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The Chequers Public House  
9 Goddards Lane  
Chipping Norton  
Oxfordshire

Tree-ring Analysis of Oak Timbers

Martin Bridge and Cathy Tyers

Discovery, Innovation and Science in the Historic Environment



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Research Report Series 2-2020

THE CHEQUERS PUBLIC HOUSE  
9 GODDARDS LANE  
CHIPPING NORTON  
OXFORDSHIRE

## **Tree-ring Analysis of Oak Timbers**

Martin Bridge and Cathy Tyers

NGR: SP 31358 27255

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ISSN 2059-4453 (Online)

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## SUMMARY

Timbers in the north-south range and east-west range were sampled. Two principal rafters from the roof of the east-west range cross-matched each other and were dated, along with the collar from the same truss, the likely felling date range for these timbers being AD 1444–76. A single purlin from the roof of the north-south range had a heartwood/sapwood boundary date of AD 1603, and its remaining degraded sapwood allowed a felling date range of c AD 1613–18 to be derived. This roof contains several possibly re-used timbers however. A single beam in the rear ground-floor bar area, also in the north-south range, gave a likely felling date range of AD 1772–1804.

## CONTRIBUTORS

Martin Bridge and Cathy Tyers

## ACKNOWLEDGEMENTS

The site was one of several sampled for tree-ring dating as part of the Early Fabric in Historic Towns: Chipping Norton project, and we thank Rebecca Lane for managing the project on behalf of Historic England. We'd also like to thank the landlord and his family for being so accommodating with this work. We are indebted to members of the Oxfordshire Buildings Record and Chipping Norton Buildings Record, especially Victoria Hubbard for her extensive input on coordinating the project, and her friendly encouragement, and Jan Cliffe for permission to reproduce her drawings in Figures 2, 3 and 5. We'd also like to thank Shahina Farid for commissioning the work, and her input into preparing this report.

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## INTRODUCTION

The Early Fabric in Historic Towns: Voluntary Group Projects, funded by Historic England, have been developed in the recognition and acknowledgement of the excellent work being undertaken by local vernacular groups in the study of local architectural trends and fabrics. The intention of these projects is to encourage this type of study through the provision of support and facilitate training of more people in building analysis and recording. The local projects were coordinated by Rebecca Lane (Historic England South West Region: Architectural Investigation).

### Early Fabric in Chipping Norton Project

Whilst Chipping Norton features in a study on historic towns in Oxfordshire (Rodwell 1975), and some buildings have been recorded and published in detail (eg Simons and Phimester 2005), no systematic research had been undertaken on the buildings of the town before this project.

The project examined vernacular historic buildings in the centre of Chipping Norton, aiming to improve understanding of the morphology and development of the historic town plan and to understand this within the framework of economic and social change. It aimed to identify early plan forms and to understand the dates of the introduction of vernacular architectural details (eg in materials, carpentry, fenestration, and decorative features), thus mapping the survival of early (pre-1900) fabric and revealing the architectural evolution of the town's buildings.

Initially, 21 properties were identified that were thought to be key to understanding the town's architectural development for a programme of comprehensive investigation. These properties were assessed for their suitability for dendrochronology and 12 that contained oak timber considered suitable for analysis were initially sampled and analysed. Oak timbers from seven of these buildings could be dated by ring-width dendrochronology, whilst radiocarbon wiggle-matching was undertaken for one of the buildings where the ring-width dendrochronology had produced an undated site master chronology.

The results of the project are presented by Rosen and Cliffe (2017). The reports produced on the historic buildings recorded as part of this project by the Chipping Norton Buildings Record/Oxfordshire Buildings Record (OBR) will be deposited in the Oxfordshire Historic Environment Record.

### The Chequers Public House

The Chequers Public House (formerly recorded as the Blue Anchor) sits in the north-west corner of the old market square area of the town (Fig 1). It is a grade II listed building (LEN 1052654), constructed of coursed and squared stone rubble with two storeys and an attic and of L-shaped plan. As an important early building in the town, it was a natural candidate for dendrochronological investigation as part of the *Early Fabric in Historic Towns: Chipping Norton* project. It was hoped that any results might give additional evidence on the development of the building and hence enhance understanding of its part in the early development of this historic

town. Of particular interest was the truss found in the east-west range, parallel to Goddards Lane, which has principal rafters with curved feet, thought to be of some age by the OBR, who had investigated the building, and the relationships between this east-west range and that truncating it to the west, which runs north-south. This north-south range roof contains many re-used timbers. It has principal rafter couples and two tiers of purlins, many of which are elm.

## METHODOLOGY

Fieldwork for the present study was carried out in early September 2015, following an initial assessment of the potential for dating a few weeks beforehand, and consultation with those involved in the project and the landlord of the Chequers. In the initial assessment, accessible oak timbers with more than 50 rings and where possible traces of sapwood were sought, although slightly shorter sequences are sometimes sampled if little other material is available. Those timbers judged to be potentially useful were cored using a 16mm auger attached to an electric drill. The cores were labelled, and stored for subsequent analysis.

The cores were polished on a belt sander using 80 to 400 grit abrasive paper to allow the ring boundaries to be clearly distinguished. The samples had their tree-ring sequences measured to an accuracy of 0.01mm, using a specially constructed system utilising a binocular microscope with the sample mounted on a travelling stage with a linear transducer linked to a PC, which recorded the ring widths into a dataset. The software used in measuring and subsequent analysis was written by Ian Tyers (2004). Cross-matching was attempted by a process of qualified statistical comparison by computer, supported by visual checks. The ring-width series were compared for statistical cross-matching, using a variant of the Belfast CROS program (Baillie and Pilcher 1973). Ring sequences were plotted on the computer monitor to allow visual comparisons to be made between sequences. This method provides a measure of quality control in identifying any potential errors in the measurements when the samples cross-match.

