

APPENDIX 10

**(Soils and Agricultural Land Classification -
Dr S McRae)**

**LAND AT KNEPP CASTLE,
WEST GRINSTEAD, WEST SUSSEX**

**SOILS AND AGRICULTURAL
LAND CLASSIFICATION**

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**LAND AT KNEPP CASTLE,
WEST GRINSTEAD, WEST SUSSEX**

SOILS AND AGRICULTURAL LAND CLASSIFICATION

SUMMARY

Two blocks of land, a northern block of about 13.6 hectares and a southern block of about 6.4 hectares were investigated by standard soil investigation procedures using a soil auger supplemented by the digging of two small inspection pits. It was found that the great majority of the soils, especially in the southern block, had poorly drained soils developed more or less directly in Weald Clay (Soil Type A). In the south-east of the northern block and in isolated locations in the southern block it was just possible to detect a slightly lighter textured i.e. more loamy superficial drift, giving a thin subsoil layer between the topsoil and the Weald Clay substrate (Soil Type B). Where such a subsoil exists in the northern block it ranges from 7 to 18cm thick (average 12cm). Averaging over the whole northern area would result in an average thickness of such subsoil material of only 5cm. On the southern block, such a subsoil layer is even rarer, being detected in only two profiles, with a thickness ranging from 5 to 13cm, average 9cm in the profiles where it occurs, or 2cm on average over the whole southern site. Despite the presence of the slightly lighter textured subsoil layer, the profiles of Soil Type B are, however, just as poorly drained as those of Soil Type A. Both soil types are in Wetness Class IV and the combination of this, their heavy topsoil textures and the local climatic regime indicates an agricultural Land Classification grading of Subgrade 3b for both blocks of land. Although some areas of Weald Clay are shown on the old, provisional 1:63,360 ALC maps as Grade 4, application of the revised criteria and guidelines means that, except in exceptional circumstances, the lowest grading now possible on the worst kinds of soils over the Weald Clay, as here, is no worse than Subgrade 3b. If there had been an appreciable thickness of loamy subsoil between the topsoil and the Weald clay substrate i.e. if Soil Type B had been more extensive and the loamy subsoil layer appreciably thicker, then the recommendation would have been to strip and conserve this as a separate soil resource. However, quite simply, there is not sufficient thickness of this present in large enough areas for such a proposition to be either feasible or beneficial. Accordingly, the only soil resource on the site worth stripping is the topsoil from both Soil Types A and B: This is a dark brown, virtually stoneless, heavy silty clay loam to silty clay on average 27cm thick over the northern block, and 23cm thick over the southern block.

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SOILS AND AGRICULTURAL LAND CLASSIFICATION

INTRODUCTION & METHODOLOGY

This report describes the soils and Agricultural Land Classification (ALC) of about 20 hectares (49 acres) of land at Knepp Park, part of the Knepp Castle Estate, West Grinstead, West Sussex. The work has been carried out to support the submission of proposals for lake restoration works and landscaping works at Knepp Park.

1. The report is based on a study of published information (see Appendix 1) and a site inspection carried out on 4th May 2007.
2. During the site inspection 28 auger borings were made using a hand auger on or close to a 100 x 100m grid (see SGM 1). Two small inspections pit were also dug. The pit descriptions and a summary of the auger boring descriptions are given in Appendix 2.
3. Land quality has been assessed using the revised criteria and guidelines for the Agricultural Land Classification system introduced in 1989. When the site inspection was undertaken it was anticipated that the main areas of bunding would be along the A24 and in the north-east corner of the estate to create the Tor. The proposals have evolved over time to also include the digging of one small borrow pit, linked by a haul road to the main area of bunding together with the extension of the Tor feature to the south to meet the central landscaped bund and the construction of a southern landscaped bund. The sites of the borrow pit, extension to the Tor feature, the southern bund and the haul road have not been specifically surveyed. Appendix 3 describes the likely soils in these areas.

