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AGRICULTURAL LAND CLASSIFICATION SURVEY

CONTENTS

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INTRODUCTION

1. This report presents the findings of a semi-detailed Agricultural Land Classification (ALC) survey of land at Newton Abbot, Devon. Field survey was based on 348 auger borings and 17 soil profile pits, and was completed in May 1999. During the survey 20 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 Teignbridge Local Plan.

3. Information on climate, geology and soils, and from previous ALC surveys was considered. The published Regional ALC map (MAFF 1977), shows the majority of the site, particularly in the west, as Grade 3 but with a good proportion of Grade 2, particularly in the south and east. Grade 4 is also shown, particularly in the main floodplain. Only small parts of the site have been surveyed previously. These were at Bradley Valley (ADAS 1984), the proposed extension to Aller Pit at Milber (ADAS 1984) and a small part of the Teign Estuary Study Area (ADAS 1980), all of which show various sub-divisions of Grade 3, mainly Subgrades 3b and 3c. However, the current survey uses the Revised Guidelines and Criteria for Grading the Quality of Agricultural Land (MAFF 1988) and therefore supersedes all previous ALC information. The grade descriptions are summarised at Appendix 1.

4. Two small sites adjacent to the current survey area have been surveyed previously to the revised guidelines. These are a small site at Mile End (ADAS 1993) which found Subgrade 3b limited by restricted workability, and the northern site for the Kingskerswell Bypass (ADAS 1992) which found mainly Subgrades 3b and 3a limited by wetness and restricted workability.

5. At the time of survey, land cover was mainly grass for mixed grazing and cereals. All land in agricultural use was surveyed. Other land which was not surveyed included mainly residential and industrial land, roads, woodlands, the Aller Quarry in the south of the site, various china clay workings near Kingsteignton and the golf course at Mile End.

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.

Table 1: Distribution of ALC grades: Newton Abbot

Grade	Area (ha)	% Surveyed Area (564 ha)
2	55	10
3a	107	19
3b	260	46
4	142	25
Other land	468	
Total site area	1032	

This shows that 29% of the area was found to be best and most versatile, Grade 2 limited mainly by restricted workability and Subgrade 3a limited by restricted workability and wetness. The rest of the area was found to be Subgrade 3b and Grade 4 limited by gradient and wetness.

CLIMATE

7. 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.

8. 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 over most of the area, although a few fields in the extreme south west do have an overall climatic limitation which limits that land to Grade 2, although this is not the primary limitation.

9. Climatic variables also affect the 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. A critical boundary of 200 FC days was found in several parts of the area ranging from around 20 metres altitude in the north, around 35 metres in the south and around 50 metres around Milber in the east.

Table 2: Climatic Interpolations: Newton Abbot.

Grid Reference		SX 863722	SX 886695	SX 865695
Altitude (m)		5	125	30
Accumulated Temperature (day °C)		1604	1468	1577
Average Annual Rainfall (mm)		951	1049	973
Overall Climatic Grade		1	1	1
Field Capacity Days		196	210	200
Moisture deficit (mm):	Wheat	105	88	101
	Potatoes	98	76	93

RELIEF

10. Altitude ranges from sea level to 130 metres at Milber reservoir with mainly gentle and moderate slopes which are not limiting, but also with steeper slopes in the east and particularly in the south west where considerable areas are limited by gradient to Subgrade 3b and to Grade 4.

11. Two areas were reported to be liable to flooding, one in the flood plain of the River Teign in the north of the site and one around Aller Brook in the south of the site. However, in neither case would flooding be the primary limitation to ALC as both sites were found to be limited by wetness to Grade 4.

GEOLOGY AND SOILS

12. The underlying geology of the site is shown on the published geology map (IGS 1976) as highly varied, with slates in the west, limestone in the south west around East Ogwell, various sands and gravels in the south, greensand and breccia in the east around Milber and alluvium in the main river valleys. The recent ALC survey found parent materials matching closely to the published distribution, except the Ugbrooke sandstone in the south west of the site which was perhaps less widely distributed than indicated. The varied deposits were found to have a clear and direct influence on the soil profiles developed on them, and on ALC grade.