In comparing one sample or site master against other samples or chronologies,  $t$ -values over 3.5 are considered significant, although in reality it is common to find demonstrably spurious  $t$ -values of 4 and 5 because more than one matching position is indicated. For this reason, dendrochronologists prefer to see some  $t$ -value in the range of 5, 6, and higher, and for these to be well replicated from different, independent chronologies with both local and regional chronologies well represented, except where imported timbers are identified. Where two individual samples match together with a  $t$ -value of 10 or above, and visually exhibit exceptionally similar ring patterns, they may have originated from the same parent tree. Same-tree matches can also be identified through the external characteristics of the timber itself, such as knots and shake patterns. Lower  $t$ -values however do not preclude same tree derivation.

### Ascribing felling dates and date ranges

Once a tree-ring sequence has been firmly dated in time, a felling date, or date range, is ascribed where possible. With samples which have sapwood complete to



the underside of, or including bark, this process is relatively straightforward. Depending on the completeness of the final ring (ie if it has only the spring vessels or early wood formed, or the latewood or summer growth) a precise felling date and season can be given. If the sapwood is partially missing, or if only a heartwood/sapwood transition boundary survives, then an estimated felling date range can be given for each sample. The number of sapwood rings can be estimated by using an empirically derived sapwood estimate with a given confidence limit. If no sapwood or heartwood/sapwood boundary survives then the minimum number of sapwood rings from the appropriate sapwood estimate is added to the last measured ring to give a *terminus post quem* (*tpq*) or felled-after date.

A review of the geographical distribution of dated sapwood data from historic timbers has shown that a sapwood estimate relevant to the region of origin should be used in interpretation, which in this area is 9–41 rings (Miles 1997). It must be emphasised that dendrochronology can only date when a tree has been felled, not when the timber was used to construct the structure or object under study.

## RESULTS AND DISCUSSION

Samples were taken from several areas of the property, and details are given in Table 1, with the sample locations illustrated in Figures 2, 3 and 5, and the ring-width data of all measured samples given in the Appendix. Figure 4 is a photograph of the west truss of the east-west range. Two ceiling beams from the ground-floor bar areas in the north-south range were sampled, but that in the south (front) bar area was found to be of elm (*Ulmus* sp.) and this was rejected from further analysis. Six timbers were sampled from the roof of the east-west range parallel to Goddards Lane, thought to be the oldest part of the building, and five timbers were sampled from the roof of the north-south (front) range, lying parallel to Spring Street. This latter roof had several apparently re-used timbers.

In the east-west range, the ring width series from the two principal rafters cross-matched each other well ( $t = 6.5$  with 71 years overlap). The visual comparison of the ring series plot from the collar with those from the two principal rafters suggested possible cross-matching but no significant  $t$ -values were produced. However the pair of principal rafters and the collar could be dated independently with the database of oak reference material indicating that the relative position identified visually was actually correct. The three series were, therefore, combined to form a 77-year long site chronology, CNCHQ345, which was dated to the period AD 1362–1438, the strongest matches being shown in Table 2a. The mean heartwood/sapwood boundary date of AD 1435 for these three timbers suggests a likely felling date range of AD 1444–76, making this one of the oldest surviving roofs in the town.

The roof of the north-south range has been observed by the OBR clearly to have cut through the roof of the east-west range dated above. It appears to have been either built with a collection of odd timbers, or to have been subsequently repaired by the use of re-used timbers, and several were found to have too few rings to be suitable candidates for dendrochronology. Of the five timbers sampled (Table 1), two purlins yielded ring sequences of fewer than 40 rings, and these were rejected from

further analysis. The core from one timber had a break, and was measured as two separate short sequences, neither of which cross-matched other series from the site, and could not be dated independently. Only one series was successfully cross-dated, the upper purlin from the east side of the north-south range. This sample retained complete sapwood, but it was so degraded that the rings could not be fully resolved, but it did allow a narrow felling date range to be determined for this timber. Table 2b shows the strongest matches for the series dated to the period AD 1544–1603, the derived felling date range being *c* AD 1613–18.

A ceiling beam from the north ground-floor bar seating area in the north-south range gave a ring series dated to the period AD 1630–1763 (Table 2c), the outer measured ring being the heartwood/sapwood boundary, giving a likely felling date range of AD 1772–1804. The OBR investigation into the history of this building revealed a record in Jackson’s Oxford Journal dated 15th August 1801 concerning the sale of this building (then known as the Blue Anchor) in which it is noted, “... the Whole recently put in complete Repair at a very considerable Expense...” and it seems reasonable to suggest that this beam may relate to that period of development of the property.

The sequence formed from the east-west range truss matches very well with local sites (Table 2a), particularly sites in the nearby town of Burford, suggesting a very local origin for the timbers. The two individually dated timbers match with sites more geographically spread (Tables 2b and 2c) but are most likely to be also of local origin.

This study has given an early date for the oldest part of the building, making it earlier than the nearby Guildhall (Bridge and Tyers 2020a), sometimes named as the earliest building in the town. It has a similar felling date range to the roof at 8 Market Street (AD 1424–56), another building dated as part of this town study (Bridge and Tyers 2020b), and may therefore be pointing to the time of building around the market square generally.

A bar-diagram illustrating the relative positions of overlap and likely felling date ranges for the timbers dated by ring-width dendrochronology from The Chequers Public House is provided in Figure 6.