GENERAL DESCRIPTION OF THE SITE

Land Use

4. The land specifically investigated consists of two blocks lying to the north and south respectively of the buildings of Hill House Farm, alongside the A24.
5. The northern area consists of a single grassland field, about 13.6 hectares in extent, of which a small area in the north-east has been fenced off with a double fence and newly planted hedge.

6. The southern block is alongside the A24, separated from it by a belt of woodland. It is part of the open deer park grassland but includes a very small area in the north which lies just outside the deer park fencing. The total area of the southern block is about 6.4 hectares.

Topography

7. The northern block rises to a low dome at about 25m a.o.d. approximately in the centre of the block with gentle to moderate slopes towards the north, west and south and a lower, flatter area in the north at about 18 m a.o.d.
8. The southern block is more level, at about 20m a.o.d. with an almost imperceptible slope to the south.
9. None of the slopes are sufficiently steep to pose any form of agricultural limitation.

Climate

10. The climatic information needed to apply the Agricultural Land Classification system has been obtained from the Met Office's standard 5km grid point data set for a representative point near the middle of the northern block and is as follows:-

Reference Point:-	TQ 164225
Altitude (m):-	20
Average Annual Rainfall AAR (mm):-	798
Accumulated Temperature ATO (day degrees):-	1512
Moisture Deficit for wheat (mm):-	112
Moisture Deficit for potatoes (mm):-	107
Field Capacity Duration (days):-	169

SOILS

11. The site is shown on the published geological maps (Sheets 302, Horsham and 318, Brighton) as Weald Clay.
12. Soils developed directly in Weald Clay are heavy textured and poorly drained because of the slowly permeable nature of the clayey substrate. In many locations, however, there can be a superficial covering of more loamy, i.e. less clayey, material and this gives somewhat better drained profiles with surface horizons which are more permeable and easily cultivated.
13. Such superficial coverings are usually too thin for them to be shown on the geological map

and so it is no surprise to find no indication of them on the geological maps for the Knepp Castle Estate area, even if they were to be present.

14. The National Soil Map, however, shows the general area as having soils of the WICKHAM 1 Association. Soils in this Association are formed mainly in a covering of loamy drift usually more than 50cm thick over Weald Clay. The association however, includes soils developed where there is effectively no drift covering at all.
15. A detailed soil survey is necessary to determine the thickness of any superficial drift and its effect on soil profile drainage and hence land quality. In general, this superficial drift is a more valuable soil resource than anything derived directly from the Weald Clay and so, as here, where the assessment of soil resources is required, the determination of the thickness of drift material is an important consideration.
16. The site inspection found that the great majority of the soils, especially in the southern block had poorly drained soils developed more or less directly in Weald Clay (Soil Type A), with no sign of any superficial covering of more loamy drift.
17. In the south-east of the northern block and in isolated locations in the southern block it was just possible to detect a slightly lighter textured i.e. more loamy superficial drift, giving a thin subsoil layer between the topsoil and the Weald Clay substrate (Soil Type B). The profiles were, however, just as poorly drained as those of Soil Type A
18. Thus the accompanying soil map shows two soil types:-

Soil Type A - Poorly drained, clayey soils developed directly in Weald Clay
Soil Type B - Poorly drained, clayey soils developed in a very thin covering of superficial drift over Weald Clay
19. However, it must be stressed that the difference between these soils is minimal and the subsoil layer in Soil Type B is really of negligible thickness.
20. A typical profile of Soil Type A consists of a dark brown heavy silty clay loam to silty clay topsoil directly over stiff grey and yellowish brown mottled clay substrate which is little more than weathered Weald Clay. This substrate acts as a slowly permeable layer causing drainage impedance, such that the profiles are poorly drained, in Wetness Class IV on a scale ranging from I (well drained) to VI (virtually a swamp).
21. A typical profile of Soil Type B is similar but there are a few centimetres of greyish brown,

mottled heavy silty clay loam between the topsoil and the Weald Clay substrate. This subsoil layer is too thin materially to affect the profile drainage and all the profiles of Soil Type B are also in Wetness Class IV.

