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BENHAM GRANGE FARM
NEWBURY, BORROWPIT FOR
NEWBURY BY-PASS
STATEMENT OF PHYSICAL
CHARACTERISTICS
FEBRUARY 1994

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1.0 Summary

1.1 ADAS was commissioned by MAFF's Land Use Planning Unit to provide information on land quality and prepare a statement of physical characteristics for land at Benham Grange Farm near Newbury. The work forms part of MAFF's statutory input to the planning application for a borrowpit for the Newbury By-Pass.

1.2 Approximately 4 hectares of land relating to the aforementioned site was surveyed in February 1994. The survey was undertaken at a detailed level of approximately one boring per hectare. A total of 6 soil auger borings and 2 soil inspection pits were assessed in accordance with MAFF's revised guidelines and criteria for grading the quality of agricultural land (MAFF, 1988). These guidelines provide a framework for classifying land according to the extent to which its physical or chemical characteristics impose longterm limitations on its use for agriculture.

1.3 The work was conducted by members of the Resource Planning Team in the Guildford Statutory Group of ADAS.

1.4 At the time of the survey the land use on the site was permanent grassland.

1.5 The distribution of grades and subgrades is shown on the attached ALC map and the areas are given in the table below. The map has been drawn at a scale of 1:5,000. It is accurate at this scale, but any enlargement would be misleading. This map supersedes any previous survey information for the site.

Table 1 : Distribution of Grades and Subgrades

Grade	Area (ha)	% of Site	% of Agricultural Area
1	1.1	28.9	45.8
3b	1.3	34.2	54.2
Non agricultural	0.3	8.0	100% (2.4 ha)
Urban	1.1	28.9	
Total area of site	3.8	100%	

1.6 Appendix 1 gives a general description of the grades, subgrades and land use categories identified in the survey. The main classes are described in terms of the type of limitation that can occur, the typical cropping range and the expected level and consistency of yield.

1.7 The site is classified as grades 1 and 3b. The better quality (grade 1) land is mapped to the north and comprises medium clay loam topsoils over clay loams and clays which are very slightly stony throughout and unaffected by soil wetness or droughtiness limitations. To the south is a marked difference in soils. This land is classified as subgrade 3b and comprises very slightly stony medium clay loam topsoils over very stony sandy subsoils which impede plant rooting in the lower subsoil. Soils experience a restriction to available water reserves due to their sandy and stony nature, resulting in a significant droughtiness limitation.

2.0 Climate

2.1 The climatic criteria are considered first when classifying land as climate can be overriding in the sense that severe limitations will restrict land to low grades irrespective of favourable site or soil conditions.

2.2 The main parameters used in the assessment of an overall climatic limitation are annual average rainfall, as a measure of overall wetness, and accumulated temperature, as a measure of the relative warmth of a locality.

2.3 A detailed assessment of the prevailing climate was made by interpolation from a 5km gridpoint dataset (Met. Office 1989). The details are given in the table below and these show that there is no overall climatic limitation affecting the site.

2.4 No local climatic factors such as exposure or frost risk affect the site. It should be noted that soil properties will interact with climatic factors such as moisture deficits to increase the risk of soil droughtiness and field capacity days and rainfall to affect soil wetness problems. At this locality, field capacity days are relatively high in regional terms, whilst crop-adjusted moisture deficits are correspondingly low.

Table 2 : Climatic Interpolation

Grid Reference :	SU 413 685
Altitude (m) :	95
Accumulated Temperature (days) :	1424
Average Annual Rainfall (mm) :	728
Field Capacity (days) :	163
Moisture Deficit, Wheat (mm) :	103
Moisture Deficit, Potatoes (mm) :	95
Overall Climatic Grade :	1

3.0 Relief

3.1 The site is flat and lies at an altitude of approximately 95 metres. Nowhere on the site does relief or gradient affect agricultural land quality.

4.0 Geology and Soil

4.1 The published geological sheet for the site, Sheet 267 (BGS, 1981) shows the majority of the underlying geology to be River and Valley Gravel with a small outcrop of Upper Chalk towards the northern boundary.

4.2 The published soils information for the area, Sheet 6 (SSEW, 1983) shows the soils on the site to comprise the Frilsham association -"Well drained mainly fine loamy soils over chalk, some calcareous. Shallow calcareous fine loamy and fine silty soils in places". (SSEW,1983). A detailed inspection of soils on the site revealed the presence of deep clay loams over clay soils to the north with very stony clay loams over sandy soils in the south.

5.0 Agricultural Land Classification

5.1 Table 1 provides the details of the area measurements for each grade and the distribution of each grade is shown on the attached ALC map.

