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Plymouth-Ivybridge

Agricultural Land Classification

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Resource Planning Team
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PLYMOUTH - IVYBRIDGE

AGRICULTURAL LAND CLASSIFICATION SURVEY

CONTENTS

PLYMOUTH-IVYBRIDGE

AGRICULTURAL LAND CLASSIFICATION SURVEY

INTRODUCTION

1. This report presents the findings of a reconnaissance Agricultural Land Classification (ALC) survey of 6888 ha of land in the South Hams District of Devon to the east of Plymouth. The report draws on the findings of previous ALC surveys within in the area, supplemented by 85 auger borings and 15 topsoil samples which were analysed for particle size distribution (PSD) which comprised the only field survey within the balance of the area not previously covered by a comprehensive ALC survey.

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, specifically in relation to the possible siting of a new town within this area of search.

3. Information on climate, geology and soils as well as from the previous ALC surveys was considered and is presented in the relevant section. The published regional ALC map (MAFF 1977), shows the site at a reconnaissance scale as mainly Grade 3 but with large areas of Grade 2 in the south west of the site and several areas of Grade 4 through the remainder of the site, mainly in the river valleys and wet areas. However, this was based on criteria for grading the quality of agricultural land which have now been superseded and in particular the areas of Grade 2 shown on the published map have not been confirmed by any of the recent surveys.

SUMMARY

4. Map 1 shows the location of 15 recent comprehensive ALC surveys, all of which used the Revised Guidelines and Criteria for Grading the Quality of Agricultural Land (MAFF 1988). These surveys investigated all the areas shown as Grade 2 on the published regional ALC Map and all failed to confirm the presence of Grade 2 when using the current criteria for grading the quality of agricultural land. Several of these surveys were carried out in 1998 as part of this investigation and were specifically intended to investigate potential areas of better quality land where the climate is more favourable, so that the entire south side of the site is now covered by comprehensive survey. One additional area of potentially better quality land, between Bittaford and Ivybridge, was also surveyed comprehensively as part of this investigation.

5. The rest of the area, where no comprehensive survey exists, was investigated during this survey by selected auger borings located to sample the major types of geological parent material. Where PSD samples were collected, these were based on groups of 3 auger borings from which the topsoils were mixed to provide a combined sample for PSD analysis. This report relates this skeleton survey to the underlying geology and to previous comprehensive ALC surveys to provide an assessment of the likelihood of finding best and most versatile land within the area of search.

PREVIOUS ALC SURVEYS

6. Map 2 shows the ALC grades found in all comprehensive post revision ALC surveys within the study area. Areas are summarised in Table 1.

Table 1: Distribution of ALC grades: Previous ALC Surveys (1988-1998)

Grade	Area (ha)	% Surveyed Area (2839 ha)
3a	322	11
3b	2059	73
4	386	14
5	19	1
Agricultural land not surveyed	52	
Other land	725	
Total site area	3564	

7. This covers 52 % of the study area and shows that 11% of the area surveyed was found to be best and most versatile. This was Subgrade 3a limited mainly restricted by workability, also by wetness, and is found mainly in the south of the study area where better climatic conditions prevail. The rest of the land was found to be mainly Subgrade 3b limited by restricted workability, wetness and gradient and Grade 4 limited by wetness and gradient.

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 illustrate that there are overall climatic limitations within the study area which in broad terms limit the north of the site to Subgrade 3a, the centre of the site to Grade 2 and with no overall climatic limitation (climatic Grade 1) only in the south of the site. However, the boundaries between these areas have not been defined in detail as they are not significant on their own in the determination of ALC Grade which is controlled throughout the study area by soil factors, topsoil texture in particular.

10. 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 225 FC Days was found to run through the south of the site and is shown on Map 3. This is critical to the determination of ALC Grade specifically in relation to topsoil texture and wetness class. Topsoil textures through the study area are mainly either medium or heavy clay loam, occasionally clay: below 225 FC Days heavy clay loam may be Subgrade 3a at Wetness Class I or II, but above 225 FC Days can only be Subgrade 3b even at Wetness Class I. To find Subgrade 3a in the main part of the area which is above 225 FC Days therefore requires that the topsoil texture should be medium clay loam (maximum 26% clay). The 250 FC Days boundary was also found within the study area but this is only of minor significance in the operation of Table 13 in the revised guidelines and has not been delineated in detail.