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## TABLES

Table 1: Details of samples taken from The Chequers Inn, Goddard's Lane, Chipping Norton, Oxfordshire

| Sample number                           | Timber and position                                       | No of rings | Mean ring width (mm) | Dates spanning (AD) | h/s boundary date (AD) | Sapwood rings | Mean sensitivity | Felling date ranges (AD) |
|---|---|-------------|----------------------|---------------------|------------------------|---------------|------------------|--------------------------|
| <b>Ground floor – north-south range</b> |   |             |                      |                     |                        |               |                  |                          |
| cnchq01                                 | North bar, ceiling beam                                   | 134         | 1.09                 | 1630–1763           | 1763                   | h/s           | 0.26             | 1772–1804                |
| cnchq02*                                | South bar, ceiling beam                                   | NM          | -                    | -                   | -                      | -             | -                | -                        |
| <b>Roof – east-west range</b>           |   |             |                      |                     |                        |               |                  |                          |
| cnchq03                                 | North principal rafter                                    | 75          | 2.32                 | 1362–1436           | 1436                   | h/s           | 0.21             | 1445–77                  |
| cnchq04                                 | Collar  | 73          | 1.44                 | 1366–1438           | 1438                   | h/s           | 0.20             | 1447–79                  |
| cnchq05                                 | South principal rafter                                    | 71          | 1.16                 | 1365–1435           | 1432                   | 3             | 0.20             | 1441–73                  |
| cnchq06                                 | Tiebeam   | 84          | 1.68                 | -                   | -                      | 26¼C          | 0.24             | -                        |
| cnchq07                                 | Upper south purlin, east of truss (re-used?)              | 70          | 1.89                 | -                   | -                      | 14(+8NM)      | 0.35             | -                        |
| cnchq08                                 | Lower south purlin, west of truss                         | <40         | NM                   | -                   | -                      | -             | -                | -                        |
| <b>Roof – north-south (front) range</b> |   |             |                      |                     |                        |               |                  |                          |
| cnchq09                                 | East upper purlin   | 60          | 2.05                 | 1544–1603           | 1603                   | h/s (+10–15C) | 0.20             | c 1613–18                |
| cnchq10                                 | East lower purlin   | <40         | NM                   | -                   | -                      | -             | -                | -                        |
| cnchq11                                 | West lower purlin   | <40         | NM                   | -                   | -                      | -             | -                | -                        |
| cnchq12                                 | West upper purlin   | 81          | 1.03                 | -                   | -                      | 18 (+8NM)     | 0.31             | -                        |
| cnchq13i                                | Lower purlin on rear of west slope of the middle roof bay | 43          | 1.76                 | -                   | -                      | -             | 0.37             | -                        |
| cnchq13ii                               | <i>ditto</i>  | 38          | 1.44                 | -                   | -                      | 4             | 0.28             | -                        |

Key: NM = not measured; h/s = heartwood-sapwood boundary; C = complete sapwood, winter felled; ¼C = complete sapwood, felled the following summer; \* = elm (*Ulmus* sp.)

Table 2a: Dating evidence for the site master CNCHQ345 AD 1362–1438

| Source region:  | Chronology name:                   | Publication reference:        | File name: | Span of chronology (AD) | Overlap (years) | t-value |
|-----------------|------------------------------------|-------------------------------|------------|-------------------------|-----------------|---------|
| Oxfordshire     | 162 The Hill, Burford              | (Miles <i>et al</i> 2006)     | BURFRD6    | 1336–1458               | 77              | 8.2     |
| Gloucestershire | Weavers Hall, Cirencester          | (Bridge and Miles 2015)       | WEAVERS    | 1340–1475               | 77              | 7.9     |
| Oxfordshire     | 25 Sheep Street, Burford           | (Miles <i>et al</i> 2006)     | BURFRD2    | 1321–1486               | 77              | 7.8     |
| Oxfordshire     | Pebble Court, Swinbrook            | (Miles and Haddon-Reece 1992) | PEBBLE     | 1281–1436               | 75              | 7.8     |
| Gloucestershire | Glebe Cottage, Hanley Castle       | (Bridge unpubl)               | GLEBEHC    | 1359–1457               | 77              | 7.2     |
| Wiltshire       | Manor Farm barn, Kingston Deverill | (Tyers <i>et al</i> 2015)     | KDMBSQ01   | 1260–1409               | 48              | 6.9     |
| Oxfordshire     | 82-84 High Street, Burford         | (Miles <i>et al</i> 2006)     | BURFRD4    | 1307–1472               | 77              | 6.3     |
| Hertfordshire   | Ware Priory, High Street, Ware     | (Howard <i>et al</i> 1997a)   | WAREPRRY   | 1223–1416               | 55              | 5.9     |
| Norfolk         | St Mary's Church, Feltwell         | (Howard and Arnold 2009)      | FTWASQ01   | 1303–1494               | 77              | 5.9     |
| Shropshire      | Aston Eyre, gatehouse              | (Miles and Worthington 1998)  | ASTNEYR3   | 1357–1612               | 77              | 5.9     |
| Wiltshire       | Devizes Castle                     | (Miles <i>et al</i> 2006)     | DEVHEADX   | 1213–1407               | 46              | 5.8     |
| Hampshire       | Strete Farm, North Warnborough     | (Miles and Worthington 2002)  | STRETEFM   | 1332–1505               | 77              | 5.8     |