13. Detailed soils information is available for this site in the One Inch scale survey of the Exeter and Newton Abbot Area (SSEW 1972). This shows around 13 soil series within the ALC survey area, including most notably Pulsford series; clayey surface water gley soils over Devonian slate or slatey head; Torbryan series, shallow, clayey brown earths over Devonian limestones, Southampton series; sandy and gravely humus iron podsoils over sandy and gravely Bovey Beds and Milber series described as coarse loamy and gravely ochreous brown soils over sandy and gravely Bovey Beds and Cretaceous sands. The published distribution of soil series was entirely borne out by the current ALC survey.

AGRICULTURAL LAND CLASSIFICATION

14. 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 2

15. The areas shown as Grade 2 were found to be limited mainly by restricted workability with medium clay loam topsoil at Wetness Class I (see Appendix II) as illustrated by Pits 12 and 14 in the east of the site. The mapping unit which includes Pit 12 also includes scattered borings which were found to be Subgrade 3a limited by wetness. Pit 17 was also found to be Grade 2 although borderline to Subgrade 3a with coarse sandy loam topsoil at Wetness Class I limited mainly by droughtiness and topsoil stoniness. The profile at Pit 17 was perhaps more typical of the greensand soils to the west and south of the hill fort at Castle Plantation.

Subgrade 3a

16. Much of the area shown as Subgrade 3a was found to be limited only by restricted workability with heavy clay loam topsoil at Wetness Class I. These conditions are illustrated by Pits 4, 5, 9 and 10. Much of this is found in the area of the limestone deposits in the south west of the site.

17. In the areas underlain by Bovey Sands and Bullers Hill gravel, Subgrade 3a limited by wetness was frequently found, commonly with sandy loam topsoils over rather heavier and clayey subsoils, where evidence of wetness was found with gleying from around 45 cm and an SPL in the lower subsoil. These conditions, although variable, are illustrated by Pits 1, 7 and 16.

Subgrade 3b

18. Much of the area shown as Subgrade 3b was found to be limited by gradient with slopes of 8 to 11°.

19. Other areas shown as Subgrade 3b were found to be limited by wetness, with frequently heavy clay loam or sometimes clay or silty clay topsoil textures, particularly in the north west of the site and at Wetness Class II or III indicated by various combinations of gleying and slowly permeable subsoil. Two examples of these conditions are illustrated by Pits 6 and 8.

20. Some profiles within the area shown as Subgrade 3b, mainly on the greensand and Bullers Hill gravel deposits were found to be limited by droughtiness with coarse, sandy textures, high stone contents and occasionally restricted rooting depth. This is illustrated by Pit 2.

Grade 4

21. Much of the area shown as Grade 4 was found to be limited by wetness. This includes the larger areas within the floodplain of the River Teign and in the south of the site at Aller Brook. Conditions at Aller Brook were found to be highly variable, occasionally extremely wet, even to Grade 5 where marshy conditions were found at several observation points. Pit 15 illustrates the similar wetter conditions in this part of the Teign floodplain with a clay topsoil and a gleyed slowly permeable layer starting at 10 cm.

22. Pit 13 illustrates a Wetness Grade IV profile in a shallow depression west of Bradley Barton where gleyed and slowly permeable sub-soils were found over limestone and in head derived from limestone. The topsoil texture here was also clay.

23. Pit 3 illustrates a Wetness Class III profile with slowly permeable subsoil but gleying starting from 40 cm or below. Such conditions were frequently found on the limestone and shale parent materials in the west and south west of the site, most commonly with heavy clay loam topsoil, but in the case of Pit 3, with a clay topsoil, making this a Wetness Grade IV profile within a Subgrade 3b mapping unit.

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2 July 1999

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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 (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:

V: Visual **S:** Sieved **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' might be noted as RRC.

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.