

BROOMHALL

AGRICULTURAL LAND CLASSIFICATION SURVEY

SUMMARY

1. This report presents the findings of a semi-detailed Agricultural Land Classification (ALC) survey of 112.5 ha of land at Broomhall. Field survey was based on 56 auger borings and 3 soil profile pits, and was completed in November 1998. During the survey 4 samples were analysed for particle size distribution (PSD).
2. The survey was conducted by the Resource Planning Team of FRCA Western Region on behalf of MAFF in its statutory role in the preparation of the Worcestershire Structure Plan.
3. Information on climate, geology and soils, and from previous ALC surveys was considered. Apart from the published regional ALC map (MAFF 1977), which shows the site at a reconnaissance scale as mainly Grade 3 with some Grade 2 on the western edge, the site had not been surveyed previously. The current survey uses the Revised Guidelines and Criteria for grading the quality of agricultural land (MAFF, 1988) and supersedes any previous ALC survey. Grade descriptions are summarised in Appendix I.
4. An adjacent survey was carried out north of the site at Broomhall Way (ADAS 1995) to the revised guidelines and found mainly Subgrade 3b with significant amounts of Subgrade 3a and a small area of Grade 2.
5. At the time of the current survey land cover was permanent pasture, cereal, ploughed land, maize and hops. An area of 6.8 ha of agricultural land within the survey area was not surveyed because access to the land was not possible.
6. The distribution of ALC grades is shown on the accompanying 1: 10 000 scale ALC map. The detail of information shown at this scale is appropriate to the intensity of field survey but could be misleading if enlarged or applied to small areas. Areas are summarised in the Table 1.

Table 1: Distribution of ALC grades: Broomhall

Grade	Area (ha)	% Surveyed Area (105.8 ha)
3a	6.4	6.1
3b	92.6	87.5
Agricultural land not surveyed	6.8	6.4
Other land	6.7	-
Total site area	112.5	100.0

7. The majority of the site has been mapped as Subgrade 3b, however 6.1% has been mapped as Subgrade 3a best and most versatile land.

8. The Subgrade 3b land has a moderate wetness limitation with clay, heavy clay loam and heavy silty clay loam topsoils over gleyed slowly permeable subsoils.

9. The Subgrade 3a land has a moderate wetness limitation. It differs from the 3b land because the slowly permeable subsoils occur at greater depth resulting in Wetness Class II and III soil profiles. The Wetness Class II borings have heavy clay loam topsoils and the Wetness Class III borings have medium clay loam topsoils.

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22/1/99

APPENDIX I

DESCRIPTION OF GRADES AND SUBGRADES

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 include 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 most 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.

Source: MAFF (1988) Agricultural Land Classification of England and Wales Revised Guidelines and Criteria for Grading the Quality of Agricultural Land, MAFF Publications, Alnwick.

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SUMMARY

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Total site area	112.5	100.0

14. The underlying geology of the site is shown on the published geology map (BGS, 1993). The majority of the area is mapped as Eldersfield Mudstone formation from the Mercia Mudstone Group, with the drift geology of Third Terrace River Severn deposits and alluvium found along the western edge of the site.

15. There does appear to be some correlation between the Geology and the soils found on the site. The majority of the site was found to have reddish clayey subsoils, typically derived from Mercia Mudstone geology.

16. Soils were mapped by the Soil Survey of England and Wales at a reconnaissance scale of 1:250 000 (SSEW 1983) as Whimble 3 and Wick 1 associations. The site is mainly covered by the Whimble 3 association with a small area of Wick 1 soils on the western edge of the site.

17. Whimble 3 soils are described as reddish fine loamy or fine silty over clayey soils with slowly permeable subsoils and slight seasonal waterlogging. Some similar clayey soils are found on brows with slowly permeable seasonally waterlogged fine loamy and fine silty over clayey soils on lower slopes. Wick 1 soils are described as deep well drained coarse loamy and sandy soils, locally over gravel. There are also similar soils affected by groundwater and there may be the possibility of water erosion.

18. More detailed soils information is also available in the 1:50 000 scale survey of the Worcester area (SSEW 1986). Whimble series soils are mapped across the majority of the site. However the Bishampton soil series are found in substantial areas; across the southern half of the north east corner of the site and from Taylors Lane in the north across to Middle Broomhall Farm and Broomhall Cottages in the east. The southern half of the site also has a loop of the Spetchley soil series north of Lower Broomhall Farm curving around to Broomhall Lane. In addition to this there are small areas of the Arrow soil series by Clerkenleap Cottages, the Dunnington Heath series along Worcester Road and Worcester series in the south east corner.