Table 2b: Dating evidence for the site sequence CNCHQ09 AD 1544–1603

| Source region:  | Chronology name:              | Publication reference:       | File name: | Span of chronology (AD) | Overlap (years) | t-value |
|-----------------|-------------------------------|------------------------------|------------|-------------------------|-----------------|---------|
| Kent            | Knole                         | (Miles and Bridge 2010)      | KNOLE1     | 1431–1605               | 60              | 8.0     |
| Buckinghamshire | Olney bellframe               | (Miles <i>et al</i> 2009)    | OLNEY      | 1472–1625               | 60              | 8.0     |
| Worcestershire  | Hartlebury Castle Chapel Roof | (Tyers 2008a)                | HARTCHPL   | 1399–1678               | 60              | 7.6     |
| Oxfordshire     | Cottesmore Farm, Ewelme       | (Miles and Worthington 1997) | COTTESMR   | 1433–1601               | 58              | 7.5     |
| Worcestershire  | Hoarstone Farm, Bewdley       | (Tyers 2008b)                | HOARSTNE   | 1350–1617               | 60              | 7.2     |
| Norfolk         | Hales Hall, Loddon            | (Arnold and Howard 2014)     | HHBASQ02   | 1458–1594               | 51              | 7.0     |
| Worcestershire  | Upwich, Droitwich             | (Groves and Hillam 1997)     | UPWICH3    | 1454–1651               | 60              | 7.0     |
| Shropshire      | Stokesay Castle               | (Miles and Worthington 1997) | STOKE5     | 1463–1662               | 60              | 7.0     |
| Suffolk         | Cratfield bellframe           | (Bridge 2008)                | CRATFLD1   | 1503–1639               | 60              | 6.7     |
| Warwickshire    | Astley Castle                 | (Howard <i>et al</i> 1997b)  | ASTCSQ01   | 1495–1627               | 60              | 6.5     |
| Shropshire      | Yews Cottage, Clunbury        | (Miles <i>et al</i> 2006)    | YEWSCOT    | 1540–1646               | 60              | 6.4     |
| Kent            | Swaylands Barn, Penshurst     | (Arnold <i>et al</i> 2001)   | SWAASQ01   | 1515–1616               | 60              | 6.3     |



Table 2c: Dating evidence for the site sequence CNCHQ01 AD 1630–1763

| Source region:   | Chronology name:            | Publication reference:       | File name: | Span of chronology (AD) | Overlap (years) | t-value |
|------------------|-----------------------------|------------------------------|------------|-------------------------|-----------------|---------|
| Northamptonshire | Apethopre Hall, Apethorpe   | (Arnold <i>et al</i> 2008)   | APTASQ02   | 1574–1749               | 111             | 8.0     |
| Buckinghamshire  | Claydon House               | (Tyers 1995)                 | CLAYDON    | 1613–1756               | 127             | 7.1     |
| Buckinghamshire  | Brill Windmill              | (Miles <i>et al</i> 2007)    | BRILL      | 1585–1759               | 130             | 7.0     |
| Leicestershire   | Kibworth Harcourt           | (Arnold <i>et al</i> 2004)   | KIBASQ01   | 1582–1773               | 134             | 7.0     |
| Oxfordshire      | Magdalen College, Oxford    | (Miles and Bridge 2015)      | MAGDALN9   | 1612–1716               | 132             | 6.6     |
| Oxfordshire      | Christ Church Library       | (Miles pers comm.)           | CCL        | 1565–1737               | 108             | 6.6     |
| Oxfordshire      | Old Clarendon Building      | (Worthington and Miles 2006) | CLRNDNOX   | 1539–1711               | 82              | 6.4     |
| Shropshire       | Buildwas Abbey              | (Miles 2002)                 | BUILDWS3   | 1563–1687               | 58              | 6.4     |
| Lincolnshire     | Bay Hall, Benington         | (Howard <i>et al</i> 1998)   | BENASQ01   | 1591–1717               | 88              | 6.4     |
| Hampshire        | Church Cottage, Basingstoke | (Miles <i>et al</i> 2007)    | BSNGSTK2   | 1635–1746               | 112             | 6.3     |
| Cambridgeshire   | Ely Cathedral               | (Arnold <i>et al</i> 2005)   | ELYCSQ05   | 1592–1794               | 133             | 6.3     |
| Lincolnshire     | Sneath's Mill, Lutton Gowts | (Arnold <i>et al</i> 2016)   | SNTMSQ01   | 1593–1728               | 99              | 6.2     |