5.2 The location of the soil observation points are shown on the attached sample point map.

Grade 1

5.3 Excellent quality agricultural land is mapped to the north east of the site and comprises topsoils of medium clay loam containing 2-5% total flints over upper subsoils of the same texture with 1-4% total flints. These overlie heavy clay loam from about 45-55 cm containing 0-10% total flints which passes to clay towards the base of the profile. Soils are well drained showing no signs of wetness imperfections except in a few profiles where slight mottling was evident at depth, probably as a result of fluctuating groundwater levels. As a result soils are assigned to wetness class I and this in combination with a medium, easily workable topsoil texture and climatic factors gives a wetness classification of grade 1. The good water holding properties of these clay loam and clay soils means that they do not experience a droughtiness limitation with no restriction in water available for crop growth in the profile. Consequently land is classified as grade 1 and can support a wide range of agricultural and horticultural crops producing consistently good yields.

Subgrade 3b

5.4 Moderate quality agricultural land is mapped to the south, reflecting a marked change in soils. These consist of medium clay loam topsoils containing 2-10% total flints over upper subsoils of medium clay loam with 56% total small flints/gravel. This passes to medium sandy loam and medium loamy sand containing 63-66% total small flints/gravel. Profiles are well drained with a wetness class of I, but due to the sandy free draining lower subsoils and the very high stone contents interacting with climatic factors, available water for crop growth is significantly restricted such that a classification of subgrade 3b is appropriate.

5.5 The areas marked as Urban include car parks, a house and commercial buildings.

5.6 The areas marked as Non-agricultural include a small gravel pit.

STATEMENT OF PHYSICAL CHARACTERISTICS

6.1 Topsoil

6.1.1 One topsoil unit was identified over the site providing a resource of 7,920 cubic metres. It comprises an average of 33 cm of brown/dark brown (10YR 4/3) medium clay loam containing 2-5% total stones (flints).

6.2 Subsoil

6.2.1 Two subsoil units were identified, both with upper and lower horizons , providing a total subsoil resource of 9,570 cubic metres.

Unit 1

6.2.2 This unit coincides with the better quality agricultural land to the north east of the site. It comprises an average of 19 cm of medium clay loam over 68 cm of heavy clay loam and clay. The upper subsoil is dark yellowish brown in colour (10YR 4/4) and contains 1-4% total flints. The lower subsoil is typically yellowish brown (10YR 5/4 and 5/6), occasionally with few ochreous mottles (75YR 5/6) and contains 0-10% total flints.

6.2.3 Soil Pit 2 is typical of this subsoil unit and found the upper subsoil to comprise moderately well developed coarse subangular blocky peds of friable consistence which gives a moderate structural condition. The same applies to the horizons of heavy clay loam in the lower subsoil but when this passes to clay the structure becomes weakly developed coarse subangular blocky peds of firm consistence which also give a moderate structural condition as ped faces were found not to be gleyed.

6.2.4 There is an upper subsoil resource available of 2,090 cubic metres and a lower subsoil resource of 7,480 cubic metres.

Unit 2

6.2.5 This subsoil unit is mapped to the south and west of the site coinciding with the poorer quality land. Due to it's very stony nature auger borings did not yield much information other than that a stony, impenetrable subsoil had been encountered. Consequently the information recorded was obtained from Soil Pit 1 dug in this unit.

6.2.6 The subsoil comprises an average of 17 cm of medium clay loam over 70 cm of medium sandy loam and loamy medium sand. This accounts for a total subsoil resource of 11,310 cubic metres. The upper subsoil is dark yellowish brown in colour (10YR 4/4) and contains 56% total small flints/gravel. The lower subsoil is yellowish brown/light yellowish brown (10YR 5/6 and 6/4) and contains 63-66% total small flints/gravel. While Soil Pit 1 revealed the stoniness of these subsoils it was not possible to assess for structural condition, therefore a poor subsoil structural condition was assumed.

6.2.7 The upper subsoil resource available totals 2,210 cubic metres and he lower subsoil resource available is 9,100 cubic metres.

APPENDIX I

DESCRIPTION OF THE GRADES AND SUB-GRADES

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 includes 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 or horticultural crops can usually be grown but on some land on 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. When more demanding crops are grown yields are generally lower or more variable than on land in grades 1 and 2.

Sub-grade 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.

Sub-grade 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 the 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 moist 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.

Urban

Built-up or 'hard' uses with relatively little potential for a return to agriculture : housing, industry, commerce, education, transport, religious buildings, cemeteries. Also, hard-surfaced sports facilities, permanent caravan sites and vacant land; all types of derelict land, including mineral workings which are only likely to be reclaimed using derelict land grants.

Non-agricultural

'Soft' uses where most of the land could be returned relatively easily to agriculture, including : private parkland, public open spaces, sports fields, allotments and soft-surfaced areas on airports/airfields. Also active mineral workings and refuse tips where restoration conditions to 'soft' after-uses may apply.

