

8FCS 8180A

Winterbourne & Frampton Cotterell

Agricultural Land Classification

June 1998

Resource Planning Team
Bristol
FRCA Western Region

RPT Job Number: 8/97

FRCA File No: EL34/1208



**WINTERBOURNE AND FRAMPTON COTTERELL
AGRICULTURAL LAND CLASSIFICATION SURVEY**

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WINTERBOURNE AND FRAMPTON COTTERELL
AGRICULTURAL LAND CLASSIFICATION SURVEY

INTRODUCTION

1. This report presents the findings of a semi-detailed Agricultural Land Classification (ALC) survey of 468 ha of land on the western edge of Winterbourne and to the north of Frampton Cotterell, South Gloucestershire. Field survey was based on 203 auger borings and 10 soil profile pits, and was completed in May 1997. During the survey 2 soils 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 South Gloucestershire District Local Plan.
3. Information on climate, geology and soils, and from previous ALC surveys was considered and is presented in the relevant sections. The published regional ALC map (MAFF, 1977) shows the site at a reconnaissance scale as a combination of Grades 1, 2 and 3. Land next to the B4058 is mapped as Grade 2, with Grade 1 further west. Grade 3 is shown mainly in the north-western part of the sight, on the edge of The Marle Hills. Parts of the site were also surveyed in 1982, 1984, 1985 and 1994 at scales of 1:25 000 and 1:10 000 (ADAS, 1982; 1984; 1985 and 1994). However, the current survey uses the Revised Guidelines and Criteria for grading the quality of agricultural land (MAFF, 1988) and supersedes these previous ALC surveys. Grade descriptions are summarised in Appendix I.
4. The 1982, 1984 and 1985 surveys showed Grades 1, 2, 3a and 3b. Land on the north-western part of the site and the shallow land near to Winterbourne was mapped as Subgrade 3b. Elsewhere, where the soils are deeper and have better drainage the land was mapped as Grades 1, 2 and Subgrade 3a. The results of the 1994 survey at Green Acres Farm, Subgrade 3a, have been incorporated into the map from the current survey.
5. At the time of survey the land cover included permanent and ley pasture, cereals, and soft and top fruits. Non-agricultural land included residential areas, allotments, farmsteads, woodland and recreational grounds.

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 Table 1.
7. The agricultural land on this site has been mapped in the current survey as Grade 1 (excellent quality), Grade 2 (very good quality), Subgrade 3a (good quality) and Subgrade 3b (moderate quality). The key limitations to the agricultural use of the land are soil wetness and soil droughtiness. Over two thirds of the agricultural land surveyed has been mapped as best and most versatile with 32% of that being Grade 1.

Table 1: Distribution of ALC grades: Winterbourne and Frampton Cotterell

Grade	Area (ha)	% Surveyed Area (398.1ha)
1	128.8	32
2	49.8	13
3a	120.3	30
3b	99.1	25
Other land	69.6	-
Total site area	467.7	100

8. The Grade 1 land, mapped throughout the site, has no or only very minor limitations to its agricultural use. The profiles consist of deep, well drained, sandy soils with no drought limitation. They are developed over the Pennant Measures and Carboniferous sandstone.

9. The Grade 2 land also tends to be deep but has slightly impaired drainage. The profiles although still sandy in the upper horizons have clayey subsoils. These mapping units mainly have a minor wetness limitation but in places there may also be a minor drought limitation.

10. The Subgrade 3a land tends to be well drained, shallow land over sandstone. The soils have higher stone contents than elsewhere in the site and the sandstone bedrock may be found within the top 120 cm of the profile. This leads to a moderate droughtiness limitation.

11. Where the geology turns into the Keuper Marl the land is mapped as Subgrade 3b. The soil textures are heavier than elsewhere in the site and the clayey subsoils are poorly drained. This causes a moderate wetness limitation.

CLIMATE

12. 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.

13. 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 no overall climatic limitation.