19. The Bishampton series soils are described as having slowly permeable subsoils and are occasionally waterlogged in winter. They have a moderate amount of water available for crop growth and in most years are only slightly to moderately droughty. Spetchley soils are known as slowly permeable soils, which are at best seasonally waterlogged, with poor drainage. Arrow soils are said to suffer from groundwater problems, although this is easily controlled through drainage. Moderate water availability means there are slight drought problems. Dunnington Heath series are described as having relatively permeable upper soil horizons but drainage is impeded by slowly permeable subsoils, waterlogging is especially troublesome on level sites. Worcester series soils are generally seasonally waterlogged, also they are slightly droughty for cereals and moderately droughty for grass and potatoes.

20. The soils found on the site are similar to the above soil associations in that they have slowly permeable subsoils.

AGRICULTURAL LAND CLASSIFICATION

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Subgrade 3a

22. Subgrade 3a, good quality land is mapped to the south west and north west of the site. These soils have heavy clay loam and medium clay loam topsoils. The presence of slowly permeable subsoils which are gleyed was confirmed in soil profile Pit 3 in this area. The depth to the slowly permeable layer varies such that most are assessed as Wetness Class III with some Wetness Class II. The heavier heavy clay loam topsoils within this mapping unit are Wetness Class II, whereas the lighter medium clay loam topsoils within this unit are Wetness Class III.

Subgrade 3b

23. The remaining areas are mapped as Subgrade 3b moderate quality land. These soils are Wetness Class IV, as the slowly permeable layer appears higher up in the soil profile than with the 3a soils and Wetness Class III. The topsoils are either clay, heavy clay loam or heavy silty clay loam. The soil profiles are represented by Pits 1 and 2. Pit 1 represents the grey soils and Pit 2 the red soils. This land suffers a moderate wetness limitation.

24. PSD results obtained during this survey suggest that topsoil textures are heavier than previously thought in the adjacent survey to the north. Although ASPs 16 and 10 were mapped as Wetness Class II the PSD result for ASP 9 would also suggest that the topsoils are heavier than previously thought. ASP 10 is a clay and therefore Subgrade 3b and ASP 16 a heavy clay loam resulting in Subgrade 3a which ties in with the previous survey north of Taylors Lane (ADAS 1995).

25. ASP 56 is a grade 2 profile but is included in the 3b unit due to its isolated nature, however this should be borne in mind for any future surveys south east of the site.

Other Land

26. Access was not available to an area of agricultural land in the south west of the site and was not therefore surveyed. It is expected that this land will be Subgrades 3a or 3b depending on the depth of the slowly permeable layer and the topsoil texture. Other land not surveyed included residential areas, farmyards and farm buildings and an old landfill site.

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22/1/99

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Source: MAFF (1988) Agricultural Land Classification of England and Wales Revised Guidelines and Criteria for Grading the Quality of Agricultural Land, MAFF Publications, Alnwick.

APPENDIX II

DEFINITION OF SOIL WETNESS CLASSES

Soil wetness is classified according to the depth and duration of waterlogging in the soil profile.

Wetness Class I

The soil profile is not wet within 70 cm depth for more than 30 days in most years.

Wetness Class II

The soil profile is wet within 70 cm depth for 31-90 days in most years or, if there is no slowly permeable layer within 80 cm depth, it is wet within 70 cm for more than 90 days, but not wet within 40 cm depth for more than 30 days in most years.

Wetness Class III

The soil profile is wet within 70 cm depth for 91-180 days in most years or, if there is no slowly permeable layer within 80 cm depth, it is wet within 70 cm for more than 180 days, but only wet within 40 cm depth for between 31 and 90 days in most years.

Wetness Class IV

The soil profile is wet within 70 cm depth for more than 180 days but not within 40 cm depth for more than 210 days in most years or, if there is no slowly permeable layer within 80 cm depth, it is wet within 40 cm depth for 91-210 days in most years.

Wetness Class V

The soil profile is wet within 40 cm depth for 211-335 days in most years.

Wetness Class VI

The soil profile is wet within 40 cm depth for more than 335 days in most years.

Notes: The number of days specified is not necessarily a continuous period.

'In most years' is defined as more than 10 out of 20 years.

Source: Hodgson, J M (Ed) (1997) Soil Survey Field Handbook. Soil Survey Technical Monograph No 5, Silsoe.