# FIGURES

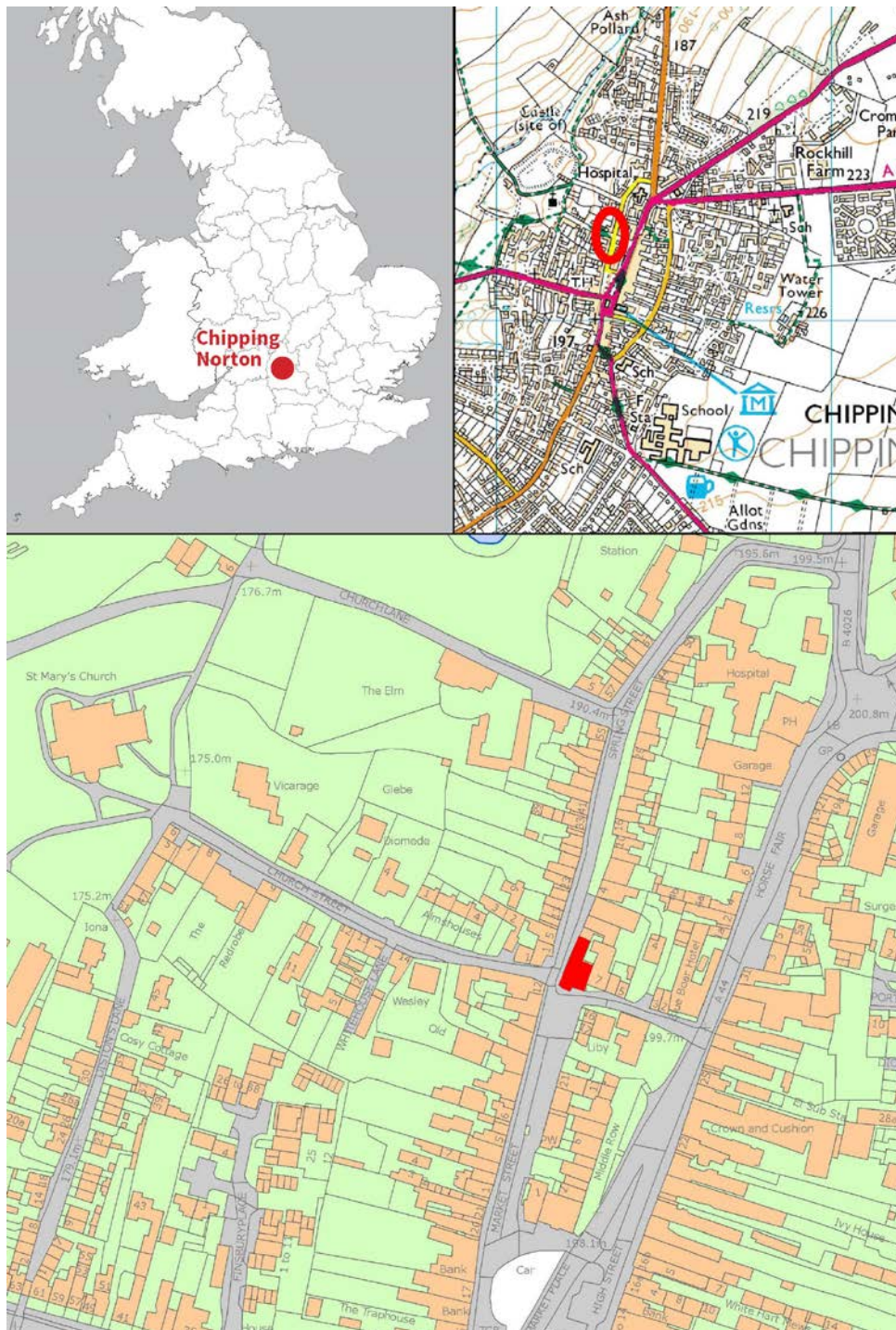


Figure 1: Maps to show the location of the Chequers Public House in Chipping Norton, marked in red. Scale: top right 1:15000; bottom 1:2000. © Crown Copyright and database right 2020. All rights reserved. Ordnance Survey Licence number 100024900. © British Crown and SeaZone Solutions Ltd 2020. All rights reserved. Licence number 102006.006. © Historic England

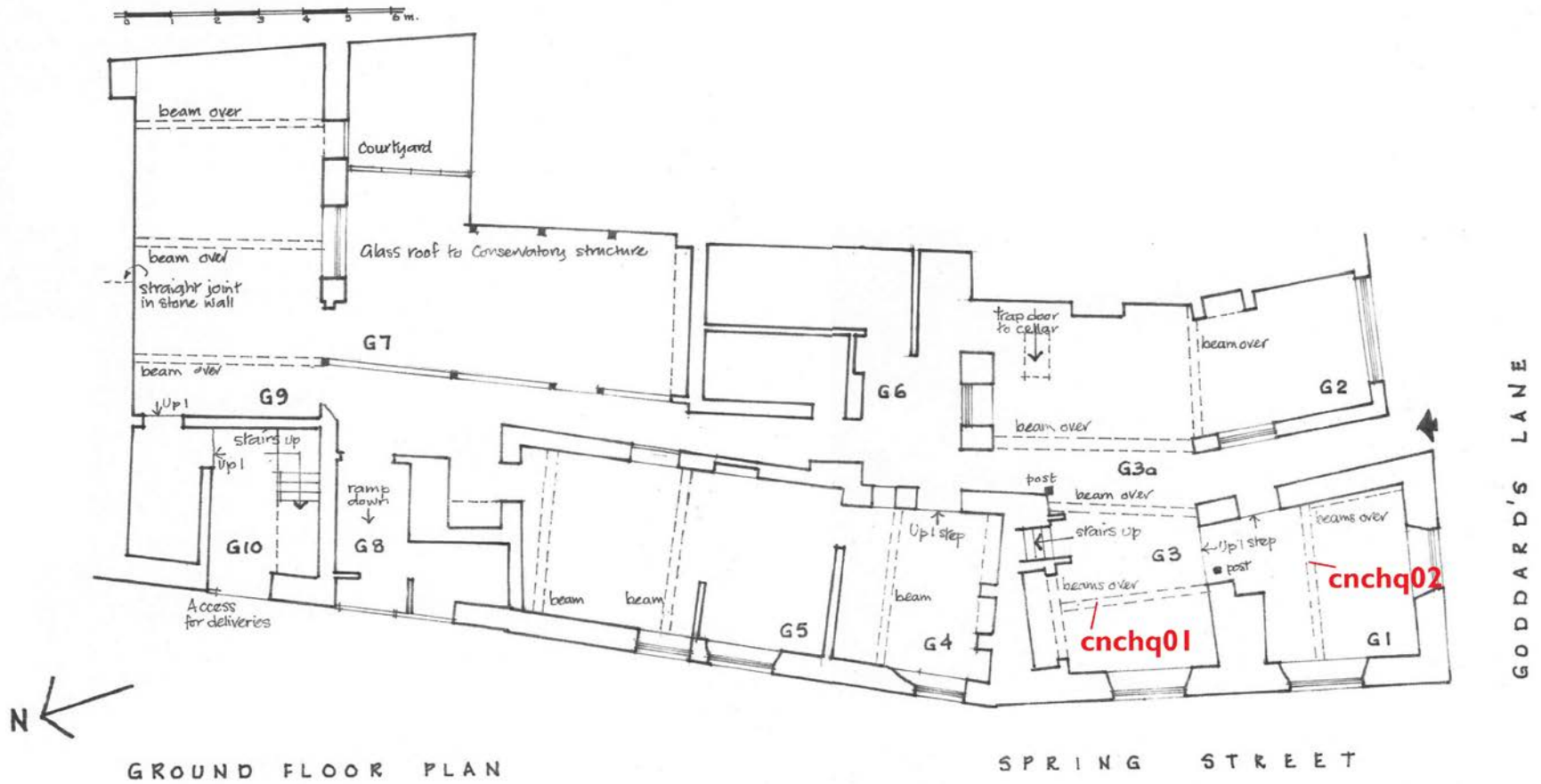


Figure 2: Drawing of the ground floor of The Chequers, showing the location of two beams sampled (based on an original by Jan Cliffe)

