe and efficient use of cultivation and harvesting machinery. Some slopes are more than 18 degrees, giving grade 5 land, but these are thin strips and not separated.

Other land
3.8 This includes an area of woodland in the northern part of the site, a small area of rough grass which is part of the golf course land, and a grass field within the present quarry boundary. The latter has been used for pasture but was inaccessible for the survey.

Grade areas
3.9 The boundaries between the different grades of land are shown on Map 3 and the areas occupied by each are shown below.

Table 1. Areas within the survey area occupied by the different land grades

<table>
<thead>
<tr>
<th>Grade/sub-grade</th>
<th>Area (ha)</th>
<th>% of agricultural land</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sub-grade 3a</td>
<td>4.4</td>
<td>20</td>
</tr>
<tr>
<td>Sub-grade 3b</td>
<td>15.9</td>
<td>75</td>
</tr>
<tr>
<td>Grade 4</td>
<td>1.2</td>
<td>5</td>
</tr>
<tr>
<td>Other land</td>
<td>5.8</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>27.3</td>
<td>100</td>
</tr>
</tbody>
</table>
4.0 Soil resources and their use

4.1 Government policy as outlined in the Defra Soil Strategy for England and Department of Communities and Local Government’s National Planning Policy Framework (paragraphs 109 and 143) is to protect valuable soil resources from loss or damage during land disturbance and ensure that stripped soils are used either for land reinstatement after quarrying or other beneficial use off-site.

4.2 There are four soil resource units, two topsoils and two subsoils, which are described below and shown on Map 1.

Topsoil T1

4.3 These are the topsoils of the heavy soils of the site and are principally heavy clay loam or clay in texture. They need careful handling to retain their structure and should be stripped when as dry as possible. Their thickness varies from 200 mm in grassland to 300 mm in arable land, giving an estimated potential yield of 28,600 m$^3$.

Topsoil T2

4.4 These are the topsoils of the loamy soils of the site and are mainly sandy clay loam in texture. They need careful handling to retain their structure and should be stripped when as dry as possible. Their thickness varies from 200 mm in grassland to 300 mm in arable land, giving an estimated potential yield of 24,000 m$^3$.

Subsoil S1

4.5 Although there is some variation across the site, the subsoils of the heavy land can be considered as a single resource. They are reddish or greyish clay usually extending to below 1.2 m depth, so the thickness of the resource could not be accurately estimated in this auger survey. It is easily damaged by mishandling and should be stripped when as dry as possible.

Subsoil S2

4.6 The subsoil of the loamy soils of the site is of similar texture to the topsoils, being sandy clay loam. It overlies sandstone in parts and clay in others but has an average thickness of around 300 mm giving an estimated yield of 30,600 m$^3$. 
Soil Handling and Restoration

4.7 All soil resources are easily damaged by being stripped or moved when wet. Consequently, stripping should only take place in the driest parts of the year, using the excavator and dumper method as described by Sheet 1 in the MAFF Good Practice Guide for Handling Soils.

4.8 If direct placement of stripped soils onto areas being restored is not possible, the resources should be stripped and stored separately in low bunds (no more than 3 m high for topsoil). Topsoil should be stripped from areas designated for storing subsoil. The bunds should be constructed either by excavator or bulldozer (Sheets 2 and 14 in the MAFF Good Practice Guide) avoiding over-compaction. They should be sown with grass to help maintain biological activity and prevent water erosion.

4.9 The soils should be removed from storage (Sheet 3 in the MAFF Good Practice Guide) and replaced by excavator during the summer using the loose tipping technique (Sheet 4 in MAFF Good Practice Guide), which avoids traffic on the restored surfaces.

¹ MAFF Good Practice Guide for Handling Soils, (www.defra.gov.uk/farm/environment/land-use/soilguid/)
5.0 Conclusions

5.1 A study and survey of 27.3 ha of agricultural land to the west of Mancetter Quarry in Warwickshire has shown that:

- The land has a mixture of heavy soils with clay topsoils over slowly permeable subsoils, and loamy soils over sandstone.

- Seasonal wetness is the principal limitation to agricultural land quality in the heavy land and the majority of this is of moderate quality in subgrade 3b. The loamier soils give best and most versatile land in subgrade 3a where the slopes are less steep, but gradient is a limiting factor over some of the site.

