

WINGMOOR FARM, BISHOP'S CLEEVE, GLOUCESTERSHIRE

SITE PHYSICAL CHARACTERISTICS

REPORT OF SURVEY

1. Introduction

This report describes the survey of agricultural land carried out in response to a proposal by The Grundon Group to extend an existing working of the gravel pit and landfill site run by Gloucestershire Sand and Gravel at Bishop's Cleeve north of Cheltenham.

The field survey work was carried out in January 1989, by the Resource Planning Group (South West Region) in order to fulfil MAFF's statutory role under the Town and Country Planning (Minerals) Act, 1981, by providing a statement of the land quality and the site physical characteristics.

2. Agricultural Land Classification (ALC)

- 2.1 A detailed ALC survey was carried out on the 49.7 hectare site in order to assess the degree to which the physical characteristics of the land impose long-term limitations to its use for agriculture, using MAFF's revised guidelines and criteria for grading the quality of agricultural land. Appendix I provides a general description of MAFF's ALC grades and sub-grades.

The distribution of the ALC grades is shown on the ALC map, Map 1, at a scale of 1:5,000 and their relative proportions are detailed below in Table 1. An auger sampling density of approximately one boring per hectare was adopted and details of the soil profiles found are contained in Appendix II. The location of the auger sample points is shown on Map 2.

Table 1: Areas of Grades and Sub-grades

<u>Grade</u>	<u>Area (ha)</u>	<u>% of Agricultural Area</u>
2	23.23	48.1
3A	25.06	51.9
Urban	0.73	100%
Farm Buildings	0.68	
Total Area	49.70 ha	Total Agricultural Area = 48.29 ha

- 2.2 Climate: estimates of important climatic variables have been obtained by interpolation from a 5km grid database and are detailed in Table 2 below. The main parameters used in assessing an overall climatic limitation are average annual rainfall (as a measure of overall wetness) and accumulated temperature (as a measure of the relative warmth of a locality). Together these parameters reveal that there is no overall climatic limitation at the site.

Table 2: Climatic Interpolations*

Accumulated Temperature (ATO)	:	1472 ^o days
Average Annual Rainfall (AAR)	:	650 mm
Field Capacity days (FCD)	:	143 days
Moisture Deficit, Wheat (MD Wheat)	:	109 mm
Moisture Deficit, Potatoes (MD Pots)	:	102 mm

*For grid reference ST 937275 at an average altitude of 40 metres

- 2.3 **Gradient and Microrelief:** the survey area is a level site where gradient is not a limiting factor. However, evidence of a ridge and furrow system still exists over much of the land. North of Wingmoor Farm the system is either very wide and shallow in nature or has been completely removed in places and therefore does not impose any physical limitation. South of the farm the system becomes much more exaggerated, in areas previously supporting orchards on the ridges. Height differences of 0.6 m between ridge and furrow occur over short distances. It is felt that this complex change in microrelief creates a significant hindrance to mechanical operations and that these limited sites should not be graded higher than 3A.
- 2.4 **Grade 2:** the 23.23 hectares of grade 2 land occur as one map unit in the northern half of the site. The land suffers from a minor droughtiness limitation in places and a minor wetness limitation and, as a result, cannot be graded above Grade 2. Soil profiles are quite variable but are generally impenetrable at 90-100 cm and exhibit a textural sequence which progresses from a medium clay loam topsoil into a heavy clay loam subsoil. The subsoil may possess clay or sandy horizons before passing into calcareous gravel deposits below approximately 90 cm. Immediately above the gravel layer, significant stone contents may occur and these, in conjunction with a profile depth of less than 120 cm (the rooting depth for cereals) limit the available water in the profile and cause a minor drought stress.

Where clay textured horizons occur, profile drainage is restricted causing minor seasonable wetness in the top 80 cms.

- 2.5 **Sub-grade 3A:** the southern 25.06 hectares of the site form a unit of 3A land. Two limited areas within this, with a complex ridge and furrow system, have been placed in this sub-grade as a direct result of the microrelief limitation. However, the majority of this sub-grade has been downgraded due to an increased droughtiness limitation as a result of moderately shallow profiles which restrict the available water reserves. The soils found exhibit similar textural sequences and variations to those classified as Grade 2.

3. **Soil Pit Information**

Map 2 shows the two sites at which soil pits were dug to examine the soil properties in greater detail and Appendix III contains the results of their descriptions. The pits were chosen to be representative of the profiles occurring throughout the area and to facilitate examination of soil structure.

Pit 1 describes a profile with moderate subsoil structural conditions and good porosity at depth. Although there is evidence of gleying in the bottom of the profile in association with a clay textured horizon, both structure and porosity prevent this being described as a slowly permeable layer and therefore suggest that the soil has no significant wetness problem and that droughtiness is the single limiting factor.