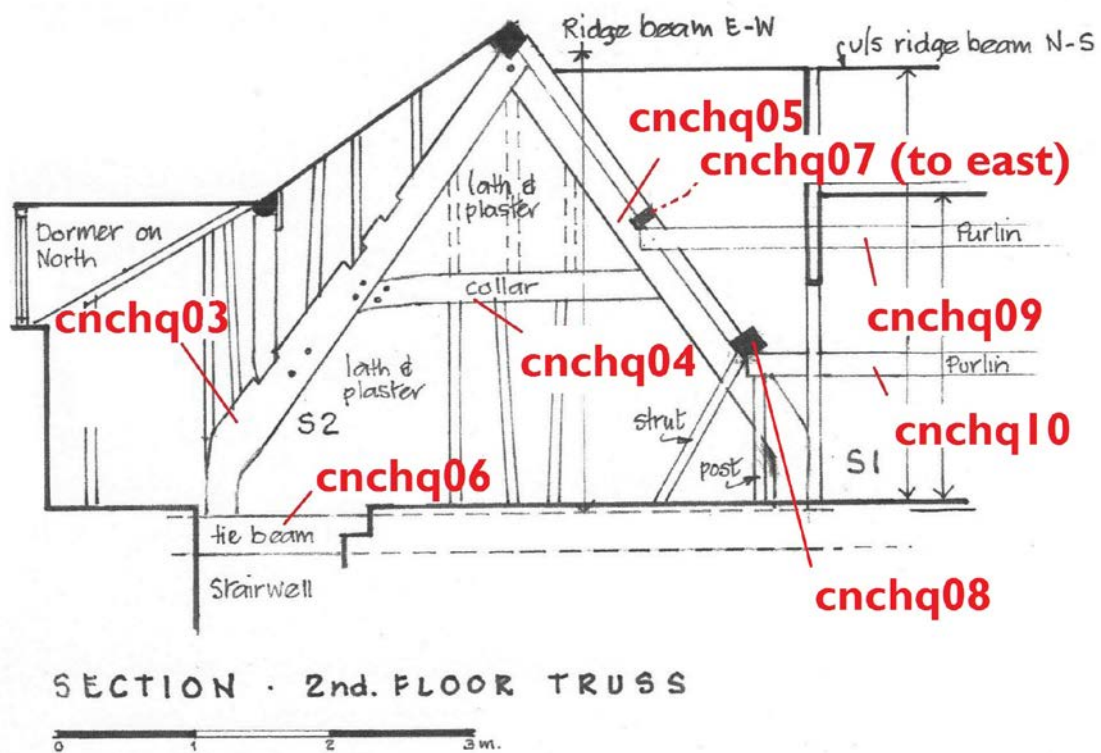


Figure 3: Drawing of the attic, looking east, showing the locations of several of the samples taken for dendrochronology (based on an original by Jan Cliffe)



*Figure 4: Photograph (looking east) of the upper part of the truss at the truncated west end of the east-west range (photo Martin Bridge)*

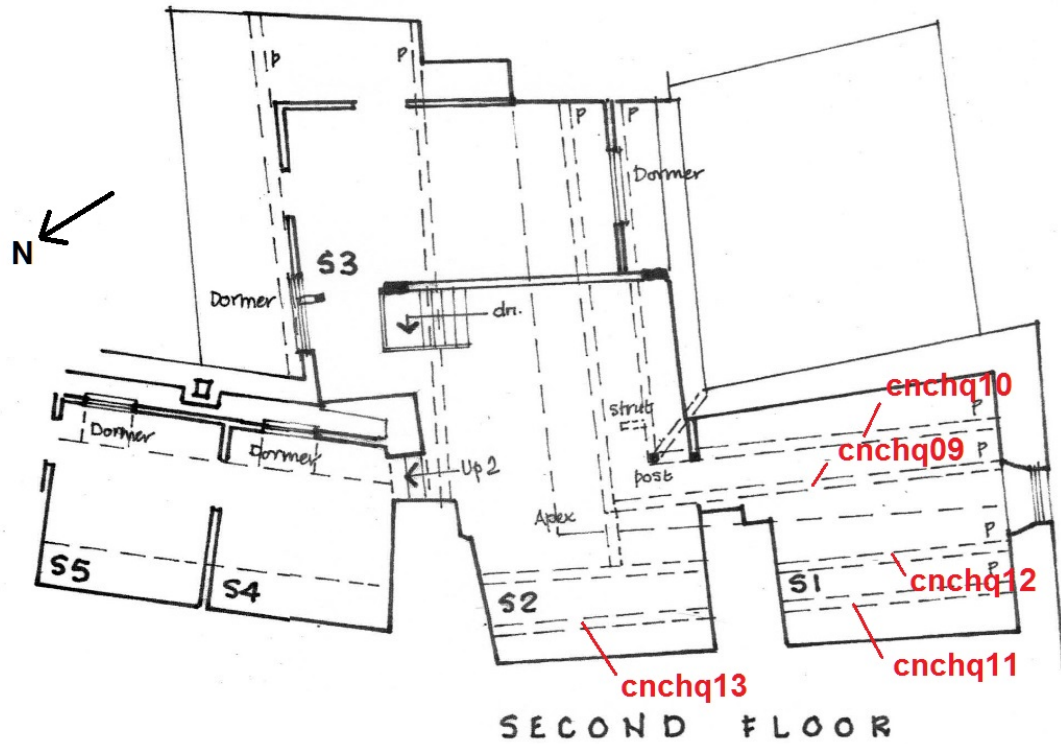


Figure 5: Plan of the attic, looking east, showing the locations of several of the samples taken for dendrochronology (based on an original by Jan Cliffe)