APPENDIX III

ABBREVIATIONS AND TERMS USED IN SURVEY DATA

Soil pit and auger boring information collected during ALC survey is held on a computer database and is reproduced in this report. Terms used and abbreviations are set out below. These conform to definitions contained in the Soil Survey Field Handbook (Hodgson, 1997).

1. Terms used on computer database, in order of occurrence.

GRID REF: National 100 km grid square and 8 figure grid reference.

LAND USE: At the time of survey

WHT:	Wheat	SBT:	Sugar Beet	HTH:	Heathland
BAR:	Barley	BRA:	Brassicas	BOG:	Bog or Marsh
OAT:	Oats	FCD:	Fodder Crops	DCW:	Deciduous Wood
CER:	Cereals	FRT:	Soft and Top Fruit	CFW:	Coniferous Woodland
MZE:	Maize	HRT:	Horticultural Crops	PLO:	Ploughed
OSR:	Oilseed Rape	LEY:	Ley Grass	FLW:	Fallow (inc. Set aside)
POT:	Potatoes	PGR:	Permanent Pasture	SAS:	Set Aside (where known)
LIN:	Linseed	RGR:	Rough Grazing	OTH:	Other
BEN:	Field Beans	SCR:	Scrub		

GRDNT: Gradient as estimated or measured by hand-held optical clinometer.

GLEY, SPL: Depth in centimetres to gleying or slowly permeable layer.

AP (WHEAT/POTS): Crop-adjusted available water capacity.

MB (WHEAT/POTS): Moisture Balance. (Crop adjusted AP - crop potential MD)

DRT: Best grade according to soil droughtiness.

If any of the following factors are considered significant, 'Y' will be entered in the relevant column.

MREL:	Microrelief limitation	FLOOD:	Flood risk	EROSN:	Soil erosion risk
EXP:	Exposure limitation	FROST:	Frost prone	DIST:	Disturbed land
CHEM:	Chemical limitation				

LIMIT: The main limitation to land quality: The following abbreviations are used.

OC:	Overall Climate	AE:	Aspect	EX:	Exposure
FR:	Frost Risk	GR:	Gradient	MR:	Microrelief
FL:	Flood Risk	TX:	Topsoil Texture	DP:	Soil Depth

CH: Chemical	WE: Wetness	WK: Workability
DR: Drought	ER: Erosion Risk	WD: Soil Wetness/Droughtiness
ST: Topsoil Stoniness		

TEXTURE: Soil texture classes are denoted by the following abbreviations:-

S: Sand	LS: Loamy Sand	SL: Sandy Loam
SZL: Sandy Silt Loam	CL: Clay Loam	ZCL: Silty Clay Loam
ZL: Silt Loam	SCL: Sandy Clay Loam	C: Clay
SC: Sandy clay	ZC: Silty clay	OL: Organic Loam
P: Peat	SP: Sandy Peat	LP: Loamy Peat
PL: Peaty Loam	PS: Peaty Sand	MZ: Marine Light Silts

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

F: Fine (more than 66% of the sand less than 0.2mm)
M: Medium (less than 66% fine sand and less than 33% coarse sand)
C: Coarse (more than 33% of the sand larger than 0.6mm)

The clay loam and silty clay loam classes will be sub-divided according to the clay content: **M:** Medium (< 27% clay) **H:** heavy (27 - 35% clay)

MOTTLE COL: Mottle colour using Munsell notation.

MOTTLE ABUN: Mottle abundance, expressed as a percentage of the matrix or surface described.

F: few <2% **C:** common 2 - 20% **M:** many 20 - 40% **VM:** very many 40%+

MOTTLE CONT: Mottle contrast

F: faint - indistinct mottles, evident only on close inspection
D: distinct - mottles are readily seen
P: Prominent - mottling is conspicuous and one of the outstanding features of the horizon.

PED. COL: Ped face colour using Munsell notation.

GLEYS: If the soil horizon is gleyed a 'Y' will appear in this column. If slightly gleyed, an 'S' will appear.

STONE LITH: Stone Lithology - One of the following is used.

HR: All hard rocks and stones	SLST: Soft oolitic or dolimitic limestone
CH: Chalk	FSST: Soft, fine grained sandstone
ZR: Soft, argillaceous, or silty rocks	GH: Gravel with non-porous (hard) stones

MSST: Soft, medium grained sandstone **GS:** Gravel with porous (soft) stones
SI: Soft weathered igneous or metamorphic rock

Stone contents are given in % by volume for sizes >2cm, >6cm and total stone >2mm.