Woodland

Includes commercial and non-commercial woodland.

Agricultural Buildings

Includes the normal range of agricultural buildings as well as other relatively permanent structures such as glasshouses. Temporary structures (eg. polythene tunnels erected for lambing) may be ignored.

Open Water

Includes lakes, ponds and rivers as map scale permits.

Land Not Surveyed

Agricultural land which has not been surveyed.

Where the land use includes more than one of the above, eg. buildings in large grounds, and where map scale permits, the cover types may be shown separately. Otherwise, the most extensive cover type will be shown.

APPENDIX II

REFERENCES

* BRITISH GEOLOGICAL SURVEY (1981), Sheet No.267, Hungerford, 1:63,360 scale.

* MAFF (1988), Agricultural Land Classification of England And Wales : Revised guidelines and criteria for grading the quality of agricultural land.

* METEOROLOGICAL OFFICE (1989), Climatological Data for Agricultural Land Classification.

* SOIL SURVEY OF ENGLAND AND WALES (1983), Sheet No.6, "Soils of South East England", 1:250,000 scale and accompanying legend.

APPENDIX III

DEFINITION OF SOIL WETNESS CLASSES

Wetness Class I

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

Wetness Class II

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

Wetness Class III

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

Wetness Class IV

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

Wetness Class V

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

Wetness Class VI

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

(The number of days is not necessarily a continuous period. 'In most years' is defined as more than 10 out of 20 years.)

APPENDIX IV

SOIL PIT AND SOIL BORING DESCRIPTIONS

Contents :

SOIL PROFILE DESCRIPTIONS : EXPLANATORY NOTE

Soil pit and auger boring information collected during ALC fieldwork is held on a database. This has commonly used notations and abbreviations as set out below.

Boring Header Information

1. **GRID REF** : national grid square and 8 figure grid reference.

2. **USE** : Land use at the time of survey. The following abbreviations are used.

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

3. **GRDNT** : Gradient as measured by a hand-held optical clinometer.

4. **GLEY/SPL** : Depth in cm to gleying or slowly permeable layers.

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

6. **MB (WHEAT/POTS)** : Moisture Balance.

7. **DRT** : Best grade according to soil droughtiness.

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

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

9. **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** : Soil Erosion Risk **WD** : Combined Soil Wetness/Droughtiness **ST** : Topsoil Stoniness

Soil Pits and Auger Borings

1. **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
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 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)

2. MOTTLE COL : Mottle colour

3. 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% +

4. 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

5. PED. COL : Ped face colour

6. STONE LITH : One of the following is used.

HR : all hard rocks and stones MSST : soft, medium or coarse grained sandstone
SI : soft weathered igneous or metamorphic SLST : soft oolitic or dolimitic limestone
FSST : soft, fine grained sandstone ZR : soft, argillaceous, or silty rocks CH : chalk
GH : gravel with non-porous (hard) stones GS :gravel with porous (soft) stones

Stone contents (> 2cm, > 6cm and total) are given in percentages (by volume).

7. 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

8. 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

9. SUBS STR : Subsoil structural condition recorded for the purpose of calculating profile droughtiness.

G : good M : moderate P : poor

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

11. IMP : If the profile is impenetrable a 'Y' will appear in this column at the appropiate horizon.

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

13. CALC : If the soil horizon is calcareous, a 'Y' will appear in this column.

14. Other notations

APW : available water capacity (in mm) adjusted for wheat
APP : available water capacity (in mm) adjusted for potatoes
MBW : moisture balance, wheat
MBP : moisture balance, potatoes

SOIL PIT DESCRIPTION

Site Name : BENHAM GRANGE BORROWPIT Pit Number : 1P

Grid Reference: SU41236840 Average Annual Rainfall : 728 mm
Accumulated Temperature : 1424 degree days
Field Capacity Level : 163 days
Land Use : Permanent Grass
Slope and Aspect : degrees

HORIZON	TEXTURE	COLOUR	STONES >2	TOT.STONE	MOTTLES	STRUCTURE
0- 30	MCL	10YR42 00	0	5		
30- 50	MCL	10YR44 00	0	56		
50- 80	MSL	10YR56 00	0	63		
80- 90	LMS	10YR64 00	0	66		

Wetness Grade : 1 Wetness Class : I
Gleying : cm
SPL : No SPL

Drought Grade : 3B APW : 73 mm MBW : -30 mm
APP : 73 mm MBP : -22 mm

FINAL ALC GRADE : 3B
MAIN LIMITATION : Droughtiness

SOIL PIT DESCRIPTION

Site Name : BENHAM GRANGE BORROWPIT Pit Number : 2P

Grid Reference: SU41306851 Average Annual Rainfall : 728 mm
Accumulated Temperature : 1424 degree days
Field Capacity Level : 163 days
Land Use : Permanent Grass
Slope and Aspect : degrees