Pit 2 describes a shallower profile which becomes sandy and stony above the gravel layer. Subsoil structure however is good and permits a high available water content in the profile meaning that only a minor droughtiness limitation exists despite the shallower overall depth as compared to Pit 1.

4. Soil Resources: Topsoil

'Topsoil' is defined as the organic rich surface horizons. Throughout the site topsoil depth and texture varies little, and is typically a medium clay loam₃ to 25 cm depth. This produces a total topsoil resource of 120,725 m³. However, part of the site is set aside for a proposed topsoil storage area covering 7.7 ha from which no topsoil would be stripped. This affects 19,250 m³ of topsoil and produces an **Adjusted Topsoil Resource** of 101,475 m³.

5. Soil Resources: Subsoil

'Subsoil' is defined as the non-organic rich lower horizons. Subsoil horizons are very variable in both texture and thickness and, as a result, it is not practical to differentiate on the basis of texture or to separate upper and lower subsoils. Only those subsoils that differ significantly in depth may be mapped separately in Table 3 below and on Map 3.

Table 3: Subsoil Resources

<u>Map Unit</u>	<u>Average depth (cm)</u>	<u>Area (ha)</u>	<u>Volume (m³)</u>
Subsoil A	75	39.79	298,425
Subsoil B	35	6.8	23,800
Subsoil C	25	1.7	4,250

The proposal to use part of the site (7.7 ha) as a topsoil storage area reduces the potential subsoil resource as it covers parts of subsoil map units A and B. The modified resources available are outlined in Table 4 below.

Table 4: Modified Subsoil Resources

<u>Map Unit</u>	<u>Average Depth (cm)</u>	<u>Area (ha)</u>	<u>Volume (m³)</u>
Subsoil A	75	34.07	255,525
Subsoil B	35	4.82	16,870
Subsoil C	25	1.70	4,250
(Unaffected)		Total Modified Subsoil Resource	276,645 m ³

DESCRIPTION OF THE GRADES AND SUBGRADES

The ALC grades and subgrades are described below in terms of the types of limitation which can occur, typical cropping range and the expected level and consistency of yield. In practice, the grades are defined by reference to physical characteristics and the grading guidance and cut-offs for limitation factors in Section 3 enable land to be ranked in accordance with these general descriptions. The most productive and flexible land falls into Grades 1 and 2 and Subgrade 3a and collectively comprises about one-third of the agricultural land in England and Wales. About half the land is of moderate quality in Subgrade 3b or poor quality in Grade 4. Although less significant on a national scale such land can be locally valuable to agriculture and the rural economy where poorer farmland predominates. The remainder is very poor quality land in Grade 5, which mostly occurs in the uplands.

Descriptions are also given of other land categories which may be used on ALC maps.

Grade 1 – excellent quality agricultural land

Land with no or very minor limitations to agricultural use. A very wide range of agricultural and horticultural crops can be grown and commonly includes top fruit, soft fruit, salad crops and winter harvested vegetables. Yields are high and less variable than on land of lower quality.

Grade 2 – very good quality agricultural land

Land with minor limitations which affect crop yield, cultivations or harvesting. A wide range of agricultural and horticultural crops can usually be grown but on some land in the grade there may be reduced flexibility due to difficulties with the production of the more demanding crops such as winter harvested vegetables and arable root crops. The level of yield is generally high but may be lower or more variable than Grade 1.

Grade 3 – good to moderate quality agricultural land

Land with moderate limitations which affect the choice of crops, timing and type of cultivation, harvesting or the level of yield. Where more demanding crops are grown yields are generally lower or more variable than on land in Grades 1 and 2.

Subgrade 3a – good quality agricultural land

Land capable of consistently producing moderate to high yields of a narrow range of arable crops, especially cereals, or moderate yields of a wide range of crops including cereals, grass, oilseed rape, potatoes, sugar beet and the less demanding horticultural crops.

Subgrade 3b – moderate quality agricultural land

Land capable of producing moderate yields of a narrow range of crops, principally cereals and grass or lower yields of a wider range of crops or high yields of grass which can be grazed or harvested over most of the year.

Grade 4 – poor quality agricultural land

Land with severe limitations which significantly restrict the range of crops and/or level of yields. It is mainly suited to grass with occasional arable crops (eg cereals and forage crops) the yields of which are variable. In moist climates, yields of grass may be moderate to high but there may be difficulties in utilisation. The grade also includes very droughty arable land.

Grade 5 – very poor quality agricultural land

Land with very severe limitations which restrict use to permanent pasture or rough grazing, except for occasional pioneer forage crops.

Descriptions of other land categories used on ALC maps

Urban

Built-up or 'hard' uses with relatively little potential for a return to agriculture including: housing, industry, commerce, education, transport, religious buildings, cemeteries. Also, hard-surfaced sports facilities, permanent caravan sites and vacant land; all types of derelict land, including mineral workings which are only likely to be reclaimed using derelict land grants.