Table 2: Climatic Interpolations: Plymouth-Ivybridge

Grid Reference		SX 603 523	SX 620 450	SX 656 564
Altitude (m)		37	80	125
Accumulated Temperature (day °C)		1583	1583	1480
Average Annual Rainfall (mm)		1129	1287	1400
Overall Climatic Grade		1	2	3a
Field Capacity Days		225	250	271
Moisture deficit (mm):	Wheat	95	82	69
	Potatoes	87	69	53

11. A local exposure limitation is considered to operate on the most exposed hilltops throughout the site, particularly in the south but any limitation due to exposure would be to Grade 2 or Subgrade 3a at worst and nowhere would it be the primary limitation.

RELIEF

12. Altitude ranges from sea level in the south of the site to 145 m near Ermington. Slopes are mainly gentle to moderate and not limiting but the area is continually undulating with incised river valleys which have steeper hill slopes and valley sides where the steeper gradients can be limiting to Subgrade 3b, Grade 4 or even to Grade 5 in small areas.

13. There has been no comprehensive assessment of the risk of flooding but several major river valleys run through the study area with catchments extending into the lower slopes of Dartmoor to the north and with small well defined areas of flat valley floor which may be susceptible to flooding. One such area at Yealmbridge was reported to flood several times a year, including the possibility of summer flooding and would be restricted to Subgrade 3b with a primary limitation due to flood risk. Another small valley near Yealmpton was also reported to be liable to flooding and was being surveyed for flood alleviation works at the time of this ALC survey. Similar small areas are likely to exist elsewhere in the main river valleys but the risk of flooding would normally be secondary to the wetness limitation.

GEOLOGY

14. The underlying geology of the site is shown on the published geology map (IGS, 1974) and an extract is shown for FRCA internal use only at Map 4. This shows the site as mainly comprising Devonian slates with the most recent deposits in the north of the site. These are considered in greater detail under agricultural land classification later in this report as the occurrence and distribution of grades of agricultural land are considered to be closely correlated with the underlying parent material so that this can be used to predict the likelihood of finding best and most versatile agricultural land.

SOILS

15. Soils are shown by the Soil Survey of England and Wales at a reconnaissance scale of 1: 250 000 (SSEW 1983) as mainly Denbigh 1, Denbigh 2 and Trusham Associations, with smaller areas of other associations.

16. Denbigh 1 Association is described as comprising well drained fine loamy and fine silty soils over Palaeozoic slatey mudstone and siltstone. Denbigh 2 Association is described in similar terms but also with some similar soils having slowly permeable subsoils and slight seasonal waterlogging. Trusham Association is described as well drained fine loamy soils developed on basic igneous and metamorphic rock.

17. Previous ALC surveys and the current survey found the published distribution of soils to be generally consistent with conditions on the ground but with mapping at 1: 250 000 the published information involves major generalisations which do not reflect the local variations of texture and particularly Wetness Class (see Appendix II) which are critical to ALC Grade. Even the published distribution of Trusham Association does not always match the published distribution of igneous tuffs etc on which they are developed and the findings of this survey would suggest that soils matching the description of Trusham Association are more closely correlated with the published distribution of geological parent material than is indicated on the published soils map.

AGRICULTURAL LAND CLASSIFICATION

18. As this study was intended to locate and delineate the major areas of best and most versatile land within the study area, several areas were subjected to comprehensive survey. These were sited to include those areas shown as Grade 2 on the published provisional ALC map, those areas below the climatic 225 FC Day boundary, those areas underlain by a more gritty slate parent materials and one area in the north of the study area to east of Ivybridge where a previous survey (ADAS 1994) had found medium clay loam topsoil. These areas have been surveyed and are reported in two separate volumes, ALC Brixton to Modbury (FRCA 1998) which includes sites at Brixton, Yealmpton, Ermington and Modbury and ALC Bittaford (FRCA 1998).

19. The rest of the area, all of which is over 225 FC Days, was sampled by auger borings at skeletal intensity located to sample the principal types of parent material. The initial batch of auger borings was conducted in groups of three, each boring 100 - 200 m apart with the topsoil to 25 cm depth from each of the 3 borings combined to provide one sample for PSD

analysis. The technique was intended to smooth out local variation in topsoil texture while providing a meaningful sample to represent each geological type in various parts of the site. The location of these borings is shown on Map 5 and the results are included in the consideration which follows. Samples from the area east of Ivybridge appeared to confirm the occurrence of Subgrade 3a and therefore led to the designation of this area for comprehensive survey as Job No 94/98, Bittaford (FRCA 1998).

20. The results of PSD analyses taken during this survey have been combined with those from previous surveys within the study area to create the results shown in Table 3 which indicates the actual occurrence of topsoil texture which has been confirmed by PSD analysis, listed by underlying geological type.