14. 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: Winterbourne and Frampton Cotterell

Grid Reference	ST 635 800	ST 645 792	ST 644 818
Altitude (m)	70	45	60
Accumulated Temperature (day °C)	1465	1493	1476
Average Annual Rainfall (mm)	767	762	773
Overall Climatic Grade	1	1	1
Field Capacity Days	171	170	172
Moisture deficit (mm):			
Wheat	98	101	99
Potatoes	88	92	90

Grid Reference	ST 658 833	ST 647 796	ST 639 808
Altitude (m)	53	45	45
Accumulated Temperature (day °C)	1482	1493	1493
Average Annual Rainfall (mm)	781	759	765
Overall Climatic Grade	1	1	1
Field Capacity Days	174	170	171
Moisture deficit (mm):			
Wheat	99	101	101
Potatoes	91	92	92

RELIEF

15. Altitude across the site range from 42 metres near Bradley Bridge, on the B4057, to 70 metres on the High Street in Winterbourne. Further north the altitude at Bradley Brook on Swan Lane is 43 metres, 63 metres at Crossley Farm, 54 metres at Perrinpit Farm and 47 metres at Cog Mill Farm. The gradients within the site are all level, and gently and moderately sloping gradients, with no limitation to the agricultural use, apart from a small area of land to the South east of Winterbourne Court.

GEOLOGY AND SOILS

16. The underlying geology of the site is shown on the published geology maps (IGS, 1970 and 1974; BGS, 1981). These show the geology to largely consist of a linear distribution of Carboniferous sandstones and sand running north-south, with Keuper Marl, a type of mudstone, in the western part of the site. Small areas of head, alluvium and limestone are also mapped.

17. The soils that were found during the current survey indicate that most of the site is underlain by sands and sandstone. On the western side of the site and in some other isolated areas the soils indicate that they are underlain by Keuper Marl. No evidence of the mapped limestone outcrop was found during the survey.

18. Soils were mapped by the Soil Survey of England and Wales at a reconnaissance scale of 1:250 000 (SSEW, 1983) and this shows them as being mainly from the Whimple 3 Association in the West and from the Hodnet Association in the East. The Worcester and

Neath Associations are mapped on the western and northern edges of the built up area, and in the north eastern part of the site respectively.

19. The Whimple 3 and Hodnet Associations are both developed over Carboniferous mudstones such as Keuper Marl. The Whimple 3 soils are described as being 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 being found on lower slopes. Hodnet soils are also reddish fine and coarse loamy soils with slowly permeable subsoils and slight seasonal waterlogging. However, there are also some similar well-drained reddish fine loamy soils and there is a slight risk of water erosion.

20. Worcester soils while also being slowly permeable are calcareous and non-calcareous reddish clayey soils over mudstone which may be shallow on slopes. They are associated with similar non-calcareous fine loamy over clayey soils and have a slight risk of water erosion.

21. In comparison to the other mapped soil types the Neath Association is described as being well-drained fine loamy soils often over rock. Small patches of similar soils with slowly permeable subsoils and slight seasonal waterlogging may also be found.

22. The soils found during the current survey were similar to those described by the Soil Survey. Soils similar to the Whimple 3 Association were found in the western part of the site where they are developed over the Keuper Marl. Where there are extensive areas of sandstone and sand the soils are reddish and freely drained, being similar to some of those from both the Hodnet and Worcester Associations. Well-drained soils developed over sandstone, similar to those from the Neath Association, were found in the north eastern part of the site and on the higher ground near Winterbourne and Frampton Cotterell. The sandstone was found at various depths within the profiles.

AGRICULTURAL LAND CLASSIFICATION

23. 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.

Grade 1

24. Land mapped as Grade 1 occurs throughout the site over the sandstone and sand deposits. The four mapping units are all relatively uniform. The land has no or only very minor limitations to its agricultural use. The profiles consist of well-drained sandy textures, with medium sandy loam topsoils over medium sandy loam, loamy medium sand and some medium sand subsoils to depth. They were assessed as Wetness Class I (see Appendix II) as shown by Soil pits 3P, 4P and 10P.