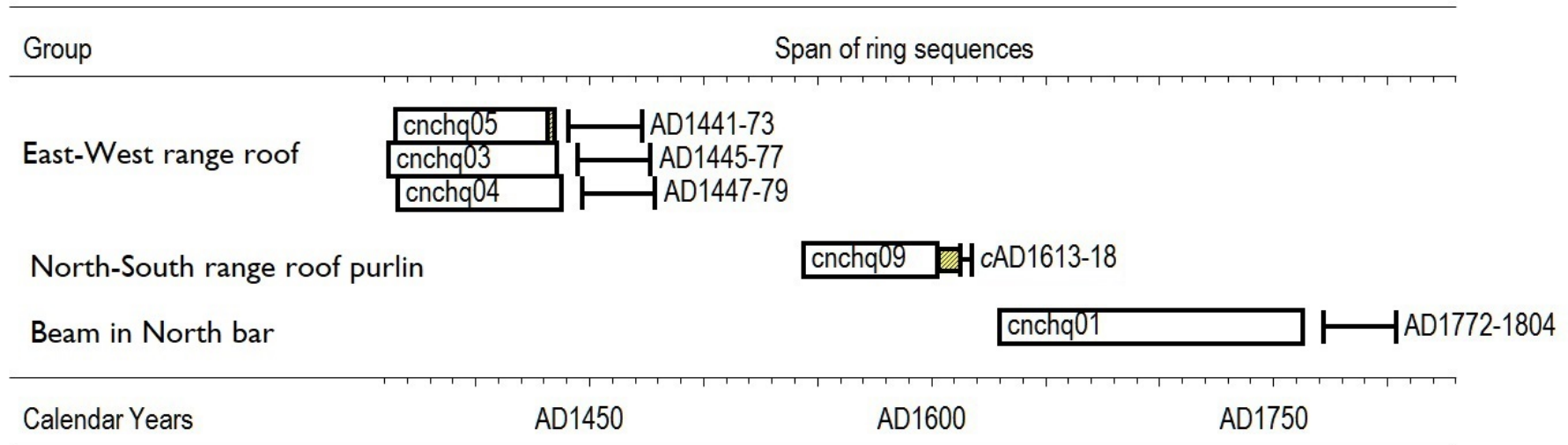


Figure 6: Bar diagram showing the relative positions of overlap and likely felling date ranges for the individual dated samples from the Chequers Public House, Chipping Norton, Oxfordshire. White bars – heartwood; yellow hatched bars – sapwood; narrow sections of bar – additional unmeasured rings

## APPENDIX

Ring width values (0.01mm) for the sequences measured

### cnchq01

|     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 300 | 276 | 316 | 265 | 138 | 132 | 223 | 120 | 168 | 132 |
| 126 | 112 | 121 | 188 | 209 | 178 | 220 | 155 | 210 | 140 |
| 156 | 127 | 92  | 111 | 105 | 285 | 153 | 152 | 155 | 122 |
| 138 | 128 | 135 | 165 | 167 | 95  | 78  | 135 | 145 | 122 |
| 105 | 73  | 68  | 56  | 39  | 46  | 34  | 88  | 101 | 68  |
| 90  | 45  | 140 | 145 | 84  | 90  | 137 | 204 | 116 | 99  |
| 81  | 116 | 60  | 86  | 96  | 92  | 103 | 133 | 166 | 173 |
| 173 | 252 | 203 | 327 | 232 | 149 | 113 | 38  | 42  | 43  |
| 45  | 50  | 54  | 52  | 38  | 35  | 43  | 50  | 58  | 77  |
| 92  | 97  | 28  | 33  | 53  | 57  | 45  | 53  | 64  | 68  |
| 77  | 65  | 100 | 87  | 71  | 76  | 79  | 74  | 110 | 130 |
| 60  | 69  | 61  | 57  | 46  | 35  | 45  | 39  | 25  | 43  |
| 30  | 49  | 44  | 48  | 68  | 90  | 87  | 71  | 90  | 120 |
| 97  | 90  | 85  | 126 |     |     |     |     |     |     |

### cnchq03

|     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 294 | 417 | 470 | 369 | 220 | 251 | 365 | 427 | 282 | 140 |
| 230 | 222 | 182 | 189 | 258 | 240 | 266 | 267 | 206 | 214 |
| 234 | 300 | 310 | 393 | 398 | 278 | 360 | 217 | 149 | 236 |
| 200 | 258 | 168 | 154 | 305 | 276 | 457 | 370 | 385 | 281 |
| 260 | 239 | 405 | 296 | 284 | 190 | 256 | 252 | 160 | 161 |
| 124 | 138 | 143 | 152 | 118 | 135 | 95  | 115 | 111 | 132 |
| 118 | 166 | 163 | 130 | 124 | 107 | 126 | 191 | 206 | 221 |
| 226 | 186 | 164 | 137 | 109 |     |     |     |     |     |

