94/98

SCCS 64848

BITTAFORD

AGRICULTURAL LAND CLASSIFICATION SURVEY

CONTENTS

BITTAFORD

AGRICULTURAL LAND CLASSIFICATION SURVEY

INTRODUCTION

1. This report presents the findings of a semi-detailed Agricultural Land Classification (ALC) survey of 185.6 ha of land between Ivybridge and Bittaford, Devon. Field survey was based on 96 auger borings and 1 soil profile pit, and was completed in November 1998. During the survey 7 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 Devon Structure Plan.

3. Information on climate, geology and soils, and from previous ALC surveys was considered and is presented in the relevant section. Apart from the published regional ALC map (MAFF 1977), which shows the sites at a reconnaissance scale as mainly Grade 3, 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. A previous detailed survey of land adjacent to this site, on the east side of Ivybridge (ADAS 1994) found Subgrade 3a with medium clay loam topsoil in the north and Subgrade 3b with heavy clay loam topsoil in the south west of the site, both limited by restricted workability.

5. At the time of survey land cover was almost entirely grass for grazing by beef, sheep and notably horses which seem to be particularly popular in this area. Other land which was not surveyed included roads, residential land, two sports fields and the southern part of the village of Bittaford.

SUMMARY

6. The distribution of ALC grades is shown on the accompanying 1: 15 000 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.

7. This shows that 30% of the area was found to be best and most versatile, Subgrade 3a limited only by restricted workability. Other land was found to be mainly Subgrade 3b limited mostly by restricted workability with smaller areas of Grade 4 limited mainly by wetness.

Table 1: Distribution of ALC grades: Bittaford

Grade	Area (ha)	% Surveyed Area (127.5 ha)
3a	38.8	30
3b	64.9	51
4	22.2	17
5	1.6	1
Other land	58.1	
Total site area	185.6	

CLIMATE

8. Estimates of climatic variables for this site were derived from the published agricultural climate dataset "Climatological Data for Agricultural Land Classification" (Meteorological Office, 1989) using standard interpolation procedures. Data for key points around the site are given in Table 2 below.

9. Since the ALC grade of land is determined by the most limiting factor present, overall climate is considered first because it can have an overriding influence by restricting land to a lower grade despite more favourable site and soil conditions. Parameters used for assessing overall climate are accumulated temperature, a measure of relative warmth and average annual rainfall, a measure of overall wetness. The results shown in Table 2 indicate that there is an overall climatic limitation which limits most of the land to Subgrade 3a above approximately the 80 m contour.

10. Climatic variables also affect ALC grade through interactions with soil conditions. The most important interactive variables are Field Capacity Days (FCD) which are used in assessing soil wetness and potential Moisture Deficits calculated for wheat and potatoes, which are compared with the moisture available in each profile in assessing soil droughtiness limitations. These are described in later sections.

Table 2: Climatic Interpolations: Bittaford

Grid Reference		SX 656 564	SX 642 551
Altitude (m)		125	35
Accumulated Temperature (day °C)		1480	1583
Average Annual Rainfall (mm)		1400	1300
Overall Climatic Grade		3a	2
Field Capacity Days		271	256
Moisture deficit (mm):	Wheat	69	85
	Potatoes	53	73

RELIEF

11. Altitude ranges from 48 metres at Earlescombe Bridge to 125 metres at the top of the site with mainly gentle and moderate slopes which are not limiting. Small areas of steeper

RELIEF

11. Altitude ranges from 48 metres at Earlescombe Bridge to 125 metres at the top of the site with mainly gentle and moderate slopes which are not limiting. Small areas of steeper short slopes mainly on the valley sides overlooking the River Ludd were found to be limited to Grade 4 with slopes of 12 - 18° or even to Grade 5 with slopes of 19 ° or more.

GEOLOGY AND SOILS

12. The underlying geology of the site is shown on the published geology map (IGS, 1974) as mainly Middle Devonian Slate with alluvium in the valley of the River Ludd and small patches of river gravel running up into the site from the south west. This was largely borne out by the current survey which found the slate to be consistently freely draining giving rise to mainly Wetness Class I profiles. (See appendix II). Soils limited by wetness were mainly confined to the areas underlain by alluvium which was predictably variable in composition and wetness class.

13. Soils were mapped by the Soil Survey of England and Wales at a reconnaissance scale of 1:250 000 (SSEW 1983) as mainly Denbigh 1 Association with Manod Association along the northern edge of the site and Yeolland Park Association just off the site to the south west.

14. Denbigh 1 Association is described as well drained fine loamy and fine silty soils over rock with some similar soils having slowly permeable subsoils and slight seasonal waterlogging. Manod Association is described as well drained fine loamy or fine silty soils over rock with shallow soils in places, bare rock locally and steep slopes common. Yeolland Park is described as comprising fine loamy permeable soils variability affected by groundwater with some slowly permeable seasonally waterlogged clayey soils. This was largely borne out by the current survey which found the area shown as Manod Association to have significantly lighter topsoil textures, subsequently identified as Subgrade 3a. The survey found mainly well-drained profiles in the areas shown as Denbigh 1 with imperfectly drained profiles largely absent, perhaps more akin to the description for Denbigh 2 Association. The survey found variably wet soils developed on alluvial deposits in the valley or the River Ludd, closely matching the description for Yeolland Park, although this was not indicated on the published map.