STRUCT: The degree of development, size and shape of soil peds are described using the following notation

<u>Degree of development</u>	WA: Weakly developed Adherent	WK: Weakly developed
	MD: Moderately developed	ST: Strongly developed
<u>Ped size</u>	F: Fine	M: Medium
	C: Coarse	VC: Very coarse
<u>Ped Shape</u>	S: Single grain	M: Massive
	GR: Granular	AB: Angular blocky
	SAB: Sub-angular blocky	PR: Prismatic
	PL: Platy	

CONSIST: Soil consistence is described using the following notation:

L: Loose	VF: Very Friable	FR: Friable	FM: Firm
VM: Very firm	EM: Extremely firm	EH: Extremely Hard	

SUBS STR: Subsoil structural condition recorded for the purpose of calculating profile droughtiness: **G:** Good **M:** Moderate **P:** Poor

POR: Soil porosity. If a soil horizon has poor porosity with less than 0.5% biopores >0.5mm, a 'Y' will appear in this column.

IMP: If the profile is impenetrable to rooting a 'Y' will appear in this column at the appropriate horizon.

SPL: Slowly permeable layer. If the soil horizon is slowly permeable a 'Y' will appear in this column.

CALC: If the soil horizon is calcareous with naturally occurring calcium carbonate exceeding 1% a 'Y' will appear this column.

2. Additional terms and abbreviations used mainly in soil pit descriptions.

STONE ASSESSMENT:

VIS: Visual	S: Sieve	D: Displacement
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MOTTLE SIZE:

EF: Extremely fine <1mm	M: Medium 5-15mm
VF: Very fine 1-2mm>	C: Coarse >15mm
F: Fine 2-5mm	

MOTTLE COLOUR: May be described by Munsell notation or as ochreous (OM) or grey (GM).

ROOT CHANNELS: In topsoil the presence of 'rusty root channels' should also be noted.

MANGANESE CONCRETIONS: Assessed by volume

N: None	M: Many	20-40%
F: Few <2%	VM: Very Many	>40%
C: Common 2-20%		

POROSITY:

P: Poor	- less than 0.5% biopores at least 0.5mm in diameter
G: Good	- more than 0.5% biopores at least 0.5mm in diameter

ROOT ABUNDANCE:

The number of roots per 100cm ² :	Very Fine and Fine	Medium and Coarse
F: Few	1-10	1 or 2
C: Common	10.25	2 - 5
M: Many	25-200	>5
A: Abundant	>200	

ROOT SIZE

VF: Very fine <1mm	M: Medium 2 - 5mm
F: Fine 1-2mm	C: Coarse >5mm

HORIZON BOUNDARY DISTINCTNESS:

Sharp: <0.5cm	Gradual: 6 - 13cm
Abrupt: 0.5 - 2.5cm	Diffuse: >13cm
Clear: 2.5 - 6cm	

HORIZON BOUNDARY FORM: Smooth, wavy, irregular or broken.*

* See Soil Survey Field Handbook (Hodgson, 1997) for details.

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SITE NAME Bromhall		PROFILE NO. Pit 1	SLOPE AND ASPECT 0 °	LAND USE Maize Stubble	Av Rainfall: 635 mm ATO: 1480 day °C	PARENT MATERIAL Eldersfield Mudstone Formation	
JOB NO. 85/98		DATE 11/11/98	GRID REFERENCE SO 858 513	DESCRIBED BY GMS/GMN	FC Days: 136 Climatic Grade: 1 Exposure Grade: 1	PSD SAMPLES TAKEN None	

Horizon No.	Lowest Av. Depth (cm)	Texture	Matrix (Ped Face) Colours	Stoniness: Size, Type, and Field Method	Mottling Abundance, Contrast, Size and Colour	Mangan Concs	Structure: Ped Development Size and Shape	Consistence	Structural Condition	Pores (Fissures)	Roots: Abundance and Size	Calcium Carbonate Content	Horizon Boundary: Distinctness and form
1	36	HCL	05YR43	1%HR(vis)	None	Common	-	-	-	-	MF, VF	-	Gradual Smooth
2	55	C	25YR44 (25YR53)	None	None	Common	MDCAB	FM	M	Low	CF, VF	-	Gradual Smooth
3	85	C	25YR44 (25YR53)	None	None	Common	MDCAB + MDFAB	VFM	M	Low	CVF	-	

Profile Gleyed From: 36

Slowly Permeable Horizon From: 36

Wetness Class: IV

Wetness Grade: 3b

Available Water	Wheat:	115 mm
	Potatoes:	119 mm
Moisture Deficit	Wheat:	111 mm
	Potatoes:	105 mm
Moisture Balance	Wheat:	+4 mm
	Potatoes:	+ 14 mm
Droughtiness Grade: 1	(Calculated to 120 cm)	

Final ALC Grade: 3b
Main Limiting Factor(s): Wetness

Remarks: H3 is predominantly made up of the weathered parent material and therefore the structure is medium and fine angular blocky which is not an SPL.