22. As mentioned above, the subsoil layer detectable in Soil Type B is of negligible thickness. Where it occurs in the northern block it ranges from 7 to 18cm thick (average 12cm). Averaging this over the whole northern block would result in an average thickness of such subsoil material of only 5cm.
23. On the southern block, such a subsoil layer is even rarer, being detected in only two profiles, with a thickness ranging from 5 to 13cm, average 9cm in the profiles where it occurs, or 2cm on average over the whole southern block.

AGRICULTURAL LAND CLASSIFICATION

24. The site is shown on the published 1:63,360 provisional ALC maps (Sheet 182) as undifferentiated Grade 3. The Report to accompany this ALC sheet notes that the Grade 3 examples are "very low in the grade range" i.e. 3b in the present division of Grade 3.
25. Under the revised ALC criteria, even the wettest and heaviest of the soils on the Weald Clay i.e. those developed directly over Weald Clay with little or no superficial drift can be graded no lower than Subgrade 3b. This is accordingly the grading for the land on both blocks of land at Knepp Castle, due to the combination of poor drainage (Wetness Class IV) and heavy topsoil textures.
26. Thus the ALC gradings are as follows:-

Grade	Northern Block		Southern Block		Whole Site	
	ha	%	ha	%	ha	%
3b	13.6	100.0	6.4	100.0	20.0	100.0

SOIL RESOURCES

27. It is clear from the description of the soils above that there is either no recognisable subsoil or, if such a layer can be detected, it is of negligible thickness and limited distribution.
28. Accordingly, the only soil resource on the site worth stripping is the topsoil from both Soil Types A and B:-
 - Topsoil - Dark brown, virtually stoneless, heavy silty clay loam to silty clay on

average 27cm thick over the northern block, and 23cm thick over the southern block.

29. If there had been an appreciable thickness of loamy subsoil between the topsoil and the Weald clay substrate then the recommendation would have been to strip and conserve this as a separate soil resource. However, quite simply, there is not sufficient thickness of this present in large enough areas for such a proposition to be either feasible or beneficial.

APPENDIX 2 - PIT AND AUGER BORING DESCRIPTIONS

Pit A near auger boring 20

- 0 - 26cm Dark brown; heavy silty clay loam to silty clay; no stones; moderately developed medium angular blocky structure; slightly moist, dry at surface; friable to firm; occasional small worms; Common grass roots (Topsoil)
- 26+ cm Light grey and yellowish brown intricately mottled, becoming predominantly grey with depth; silty clay; stoneless; very weakly developed very coarse angular blocky to massive structure; moist; plastic; no worms observed; occasional roots (Subsoil/Weald Clay substrate)

Soil Type A; Wetness Class IV; ALC Subgrade 3b

Pit B between auger borings 11,12, 17 and 18

- 0 - 27cm Dark brown; heavy silty clay loam; no stones; moderately developed medium angular blocky structure; dry; hard; no worms observed; common grass roots (Topsoil)
- 27 - 40cm Yellowish brown with common, distinct, large ochreous and greyish brown mottles; heavy silty clay loam to silty clay; stoneless; weakly developed coarse angular blocky to massive structure; dry; hard; no worms observed; occasional roots (Subsoil)
- 40 + cm Light grey and yellowish brown intricately mottled, becoming predominantly grey with depth; silty clay; stoneless; very weakly developed very coarse angular blocky to massive structure; moist; plastic; no worms observed; no roots (Subsoil/Weald Clay substrate)

Soil Type B; Wetness Class IV; ALC Subgrade 3b

Auger borings

All the following auger borings had profiles similar to the above, in Wetness Class IV and giving ALC Subgrade 3b land.

No.	Topsoil (Dark brown heavy clay loam to silty clay)	Subsoil (Greyish mottled heavy silty clay loam)	Weald Clay Substrate (Greyish mottled, silty clay)	Soil Type
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Northern block

1	0 - 28	-	28+	A
2	0 - 25	-	25+	A
3	0 - 29	-	29+	A
4	0 - 27	-	27+	A
5	0 - 30	-	30+	A
6	0 - 26	-	26+	A
7	0 - 26	-	26+	A
8	0 - 28	-	28+	A
9	0 - 28	-	28+	A

APPENDIX 2 - PIT AND AUGER BORING DESCRIPTIONS (continued)

No.	Topsoil (Dark brown heavy clay loam to silty clay)	Subsoil (Greyish mottled heavy silty clay loam)	Weald Clay Substrate (Greyish mottled, silty clay)	Soil Type
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Northern block (continued)

10	0 - 27	27 - 45	45+	B
11	0 - 26	26 - 35	35+	B
12	0 - 29	29 - 45	45+	B
13	0 - 30	26 - 40	40+	B
14	0 - 26	26+		A
15	0 - 27	27+		A
16	0 - 28	28 - 35	35+	B
17	0 - 22	22 - 35	35+	B
18	0 - 26	26 - 35	35+	B

Average thickness of topsoil	27cm
Average thickness of subsoil (overall site)	5cm
Average thickness of subsoil (for profiles where it occurs)	12cm

Southern block

19	0 - 19	19+		A
20	0 - 23	23+		A
21	0 - 25	25+		A
22	0 - 25	25+		A
23	0 - 24	24+		A
24	0 - 22	22+		A
25	0 - 21	21+		A
26	0 - 22	22 - 35	35+	B
27	0 - 23	23+		A
28	0 - 25	25 - 30	30+	B

Average thickness of topsoil	23 cm
Average thickness of subsoil (overall site)	2 cm
Average thickness of subsoil (for profiles where it occurs)	9 cm

APPENDIX 1 - PUBLISHED INFORMATION CONSULTED

Geological Survey, Sheet 302 (Horsham), 1:50,000

Geological Survey, Sheet 318 (Brighton), 1:50,000

Soil Survey of England and Wales, National Soil Map, Sheet 6 (South East England), 1:250,000 and accompanying Regional Bulletin.

Agricultural Land Classification, Sheet 182 (Brighton and Worthing) 1:63,360 and accompanying Report.