HORIZON	TEXTURE	COLOUR	STONES >2	TOT.STONE	MOTTLES	STRUCTURE
0- 30	MCL	10YR43 00	0	3		WKCSAB
30- 44	MCL	10YR44 00	0	1		MDCSAB
44- 54	HCL	10YR44 00	0	1		MDCSAB
54- 86	C	75YR44 00	0	1	F	MDCSAB
86-110	C	10YR56 00	0	5	F	WKCSAB
110-120	C	10YR56 00	0	0	F	WKCSAB

Wetness Grade : 1 Wetness Class : I
Gleying : cm
SPL : No SPL

Drought Grade : 1 APW : 140mm MBW : 37 mm
APP : 116mm MBP : 21 mm

FINAL ALC GRADE : 1
MAIN LIMITATION :

SAMPLE NO.	GRID REF	USE	ASPECT	GRDNT	GLEY	SPL	--WETNESS-- CLASS	GRADE	-WHEAT- AP	MB	-POTS- AP	MB	M.REL DRT	FLOOD	EROSN EXP	FROST DIST	CHEM LIMIT	ALC	COMMENTS
1	SU41256853	PGR	S	02			1	1	124	21	114	19	2				DR	2	IMP95Q1
1P	SU41236840	PGR					1	1	73	-30	73	-22	3B				DR	3B	ROOTS90
2	SU41356850	PGR	S	02			1	1	145	42	117	22	1					1	
2P	SU41306851	PGR					1	1	140	37	116	21	1					1	
3	SU41306840	PGR					1	1	104	1	116	21	3A				DR	3A	IMP70Q2
4	SU41236842	PGR					1	1	57	-46	57	-38	3B				DR	3B	IMP35 AS 1P
5	SU41346845	PGR					1	1	141	38	116	21	1					1	
6	SU41246849	PGR					1	1	69	-34	69	-26	3B				DR	3B	IMP40 AS 1P

SAMPLE	DEPTH	TEXTURE	COLOUR	MOTTLES COL	MOTTLES ABUN	MOTTLES CONT	PED COL.	GLEY	STONES >2	STONES >6	STONES LITH	STONES TOT	STRUCT/ CONSIST	SUBS STR	SUBS POR	SUBS IMP	SUBS SPL	SUBS CALC
1	0-30	mcl	10YR43 00						0	0	HR	3						
	30-70	mcl	10YR44 00						0	0	HR	4		M				
	70-86	hcl	10YR56 00						0	0	HR	5		M				
	86-95	c	10YR56 00						0	0	HR	10		M				
1P	0-30	mcl	10YR42 00						0	0	HR	5						
	30-50	mcl	10YR44 00						0	0	HR	56		P				
	50-80	msl	10YR56 00						0	0	HR	63		P				
	80-90	lms	10YR64 00						0	0	HR	66		P				
2	0-35	mcl	10YR42 00						0	0	HR	2						
	35-55	mcl	10YR54 00						0	0	HR	1		M				
	55-70	hcl	10YR54 00	10YR56 00	F				0	0	HR	1		M				
	70-120	c	10YR56 00						0	0	HR	1		M				
2P	0-30	mcl	10YR43 00						0	0	HR	3	WKCSAB	FM				
	30-44	mcl	10YR44 00						0	0	HR	1	MDCSAB	FR	M		Y	
	44-54	hcl	10YR44 00						0	0	HR	1	MDCSAB	FR	M		Y	
	54-86	c	75YR44 00	75YR56 00	F		75YR54 00		0	0	HR	1	MDCSAB	FM	M		Y	
	86-110	c	10YR56 00	75YR56 00	F				0	0	HR	5	WKCSAB	FM	M		Y	
	110-120	c	10YR56 00	10YR58 00	F				0	0		0	WKCSAB	FM	M			
3	0-35	mcl	10YR43 00						0	0	HR	2						
	35-45	mcl	10YR44 00						0	0	HR	1		M				
	45-65	hcl	10YR56 00						0	0	HR	2		M				
	65-70	c	10YR56 00						0	0	HR	10		M				
4	0-35	mcl	10YR43 00						0	0	HR	10						
5	0-35	mcl	10YR43 00						0	0	HR	2						
	35-45	mcl	10YR43 44						0	0	HR	2		M				
	45-55	hcl	10YR43 44						0	0	HR	5		M				
	55-120	c	10YR56 00	75YR56 00	F				0	0	HR	2		M				
6	0-35	mcl	10YR43 00						0	0	HR	2						
	35-40	mcl	10YR44 00						0	0	HR	10		M				