Non-agricultural

'Soft' uses where most of the land could be returned relatively easily to agriculture, including: golf courses, private parkland, public open spaces, sports fields, allotments and soft-surfaced areas on airports/airfields. Also active mineral workings and refuse tips where restoration conditions to 'soft' after-uses may apply.

Woodland

Includes commercial and non-commercial woodland. A distinction may be made as necessary between farm and non-farm woodland.

Agricultural buildings

Includes the normal range of agricultural buildings as well as other relatively permanent structures such as glasshouses. Temporary structures (eg polythene tunnels erected for lambing) may be ignored.

Open water

Includes lakes, ponds and rivers as map scale permits.

Land not surveyed

Agricultural land which has not been surveyed.

Where the land use includes more than one of the above land cover types, eg buildings in large grounds, and where map scale permits, the cover types may be shown separately. Otherwise, the most extensive cover type will usually be shown.

Soil Profile Descriptions: Explanatory Note

Soil texture classes are denoted by the following abbreviations:

Sand **S**; Loamy Sand **LS** Sandy Loam **SL**; Sand Silt Loam **SZL**; Silt Loam **ZL**;

Medium Silty Clay Loam **MZCL**; Medium Clay Loam **MCL**; Sandy Clay Loam **SCL**;

Heavy Silty Clay Loam **HZCL**; Heavy Clay Loam **HCL**; Sandy Clay **SC**;

Silty Clay **ZC**; Clay **C**

For the sand, loamy sand, sandy loam and sandy silt loam classes the predominant size of sand fraction may be indicated by the use of prefixes, thus:

F fine (more than $\frac{2}{3}$ of sand less than 0.2 mm)
C coarse (more than $\frac{1}{3}$ of sand greater than 0.6 mm)
M medium (less than $\frac{2}{3}$ fine sand and less than $\frac{1}{3}$ coarse sand)

The sub-divisions of clay loam and silty clay loam classes according to clay content are indicated as follows:-

M medium (less than 27% clay); **H** heavy (27-35% clay)

Other possible texture classes include:

Peat **P**; Sandy Peat **SP**; Loamy Peat **LP**; Peaty Loam **PL**;
Peaty Sand **PS**; Marine Light Silts **MZ**

The prefix "**Calc**" is used to identify naturally calcareous soils containing more than 1% Calcium Carbonate.

For organic mineral soils, the texture of the mineral fraction is prefixed by "**org**".

Other notation:

st	stones (6 cm)
sst	small stones (2 cm - 6 cm)
vsst	very small stones (2 mm - 2 cm)
Mn	manganese
cdom/cfom	common distinct/feint ochreous mottles
mpom	many prominent ochreous mottles (VMPOM = very many ..)

Few = 1-5%; **common** = 6-15%; **many** = 16-35%; **very many** = +35%

APPENDIX IISOIL PIT DESCRIPTIONSPit No 1

<u>Topsoil</u>	:	0-21cm Medium Clay Loam 10YR5/3 Medium Sub-angular Blocky (Moderately developed; firm)
<u>Subsoil 1</u>	:	21-50cm Heavy Clay Loam 2.5Y5/3 Medium Sub-angular Blocky (Weakly developed; firm)
<u>Subsoil 2</u>	:	50-90cm Clay 2.5Y6/4 Common distinct ochreous mottling Coarse Sub-angular Blocky (Moderately developed; firm) 5% biopores 5-10% s. calc st
<u>Subsoil 3</u>	:	90-105cm Medium Clay Loam 30% s. calc st
<u>Impenetrable</u>	:	+ 105cm

MB Wheat = + 21.5 mm

MB Potatoes = + 12 mm

Grade according to Droughtiness = Grade 2

Soil Pit No 2

- Topsoil : 0-16cm
Medium Clay Loam; non-calcareous
10YR53
Fine Sub-angular blocky to Medium Granular; Friable
- Subsoil : 16-56cm
Medium Clay Loam; sandy
10YR54
Medium Sub-angular Blocky; Weak to Moderately Developed;
Friable
2-5% Medium pores
- Subsoil 2 : 56-70cm
Medium Sandy Loam (almost LMS)
30% small calcareous stones (visual)
Granular and Friable
10YR56
- Subsoil 3 : 70-90cm
Gravel with porous stones
- Impenetrable : + 90cm

MB Wheat = +28 mm

MB Potatoes = +29 mm

Grade according to droughtiness = Grade 2

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 2.5Y5/3
 Medium Sub-angular Blocky (Weakly developed; firm)

Subsoil 2 : 50-90cm
 Clay
 2.5Y6/4
 Common distinct ochreous mottling
 Coarse Sub-angular Blocky (Moderately developed; firm)
 5% biopores
 5-10% s. calc st

Subsoil 3 : 90-105cm
 Medium Clay Loam
 30% s. calc st

Impenetrable : + 105cm

MB Wheat = + 21.5 mm

MB Potatoes = + 12 mm

Grade according to Droughtiness = Grade 2