### cnchq04

|     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 285 | 365 | 381 | 390 | 423 | 332 | 272 | 189 | 151 | 201 |
| 268 | 292 | 265 | 285 | 255 | 276 | 164 | 156 | 187 | 145 |
| 188 | 105 | 100 | 96  | 135 | 216 | 251 | 174 | 208 | 122 |
| 158 | 124 | 121 | 106 | 86  | 125 | 80  | 124 | 102 | 90  |
| 89  | 66  | 71  | 69  | 60  | 76  | 80  | 118 | 85  | 96  |
| 66  | 66  | 65  | 63  | 67  | 78  | 73  | 103 | 105 | 73  |
| 62  | 54  | 98  | 92  | 77  | 63  | 83  | 78  | 90  | 65  |
| 55  | 65  | 104 |     |     |     |     |     |     |     |

### cnchq05

|     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 167 | 99  | 83  | 110 | 132 | 90  | 52  | 87  | 97  | 87  |
| 68  | 85  | 107 | 149 | 130 | 129 | 110 | 125 | 127 | 143 |
| 134 | 159 | 123 | 102 | 74  | 75  | 103 | 100 | 144 | 121 |
| 114 | 168 | 187 | 215 | 224 | 153 | 188 | 166 | 181 | 135 |
| 120 | 103 | 101 | 150 | 159 | 98  | 71  | 74  | 85  | 95  |
| 100 | 76  | 83  | 66  | 83  | 61  | 70  | 76  | 114 | 110 |
| 106 | 65  | 86  | 110 | 126 | 120 | 149 | 190 | 114 | 100 |
| 117 |     |     |     |     |     |     |     |     |     |

### cnchq06

|     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 404 | 375 | 469 | 321 | 232 | 217 | 191 | 153 | 208 | 175 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|



|     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 197 | 256 | 225 | 192 | 327 | 357 | 314 | 344 | 333 | 362 |
| 381 | 233 | 111 | 149 | 119 | 157 | 156 | 171 | 220 | 114 |
| 124 | 115 | 160 | 158 | 239 | 218 | 240 | 421 | 228 | 251 |
| 251 | 152 | 153 | 219 | 282 | 278 | 223 | 227 | 220 | 317 |
| 141 | 200 | 96  | 32  | 26  | 26  | 22  | 28  | 28  | 34  |
| 35  | 33  | 44  | 63  | 73  | 84  | 75  | 126 | 74  | 39  |
| 37  | 49  | 44  | 62  | 80  | 77  | 57  | 38  | 71  | 77  |
| 87  | 92  | 74  | 54  |     |     |     |     |     |     |

cnchq07

|     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 108 | 150 | 192 | 255 | 255 | 99  | 94  | 126 | 163 | 198 |
| 260 | 435 | 48  | 58  | 90  | 97  | 83  | 120 | 65  | 172 |
| 249 | 254 | 166 | 344 | 203 | 173 | 293 | 305 | 252 | 382 |
| 297 | 229 | 286 | 331 | 361 | 399 | 454 | 364 | 310 | 434 |
| 321 | 316 | 67  | 43  | 55  | 41  | 49  | 47  | 52  | 116 |
| 107 | 113 | 171 | 412 | 346 | 230 | 276 | 276 | 46  | 84  |
| 38  | 58  | 49  | 60  | 58  | 80  | 146 | 89  | 141 | 199 |

cnchq09

|     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 359 | 313 | 307 | 263 | 286 | 394 | 348 | 325 | 179 | 192 |
| 190 | 250 | 171 | 121 | 116 | 113 | 208 | 191 | 272 | 185 |
| 233 | 258 | 198 | 181 | 218 | 316 | 270 | 253 | 191 | 185 |
| 217 | 230 | 202 | 227 | 175 | 203 | 224 | 179 | 131 | 128 |
| 249 | 330 | 302 | 264 | 162 | 194 | 136 | 157 | 189 | 156 |
| 211 | 178 | 148 | 141 | 131 | 97  | 69  | 59  | 59  | 78  |

cnchq12

|     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 200 | 234 | 169 | 210 | 112 | 173 | 204 | 165 | 160 | 134 |
| 136 | 133 | 177 | 87  | 40  | 46  | 64  | 75  | 140 | 157 |
| 101 | 52  | 63  | 65  | 77  | 73  | 112 | 301 | 67  | 47  |
| 31  | 33  | 50  | 41  | 100 | 141 | 397 | 104 | 78  | 100 |
| 73  | 114 | 70  | 103 | 93  | 102 | 71  | 135 | 149 | 112 |
| 129 | 139 | 155 | 210 | 127 | 144 | 44  | 32  | 31  | 32  |
| 44  | 49  | 42  | 51  | 52  | 63  | 72  | 111 | 89  | 82  |
| 108 | 126 | 68  | 32  | 44  | 45  | 59  | 62  | 75  | 75  |
| 88  |     |     |     |     |     |     |     |     |     |

cnchq13i

|     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 124 | 75  | 203 | 371 | 310 | 521 | 424 | 252 | 210 | 184 |
| 207 | 279 | 88  | 46  | 65  | 160 | 134 | 309 | 365 | 177 |
| 143 | 216 | 232 | 234 | 102 | 104 | 153 | 183 | 290 | 368 |
| 276 | 172 | 126 | 58  | 45  | 42  | 32  | 44  | 58  | 34  |
| 45  | 39  | 54  |     |     |     |     |     |     |     |

cnchq13ii

|     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 139 | 143 | 149 | 286 | 177 | 120 | 165 | 200 | 236 | 260 |
| 186 | 237 | 311 | 165 | 102 | 72  | 61  | 112 | 124 | 124 |
| 117 | 112 | 119 | 136 | 138 | 63  | 39  | 68  | 79  | 138 |
| 172 | 108 | 172 | 155 | 187 | 140 | 90  | 79  |     |     |



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