- There are four soil resources, comprising two topsoils, one heavy and one medium textured, and two subsoils, one heavy and one medium textured.
Mancetter Quarry: ALC and soil resources survey June 2014 - Details of observations at each sampling point

<table>
<thead>
<tr>
<th>Obs No</th>
<th>Topsoil Depth (cm)</th>
<th>Topsoil Texture</th>
<th>Stones (%)</th>
<th>Upper subsoil Depth (cm)</th>
<th>Upper subsoil Texture</th>
<th>Mottling Depth (cm)</th>
<th>Mottling Texture</th>
<th>Lower subsoil Depth (cm)</th>
<th>Lower subsoil Texture</th>
<th>Mottling (°)</th>
<th>Slope Class</th>
<th>Wetness Grade</th>
<th>Agricultural quality Main limitation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0-20</td>
<td>MXCL</td>
<td>0</td>
<td>20-50</td>
<td>MZCL</td>
<td>o</td>
<td>50+</td>
<td>stopped on stone</td>
<td>14</td>
<td>I</td>
<td>4</td>
<td>Si</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>0-20</td>
<td>HCL</td>
<td>0</td>
<td>20-110</td>
<td>C</td>
<td>xxx</td>
<td></td>
<td></td>
<td>0</td>
<td>IV</td>
<td>3b</td>
<td>W</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>0-30</td>
<td>MCL</td>
<td>0</td>
<td>30-65</td>
<td>SCL</td>
<td>o</td>
<td>65-70</td>
<td>rb LMS stopped on stone</td>
<td>o</td>
<td>4</td>
<td>I</td>
<td>3a</td>
<td>D</td>
</tr>
<tr>
<td>4</td>
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<td>18-38</td>
<td>yb C</td>
<td>xxx</td>
<td>38-110</td>
<td>gr C</td>
<td>xxx</td>
<td>9</td>
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<td>3b</td>
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<td>stopped on stone</td>
<td>1</td>
<td>III</td>
<td>3b</td>
<td>D, W</td>
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<td>20-50</td>
<td>br SCL</td>
<td>o</td>
<td>50+</td>
<td>stopped on stone</td>
<td>1</td>
<td>I</td>
<td>3a</td>
<td>D</td>
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</tr>
<tr>
<td>7</td>
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<td>I</td>
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<td>D</td>
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<td>18-40</td>
<td>HCL</td>
<td>xxx</td>
<td>40-110</td>
<td>gr C</td>
<td>xxx</td>
<td>3</td>
<td>IV</td>
<td>3b</td>
<td>W</td>
</tr>
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<td>50-110</td>
<td>r C+skerry</td>
<td>x</td>
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<td>30-110</td>
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<td>35-80</td>
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<td>xxx</td>
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<td>IV</td>
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<td>Si,W</td>
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<td>2</td>
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<td>C</td>
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<td>st yb C</td>
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<td>50-80</td>
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<td>HCL stopped on stone</td>
<td>xx</td>
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<td>II</td>
<td>3a</td>
<td>W</td>
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<td>Other land</td>
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<td></td>
<td></td>
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</tr>
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</tr>
<tr>
<td>28</td>
<td>0-30</td>
<td>HCL</td>
<td>3</td>
<td>30-40</td>
<td>HCL</td>
<td>xxx</td>
<td>40-110</td>
<td>gr+yb C</td>
<td>xxx</td>
<td>6</td>
<td>IV</td>
<td>3b</td>
<td>W</td>
</tr>
<tr>
<td>29</td>
<td>Other land</td>
<td></td>
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</table>
### Key to table

**Mottle intensity:**
- o  unmottled
- x  few to common rusty root mottles (topsoils)
- xx  or a few ochreous mottles (subsoils)
- xxx  common to many ochreous mottles and/or dull structure faces
- xxxx  dominantly grey, often with some ochreous mottles (gleyed horizon)

**Texture:**
- C - clay
- ZC - silty clay
- SC - sandy clay
- CL - clay loam (H-heavy, M-medium)
- ZCL - silty clay loam (H-heavy, M-medium)
- SCL - sandy clay loam
- SZL - sandy silt loam (F-fine, M-medium,C-coarse)
- SL - sandy loam (F-fine, M-medium, C-coarse)
- LS - loamy sand (F-fine, M-medium, C-coarse)
- P - peat (H-humified, SF-semi-fibrous, F-fibrous)
- LP - loamy peat; PL - peaty loam

**Limitations:**
- W - wetness/workability
- D - droughtiness
- De - depth
- St - stoniness
- Sl - slope
- F - flooding
- T - topography/microrelief

**Texture suffixes & prefixes:**
- S - sand (F-fine, M-medium, C-coarse)
- ca – calcareous: x-extremely, v-very, sl-slightly
- P - peat (H-humified, SF-semi-fibrous, F-fibrous)
- LP - loamy peat; PL - peaty loam

A depth underlined (e.g. 50) indicates the top of a slowly permeable layer.
Map 2
Agricultural Land Quality