AGRICULTURAL LAND CLASSIFICATION

15. The distribution of ALC grades found by the current survey is shown on the accompanying 1: 15 000 scale map and areas are summarised in Table 1. 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.

Subgrade 3a

16. The area shown as Subgrade 3a was found to have mainly medium clay loam topsoil textures at Wetness Class I, limited only by restricted workability. This is the best grade which can be found on this site where an overall climatic limitation to Subgrade 3a is found.

Indeed, the climatic data indicates FC Days in excess of 250 which indicates severe climatic conditions for enclosed land and it is somewhat remarkable to find Subgrade 3a within two fields of the rough land of Dartmoor. However, most of the borings in the area extended to 70 or 80 cm, sufficient to confirm Wetness Class I and the topsoil texture was confirmed by 4 PSD analyses at this site in addition to the one taken on adjacent land during the 1994 survey at Ivybridge. A typical profile is illustrated by Pit 1.

Subgrade 3b

17. Much of the area shown as Subgrade 3b was found to have heavy clay loam topsoil texture at Wetness Class I, limited only by restricted workability. Such profiles were similar to that described at Pit 1 but with slightly higher clay content in the topsoil as confirmed by PSD analyses at several points through the area. Only a few borings in this mapping unit, mainly in the river valley south of Bittaford village, were found to be limited by wetness, and a few others by gradient.

Grade 4

18. Much of the area shown as Grade 4 was found to be limited by wetness with heavy clay loam topsoil and slowly permeable subsoil leading to assessment as Wetness Class III or IV.

19. A few small areas were found to be limited to Grade 4 by gradient of slopes of 12 to 18°, mainly on the valley sides of the River Ludd.

Grade 5

20. One small area of steeply sloping land overlooking Peekmill bridge was found to be limited to Grade 5 with maximum slopes of just over 20°.

P Barnett
Resource Planning Team
FRCA Bristol
14 December 1998

REFERENCES

ADAS RESOURCE PLANNING TEAM, (1994) Agricultural Land Classification Survey of Ivybridge. Scale 1: 10 000, Reference 88.94 ADAS Bristol.

INSTITUTE OF GEOLOGICAL SCIENCES (1974) Sheet 349, Ivybridge, 1:50 000 series Drift edition, IGS, London.

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

MAFF (1977) 1:250 000 series Agricultural Land Classification, South West Region. MAFF Publications, Alnwick.

MAFF (1988) Agricultural Land Classification of England and Wales. Revised Guidelines and Criteria for grading the quality of agricultural land. MAFF Publications, Alnwick.

METEOROLOGICAL OFFICE (1989) Climatological Data for Agricultural Land Classification. Meteorological Office, Bracknell.

SOIL SURVEY OF ENGLAND AND WALES (1983) Sheet 5, Soils of South West England, 1:250 000 scale. SSEW, Harpenden.

SOIL SURVEY OF ENGLAND AND WALES (1984) Soils and Their Use in South West England, Bulletin No 14. SSEW, Harpenden.

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.

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.

GLEY: 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

Degree of development	**WA:**	Weakly developed Adherent	**WK:**	Weakly developed
	MD:	Moderately developed	**ST:**	Strongly developed
Ped size	**F:**	Fine	**M:**	Medium
	C:	Coarse	**VC:**	Very coarse
Ped Shape	**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

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.

SITE NAME	PROFILE NO.	SLOPE AND ASPECT	LAND USE		PARENT MATERIAL
Bittaford	Pit 1 (Nr Asp 25)	6 ° S	Ley	Av Rainfall: 1400 mm ATO: 1480day °C FC Days: 270 ClimaticGrade: 3a Exposure Grade: 1/2	Slate
JOB NO.	DATE	GRID REFERENCE	DESCRIBED BY		PSD SAMPLES TAKEN
94.98	3.11.98	SX 65785641	PB		TS 0 - 25cm : MCL (S32: Z46: C22%)

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	30	MCL	10YR43	10% HR (vis)	0	0	-	-	-	-	CF,VF	-	Grad Smooth
2	52	HCL	10YR44	30%HR, ZR (vis)	0	0	WKMSAB	FR	G	G	FVF	-	Grad Smooth
3	85	C	10YR54,53	60% ZR (vis)	0	0	Too strong	-	(M)	G	FVF	-	

Profile Gleyed From: -

Slowly Permeable Horizon From: -

Wetness Class: I

Wetness Grade: 3a

Available Water Wheat: 114 mm

Potatoes: 102 mm

Moisture Deficit Wheat: 69 mm

Potatoes: 53 mm

Moisture Balance Wheat: +45 mm

Potatoes: +49 mm

Droughtiness Grade: 1 (Calculated to 100 cm)

Final ALC Grade: 3a

Main Limiting Factor(s): WK

Remarks: