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Ancient Monuments Laboratory
Report 37/98

TREE-RING ANALYSIS OF TIMBERS FROM THE HOME FARM COMPLEX, NEWDIGATE, SURREY

M C Bridge

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Summary

Three buildings in this farm complex were investigated, the house, the South Barn, and the East Barn. Four phases of the house were dated- i) the trees for the primary base-cruck phase were felled in AD 1351. ii) oaks used in a second range were most likely felled in the period AD 1488 - 1507 and were found to be contemporaneous with the East Barn (AD 1484 - 1491). iii) new framing, incorporating a large entrance door, was added to the east side of the house from trees probably felled in AD 1574 - 1603. iv) trees for a rear range were felled in AD 1639. The South Barn was found to be younger than estimated on stylistic grounds, the oaks for the primary phase having been felled in the period AD 1411 - 1422. Timbers for the easternmost bays of this barn were cut in the winter of AD 1608/9. Two well-replicated site chronologies were formed, NEWDIGATE 1 (AD 1261 - 1483), and NEWDIGATE 2 (AD 1492 - 1639), which will be of use in dating other structures in this region.

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Introduction

This report details the dendrochronological investigation of the oak timbers used in various phases of three buildings amongst the Home Farm complex at Newdigate, Surrey (NGR TQ 207407) the relative positions of which are shown in Figure 1. The work was carried out at the request of, and funded by, English Heritage, in order to answer several questions. These include enquiries about the dates of the various phases of the three buildings and their inter-relationships, the chronological development of the site, and the site's importance in relation to other sites in the county. The work was also commissioned to inform a review of the listed status of the buildings.

The three buildings under consideration were investigated and recorded in March 1998 by Mr Peter Gray and much of the following introductory information is taken from his observations.

The farmhouse, now known as Home Farm, but previously known as Newdigate Place, is thought to represent a significant fragment of a former large timber-framed courtyard house (Gray 1998). Several phases have been recognised, including a two-bay base-cruck range with crown-post roof, dated on stylistic grounds to the early- to mid-fourteenth century, a rebuild of the low end of the hall of probable *c* AD 1500 date, an Elizabethan-style east facade, including a large doorway, and a large two-and-a-half storey range thought to be of late sixteenth-century origin. Later alterations of nineteenth-century construction are also evident.

The South Barn is an impressive structure incorporating a five-bay barn thought on stylistic grounds to be of early fourteenth-century date (Gray 1998), with an additional three bays added at the eastern end, thought to be of late seventeenth-century construction. The primary phase framing incorporates many features thought to be of early style, eg passing braces and substantial arch braces in the wall framing, and a *trait de jupiter* scarf joint in the wall plate on the north side. The roof was originally of crown-post construction, as evidenced by peg holes and mortices in the ties, though it has been replaced subsequently, possibly at the same time as the eastern bays were added. The present side purlin roof has notably straight wind braces (Gray 1998).

The East Barn today consists of three bays of what is thought to have been originally a six-bay structure. It has a crown-post roof and substantial wall framing incorporating original wattled panels. Stylistically, the bridled scarfs and general structure suggest a date of construction around AD 1500 (Gray 1998).

The methodology employed in this dendrochronological study of the buildings is described below, after which the sampling details and results for each building is discussed separately. The results are then interpreted for each building and the complex as a whole.

Methodology

The site was visited on three days in July 1998. After assessing the suitability of timbers for dendrochronological study, cores were taken from timbers in the two phases of the South Barn, the primary phase of the East Barn, and four phases of the farmhouse. Details of the samples taken are given in the appropriate section below.

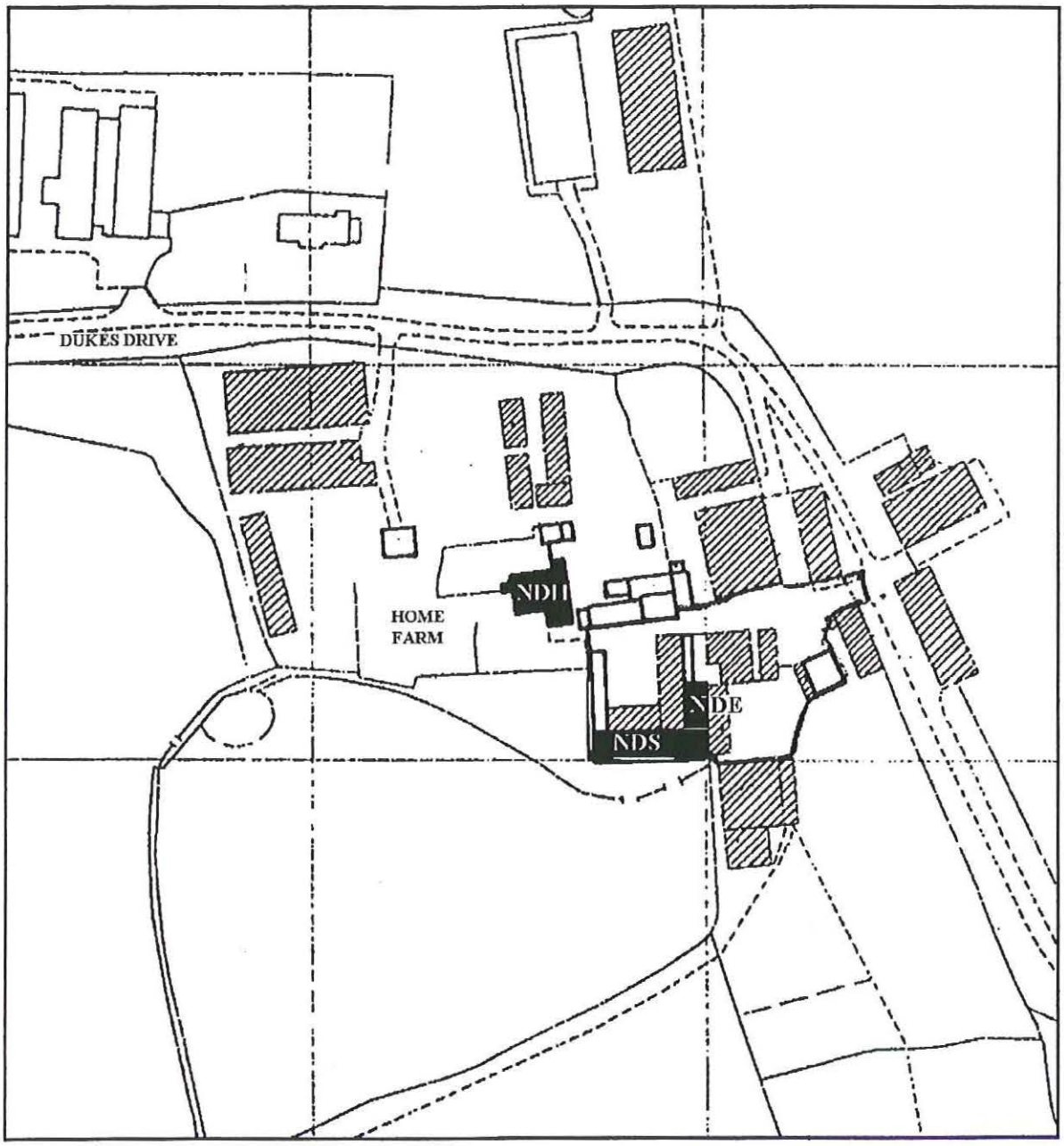

Figure 1: Site plan of the Home Farm complex, Newdigate, Surrey, showing the relative positions of the buildings studied.
NDH = Home Farm House, NDS = South Barn, and NDE = East Barn

Core samples were obtained using a 15mm auger attached to an electric drill. The cores were glued to wooden laths, labelled, and stored for subsequent analysis. Holes in the barns and roof space of the house were left open, whilst most of those in the rooms of the house were plugged with dowels glued into position with Evostik wood adhesive and stained to lessen any aesthetic damage. The samples were prepared for measuring by sanding using an electric belt-sander with progressively finer grit papers down to 400 grit. Any further preparation necessary, eg where bands of narrow rings occurred, was done manually. Those samples with more than 50 annual rings had their sequences measured to an accuracy of 0.01 mm using a specially constructed system utilizing a binocular microscope with the sample mounted on a travelling stage with a linear transducer linked to an Atari desktop computer. Samples with less than 50 rings can only very rarely be reliably crossmatched and are generally rejected from further analysis. The software used in measuring and subsequent analysis was written by Ian Tyers (pers comm 1992).

Ring sequences were plotted on translucent semi-log graph paper to allow visual comparisons to be made between sequences on a light table. This activity also acts as a measure of quality control in identifying any errors in the measurements. Statistical comparisons were made using Student's *t*-test (Baillie and Pilcher 1973; Munro 1984). Any internal site mean sequences produced are then compared with a number of reference chronologies (multi-site chronologies from a region) and dated individual site masters in an attempt to date them. The *t*-values quoted below were derived from the original CROS program (Baillie and Pilcher 1973) in which *t*-values in excess of 3.5 are taken to be indicative of acceptable matching positions provided that they are supported by satisfactory visual matches (Baillie 1982, 82-5). Any timbers not included in the site mean are tested against it to see if they crossmatch, and are also compared individually with the reference data.

The dates thus obtained represent the time of formation of the rings available on each sample. Interpretation of these dates then has to be undertaken to relate these findings to the construction date of the phase under investigation. An important aspect of this interpretation is the estimate of the number of sapwood rings missing. In this instance, the sapwood estimates are based on those proposed for this area by Miles (1997), in which 95% of samples are likely to have from 9 to 41 sapwood rings. When the final ring is the last sapwood ring before the bark, it is often possible to determine the season of felling, depending on the stage of development of this ring. Sometimes this ring has deteriorated too much for this to be possible on a core sample.

The dates derived for the felling of the trees used in construction do not necessarily relate directly to the date of construction of the various phases. However, evidence suggests that, except in the re-use of timbers, construction in most historical periods took place within a very few years after felling (Salzman 1952; Hollstein 1965).

Results

All the timbers sampled were of oak (*Quercus* spp.) and the results and interpretation for each phase of the buildings are given in the appropriate section below. The tree-ring data for the phase chronologies, individual sample series (where appropriate) and the site means are presented in the Appendix.

Home Farm House (formerly Newdigate Place)

Before work began on the four phases under investigation, a tour of the house was made with Mr Peter Gray, who knew the house well and had recently been engaged in recording it. During this familiarisation process, the timbers were assessed for their usefulness for dendrochronological study, looking at the likely number of rings on each timber, the presence of sapwood, and the accessibility allowing radial cores to be taken. Although some phases were only represented by a small number of suitable timbers, it was decided to sample from each of the four phases.

PHASE I (Base-cruck and crown-post roof)

Details of the cores are given in Table I.1 with their positions being illustrated in Figures I.1 and I.2. The correlation between the two samples NDH04 and NDH05 ($t = 9.3$) shown in Table I.2 was very high, and the two series were meaned for further analysis. The correlation levels between the remaining samples was quite low (Table I.2) and the individual samples were therefore independently dated against reference material as a check on their relative positions (Table I.3). The four series were combined to produce a single chronology for the base-cruck phase, which was subsequently dated against several regional and site chronologies (Table I.4). The relative positions of overlap of the dated samples are illustrated in Figure D2.

The presence of bark on two timbers enables one to derive a precise felling date of summer or autumn AD 1351 for both of them. The other two timbers have probable felling dates which include AD 1351, and it seems likely that all four were felled at the same time for the purpose of this construction. Several of the cores from this phase contain both the pith and sapwood, indicating that very young trees were felled for this phase of building, which is likely to have been built in, or very shortly after AD 1351.

This date agrees well with the dating on stylistic evidence which suggested an early- to mid-fourteenth century date for this phase.

The tree-ring series show good correlation with regional chronologies from central southern and south-eastern chronologies, and the strongest correlations with individual site chronologies include two nearby sites, Kingston (Surrey), and Field Place Barn, which is only about 10km south. This suggests that the timber is of local origin.

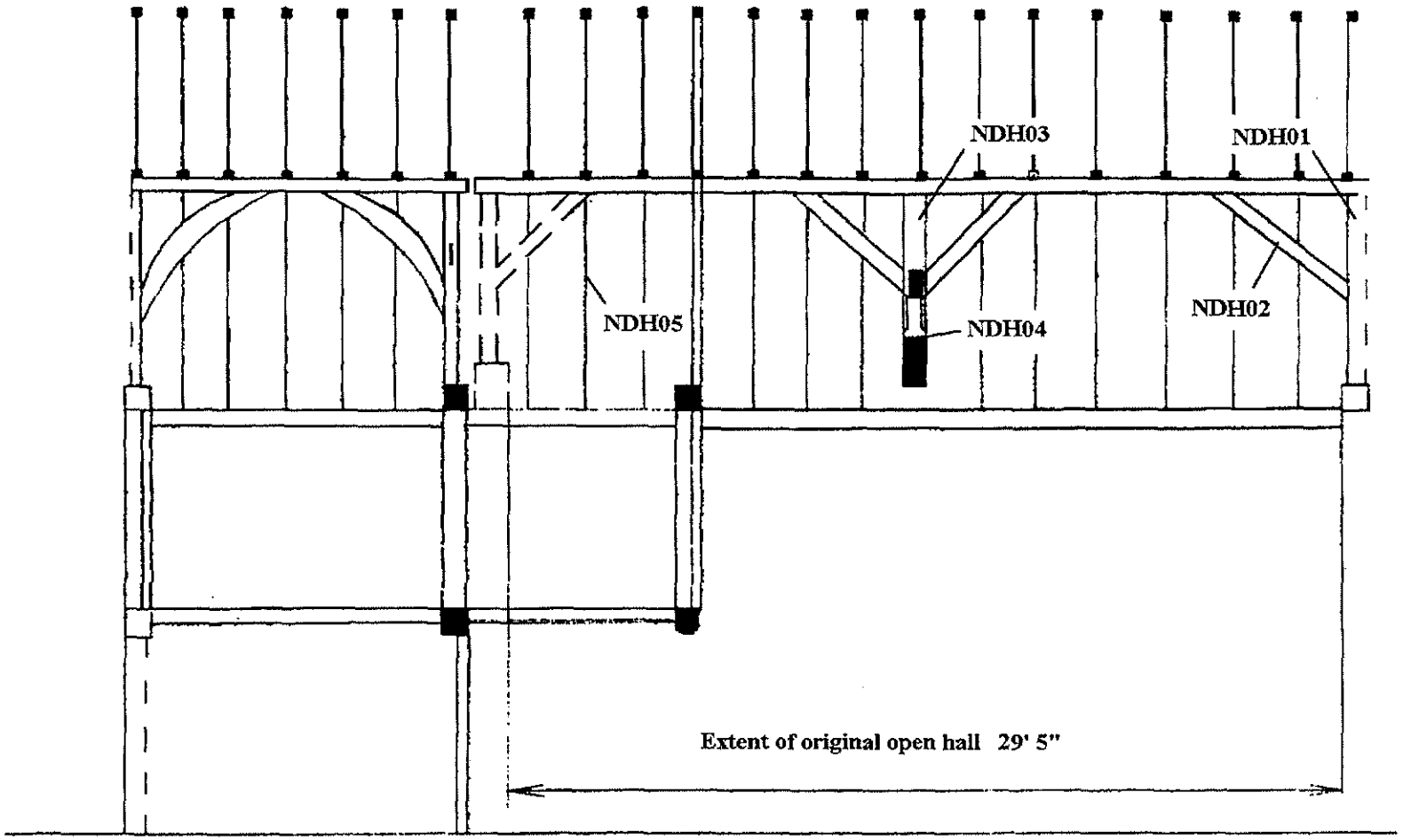

Figure I.1: Drawing of the base-cruck and crown-post roof (phase I) of Home Farm House, Newdigate, Surrey, showing the locations of dendrochronological sampling.

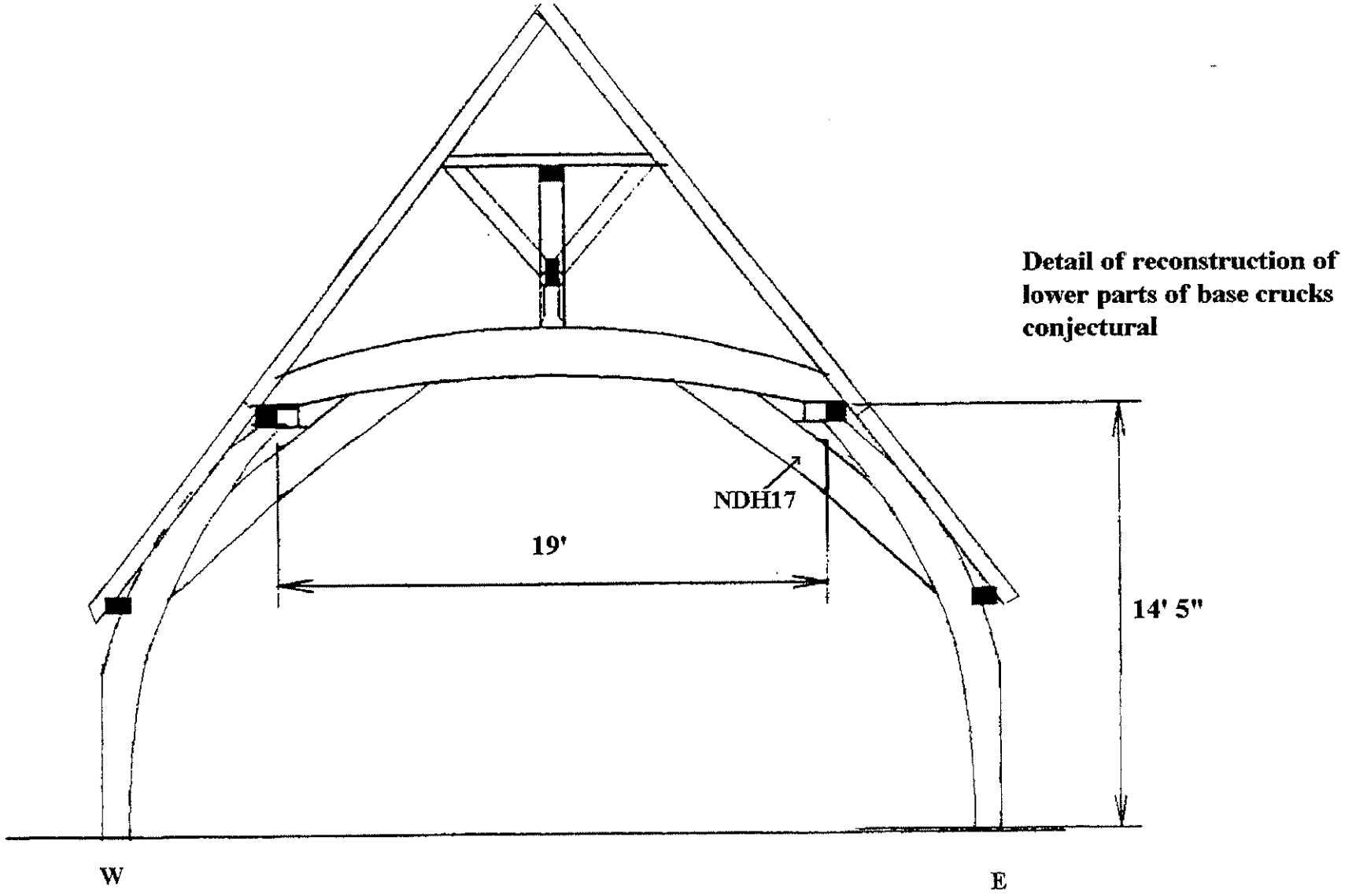

Figure I.2: Drawing of the base-cruck truss (phase I) of Home Farm House, Newdigate, Surrey, showing the location of sample NDH17.

Table I.1: Details of the samples taken from the primary base-cruck phase, Home Farm, Newdigate, Surrey.

h/s = heartwood - sapwood boundary, bk = bark

Sample no	Origin of core	Total no of years	Average growth rate (mm yr^{-1})	Sapwood details	Date of sequence AD	Felling date of timber AD
NDH01	North crown post	51	1.60	15 bk	1301 - 1351	1351
NDH02	North N-S brace	*c* 30	not measured	-	unknown	unknown
NDH03	South crown post	43	not measured	h/s	unknown	unknown
NDH04	South tie beam	68	2.37	h/s	1266 - 1333	1342 - 1374
NDH05	Rafter (west side)	66	1.38	18 bk	1286 - 1351	1351
NDH17	Cruck brace (east)	76	3.24	2	1261 - 1336	1343 - 1375

Table I.2: Correlation between the dated series of the primary base-cruck phase, Home Farm, Newdigate, Surrey.

- = *t* value below 3.0

	***t* - values**		
Sample	**04**	**05**	**17**
01	3.5	-	-
04		9.3	3.8
05		-	-

Table I.3: Correlation between the dated samples from the primary base-cruck phase, Home Farm, Newdigate, Surrey, and the independent reference chronology, London1175 (Tyers pers comm)

	***t* - values**		
Sample	**01**	**04/05**	**17**
London1175 (Tyers pers comm)	4.7	7.3	5.3

Table I.4: Dating of the oaks from Phase I Home Farm House, Newdigate, Surrey

	Home Farm House Phase I AD 1261 - 1351	
Dated reference or site master chronology	***t*-value**	**overlap (yrs)**
London 1175 (Tyers pers comm)	11.0	91
Hants 97 (Miles pers comm)	7.9	91
Kent (Laxton and Litton 1989)	6.3	91
Oxon 93 (Miles pers comm)	5.8	91
Southern England (Bridge 1988)	5.2	91
Zacharius (Miles and Haddon-Reece 1996)	5.1	91
Kingston (Miles pers comm)	4.4	91
Field Place Barn (Bridge unpubl)	4.4	43
Eastbury (Tyers 1997a)	4.3	91

PHASE II (rebuild of the lower end of the hall)

Details of the cores and their locations in the building are given in Table II.1 and Figures II.1 and II.2. The inter-correlation between the dated series is shown in Table II.2 and the comparisons with regional and site chronologies are given in Table II.3.

If one considers the dated timbers to represent a single batch, all felled at the same time, the probable sapwood estimates suggest a likely felling period for these timbers of AD 1480 - 1507. Given that the trees were usually used very soon after felling, the likely date of construction of the replacement lower end of the hall is also in, or very soon after, this period. This agrees well with the stylistic evidence which suggested a date *c* AD 1500.

Evidence presented below suggests that this phase of the house is exactly contemporaneous with the construction of the East Barn.

Some of the strongest matches with site chronologies are found with geographically close sites eg Addington (Surrey), and Cowfold and Field Place (just over the county borders in Sussex), although good matches were also found with sites in Somerset and Staffordshire (Table II.3).

Most of the trees used are again relatively young (mostly under 100 years old at the time of felling), although not as young as those used in the base-cruck phase.

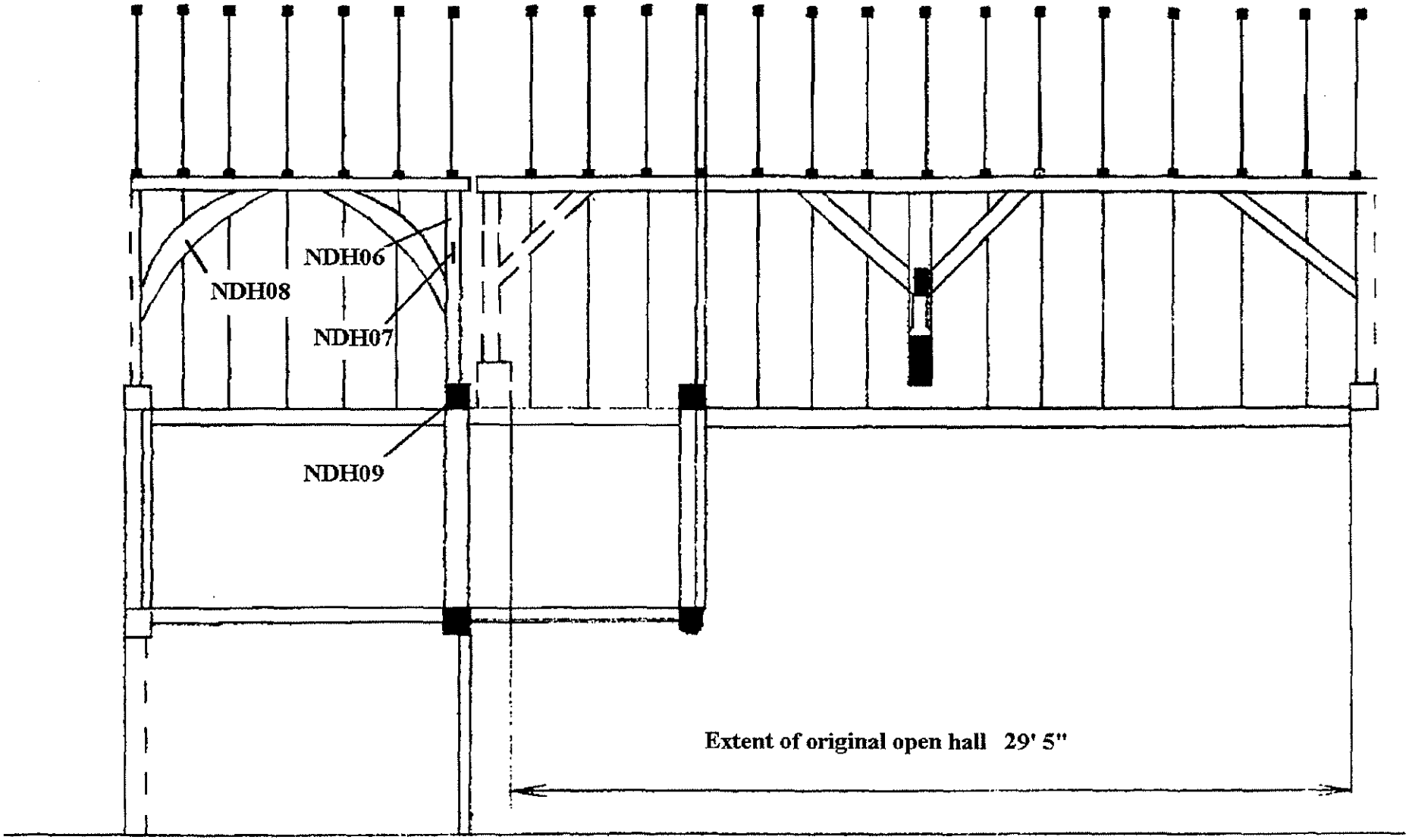

Figure II.1: Drawing of the roof of Home Farm House, Newdigate, Surrey, showing the locations of some of the dendrochronological samples representing phase II of the building

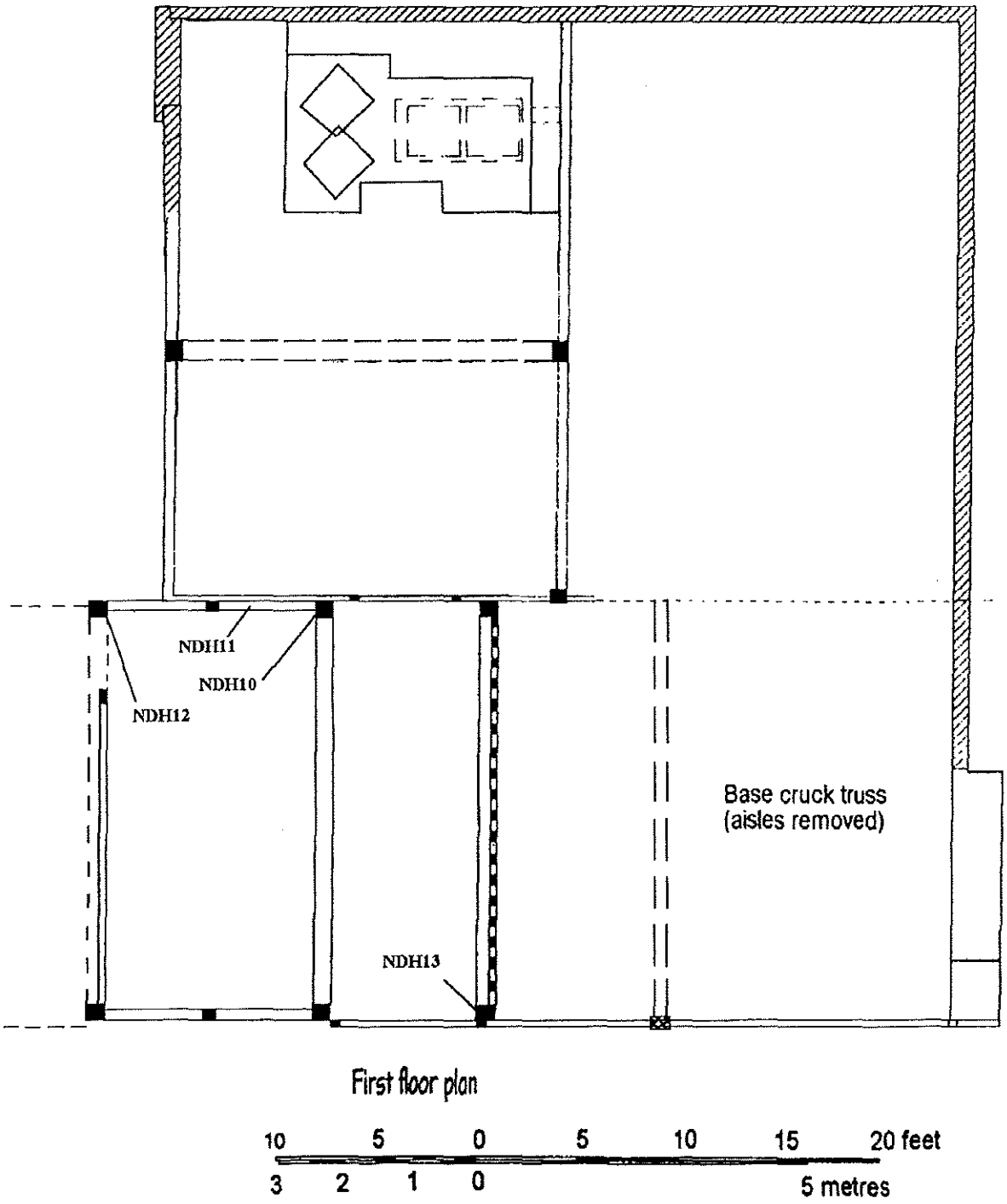

Figure II.2: First floor plan of Home Farm House, Newdigate, Surrey, showing the locations of some of the dendrochronological samples from phase II of the building

Table II.1: Details of the samples taken from Phase II, Home Farm, Newdigate, Surrey.

h/s = heartwood - sapwood boundary.

Sample no	Origin of core	Total no of years	Average growth rate (mm yr^{-1})	Sapwood details	Date of sequence AD	Felling date of timber AD
NDH06	North crown post	127	1.21	h/s	1342 - 1468	1477 - 1509
NDH07	East brace to north crown post	42	not measured	-	unknown	unknown
NDH08	Southern N-S curved brace	52	1.90	2	1422 - 1473	1480 - 1512
NDH09	North tie beam	54	2.97	-	1426 - 1479	after 1488
NDH10	West intermediate post	30	not measured	-	unknown	unknown
NDH11	West wall plate	65	1.92	h/s	1407 - 1471	1480 - 1512
NDH12	South-west post	89	1.72	h/s	1378 - 1466	1475 - 1507
NDH13	North-east post	58	2.38	-	1401 - 1458	after 1467

Table II.2 Correlations between the dated series of Phase II, Home Farm House, Newdigate, Surrey

	t - values				
Sample	**NDH 08**	**NDH 09**	**NDH 11**	**NDH 12**	**NDH 13**
NDH06	-	-	3.6	4.5	4.1
NDH08		4.8	-	5.0	-
NDH09			-	5.7	-
NDH11				3.8	-
NDH12					5.9

Table II.3: Dating of the oaks from Phase II of Home Farm House, Newdigate, Surrey

	Home Farm House Phase II AD 1342 - 1479	
Dated reference or site master chronology	***t*-value**	**overlap (yrs)**
London 1175 (Tyers pers comm)	8.3	138
Hants 97 (Miles pers comm)	6.7	138
Kent (Laxton and Litton 1989)	5.8	138
Oxon 93 (Miles pers comm)	5.6	138
Southern England (Bridge 1988)	4.7	138
Sinai Park (Tyers 1997b)	7.6	138
Mary Rose 'original' (Bridge unpubl)	7.2	138
Field Place Barn (Bridge unpubl)	7.1	124
Wambrook (Tyers 1994)	7.1	106
Addington (Bridge 1998)	6.7	111
Cowfold (Tyers pers comm)	6.4	103

PHASE III (East facade and doorway)

This phase is represented by only three timbers, the locations of those sampled being shown in Figure III.1. These timbers represent a period when the aisles of the original base-cruck construction were removed and replaced with new wall framing incorporating a wide doorway.

The three samples obtained crossmatch with each other well (Table III.2) and were combined to form a single sequence which was subsequently dated. Their relative positions of overlap are illustrated in Figure D3.

This phase is dated on stylistic evidence to the Elizabethan era, a date supported by the independent dendrochronological evidence which dates the most likely felling period for the trees used to AD 1574 -1603 (Table III.3). Although the best matches are found with the expected 'local' regional chronologies, the best matches with site chronologies cover a wide geographical range.

Once again the trees used were felled relatively young, probably under 100 years old.

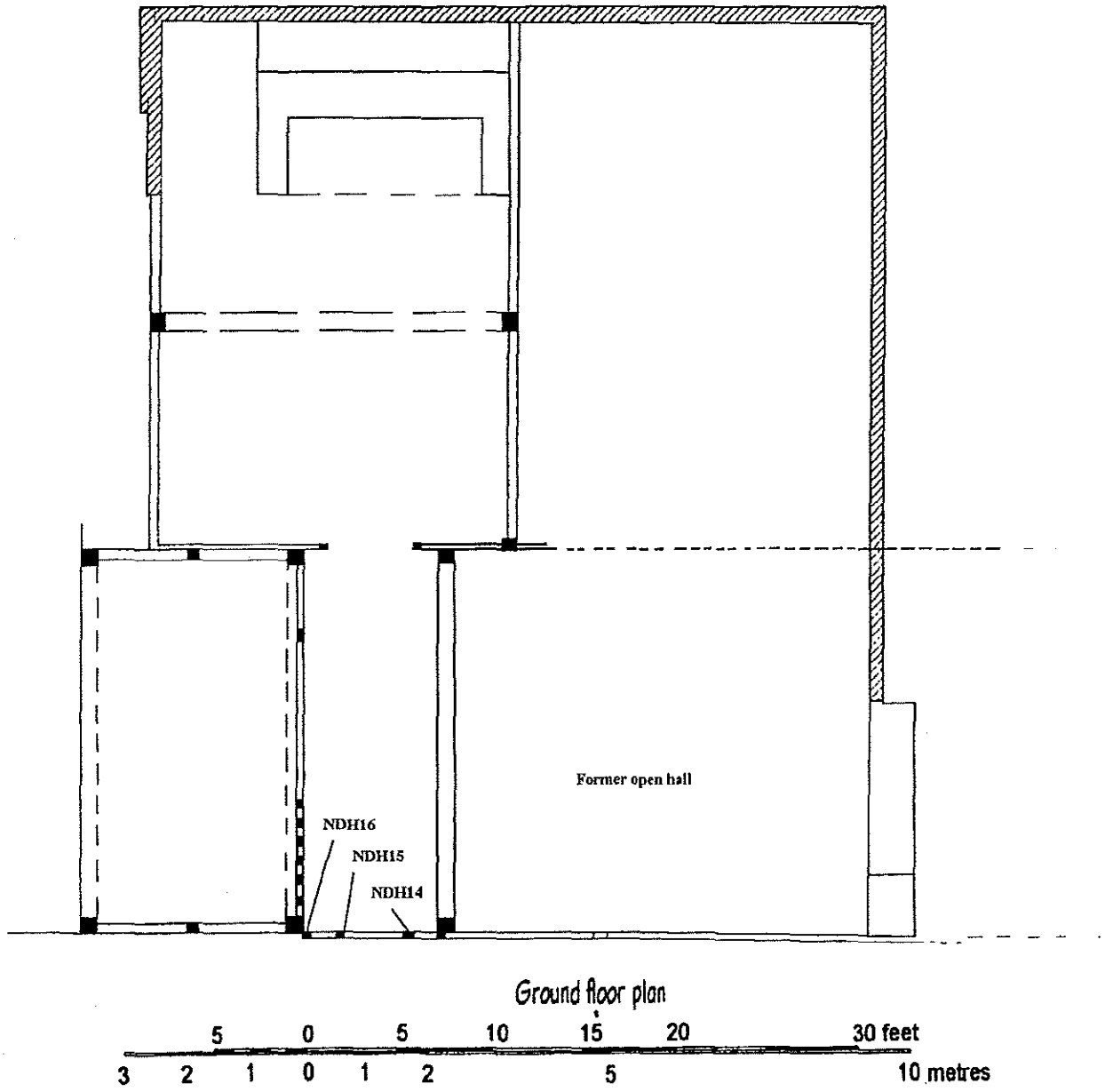

Figure III.1: Ground floor plan of Home Farm House, Newdigate, Surrey, showing the locations of the dendrochronological samples from phase III of the building

Table III.1: Details of the samples taken from Phase III (east facade), Home Farm House, Newdigate, Surrey.
h/s = heartwood - sapwood boundary

Sample no	Origin of core	Total no of years	Average growth rate (mm yr^{-1})	Sapwood details	Date of sequence AD	Felling date of timber AD
NDH14	North door jamb	67	2.39	h/s	1499 - 1565	1574 - 1606
NDH15	South door jamb	73	1.99	5	1497 - 1569	1573 - 1605
NDH16	South stud	71	2.40	h/s	1492 - 1562	1571 -1603

Table III.2: Correlations between the dated series of Phase III, Home Farm House, Newdigate, Surrey.

	***t* - values**	
Sample	**NDH15**	**NDH16**
NDH14	6.8	4.1
NDH15	-	5.4

Table III.3: Dating of the oaks from Phase III of Home Farm House, Newdigate, Surrey

	Home Farm House Phase III AD 1492 - 1569	
Dated reference or site master chronology	***t*-value**	**overlap (yrs)**
London 1175 (Tyers pers comm)	8.2	78
Hants 97 (Miles pers comm)	6.6	78
Kent (Laxton and Litton 1989)	5.2	49
Oxon 93 (Miles pers comm)	3.7	78
Hereford_FC (Tyers 1996)	5.7	78
Mary Rose 'refit' (Bridge unpubl)	5.3	44
Dore2 (Tyers and Boswijk 1998)	5.1	78
Upwich3 (Groves and Hillam 1997)	5.1	78

PHASE IV (Rear service range)

This phase is represented by only three timbers, these being the two posts and a tie beam of an internal truss. Details of the cores are given in Table IV.1, with an indication of the locations of the sampled timbers illustrated in Figure IV.1. The core from the tie beam (NDH18) had only 43 rings and would usually have been discarded from further analysis. In this case however the remaining two cores did not crossmatch with each other well (t = 2.7), although the visual comparison did not rule out their crossmatching altogether, and the short core was measured. It gave very satisfactory visual crossmatching with the other two cores and was therefore dated by comparison with them, and included in the final chronology representing this phase. The two longer cores were seen to crossmatch with reference material well (details of the crossdating are given in Table IV.2) and their lack of agreement with each other may be the result of individual influences on the trees during their growth, or it may suggest different geographical origins.

Having a third timber with a similar likely felling period helps in establishing a date for the construction of the phase, which would otherwise be based on just two timbers of possibly different origins. The tree represented by sample NDH20 was felled in the late summer or early autumn of AD 1639. The relative positions of overlap of these samples are illustrated in Figure D3.

One of the problems in crossdating this phase is that the tree-ring sequences for the early seventeenth-century are not well replicated in this region.

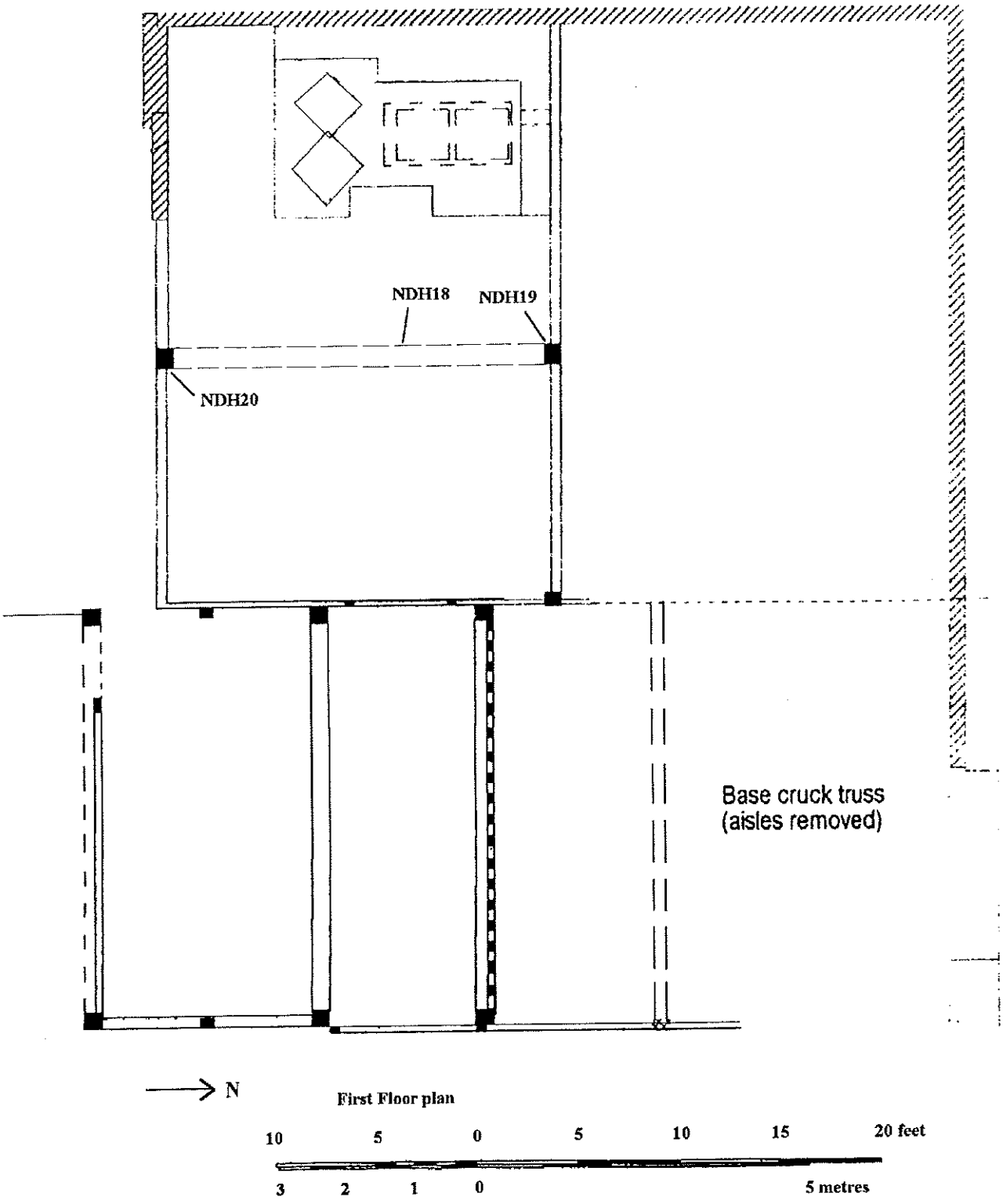

Figure IV.1: Locations of the dendrochronological samples taken from the rear service range (phase IV), Home Farm House, Newdigate, Surrey

Table IV.1: Details of the samples taken from Phase IV (rear service range), Home Farm House, Newdigate, Surrey.

h/s = heartwood - sapwood boundary, bk = bark

Sample no	Origin of core	Total no of years	Average growth rate (mm yr^{-1})	Sapwood details	Date of sequence AD	Felling date of timber AD
NDH18	N-S tie beam	43	2.70	h/s	1573 -1615	1624 - 1656
NDH19	North post	64	2.10	8	1569 - 1632	1633 - 1665
NDH20	South post	83	2.08	18 bk	1557 - 1639	summer 1639

Table IV.2: Dating of the oaks from Phase IV of Home Farm House, Newdigate, Surrey

	NDH19 AD 1569 - 1632		NDH20 AD 1557 - 1639		Home Farm House Phase IV (3 timbers) AD 1557 - 1639	
Dated reference or site master chronology	***t*-value**	**overlap (yrs)**	***t*-value**	**overlap (yrs)**	***t*-value**	**overlap (yrs)**
London 1175 (Tyers pers comm)	4.0	64	5.2	83	5.6	83
Oxon 93 (Miles pers comm)	4.8	64	4.9	83	6.1	83
East Midlands (Laxton and Litton 1988)	4.8	64	4.4	83	4.8	83
Hereford and Worcester (Siebenlist-Kerner 1978)	-	-	4.3	80	5.1	80
Newington House (Miles pers comm)	-	-	5.7	83	4.9	83
Dore2 (Tyers and Boswijk 1998)	3.8	64	-	-	3.6	56
Upwich3 (Groves and Hillam 1997)	3.5	64	3.8	83	4.5	83

South Barn, Home Farm, Newdigate, Surrey

This barn was originally listed as sixteenth-century or later, although a number of features of the framing, such as the passing braces and use of the *trait de jupiter* scarf suggest a much earlier origin. The barn appears to have a virtually complete five-bay Phase I (Fig SB1), with an additional three bays added at the east end (Phase II), and a renewed roof throughout, probably contemporaneous with the east bays (Gray 1998). Samples were taken from the north wall plate on either side of the *trait de jupiter* scarf (NDS07 and NDS20) and these are discussed below.

PHASE I (West bays)

For the purpose of this study, the trusses and bays were numbered from the west end of the barn. Fifteen samples were taken from a selection of timbers from this phase, the details of which are given in Table SBI.1, with the locations of some of the samples being shown in Figure SB1.

The agreement between the samples is shown in Table SBI.2 and the dating of the resulting chronology is shown in Table SBI.3, with the relative positions of overlap of the dated samples being illustrated in Figure D2. By taking the sapwood estimates for all the dated timbers in the phase and then looking at the latest first sapwood ring and the earliest end of the sapwood in the group, the most likely felling period, if these are a single batch of timbers, falls in the period AD 1411 - 1422. This date makes the barn rather younger than had been deduced on stylistic grounds (Gray 1998). It also shows that the wall plate to the east of the *trait de jupiter* scarf is part of the primary construction phase.

A large number of samples end in AD 1405 and 1406, and it is possible that this was the last sapwood year (though there is no evidence for this). It could be therefore that a number of the timbers were actually felled in these two years, and either stockpiled for a few years before use, or that some timbers were replaced early in the life of the barn, though his latter option seems unlikely. The timber from which sample NDS03 was taken was recorded as possibly having the bark edge, which would make its felling date AD 1411/12, but since this could not be determined on the sample itself, the usual sapwood estimate was applied to this sample. The trees felled for the larger timbers, such as tie beams and posts were in the region of about 100 years old.

The chronology from this phase dates particularly well against local site chronologies such as Kingston (Surrey) and Field Place Barn (north Sussex).

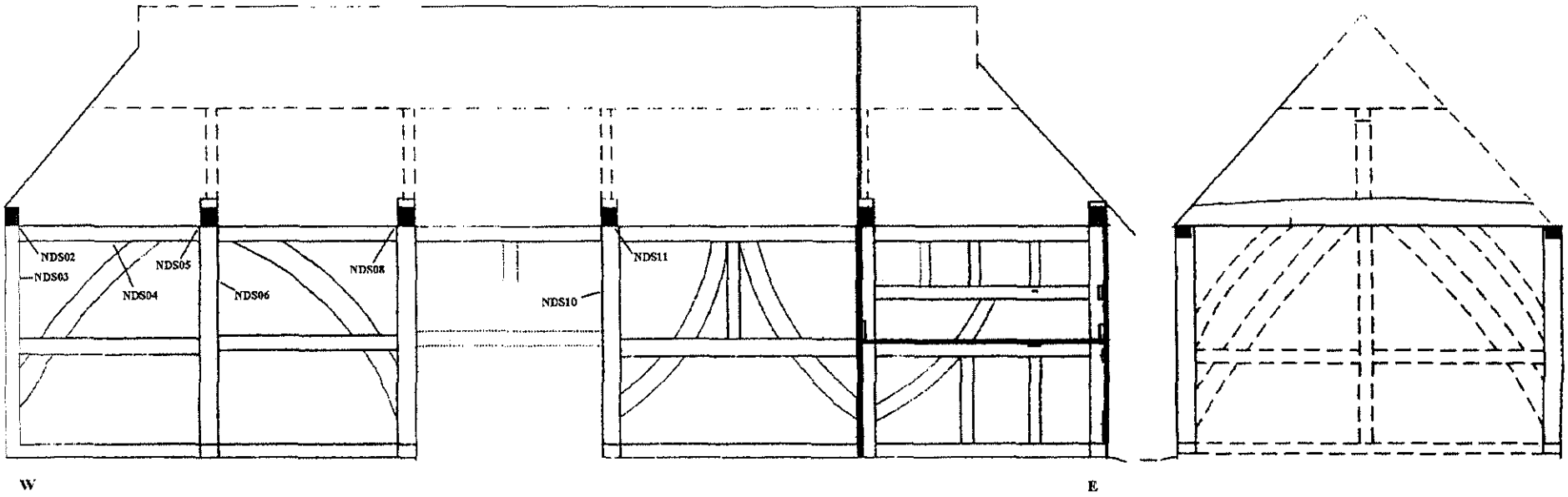

Figure SB1: Reconstruction of the original five-bay South Barn, seen from the south (based on Gray 1998), showing the location of samples taken for dendrochronology

Table SBI.1: Details of the samples taken from Phase I, South Barn, Home Farm, Newdigate, Surrey.

h/s = heartwood - sapwood boundary. Trusses numbered from the west end

Sample no	Origin of core	Total no of years	Average growth rate (mm yr^{-1})	Sapwood details	Date of sequence AD	Felling date of timber AD
NDS01	North west post, truss 1	76	1.79	17	1331 - 1406	1407 - 1430
NDS02	Tie beam 1	43	not measured	-	-	unknown
NDS03	South west post, truss 1	65	2.94	16, bark?	1347 - 1411	?1411/12
NDS04	South wall plate, bay 1	47	not measured	3	-	unknown
NDS05	Tie beam 2	50	2.06	10	1357 - 1406	1407 - 1437
NDS06	Post 2, south	94	2.39	17	1312 - 1405	1406 - 1429
NDS08	Tie beam 3	50	2.75	3	1346 - 1395	1401 - 1433
NDS09	Post 3, north	81	3.03	h/s	1315 - 1395	1404 - 1436
NDS10	Post 4, south	41	not measured	h/s	-	unknown
NDS11	Tie beam 4	94	1.99	12	1312 - 1405	1406 - 1434
NDS12	South brace, truss 4	81	1.52	14	1325 - 1405	1406 - 1432
NDS18	Post 4, north	96	2.04	h/s + 18 rings*	1293 - 1388	1406 - 1429
NDS19	Principal rafter 4, north	45	not measured	-	-	unknown
NDS20	North wall plate, bay 4	113	1.24	14	1283 - 1395	1396 - 1422
NDS21	Mid-rail, bay 4, north	81	1.78	h/s?	1309 - 1389	after 1398

* these rings had broken off the core and were distorted, they were not therefore measured

Table SBI.2: Cross-correlation between individual samples of Phase I of the South Barn, Home Farm, Newdigate, Surrey

***t*-values**

Sample no	NDS03	NDS05	NDS06	NDS08	NDS09	NDS11	NDS12	NDS18	NDS20	NDS21
NDS01	-	-	5.5	-	3.5	-	-	3.9	4.2	4.2
NDS03	-	3.6	-	3.7	4.4	-	5.3	3.5	-	-
NDS05		-	3.6	3.7	-	-	-	-	4.1	-
NDS06			-	-	5.0	5.1	-	-	3.6	-
NDS08				-	5.4	-	-	-	-	-
NDS09					-	4.7	4.4	-	-	4.3
NDS11						-	-	-	-	-
NDS12							-	-	-	-
NDS18								-	3.7	-
NDS20									-	5.4
										-

Table SBI.3: Dating evidence for Phase I of the South Barn, Home Farm, Newdigate, Surrey

	NDS_ONE AD 1283 - 1411	
Dated reference or site master chronology	***t*-value**	**overlap (yrs)**
London 1175 (Tyers pers comm)	11.1	129
Hants 97 (Miles pers comm)	9.4	129
Oxon 93 (Miles pers comm)	8.6	129
Kent (Laxton and Litton 1989)	6.9	129
Southern England (Bridge 1988)	4.2	129
Sinai (Tyers 1997b)	5.9	127
Kingston (Miles pers comm)	5.8	129
Field Place Barn (Bridge unpubl)	5.7	103
Falconers Hall (Bridge unpubl)	5.5	88
Sutton House (Tyers and Hibberd 1993)	5.3	93

PHASE II (East end of barn)

The timbers of the second phase include the tie beams, posts, and a wall plate of the trusses and bays recognised as being of probable late seventeenth-century origin (Gray 1988), the details of these samples being shown in Table SBII.1. They also include a wall plate from the west end of the barn on the north side, the east end of which forms half of the *trait de jupiter* scarf referred to in Phase I. These timbers crossmatch well with each other (Table SBII.2), apart from NDS13, from post 8 north, which had many more growth rings than the other samples, but which included several bands of very narrow rings, and which could not be satisfactorily dated. The relative positions of overlap of the dated samples are illustrated in Figure D3.

The results (Table SBII.3) show that the trees for this phase were each cut in the winter of AD 1608/9, making this phase of the barn considerably older than was expected. It also shows that the western wall plate on the north side was replaced during this phase of work, and that the carpenters copied the existing scarf to match the older wall plate to the east. It was suspected that the re-roofing of the whole barn took place in this phase, though the only principal rafter sampled, NDS19, contained too few rings to be dated.

Table SBII.1: Details of the samples taken from Phase II, South Barn, Home Farm, Newdigate, Surrey.

h/s = heartwood - sapwood boundary, bk = bark. Trusses numbered from the west end

Sample no	Origin of core	Total no of years	Average growth rate (mm yr^{-1})	Sapwood details	Date of sequence AD	Felling date of timber AD
NDS07	North wall plate, bay 2	85	1.97	18bk	1524 - 1608	winter 1608/9
NDS13	Post 8, north	*c* 158	0.90	16bk	unknown*	unknown
NDS14	Post 8, south	60	3.82	18bk	1549 - 1608	winter 1608/9
NDS15	Post 7, south	53	3.83	9bk	1556 - 1608	winter 1608/9
NDS16	South wall plate, bay 7	90	1.42	19bk	1519 - 1608	winter 1608/9
NDS17	Tie beam 7	82	2.21	15bk	1527 - 1608	winter 1608/9
NDS22	Tie beam 8	104	2.29	14bk	1505 - 1608	winter 1608/9

*Sample NDS13 showed very distorted growth and some anomalies and it was decided to discard it from further analysis

Table SBII.2: Cross-correlation between individual samples of Phase II of the South Barn, Home Farm, Newdigate, Surrey

***t*-values**

Sample no	NDS14	NDS15	NDS16	NDS17	NDS22
NDS07	-	-	7.0	5.8	5.9
NDS14		6.1	5.5	-	-
NDS15		-	-	-	-
NDS16				3.8	5.8
NDS17					-

Table SBII.3: Dating of the oaks from Phase II of the South Barn, Home Farm, Newdigate, Surrey

	NDS_TWO AD 1505 - 1608	
Dated reference or site master chronology	***t*-value**	**overlap (yrs)**
London 1175 (Tyers pers comm)	6.5	104
Hants 97 (Miles pers comm)	6.2	104
Oxon 93 (Miles pers comm)	6.1	104
Nuffield (Miles pers comm)	4.9	104
Windsor Castle - kitchen (Hillam and Groves 1996)	4.4	69
Dore2 (Tyers and Boswijk 1998)	4.3	104
Fenny Stratford (Bridge unpubl)	4.1	87

East Barn, Home Farm, Newdigate, Surrey

All the timbers from this barn represent a single phase of what is thought to have once been a longer barn. The samples (Table EBI.1; Fig EB1) crossmatched with each other well (Table EBI.2) and were combined to form a single chronology which dates against several regional and site chronologies (Table EBI.3) to the period AD 1312 - 1483, giving a probable date for the construction of the barn in the period AD 1484 - 1491, in line with the stylistic evidence (Gray 1998). Good crossdating is found with local chronologies from Addington and Field Place, as well as more distant sites, eg Hereford.

The timbers from this site are thought to be exactly contemporaneous with those of Phase II of Home Farm House (see Discussion and Fig D1).

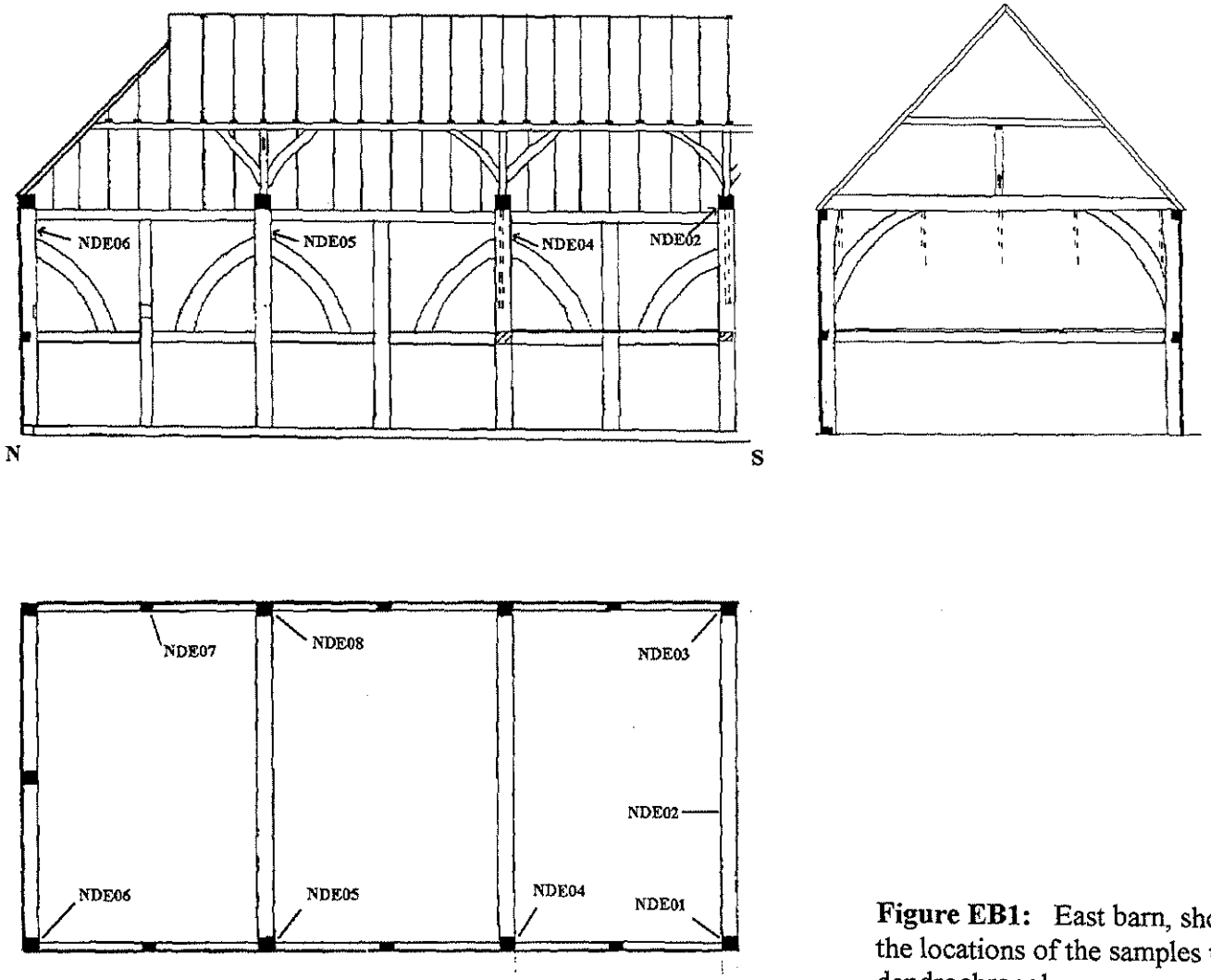

Figure EB1: East barn, showing the locations of the samples taken for dendrochronology

Table EBL1: Details of the samples taken from the East Barn, Home Farm, Newdigate, Surrey.

h/s = heartwood - sapwood boundary. Trusses are numbered from the south end

Sample no	Origin of core	Total no of years	Average growth rate (mm yr^{-1})	Sapwood details	Date of sequence AD	Felling date of timber AD
NDE01	South-west corner post	138	1.52	h/s	1323 - 1460	1469 - 1501
NDE02	Tie beam 1	68	2.16	h/s	1402 - 1469	1478 - 1510
NDE03	South-east corner post	95	2.25	h/s	1356 - 1450	1459 - 1491
NDE04	Post 2, west	150	1.59	-	1312 - 1461	after 1470
NDE05	Post 3, west	99	2.13	h/s	1353 - 1451	1460 - 1492
NDE06	Post 4, west	61	2.11	-	1361 - 1421	after 1430
NDE07	Intermediate post, bay 3, east	162	1.03	12	1318 - 1479	1480 - 1508
NDE08	Post 3, east	119	1.85	26	1365 - 1483	1484 - 1498

Table EBI.2: Cross-correlation between the tree-ring series from the East Barn, Home Farm, Newdigate, Surrey

Sample no	NDE 02	NDE 03	NDE 04	NDE 05	NDE 06	NDE 07	NDE 08
NDE01	8.1	6.6	8.2	9.3	5.7	7.2	8.6
NDE02		6.4	7.7	6.2		6.9	6.2
NDE03			9.4	7.8	6.0	8.8	9.9
NDE04				6.3	4.7	4.4	9.2
NDE05					4.4	8.0	7.9
NDE06						4.3	3.5
NDE07							8.2

Table EBI.3: Dating evidence for the chronology from the East Barn, Home Farm, Newdigate, Surrey

	East Barn AD 1312 -1483	
Dated reference or site master chronology	***t*-value**	**overlap (yrs)**
London 1175 (Tyers pers comm)	10.3	172
Hants 97 (Miles pers comm)	9.5	172
Oxon 93 (Miles pers comm)	7.8	172
Southern England (Bridge 1988)	5.7	172
Kent (Laxton and Litton 1989)	5.5	172
Sherborne Abbey (Bridge 1983)	8.1	136
Mary Rose 'original' (Bridge unpubl)	7.8	150
Windsor Castle kitchen (Hillam and Groves 1996)	7.5	153
Hereford Farmers Club (Tyers 1996)	6.3	171
Cowfold (Tyers pers comm)	6.5	107
Addington (Bridge 1998)	5.1	115

Discussion

There is compelling evidence that Phase II of the house and the East Barn are exactly contemporaneous, the crossmatching between their timbers being of a high order (Table D1). Their relative positions of overlap are shown in Figure D1. Many of the house timbers actually crossmatch better with samples from the East Barn than with other house timbers. The dated samples from these two groups were combined to produce a single chronology NDE_NDHII, which crossdates with many regional and site chronologies (Table D2). It appears from the data that if the two groups were actually felled as a single batch, the older timbers tended to be selected for use in the barn. As a result of these small differences, and without further evidence, it was decided for the purposes of this report, to maintain the separation of the two groups for dating purposes. If they were to be accepted as a single batch, this would reduce the probable felling period to AD 1488-91.

The several dated series from this complex of buildings enables longer site chronologies to be made, and two chronologies, Newdigate 1 (AD 1261 - 1483) and Newdigate 2 (AD 1492 - 1639) are presented in the Appendix, with the relative positions of overlap of the samples in each chronology being illustrated in Figures D2 and D3 respectively. These well-replicated chronologies will be of great use in dating other structures in the region.

The nature of the timbers varies between the various phases, the base-cruck phase of the house being notable for its use of very young, small diameter trees. Most of the other phases employ relatively young trees, mostly of around 100 years old or less. All phases crossdate well with very local material eg from Addington (Bridge 1998) and Field Place, only a few kilometres to the south (Bridge unpubl), suggesting that the trees used are probably all of local origin. It should be noted however, that good crossdating can be found with site chronologies from further afield.

This dendrochronological study has provided extensive evidence of the development of the farm complex, establishing dates for various phases which sometimes agree with the previous dating based on stylistic evidence and sometimes require that evidence to be reassessed.

Table D1: Inter-correlation between samples from Home Farm House Phase II and the East Barn, Newdigate, Surrey

	***t* - values**												
	NDH 08	**NDH 09**	**NDH 11**	**NDH 12**	**NDH 13**	**NDE 01**	**NDE 02**	**NDE 03**	**NDE 04**	**NDE 05**	**NDE 06**	**NDE 07**	**NDE 08**
NDH06	-	-	3.6	4.5	4.1	6.2	3.7	9.1	4.2	6.0	3.8	6.7	7.0
NDH08	-	4.8	-	5.0	-	5.6	5.2	6.5	5.9	7.0	\	6.4	4.0
NDH09		-	-	5.7	-	6.5	4.7	4.0	4.9	4.2	\	5.7	5.4
NDH11			-	3.8	-	-	-	-	3.8	-	-	-	3.9
NDH12				-	5.9	10.7	7.6	7.2	7.8	7.4	5.5	9.0	8.3
NDH13					-	5.3	4.4	4.7	4.5	5.0	-	4.4	7.3

\ = Less than 15 years overlap

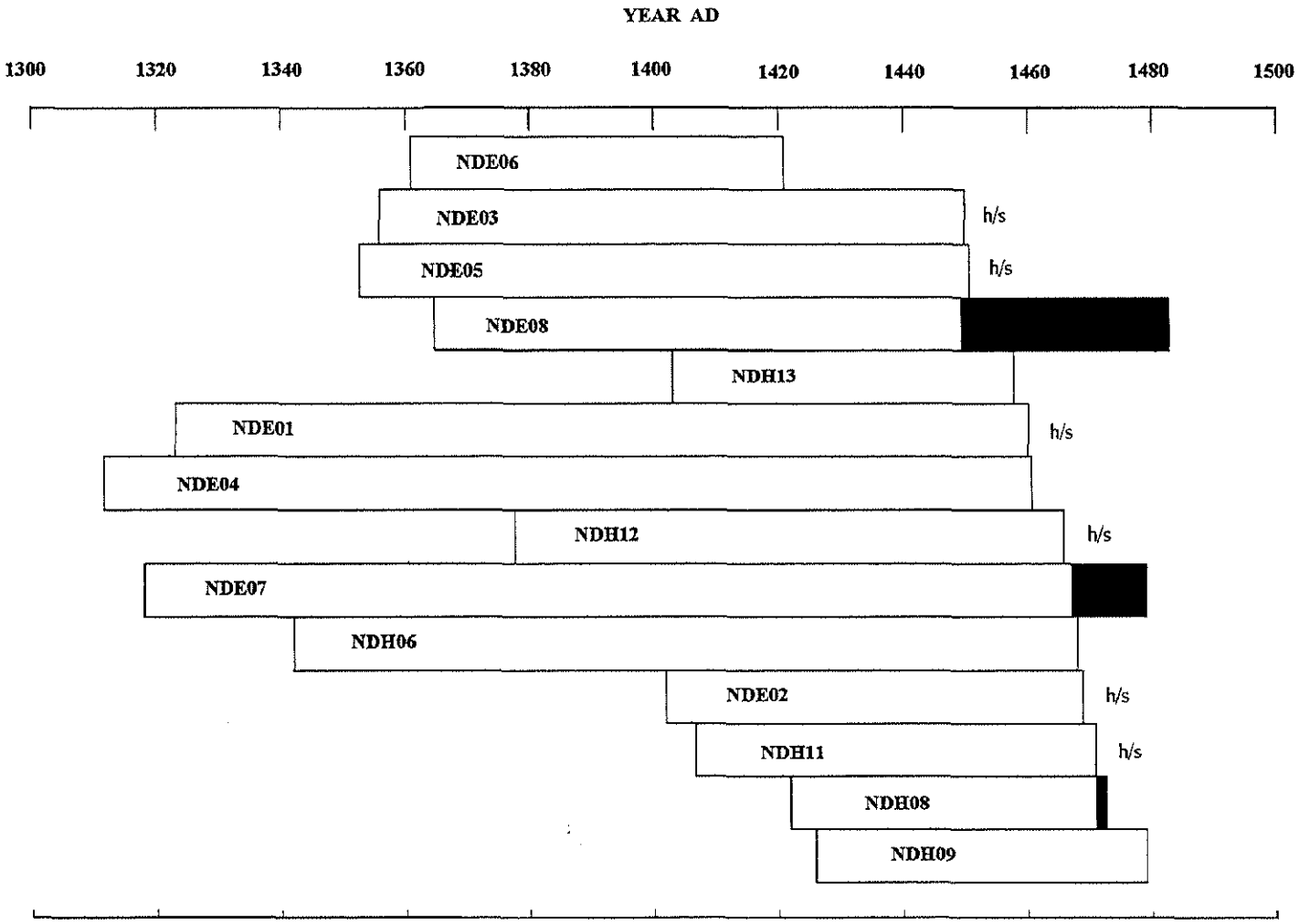

Figure D1: Diagram showing the relative positions of overlap of the samples from the East Barn (NDE) and phase II of Home Farm House (NDH). The shaded areas represent sapwood rings, and h/s = heartwood - sapwood boundary

Table D2: Dating of the chronology made from Phase II of Home Farm House combined with the East Barn, Home Farm, Newdigate, Surrey

	NDE_NDHII AD 1312 - 1483	
Dated reference or site master chronology	***t*-value**	**overlap (yrs)**
London 1175 (Tyers pers comm)	9.6	172
Hants 97 (Miles pers comm)	8.6	172
East Midlands (Laxton and Litton 1988)	8.4	172
Oxon 93 (Miles pers comm)	7.2	172
Mary Rose 'original' (Bridge unpubl)	8.0	150
Sherborne Abbey (Bridge 1983)	7.4	136
Windsor Castle kitchen (Hillam and Groves 1996)	7.1	153
Field Place Barn (Bridge unpubl)	6.6	154
Hereford Farmers Club (Tyers 1996)	6.4	171
Cowfold (Tyers pers comm)	6.1	107
Addington (Bridge 1998)	5.3	115

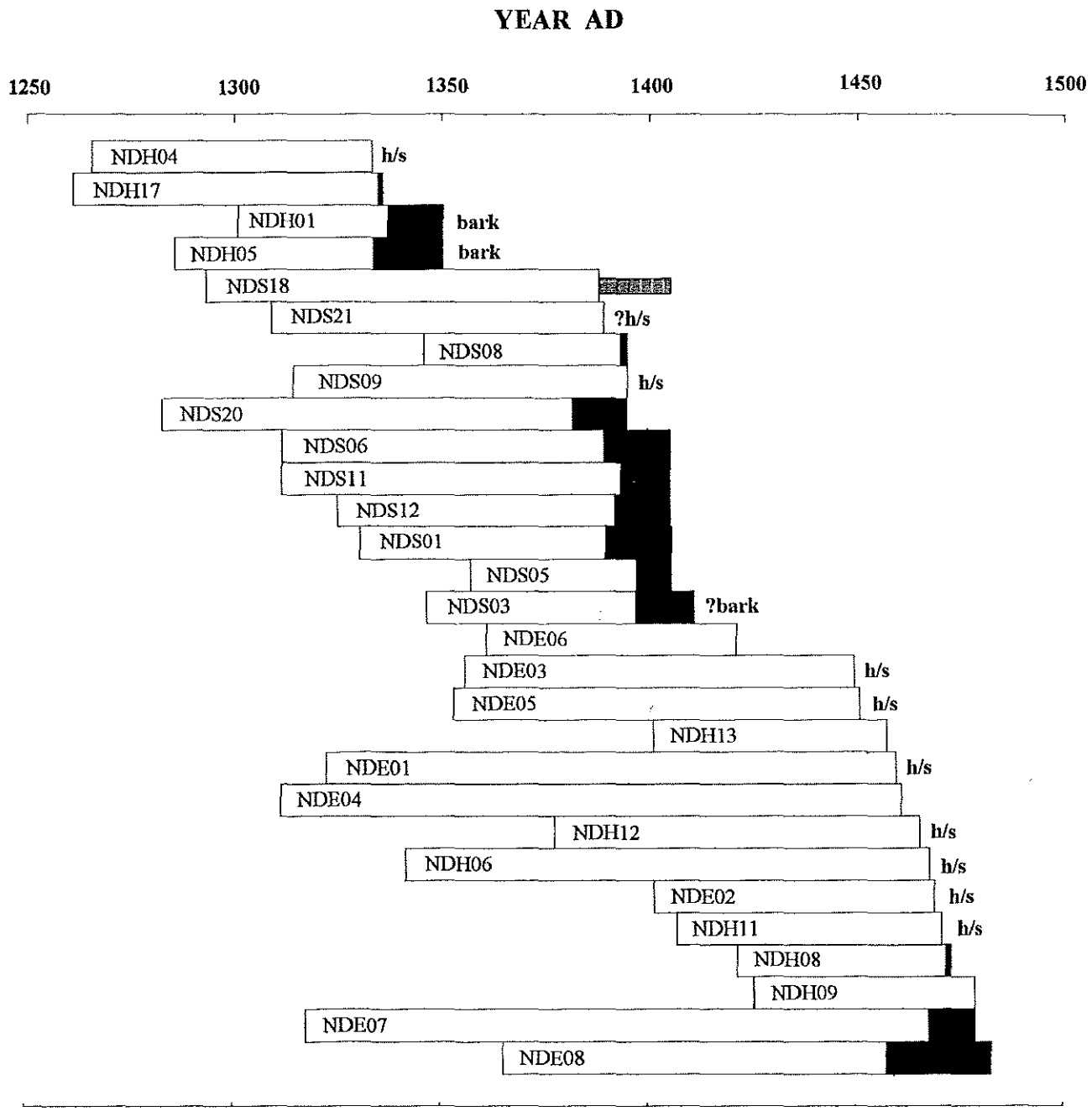

Figure D2: Diagram showing the relative positions of overlap of the dated samples used to construct the site chronology NEWDIGATE1. The dark shaded areas represent sapwood rings, the lighter-shaded narrow bar represents unmeasured sapwood rings, and h/s = heartwood - sapwood boundary

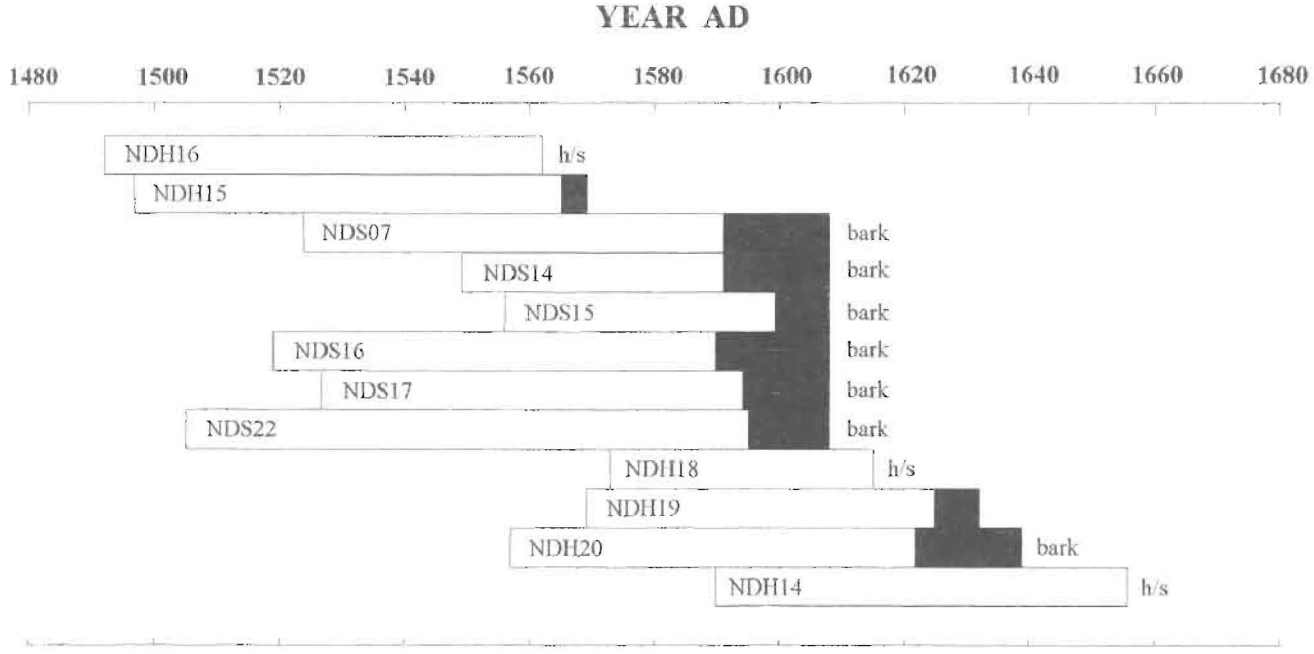

Figure D3: Diagram showing the relative positions of overlap of the dated samples used to construct the site chronology NEWDIGATE2. The dark shaded areas represent sapwood rings, and h/s = heartwood - sapwood boundary

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APPENDIX

Tree-ring data from oaks at Home Farm, Newdigate, Surrey

Year	ring widths (0. 01mm)	No of trees
HOUSE PHASE I		
AD1261	390 533 624 601 520 514 371 464 437 451	1 1 1 1 1 2 2 2 2 2
	456 289 474 364 312 218 256 240 312 409	2 2 2 2 2 2 2 2 2 2
	344 380 385 326 335 253 198 141 252 379	2 2 2 2 2 3 3 3 3 3
	325 461 397 423 334 306 237 156 173 210	3 3 3 3 3 3 3 3 3 3
AD1301	232 268 181 208 216 190 304 265 150 148	4 4 4 4 4 4 4 4 4 4
	185 208 207 209 218 184 197 165 191 162	4 4 4 4 4 4 4 4 4 4
	175 147 113 93 95 112 177 165 175 160	4 4 4 4 4 4 4 4 4 4
	98 146 183 165 217 148 106 106 117 109	4 4 4 3 3 3 2 2 2 2
	93 71 62 63 107 99 90 98 82 97	2 2 2 2 2 2 2 2 2 2
AD1351	95	2
HOUSE PHASE II		
AD1342	116 49 78 132 116 174 216 308 199	1 1 1 1 1 1 1 1 1
AD1351	257 196 287 202 72 109 94 89 202 195	1 1 1 1 1 1 1 1 1 1
	266 389 277 312 290 303 176 208 190 159	1 1 1 1 1 1 1 1 1 1
	110 204 192 215 154 158 115 204 266 165	1 1 1 1 1 1 1 2 2 2
	178 202 176 168 161 274 218 192 144 129	2 2 2 2 2 2 2 2 2 2
	164 150 175 162 169 205 151 169 188 161	2 2 2 2 2 2 2 2 2 2
AD1401	230 184 291 250 233 244 232 243 236 241	3 3 3 3 3 3 4 4 4 4
	249 207 127 132 140 154 190 216 170 262	4 4 4 4 4 4 4 4 4 4
	202 174 218 183 143 159 176 234 233 197	4 5 5 5 5 6 6 6 6 6
	244 265 179 166 197 190 240 230 204 195	6 6 6 6 6 6 6 6 6 6
	238 193 194 174 145 133 157 176 183 181	6 6 6 6 6 6 6 6 6 6
AD1451	203 149 143 178 161 167 137 123 128 141	6 6 6 6 6 6 6 6 5 5
	115 119 164 120 146 163 155 182 198 164	5 5 5 5 5 5 4 4 3 3
	139 245 225 387 435 288 233 237 360	3 2 2 1 1 1 1 1 1
HOUSE PHASE III		
AD1492	184 303 344 228 333 333 237 257 177	1 1 1 1 1 2 2 3 3 3
AD1501	182 241 217 156 169 209 243 247 298 309	3 3 3 3 3 3 3 3 3 3
	297 247 261 262 268 227 230 331 347 175	3 3 3 3 3 3 3 3 3 3
	180 250 198 213 126 104 120 221 171 136	3 3 3 3 3 3 3 3 3 3
	254 266 233 250 187 257 245 304 279 362	3 3 3 3 3 3 3 3 3 3
	318 140 160 154 169 174 235 227 284 207	3 3 3 3 3 3 3 3 3 3
AD1551	298 184 196 219 264 234 222 194 186 165	3 3 3 3 3 3 3 3 3 3
	206 246 224 241 151 86 152 287 310	3 2 2 2 1 1 1 1

Year	ring widths (0. 01mm)	No of trees

HOUSE PHASE IV

NDH19

AD1569 356 409
459 436 301 249 324 225 264 147 188 319
239 199 264 256 306 222 291 201 236 120
117 138 124 119 134 176 143 176 182 186

AD1601 183 175 217 245 175 294 312 300 197 142
132 173 224 102 84 90 130 139 145 157
138 179 187 173 212 210 172 194 200 186
183 286

NDH20

AD1557 201 310 245 313
241 402 317 336 305 214 190 182 200 235
270 287 315 247 187 128 198 235 244 332
199 192 176 169 294 190 193 159 200 139
121 183 195 230 144 168 93 97 94 89

AD1601 118 97 127 130 104 165 199 308 293 250
163 193 240 216 253 271 272 190 164 236
282 290 248 233 248 171 186 169 211 152
150 176 152 134 175 132 186 284 255

Year	ring widths (0. 01mm)	No of trees
SOUTH BARN		
NDS_ONE		
AD1283	255 213 348 308 156 155 197 204	1 1 1 1 1 1 1 1
	208 308 211 217 191 184 173 122 128 178	1 1 2 2 2 2 2 2 2 2
AD1301	186 170 108 144 104 90 113 78 121 116	2 2 2 2 2 2 2 2 3 3
	156 276 279 330 382 313 330 298 431 299	3 5 5 5 6 6 6 6 6 6
	333 308 218 161 125 118 179 220 249 214	6 6 6 6 7 7 7 7 7 7
	164 208 262 279 307 239 216 222 256 241	8 8 8 8 8 8 8 8 8 8
	201 224 183 182 276 261 277 262 248 236	8 8 8 8 8 9 10 10 10 10
AD1351	303 224 268 240 194 187 192 175 225 230	10 10 10 10 10 10 11 11 11 11
	211 299 258 253 219 227 227 244 226 199	11 11 11 11 11 11 11 11 11 11
	157 180 165 215 189 200 156 202 217 170	11 11 11 11 11 11 11 11 11 11
	185 194 168 137 151 208 197 186 130 111	11 11 11 11 11 11 11 11 10 9
	104 124 144 139 160 156 138 168 166 142	9 9 9 9 9 6 6 6 6 6
AD1401	134 116 147 158 164 168 181 189 291 243	6 6 6 6 6 3 1 1 1 1
	253	1
NDS_TWO		
AD1505	544 310 341 277 308 440	1 1 1 1 1 1
	485 375 435 326 425 274 281 338 431 343	1 1 1 1 1 1 1 1 2 2
	398 474 382 238 255 282 243 269 203 153	2 2 2 3 3 3 4 4 4 4
	226 147 182 234 286 186 204 252 285 298	4 4 4 4 4 4 4 4 4 4
	237 183 202 114 181 182 212 205 339 272	4 4 4 4 4 4 4 4 5 5
AD1551	276 236 245 263 314 286 255 252 267 279	5 5 5 5 5 6 6 6 6 6
	321 295 297 263 208 144 243 287 257 276	6 6 6 6 6 6 6 6 6 6
	257 247 232 242 192 133 187 190 279 308	6 6 6 6 6 6 6 6 6 6
	227 218 224 241 302 309 255 234 256 182	6 6 6 6 6 6 6 6 6 6
	222 254 272 280 228 209 194 183 161 208	6 6 6 6 6 6 6 6 6 6
AD1601	245 224 247 216 178 215 169 154	6 6 6 6 6 6 6 6

Year	ring widths (0. 01mm)										No of trees									
EASTBARN																				
AD1312		47	26	28	37	105	52	27	57	69		1	1	1	1	1	1	2	2	2
	60	36	54	70	45	41	76	86	141	105	2	2	3	3	3	3	3	3	3	3
	59	115	167	176	167	125	103	108	138	105	3	3	3	3	3	3	3	3	3	3
	142	96	123	132	144	117	98	124	83	91	3	3	3	3	3	3	3	3	3	3
AD1351	117	107	171	146	119	163	155	148	189	183	3	3	4	4	4	5	5	5	5	5
	197	291	305	312	281	280	258	257	268	217	6	6	6	6	7	7	7	7	7	7
	181	269	279	400	291	261	226	273	344	294	7	7	7	7	7	7	7	7	7	7
	264	301	249	251	236	333	325	266	197	139	7	7	7	7	7	7	7	7	7	7
	145	168	191	176	219	240	174	221	226	190	7	7	7	7	7	7	7	7	7	7
AD1401	184	155	207	201	211	248	157	162	163	147	7	8	8	8	8	8	8	8	8	8
	206	142	106	138	150	127	160	174	121	223	8	8	8	8	8	8	8	8	8	8
	188	122	179	146	108	83	114	208	163	111	8	7	7	7	7	7	7	7	7	7
	140	186	100	107	138	173	176	163	114	124	7	7	7	7	7	7	7	7	7	7
	151	109	147	146	117	82	100	123	123	120	7	7	7	7	7	7	7	7	7	7
AD1451	153	106	111	116	129	162	131	134	116	144	6	5	5	5	5	5	5	5	5	5
	97	109	134	108	171	170	196	216	162	103	4	3	3	3	3	3	3	3	3	2
	71	92	92	111	162	132	84	85	121	84	2	2	2	2	2	2	2	2	2	1
	83	121	109								1	1	1							

Year	ring widths (0. 01mm)	No of trees
NEWDIGATE 1		
AD1261	390 533 624 601 520 514 371 464 437 451	3 3 3 3 3 6 6 6 6 6
	456 289 474 364 312 218 256 240 312 409	6 6 6 6 6 6 6 6 6 6
	344 380 367 310 337 259 194 143 247 361	6 6 7 7 7 10 10 10 10 10
	313 446 385 410 326 296 234 154 167 206	10 10 10 10 10 10 10 10 10 10
AD1301	191 245 182 211 219 199 259 202 134 116	10 10 10 10 10 10 10 10 11 11
	170 236 235 241 284 239 261 211 280 207	11 13 13 13 14 14 14 15 15 15
	235 206 154 122 111 121 190 193 201 176	15 15 15 15 16 16 16 16 16 16
	118 172 217 214 251 190 159 164 199 186	17 17 17 14 14 14 11 11 11 11
	148 153 121 121 191 174 201 194 190 177	11 12 12 12 12 13 14 14 14 14
AD1351	226 200 239 207 167 162 171 146 199 202	14 11 12 12 12 12 13 13 13 13
	194 285 257 257 229 243 225 229 228 200	14 14 14 14 15 15 15 15 15 15
	157 196 190 252 207 208 169 214 254 196	15 15 15 15 15 15 15 16 16 16
	191 204 185 165 171 247 227 208 154 123	16 16 16 16 16 16 16 16 16 15
	125 138 166 153 179 192 157 182 194 166	15 15 15 15 15 12 12 12 12 12
AD1401	177 142 199 191 190 214 199 197 211 200	13 13 13 13 13 10 9 9 9 9
	231 179 123 128 142 145 174 204 151 241	9 8 8 8 8 8 8 8 8 8
	206 164 217 177 133 134 154 221 215 172	8 8 8 8 8 9 9 9 9 9
	212 248 158 151 185 184 223 216 176 176	9 9 9 9 9 9 9 9 9 9
	209 168 170 160 130 111 138 154 160 155	9 9 9 9 9 9 9 9 9 9
AD1451	173 132 129 156 148 158 135 128 118 141	9 8 8 8 8 8 8 8 7 7
	108 110 151 114 146 158 160 181 165 139	7 7 7 7 7 7 6 6 5 5
	112 168 158 203 253 184 133 136 201 84	5 4 4 3 3 3 3 3 3 1
	83 121 109	1 1 1
NEWDIGATE 2		
AD1492	184 303 344 228 333 333 237 257 177	1 1 1 1 1 2 2 3 3
AD1501	182 241 217 156 263 234 268 255 301 341	3 3 3 3 4 4 4 4 4 4
	344 279 305 278 307 238 243 333 381 242	4 4 4 4 4 4 4 4 5 5
	267 339 272 225 190 193 190 248 189 146	5 5 5 6 6 6 7 7 7 7
	238 198 204 241 244 216 221 274 282 325	7 7 7 7 7 7 7 7 7 7
	272 164 184 131 176 179 222 214 318 248	7 7 7 7 7 7 7 7 8 8
AD1551	284 216 226 246 295 268 240 240 241 248	8 8 8 8 8 9 10 10 10 10
	279 291 283 266 206 146 225 274 268 288	10 10 9 9 9 8 8 8 9 8
	284 276 251 243 208 144 198 190 264 313	8 8 8 8 8 8 8 8 8 8
	225 213 223 234 301 284 252 221 247 169	8 8 8 8 8 8 8 8 8 8
	196 231 244 254 206 200 175 171 156 190	8 8 8 8 8 8 8 8 8 8
AD1601	222 202 228 209 168 218 190 192 246 197	8 8 8 8 8 8 8 8 2 2
	148 184 233 160 169 181 202 165 155 197	2 2 2 2 2 2 2 2 2 2
	211 235 218 204 231 191 180 182 206 170	2 2 2 2 2 2 2 2 2 2
	167 232 153 135 176 133 187 285 256	2 2 1 1 1 1 1 1 1