25. In the northern part of the site there are also some clayey profiles that are well drained. These profiles typically have medium clay loam topsoils over heavy clay loam upper subsoils and clay lower subsoils, with sandstone bedrock occasionally within the top 120 cm of the profile. They were also assessed as Wetness Class I.

Grade 2

22. The small Grade 2 mapping units have minor drought, workability and wetness limitations. Most of the profiles have medium clay loam topsoils over heavy clay loam and clay subsoils. In places the clay lower subsoils have restricted drainage and are slowly permeable layers resulting in the profiles being assessed as Wetness Class II. Occasionally there is no slowly permeable layer but gleying is evident above 40 cm and these profiles were also assessed as Wetness Class II.

23. Isolated profiles are shallow over sandstone bedrock and have a minor drought limitation. These are well drained and were assessed as Wetness Class I.

24. The two Grade 2 mapping units near Swan Lane and Winterbourne Court, and the larger unit near Frampton Cotterell have isolated Subgrade 3a profiles within them. It was not possible to map these areas of poorer quality land at this level of detail. The Frampton Cotterell unit also contains a few Grade 1 profiles.

Subgrade 3a

25. Land graded as Subgrade 3a is found throughout the site occurring over shallow areas of sandstone bedrock. The profiles were assessed as Wetness Class I. The bedrock is found at depths of 55 cm to 70 cm and restricts the amount of easily available water for crops. The moisture balances for winter wheat and potatoes place these soils in Subgrade 3a on droughtiness. Soil pits 7P and 9P are representative of these mapping units.

26. Within the Subgrade 3a mapping units to the north of North Corner there are some isolated Grade 1 and 2 profiles which could not be mapped at this level of survey.

Subgrade 3b

27. The land mapped as Subgrade 3b has a moderate wetness limitation. Typically the profiles have medium clay loam topsoils over either heavy clay loam or clay upper subsoils and clay lower subsoils. The reddish clay subsoils are derived from the Keuper Marl geology and although they do not show evidence of wetness they are poorly drained. These slowly permeable layers start higher up the profile than 60 cm and extend to below 100 cm so the profiles were assessed as Wetness Class IV. Soil pit 5 is representative of these mapping units.

28. In the mapping unit to the north of Perrinpit Farm there are some profiles which contain "Tea Green" marl. This occurs naturally in situ within the dominant red marl and has been graded as a red soil would be regarding its drainage regime. Soil pit 8 is an example of this where the profile was assessed as Wetness Class IV, Subgrade 3b.

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June 1998

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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 (e.g. 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 (In preparation) Soil Survey Field Handbook, Revised Edition.

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, 1974).

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

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

USE: 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		

ASPECT: The aspect of the land.

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

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

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

MB (WHEAT AND 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.

M.REL:	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, and '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

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%		

STRUCTURE: Ped Development *

WA: Weakly adherent
W: Weakly developed

M: Moderately developed
S: Strongly developed

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, 1974) for details.

SITE NAME Winterbourne		PROFILE NO. Pit 1 (ASP108)	SLOPE AND ASPECT Flat	LAND USE FRT	Av Rainfall: 773 mm ATO: 1476 day °C	PARENT MATERIAL Carboniferous Pennnant Measures (sandstone)
JOB NO. 8/97		DATE 17/4/97	GRID REFERENCE ST 6623 8221	DESCRIBED BY GS/SH	FC Days: 172 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	28	MCL	7.5YR42	0% (vis)	None	None	-	-	-	-	FVF	-	Clear Smooth
2	45	HCL	7.5YR54	0% (vis)	FFFO 75YR5/6	None	MDCSAB	Friable	Moderate	Good	FVF	-	Clear Smooth
3	60-65	C	25YR44-46 (no pale ped faces)	10% MSST (vis)	MDFO 5YR5/6 (in patches)	Many (large patches)	MDCSAB	Firm	Moderate	Good	FVF	-	-
4	65+	MSST	-	-	-	-	-	-	-	-	-	-	-

Profile Gleyed From: Not gleyed

Slowly Permeable Horizon From: No spl

Wetness Class: II by wetness definitions (WC I from pit).