SITE NAME Bromhall		PROFILE NO. Pit 2	SLOPE AND ASPECT 0 °	LAND USE Cereal Stubble	Av Rainfall: 635 mm ATO: 1480 day °C	PARENT MATERIAL Eldersfield Mudstone Formation	
JOB NO. 85/98		DATE 11/11/98	GRID REFERENCE SO 864 520	DESCRIBED BY GMS/GMN	FC Days: 136 Climatic Grade: 1 Exposure Grade: 1	PSD SAMPLES TAKEN None	

Horizon No.	Lowest Av. Depth (cm)	Texture	Matrix (Ped Face) Colours	Stoniness: Size, Type, and Field Method	Mottling Abundance, Contrast, Size and Colour	Mangan Concs	Structure: Ped Development Size and Shape	Consistence	Structural Condition	Pores (Fissures)	Roots: Abundance and Size	Calcium Carbonate Content	Horizon Boundary: Distinctness and form
1	34	HCL	7.5YR41	None	None	None	-	-	-	-	MVF, CF	-	Smooth Abrupt
2	50	C	10YR52 (7.5YR53)	None	MDMO 7.5YR68	Few	MDCPr	Firm	Poor	Low (borderline)	CVF,F	-	Smooth Clear
3	70+	C	2.5YR43 (25YR53)	None	None below transition	Common	MDCAB	Firm	Poor	Low	CVF	-	

Profile Gleyed From: 34 cm

Slowly Permeable Horizon From: 34 cm

Wetness Class: IV

Wetness Grade: 3b

Available Water	Wheat:	117 mm
	Potatoes:	108 mm
Moisture Deficit	Wheat:	111 mm
	Potatoes:	105 mm
Moisture Balance	Wheat:	+6 mm
	Potatoes:	+ 3 mm
Droughtiness Grade: 2	(Calculated to 100 cm)	

Final ALC Grade: 3b
Main Limiting Factor(s): Wetness

Remarks: H2 not present around whole pit Green Marl present in H3

SITE NAME Bromhall		PROFILE NO. Pit 3	SLOPE AND ASPECT 1°N	LAND USE Permanent Pasture	Av Rainfall: 635 mm ATO: 1480 day °C	PARENT MATERIAL Eldersfield Mudstone Formation
JOB NO. 85/98		DATE 19/11/98	GRID REFERENCE SO 858 510	DESCRIBED BY GMS/GMN	FC Days: 136 Climatic Grade: 1 Exposure Grade: 1	PSD SAMPLES TAKEN Topsoil: S:21% Z:54% C:25% MCL*MZCL

Horizon No.	Lowest Av. Depth (cm)	Texture	Matrix (Ped Face) Colours	Stoniness: Size, Type, and Field Method	Mottling Abundance, Contrast, Size and Colour	Mangan Concs	Structure: Ped Development Size and Shape	Consistence	Structural Condition	Pores (Fissures)	Roots: Abundance and Size	Calcium Carbonate Content	Horizon Boundary: Distinctness and form
1	25	MCL	5YR42	<1% HR (vis)	None	Few	-	-	-	-	MVF	Not calc	Clear Smooth
2	50	HCL	5YR53	< 1% HR (vis)	CDFO 5YR54,56	Common	MDCSAB tending to CAB	Friable	Mod	Good	CVF	-	Clear Smooth
3	75+	C	2.5YR43 (25YR53)	<1%HR (vis)	None	Common	MDCAB	Firm	Poor	Low	CVF between peds	-	

Profile Gleyed From: 25 cm	Available Water	Wheat: 119 mm	Final ALC Grade: 3a
Slowly Permeable Horizon From: 50 cm		Potatoes: 110 mm	Main Limiting Factor(s): Wetness
Wetness Class: III	Moisture Deficit	Wheat: 111mm	
Wetness Grade: 3a		Potatoes: 105 mm	Remarks:
	Moisture Balance	Wheat: +8 mm	
		Potatoes: + 5 mm	
	Droughtiness Grade: 2	(Calculated to 100 cm)	