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

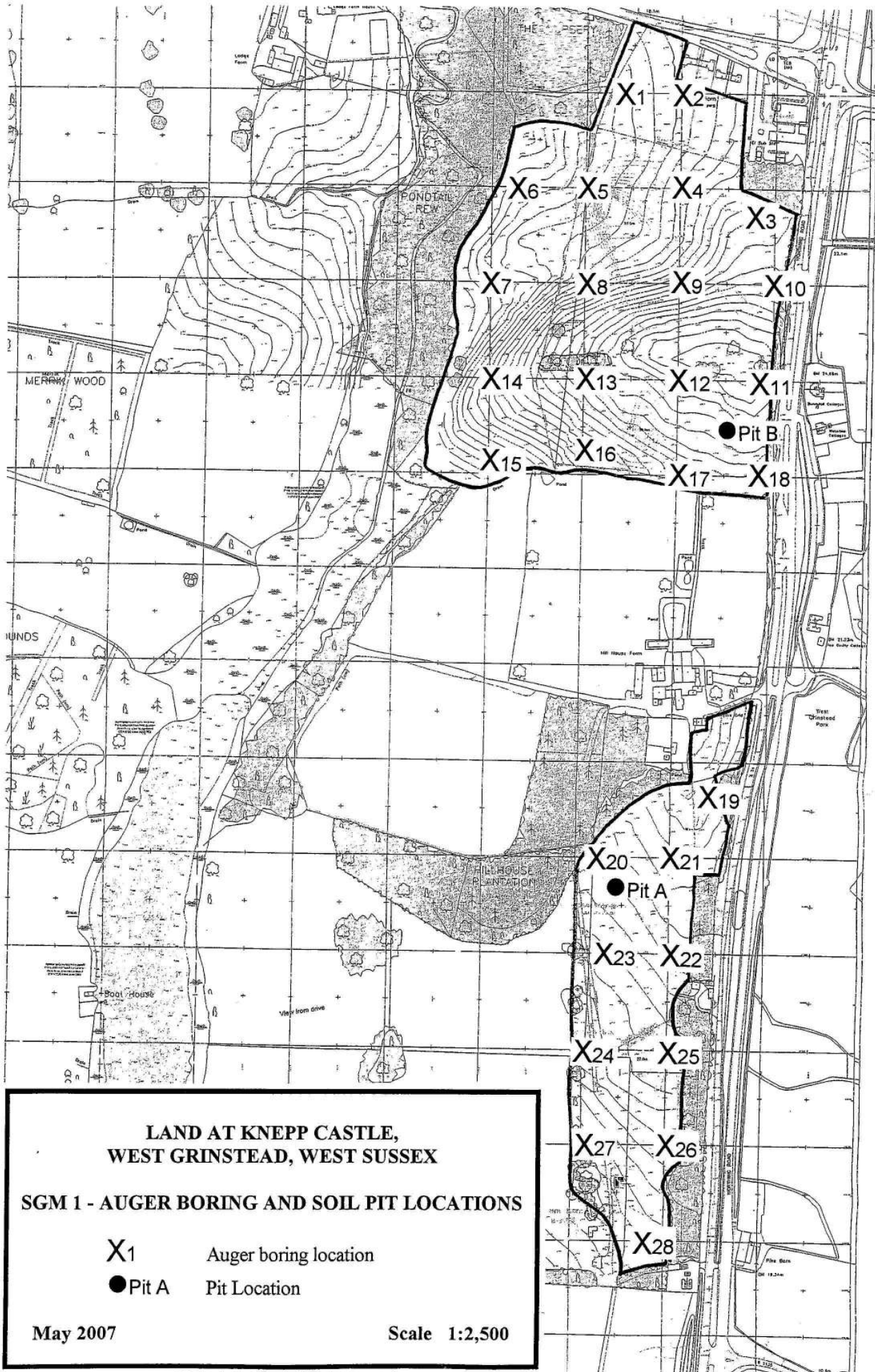
The Met. Office *Climatological data for Agricultural Land Classification.* January 1989.

APPENDIX 3 - BORROW-PITS

In addition to the main areas of bunding along the A24 and in the north-east corner of the estate, the proposals also include the digging of one small borrow pit, linked by a haul road to the main area of bunding together with the extension of the Tor feature to the south to meet the central landscaped bund and the construction of a southern landscaped bund.

The sites of the borrow pit, extension to the Tor feature, the southern bund and the haul road have not been specifically surveyed. However, all the indications from the published geological and soil maps, as well as the general impression of the site gained during the site inspection, lead to the conclusion that the soils on these are the same as those on the main bunding areas and that the land is of ALC Subgrade 3b quality. The footprint of the southern bund comprises in part an existing bund which is planted with tall Leylandii trees. As the existing bund is a man made feature it is considered unlikely that there will be significant soil resources in the bund.

Thus on the borrow pit, the extension to the Tor feature and the southern bund outside the area of the existing bund and the haul road the recommendation would be to save as a soil resource only the topsoil about 25cm thick. It is assumed that, as on the main bunding areas, there is either no recognisable subsoil or, if such a layer can be detected, it is of negligible thickness and limited distribution.