Wetness Grade: 2

Available Water Wheat: 96 mm
Potatoes: 107 mm

Moisture Deficit Wheat: 99 mm
Potatoes: 90 mm

Moisture Balance Wheat: -3 mm
Potatoes: +17 mm

Droughtiness Grade: 3a (Calculated to 70 cm)

Final ALC Grade: 3a

Main Limiting Factor(s): Drought

Remarks: Hard sandstone at 65 cm Water sitting on the rock. If calculated to 81 cm then Grade 2 on drought. Grade 2 mapping unit.

SITE NAME Winterbourne		PROFILE NO. Pit 2 (ASP110)	SLOPE AND ASPECT 0°	LAND USE Potatoes	Av Rainfall: 773 mm ATO: 1476 day °C	PARENT MATERIAL Carboniferous Pennnant Measures (sandstone)
JOB NO. 8/97		DATE 17/4/97	GRID REFERENCE ST 6653 8220	DESCRIBED BY SH/GMS	FC Days: 172 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	20	MCL	7.5YR42	1% HR (vis)	None	None	-	-	-	-	FVF	-	Clear Smooth
2	38	MCL	05YR54	1% HR (vis)	CDFO 05YR5/6	None	MDCSAB	Friable	Moderate	Good	FVF	-	Gradual Smooth
3	62	SCL	2.5YR44	25% HR (vis)	CFFO 2.5YR46	Many	MDCSAB	Friable	Moderate	Good	FVF	-	Clear Wavy
4	100+	C	10R44	12%HR *1 (vis)	CFFO 2.5YR46	Many	MDCSAB	Firm	Moderate	Good	FVF	-	-

Profile Gleyed From: Not gleyed
 Slowly Permeable Horizon From: No spl
 Wetness Class: II from definitions (WCI from pit)
 Wetness Grade: 2

Available Water Wheat: 123 mm
 Potatoes: 103 mm
 Moisture Deficit Wheat: 99 mm
 Potatoes: 90 mm
 Moisture Balance Wheat: 34 (29) mm
 Potatoes: 13 (13) mm
 Droughtiness Grade: 1 (Calculated to 120 cm)

Final ALC Grade: 2
 Main Limiting Factor(s): Wetness

Remarks: No water in pit unlike Pit 1.
 *1 decreasing below 70cm to negligible.

SITE NAME		PROFILE NO.	SLOPE AND ASPECT	LAND USE	Av Rainfall: 773 mm	PARENT MATERIAL
Winterbourne		Pit 3 (ASP120)	Flat	Ploughed	ATO: 1476 day °C	
JOB NO.		DATE	GRID REFERENCE	DESCRIBED BY	FC Days: 172	PSD SAMPLES TAKEN
8/97		22/4/97	ST 6542 8213	HLJ/SH	Climatic Grade: 1	
					Exposure Grade: 1	

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	28	MCL	2.5YR34	<1% HR (vis)	None	None	-	-	-	Good	MF+VF	-	Abrupt Smooth
2	57	SCL	25YR44,46 ^{*1}	1%MSST(vis)	None	Common ^{*1}	MDCSAB	Friable	Moderate	Good	CF+VF	-	Clear Smooth
3	78	C	10R46	<1% MSST	None	None	WKCSAB	Friable	Moderate	Good	FM, CF	-	Clear Smooth
4	100+	SCL ^{*3}	10R44,42	40%MSST (vis)	None	None	WKCPL ^{*4}	Friable	Poor	Poor (assumed)	FM,FF	-	-

Profile Gleyed From: Not gleyed

Slowly Permeable

Horizon From: No spl

Wetness Class: I

Wetness Grade: 1

Available Water Wheat: 130 mm

Potatoes: 114 mm

Moisture Deficit Wheat: 99 mm

Potatoes: 90 mm

Moisture Balance Wheat: 31 mm

Potatoes: 24 mm

Droughtiness Grade: 1 (Calculated to 120 cm)

Final ALC Grade: 1

Main Limiting Factor(s):

Remarks: ^{*1} 46 colours are lighter textured patches
^{*2} on/in the sandstone
^{*3} overall texture
^{*4} from depostional planes.