Table 3: Topsoil PSD by underlying geology

	MCL	HCL	C
Upper Devonian Slate	1	10	2
Middle Devonian Slate	5	27	9
Staddon Grits	4	0	0
Meadfoot Group	0	5	0
Igneous Tuffs etc	8	8	0
River Gravel	2	4	0
Alluvium	2	0	2

Source: ALC Job Nos 1a.89, 87.94, 88.94, 89.94, 60.98, 61.98, 62.98, 86.98, 94.98, 59.98. The location of PSD samples taken during 208.88, 1b.89 and 1c.89 cannot be traced, and no samples were taken from 40.94.

Upper Devonian Slate

21. Upper Devonian slate clearly gives rise to topsoil textures which are mainly heavy clay loam but this parent material is not found within the unsurveyed part of the study area.

Middle Devonian Slate

22. Of the PSD samples taken from Middle Devonian slate and identified as medium clay loam, 4 out of 5 came from the area between Ivybridge and Bittaford and are shown as Subgrade 3a in that survey. Of the remainder, the vast majority are seen to be heavy clay loam or clay.

Staddon Grits

23. Although only 4 samples have been taken from the area of Staddon Grits, all were found to be medium clay loam, but the area within which this deposit occurs has been entirely covered by comprehensive surveys at Ermington and at Modbury.

Meadfoot Group

24. The Meadfoot Group comprising slates with grit, has also been covered by comprehensive survey at Modbury and is shown to be mainly heavy clay loam although on the basis of relatively few samples.

Igneous Schalsteins and Tuffs

25. Subgrade 3a is perhaps most likely to be found at Wetness Class I in the area underlain by igneous schalsteins and tuffs, as Table 3 indicates that 50% of relevant PSD samples were found to be medium clay loam.

26. This deposit was observed to give rise to generally reddish soils, but of variable topsoil texture, wetness and stoniness. Table 4 shows an analysis of topsoil texture found on these deposits during 7 relevant ALC surveys within the study area and indicates the likelihood of finding medium clay loam topsoil and relates this to wetness class.

Table 4: Topsoil texture and wetness class assessed during various ALC Surveys in soils developed on deposits shown as Igneous Tuffs etc.

	TOPSOIL		WETNESS CLASS			
Job	MCL	HCL	I	II	III	IV
57.93	0	1	1	0	0	0
87.94	5	20	19	6	0	0
59.98	2	35	14	15	4	1
60.98	0	7	5	2	0	0
61.98	23	29	36	11	5	0
62.98	3	11	9	5	0	0
86.98	1	5	3	3	0	0
Total	34(24%)	108	87 (63%)	42	9	1

27. This shows that 24% of all borings in soils developed on igneous tuffs etc were considered to be medium clay loam and that 63% of all borings were found to be Wetness Class I. This indicates that the likelihood of finding medium clay loam at Wetness Class I through the study area is 15%.

28. However, many of the MCL topsoil textures where found by Job No 61.98 in well defined areas towards the south of the study area, and an intensive traverse of borings on igneous deposits on Job No 59.98 found only 2 out of 24 to be MCL. Therefore it would be reasonable to exclude the results from low lying borings in the south of 61.98, in which case the overall likelihood of finding medium clay loam at Wetness Class I is reduced to around 10%. This is considered to be the likelihood of finding Subgrade 3a in the unsurveyed area shown as underlain by igneous tuffs and schalsteins where not limited by gradient.

River Gravel and Alluvium

29. The deposits of river gravel and alluvium are shown to be highly variable with a good chance of showing medium clay loam topsoil. However, in these areas wetness was generally found to be the primary limitation and medium clay loam is less likely to be found at Wetness Class I.

Conclusion

30. Actual ALC grades are shown on Map 2 for those areas which have been comprehensively surveyed. These comprise 52% of the study area.

31. In that part of the study area which as not been comprehensively surveyed, most of the land is likely to be Subgrade 3b or worse, limited by wetness, restricted workability and gradient. The best grade likely to be found over any significant area is Subgrade 3a and this is most likely on the parent material shown as igneous schalstiens and tuffs. This extends to 680 ha, of which approximately 180 ha appear from an inspection of the contours shown on 1: 10 000 scale OS maps to be limited by gradient to Subgrade 3b or worse. This report suggests that there is a maximum 10% chance of finding Subgrade 3a on the remaining 500 ha and this is likely to be found at the tops of hills where topsoil stoniness may be a further limitation, such as has been reported for the Yealmpton site (FRCA 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 (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.