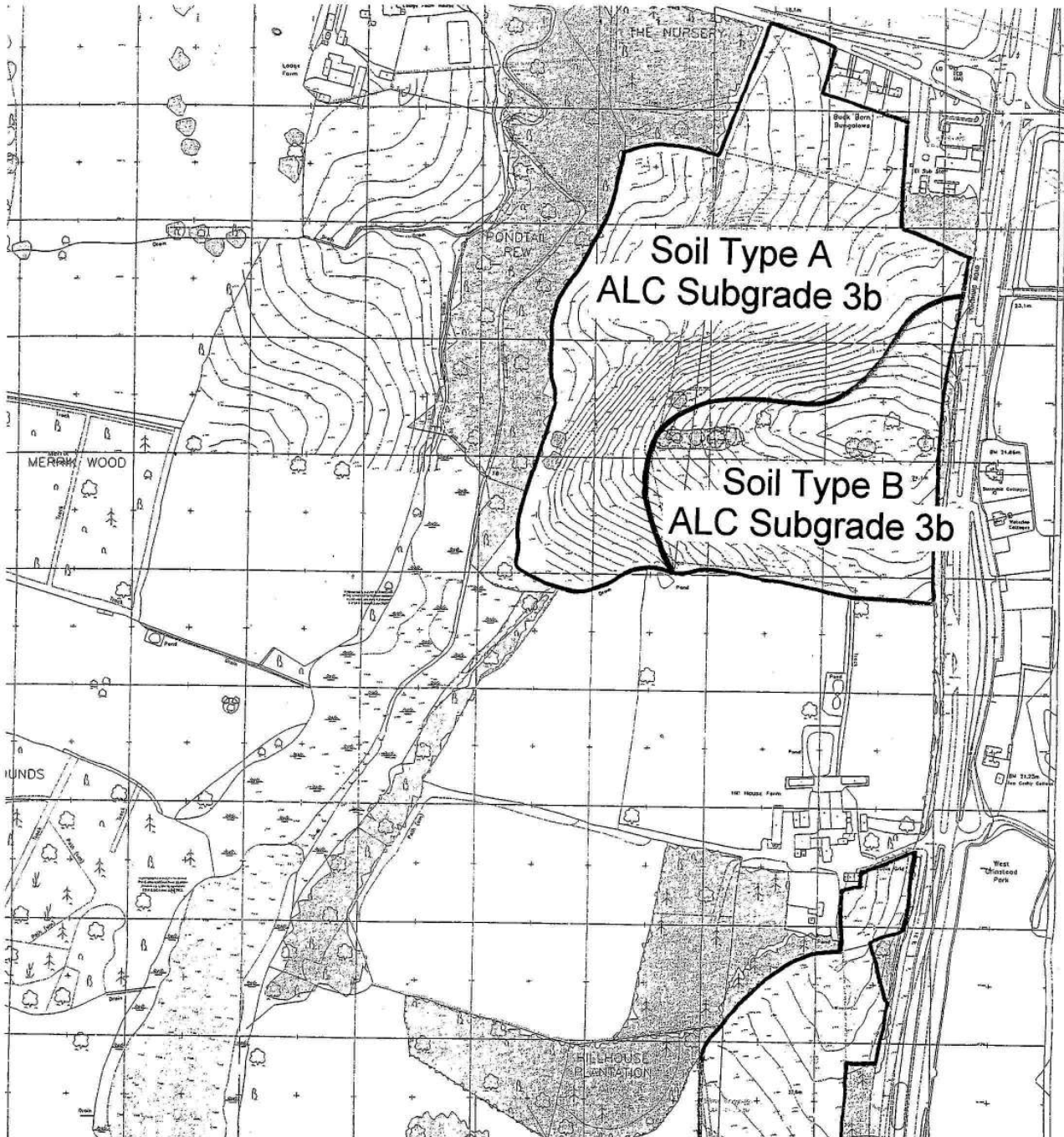
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SGM 1 - AUGER BORING AND SOIL PIT LOCATIONS

- X1 Auger boring location
- Pit A Pit Location

May 2007

Scale 1:2,500



**LAND AT KNEPP CASTLE,
WEST GRINSTEAD, WEST SUSSEX**

**SGM 2 - SOILS AND AGRICULTURAL LAND
CLASSIFICATION**

Soil Type A - Poorly drained, clayey soils developed directly in Weald Clay (ALC Subgrade 3b)

Soil Type B - Poorly drained, clayey soils developed in a very thin covering of superficial drift over Weald Clay (ALC Subgrade 3b)

May 2007

Scale 1:2,500