SITE NAME		PROFILE NO.	SLOPE AND ASPECT	LAND USE	Av Rainfall: 773 mm	PARENT MATERIAL	
Winterbourne		Pit 4 (near Asp 167)	1° North West	Ploughed/Sown	ATO: 1476 day °C	Sandstone	
JOB NO.		DATE	GRID REFERENCE	DESCRIBED BY	FC Days: 172	PSD SAMPLES TAKEN	
8/97		22/4/97	ST 6465 8165	HLJ/GMS	Climatic Grade: 1	T/S MSL:S73: Z14: C13	
					Exposure Grade: 1		

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	28	MSL	2.5YR43	<1% HR (vis)	None	None	-	-	-	-	CF+VF	-	Clear Smooth
2	58	MSL	10R43	1%HR (vis)	None	None	MDCAB* ¹	Friable	Moderate	Good	FVF	-	Gradual Smooth
3	77	MSL	10R53/43	0%(vis)	None	None	WK CAB* ¹	Friable	Good	Good	FVF	-	Gradual Smooth
4	100+	SCL	10R43	0% (vis)	None	None	WKCSAB	Friable	Good	Good	FVF	-	-

Profile Gleyed From: Not gleyed

Slowly Permeable Horizon From: No spl

Wetness Class: I

Wetness Grade: 1

Available Water Wheat: 174 mm

Potatoes: 113 mm

Moisture Deficit Wheat: 99 mm

Potatoes: 90 mm

Moisture Balance Wheat: 75 mm

Potatoes: 23 mm

Droughtiness Grade: 1 (Calculated to 120 cm)

Final ALC Grade: 1

Main Limiting Factor(s):

Remarks: *¹ also some SAB

SITE NAME Winterbourne		PROFILE NO. Pit 5 (Asp 72)	SLOPE AND ASPECT 2° East	LAND USE Permanent Grass	Av Rainfall: 773 mm ATO: 1476 day °C	PARENT MATERIAL Keuper Marl
JOB NO. 8/97		DATE 22/4/97	GRID REFERENCE ST 6542 8256	DESCRIBED BY GMS/HLJ	FC Days: 172 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	23	MCL	05YR44	None (vis)	None	None	-	-	-	-	MF + VF	-	Clear Smooth
2	38	MCL	05YR53	None (vis)	FDFO (7.5YR56)	Few ^{*2}	MDCSAB ^{*1}	Friable	Moderate	Good	MF + VF	-	Clear Smooth
3	100+	C	2.5YR43	None (vis)	None	Few	WKCSAB ^{*4}	Firm	Moderate	Poor ^{*5}	FVF ^{*3}	-	-

Profile Gleyed From: Not gleyed

Slowly Permeable Horizon From: 38-100+ cm

Wetness Class: IV

Wetness Grade: 3b

Available Water Wheat: 141 mm

Potatoes: 117 mm

Moisture Deficit Wheat: 99 mm

Potatoes: 90 mm

Moisture Balance Wheat: 42 mm

Potatoes: 27 mm

Droughtiness Grade: 1 (Calculated to 120 cm)

Final ALC Grade: 3b

Main Limiting Factor(s): Wetness

Remarks: ^{*1} Close to MMSAB ^{*2} Common in patches
^{*3} Following worm channels, common in top 5cm of horizon
^{*4} Some AB and moderate areas
^{*5} Few large worm chnnels
 NB WCIII boring a few feet away but clay definitely comes in at 40cm which is WCIV.

SITE NAME		PROFILE NO.	SLOPE AND ASPECT	LAND USE	Av Rainfall: 773 mm	PARENT MATERIAL	
Winterbourne		Pit 6 (Asp 26)	Flat	Ploughed/Sown	ATO: 1476 day °C	Carboniferous Pennant Measures Sandstone	
JOB NO.		DATE	GRID REFERENCE	DESCRIBED BY	FC Days: 172	PSD SAMPLES TAKEN	
8/97		22/4/97	ST 6669 8311	HLJ/GMS	Climatic Grade: 1	T/S MCL/FSZL: S44: Z38:C18	
					Exposure Grade: 1		

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	23	MCL	7.5YR43	5% HR (vis)	None	None	-	-	-	-	FF+VF	-	Clear Smooth
2	52	HCL	05YR43	10%HR (vis)	None	None	WKCSAB	Friable	Moderate	Good	FVF+F	-	Gradual Smooth
3	76	C	05YR44	20% HR (vis)	Fragments of yellow weathered rock	Common	WKCSAB	Friable	Moderate	Good	FVF+F	-	Clear Smooth
4	80	C	05YR54 (patches of 7.5YR54 with mottling)	10%HR (vis)	FDF0 7.5YR56,66 (in patches)	Many	WKCSAB	Friable	Moderate	Good	FVF	-	-
5	100-120	MSL	-	-	-	-	-	-	-	-	-	-	-

Profile Gleyed From: Not gleyed

Slowly Permeable

Horizon From: No spl

Wetness Class: I

Wetness Grade: 1

Available Water Wheat: 135 mm

Potatoes: 105 mm

Moisture Deficit Wheat: 99 mm

Potatoes: 90 mm

Moisture Balance Wheat: 36 mm

Potatoes: 15 mm

Droughtiness Grade: 1 (Calculated to 120 cm)

Final ALC Grade: 1

Main Limiting Factor(s):

Remarks: NB MSL encountered at bottom of auger boring. When H4 is augered yellow is more dominant giving impression of mottling, and soil forms a solid bullet despite no spl. Augered to 120cm.

SITE NAME Winterbourne	PROFILE NO. Pit 7 (Asp 48)	SLOPE AND ASPECT 0°	LAND USE PGR	Av Rainfall: 773 mm ATO: 1476 day °C	PARENT MATERIAL Carboniferous Pennant Measures (sandstone)
JOB NO. 8/97	DATE 23/4/97	GRID REFERENCE ST 6622 8287	DESCRIBED BY HLJ/GMS	FC Days: 172 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	20	MCL	05YR43	2% HR (vis)	None	None	-	-	-	-	MF+VF	-	Clear Smooth
2	35	MCL	05YR43	18% >2 cm (s) 30% <2 cm (s+d) 48% TOTAL HR	None	None	MDMSAB	Friable	Good	Good	MF+ VF	-	Gradual Smooth
3	75+	HCL	2.5YR44*1	12% >2cm (s) 27% <2cm (s+d) 39% TOTAL HR	None	None	WKCSAB	Friable	Moderate	Good	CF+VF	-	-

Profile Gleyed From: Not gleyed

Slowly Permeable

Horizon From: No spl

Wetness Class: I

Wetness Grade: 1

Available Water Wheat: 99 mm

Potatoes: 88 mm

Moisture Deficit Wheat: 99 mm

Potatoes: 90mm

Moisture Balance Wheat: 0 mm

Potatoes: -2 mm

Droughtiness Grade: 3a (Calculated to 100 cm)

Final ALC Grade: 3a

Main Limiting Factor(s): Drought

Remarks: *1 patches of paler, heavier material around the stones with grey and ochreous colours

SITE NAME		PROFILE NO.	SLOPE AND ASPECT		LAND USE		Av Rainfall: 773 mm		PARENT MATERIAL			
Winterbourne		Pit 8 (ASP18)	4° East		PGR		ATO: 1476 day °C		Keuper Marl			
JOB NO.		DATE	GRID REFERENCE		DESCRIBED BY		FC Days: 172		PSD SAMPLES TAKEN			
8/97		23/4/97	ST 6554 8311		HLJ/GMS		Climatic Grade: 1		None			
							Exposure Grade: 1					

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	HCL	05YR42	<1% HR (vis)	None	None (Few at boundary)	-	-	-	-	MF+VF	-	Gradual Smooth
2	52	C	05YR53	<1%HR (vis)	None	None	MDCSAB ^{*1}	Firm	Good	Poor	FF+VF	-	Clear Wavy
3	64	C	10Y51 & 05YR53	<1%HR (vis)	None	None	WK MPL	Firm	Poor	Poor	FVF	-	Clear Wavy
4	85+	C	05YR53	<1%HR(vis)	None	None	WKM+FAB	Firm	Mod/Poor	Poor	FVF	-	-

Profile Gleyed From: Not gleyed

Slowly Permeable Horizon From: 52

Wetness Class: III

Wetness Grade: 3b

Available Water Wheat: 146 mm

Potatoes: 123 mm

Moisture Deficit Wheat: 99 mm

Potatoes: 90 mm

Moisture Balance Wheat: 47 mm

Potatoes: 33 mm

Droughtiness Grade: 1 (Calculated to 120 cm)

Final ALC Grade: 3b

Main Limiting Factor(s): Wetness

Remarks: ^{*1} close to MMSAB, breaking to FSAB. No green marl found in borings. Green marl graded as red marl in respect of hydraulic conductivity.

SITE NAME Winterbourne		PROFILE NO. Pit 9 (Asp 215)	SLOPE AND ASPECT 5° West	LAND USE Permanent Grass	Av Rainfall: 773 mm ATO: 1476 day °C FC Days: 172 Climatic Grade: 1 Exposure Grade: 1	PARENT MATERIAL Sandstone
JOB NO. 8/97		DATE 14/5/97	GRID REFERENCE ST 6428 8087	DESCRIBED BY HLJ		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	29	MSL	2.5YR43	1% > 2cm (s) 4% < 2cm (s+d) 5% MSST	None	None	-	-	-	-	MF+ VF	-	Clear Smooth
2	45	MSL	10R44	5% > 2cm (s) 7% < 2 cm (s+d) 12% MSST	None	None	WKCAB	Friable	Good	Good	CF+VF	-	Abrupt Smooth
3	80+	LMS	10R44	20% > 2cm (s) 32% < 2cm (s+d) 59% MSST	None	None	WKMSAB	Friable	Good	Good	FVF	-	-

Profile Gleyed From: Not gleyed

Slowly Permeable Horizon From: No spl

Wetness Class: I

Wetness Grade: 1

Available Water Wheat: 102 mm

Potatoes: 85 mm

Moisture Deficit Wheat: 99 mm

Potatoes: 90 mm

Moisture Balance Wheat: 3 mm

Potatoes: -5 mm

Droughtiness Grade: 3a (Calculated to 120 cm)

Final ALC Grade: 3a

Main Limiting Factor(s): Drought

Remarks: Some rock might be HR

SITE NAME Winterbourne		PROFILE NO. Pit 10 (Asp 198)	SLOPE AND ASPECT Level	LAND USE Permanent Grass	Av Rainfall: 773 mm ATO: 1476 day °C	PARENT MATERIAL Pennant Sands
JOB NO. 8/97		DATE 14/5/97	GRID REFERENCE ST 6470 8118	DESCRIBED BY HLJ	FC Days: 172 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	32	MSL	2.5YR43	1%HR (vis)	None	None	-	-	-	-	MF+VF	-	Clear Smooth
2	50	MSL	2.5YR44	0% (vis)	None	None	WK CAB	Friable	Good	Good	CF+VF	-	Clear Smooth
3	90+	SCL	10R43	0% (vis)	None	None	WKCSAB	Friable	Moderate	Good	CVF	-	-

Profile Gleyed From: Not gleyed

Slowly Permeable

Horizon From: No spl

Wetness Class: I

Wetness Grade: 1

Available Water Wheat: 154 mm

Potatoes: 114 mm

Moisture Deficit Wheat: 99 mm

Potatoes: 90 mm

Moisture Balance Wheat: 55 mm

Potatoes: 24 mm

Droughtiness Grade: 1 (Calculated to 120 cm)

Final ALC Grade: 1

Main Limiting Factor(s):

Remarks: