ARCHAEOLOGICAL SERVICES
DURHAM UNIVERSITY

on behalf of

Persimmon Homes and Bellway

Arcot, Phase 1
Cramlington
Northumberland

post-excavation analysis

report 5184
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Durham University

Contents

Photographs

Figures

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1. Summary

The project

1.1 This report presents the results of analysis of an archaeological excavation conducted for a development at land off Fisher Lane (A1068), Cramlington, Northumberland. A suite of radiocarbon dates and subsequent palaeoenvironmental analysis was conducted to supplement earlier data.

1.2 The works were commissioned by Persimmon Homes and Bellway, and conducted by Archaeological Services Durham University.

1.3 A flint flake and a Bronze Age radiocarbon date from residual material indicates that there may have been pre-Iron Age activity on the site.

1.4 More definitive evidence for settlement on the site comprised two adjacent and contemporary pits, one probably an open hearth and the other a covered earth oven. Both were radiocarbon dated to the earlier Iron Age, and had been used for cooking hazelnuts and meat.

1.5 A rectilinear settlement enclosed by a palisade was built on the site. Within the enclosure was a central roundhouse and two smaller roundhouses. The houses comprise surviving elements of internal wall construction slots and eaves-drip gullies. There are no indications that the enclosure or houses were rebuilt. Radiocarbon dating indicated that the settlement was occupied in the later 4th and the 3rd centuries BC, when it was abandoned. It was not subsequently reoccupied. The enclosure and houses had entrances facing to the south-west.

1.6 A contemporary ditch *c.*100m to the north-east of the roundhouse may be an associated field boundary and indicate management of the wider landscape. There was some limited evidence for the use of cultivated cereals, including wheat, within the settlement, which may reflect this, as well as for exploitation of a local lowland oak woodland. Small-scale ironworking also took place on the site.

1.7 The area was used for agriculture from the medieval period onwards, with post-medieval evidence for a track associated with a 19th century planation identified, as well as a possible mine shaft.

2. Project background

Location (Figure 1)

2.1 The site was located at White Hall Farm, Beaconhill, Cramlington, Northumberland (NGR centre: NZ 24207 76793). It covered an area of approximately 22.6ha. The site was bound to the west by Fisher Lane (A1068), and by a tree plantation to the north, with farmland to the east and south.

Development

2.2 The development is residential.

Objective

2.3 The objective of the scheme of works was to analyse the data produced from the excavation, so that a coherent narrative for the site could be produced, set within its regional context.

Research objectives

2.4 The regional research framework (Petts & Gerrard 2006) contains an agenda for archaeological research in the region. The scheme of works was designed to address Agenda Items Iii: Late Bronze Age and Iron Age and Settlement and Iiii: Landscapes, AG13 Charcoal analysis, and SEii Palaeoenvironmental evidence.

Specification

2.5 The works have been undertaken in accordance with an Updated Project Design produced by Archaeological Services.

Dates

2.6 Fieldwork was undertaken between 3rd and 20th July 2017. This report was prepared for October 2019.

Personnel

2.7 Fieldwork was supervised by Matthew Claydon. This report was prepared by Matthew Claydon, with illustrations by David Graham, and editing by Peter Carne. Specialist reporting was conducted by Dr Helen Drinkall (lithics), Jenny Jones (other artefacts), and Lorne Elliott and Dr Charlotte O'Brien (palaeoenvironmental). The Project Manager was Daniel Still.

Archive/OASIS

2.8 The site code is **ACN17**, for **A**rcot, **C**ramlington, **N**orthumberland 20**17**. The archive is currently held by Archaeological Services Durham University and will be transferred to Great North Museum. Archaeological Services Durham University is registered with the **O**nline **A**cces**S** to the **I**ndex of archaeological investigation**S** project (**OASIS**). The OASIS ID number for this project is **archaeol3-368584**.

3. Landuse, topography and geology

3.1 At the time of excavation the wider site comprised five fields, three of arable and two of scrub / set-aside. The excavated areas were located in the north of the site, in arable fields.

3.2 The evaluation area sloped down to the south, declining from 85m OD to 72m OD.

3.3 The underlying solid geology of the area comprises Carboniferous mudstone, siltstone and sandstone strata of the Pennine Middle Coal Measures Formation, which are overlain by Devensian diamicton till (British Geological Society 2019).

4. Previous archaeological works

4.1 A programme of fieldwalking was conducted which did not identify any significant archaeological resource in or near the site. Geophysical survey in the area identified ridge and furrow, alongside linear features which did not form a recognisable pattern (Robinson & Biggins 2000). The results were summarised in an archaeological desk-based assessment and an accompanying addendum (Richardson & Pugh 2011; McKelvey 2014).

4.2 Subsequently, a programme of geophysical survey and trial trenching was conducted immediately to the south of the site for a new access road (Scott 2011). This identified ridge and furrow alongside a small number of other linear features. Follow-up trial trenching identified ridge and furrow, with no other evidence of archaeological activity (Frain 2011). A later geomagnetic survey was conducted by Archaeological Services (2014), covering the site. It identified ridge and furrow, alongside a small number of linear and curvilinear geomagnetic anomalies. Also in 2014, topographic survey was undertaken on extant earthwork features immediately south of the site, identified as late post-medieval water tanks (AD Archaeology 2014). This was followed up by an archaeological strip and record scheme for an access route for the housing development, directly north of the earthwork complex (McKelvey 2015). This identified extensive ridge and furrow, alongside trackways, defined by gullies, that may relate to the earthwork complex.

4.3 Evaluation trenches were excavated across the site subsequent to the 2014 geomagnetic survey (Archaeological Services 2016). The trenches identified a ring-gully and a curvilinear gully, from which small fragments of probable pottery of possible Iron Age date were recovered. A small ditch of unknown date was also identified. Extensive evidence for medieval or post-medieval ridge and furrow cultivation was also recorded. An excavation was subsequently conducted, and a subsequent post-excavation assessment report produced (Archaeological Services 2017).

5. The excavation

Introduction

5.1 Two areas were opened for excavation. Area 1 (70m by 50m) contained part of an Iron Age palisaded enclosure, within which were three roundhouses. Area 2 (50m by 50m) included part of a ditch, and a post-medieval mine shaft or pit. For this report, 14 radiocarbon dates were obtained, which have been used to establish a dated sequence for the site.

5.2 Natural subsoil, an orange clay [2], was identified across the site at approximately 0.3m-0.4m below the ground surface.

Phase 1: Early Iron Age

5.3 Two pits were adjacent to each other, located outside the entrance to the later enclosure. One of the these was a probable open hearth [F12: 0.8m by 0.5m, 0.1m deep; Photo 1] filled with burnt orange-red and brown clay [11]. The second was a probable earth oven [F14: 0.45m diameter, 0.25m deep] filled with black sandy silty clay [13]. The features returned similar radiocarbon dates within the range of 760-400 cal BC, and had similar compositions of burnt organic materials, implying they were contemporary. Both had been used for cooking hazelnuts and meat.

Phase 2: Middle-Late Iron Age

5.4 The south-western part of a rectilinear palisaded enclosure was identified. The western boundary and parts of the northern and southern boundaries were within the trench, giving minimum dimensions to the enclosure of 46m by 66m. There was an entrance 3m wide, facing to the south-west. The trench for the palisade was of a consistent small size [F10: 0.2m wide, up to 0.2m deep, F8: 0.2m wide, up to 0.2m deep; Photo 2], and was filled with a mottled light orange-grey sandy clay [9, 7]. No packing stones were present, which may be taken to indicate contiguous wall posts.

5.5 The southern side of the entrance was defined by the palisade gully turning inwards. Charcoal from the south gully terminus [7] was radiocarbon dated to 760-410 cal BC, closely corresponding to the radiocarbon dates from the nearby hearth and pit to the west, and probably reflecting residual material. Charcoal from the north terminus [9] returned a radiocarbon date of 370-180 cal BC, similar to those from the structures within the enclosure.

5.6 The entrance was further defined by two internal construction cuts, running parallel with the palisade for up to 3m either side of the entrance. These were positioned *c*.3m inside the palisade boundary. There were no indications that they extended to form part of a contiguous circuit around the enclosure. The features were similar in profile but larger than the outer circuit [F18: 3m by 0.5m, 0.3m deep, brown clay loam fill 17, F16: 2.6m by 0.5m, 0.35m deep, grey sandy silty clay fill 15 Photo 3]. Internal to these features a single posthole was identified which may also relate to the entrance [F24: 0.25m diameter, 0.12m deep, grey mottled clay fill 23]. All three features returned radiocarbon dates [360-50 cal BC; 390-200 cal BC; 390-200 cal BC) similar to that from the palisade trench north of the entrance and the other internal structures.

Roundhouses

5.7 Remains of three roundhouse were recorded within the enclosure. Towards the north-east corner of the area were two surviving parts of a penannular ring-gully, characteristically a drainage feature of later prehistoric roundhouses. The northern [F20: 14m by 0.5m, 0.1m deep] and southern [F22: 20m by 0.5m, 0.1m deep; Photo 4] parts of the gully were filled with mottled orange-grey sandy clay [19, 21]. Charcoal from this has been radiocarbon dated to 410-230 cal BC. At the west side both gullies had corresponding rounded terminals indicating the entrance into the roundhouse; at the north-east side both gullies petered out, indicating probable truncation by ploughing.

5.8 Internal to the ring-gully were two parts of a concentric narrow, shallow construction cut for the roundhouse wall, either side of a 2m-wide entrance. The northern element [F28: 0.2m wide, up to 0.2m deep] extended for 2.5m, the southern element [F34: 0.2m wide, 0.1m deep] for 8m, both petering out to the east, again probably from plough truncation. They were filled with mottled yellow-grey sandy clay [27, 33]. There was a posthole [F50: 0.5m diameter, 0.35m deep, filled with grey-brown clay [49] in the southern terminal to the entrance; a charred nutshell from the posthole fill was radiocarbon dated to 400-200 cal BC. Charcoal from the northern construction cut [27] was radiocarbon dated to 370-170 cal BC. Charcoal from the fill of the southern section was radiocarbon dated to 1630-1500 cal BC, likely to reflect residual material from earlier activity on the site.

5.9 Internal to the roundhouse near the entrance was a single posthole [F44: 0.45m diameter, 0.15m deep], filled with brown clay loam [43].

5.10 To the north-west was part of a second roundhouse. The northern parts of two concentric ring-gullies survived (Photo 5). The outer gully [F32: 0.5m wide, 0.2m deep] and inner gully [F30: 0.5m wide, 0.1m deep] were filled with mottled yellow-grey clay [31, 29]. Charcoal within the fill of the inner gully was radiocarbon dated to 370-190 cal BC. There were no further features associated with this house.

5.11 To the south-west, most of a penannular ring-gully, possibly a wall-slot, survived in two parts: the north part [F46: 0.4m wide, 0.1m deep] filled with mottled yellow-grey sandy clay [45], the south part [F26: 0.4m wide, 0.2m deep; Photo 6] filled with similar material [25] from which a small sherd of pottery and a flint flake were recovered. Charcoal from the fill was radiocarbon dated to 370-170 cal BC. Clear terminals defined a 3.3m-wide entrance at the south-west; the south terminal [F26] may have incorporated a posthole. A corresponding break in the gully to the north-east was probably the consequence of plough truncation. There were no further features associated with this house.

5.12 In Area 2 a linear ditch [F3: 0.5m wide, 0.25m deep; Photo 7] cut the clay on a roughly north-east / south-west alignment. It was filled with grey-brown sandy silty clay [4=6], overlain at the north end by brown loam [5]. Charcoal from this deposit was radiocarbon dated to 380-200 cal BC. A small fragment of glass was recovered from this context, but this could be intrusive. The ditch extended across the entire length of the trench, continuing beyond the limit of the excavation to both the north and south. There was a pronounced kink in the course of the ditch towards the centre of the trench, and a gradual curve towards the east at the south end.

Phase 3: Medieval

5.13 The natural subsoil was cut by seven plough furrows [0.5m-2m wide] roughly aligned north/south. The furrows were evenly spaced between 10m-7m apart and were filled by brown clayey silts.

Phase 4: Post-medieval

5.14 Cutting the plough furrows in the north-east part of Area 2 was a shale-filled [47] mine shaft or pit [F48: 8m in diameter; Photo 8]. The pit does not appear on any Ordnance Survey map, suggesting it pre-dates the 1850s, was short-lived and quickly in-filled, or otherwise not mapped.

5.15 Two parallel ditches [F36 & F38; Photo 9] filled with orange-brown clay loam [35 and 37] were recorded across the northern edge of Area 1. The ditches were similar in form and ran 2m apart, indicating that they were contemporary and associated. These are probably post-medieval and probably defined a track leading to the adjacent tree plantation.

6. The artefacts

Pottery

Results

6.1 Two pieces of pot (5g wt) were found. A single small sherd (<2g wt) came from ring-gully context [25]. It has no original edges and does not survive to full thickness. The fabric is reduced, with crushed ?rock and rounded quartz inclusions.

6.2 A body sherd of 19th century transfer-printed earthenware was found in the sample from posthole context [43], which may be intrusive.

Discussion

6.3 The sherd from [25] is too small for secure identification or dating. From its general appearance, it is likely to be either prehistoric or early medieval.

Calcined bone

6.4 Small quantities (c58g wt total) of calcined bone were recovered from the samples from 6 pit, posthole and ring-gully contexts [7, 11, 13, 19, 25 & 49]. Specialist opinion suggests that there is animal bone (though not identifiable to species) amongst the *c.*28g wt of material from posthole context [13], but none of the remaining material can be identified as being either animal or human.

Lithics

Results

6.5 Two tiny chips were recovered from the samples from context [7] and [49]. Both are on brown flint, one slightly more patinated than the other. Although they are very small in size they clearly show evidence of being derived from flint knapping.

6.6 Context [25] produced a flake on similar brown flint to the chips, with cream speckles. The distal and proximal ends are broken. The piece is in fresh condition and non-diagnostic. It is finely made and the form hints at a perhaps a Mesolithic or Neolithic origin, however the lack of defining features makes this difficult to assess (L = 21.72mm, W = 11.92mm, Th = 2.07mm).

Discussion

6.7 The assemblage is small, and the flake is the only piece which is large enough to offer any evidence as to age. Although this suggests affinity with a Mesolithic or Neolithic flint tradition, this cannot be said with certainty, so the age range is naturally broad, spanning the Mesolithic to Bronze Age.

Glass

Results

6.8 Chips of water white, unweathered glass were found in the samples from gully and hearth contexts [5 and 11]. These are likely to be of post-medieval to modern date.

Fired clay

Results

6.9 A total of 265g wt of non-vitrified fired clay fragments came from the samples from pit and wall slot contexts [13 & 27]. Just one fragment came from [27], with the remainder from [13]. The material is oxidised and tempered with rounded grit and has no original surfaces. It may be fired daub or possibly part of an oven or furnace, though there are no substrate impressions for confirmation of this. Undateable.

Industrial residues

Results

6.10 Around 240g wt of semi-vitrified oven, hearth or furnace lining fragments were recovered, most from ring-gully context [19], which produced the three largest hand-recovered pieces (160g wt), with a further 85g found in the sample. The largest of these is 64 x 44 x 42mm thick, made from a hard-fired fabric liberally tempered with minute pieces soft ironstone and rounded and angular grit. Some 20mm of the thickness of the fragment is dark, bubbly and completely vitrified. Samples from pit/hearth context [11] and ditch/pit context [15] also produced small quantities (<10g wt) of semi-vitrified clay.

6.11 There is no evidence of incorporated metal working residues in the semi-vitrified clay, but context [19] also produced 260g wt of fragments of indeterminate ironworking slag. The pieces are fairly small and have probably been broken up for disposal. Examination of a freshly exposed interior shows it to be dark and fairly dense, with some vesicularity. The sample from context [43] contained two pieces of spheroidal and flake hammerscale. The residues are undateable, and no further work on them is worthwhile.

Discussion

6.12 There is a possibility that the semi-vitrified clay from [19] was associated with the ironworking activity. However, none of the residues were recovered from their working locations, and have an association only by disposal. However, the occurrence of both kinds of residues does indicate that industrial activity - though probably on a small scale - was taking place in the vicinity.

Burnt stones

Results

6.13 Five pieces of burnt or heat-affected sandstone were found – two from pit context [13] and three larger pieces from ring-gully context [19]. Heated stones were extensively used in the past to heat water, to cook food and also in aspects of industrial activity. They are undateable.

7. The palaeoenvironmental evidence and charcoal analysis

Summary

7.1 A palaeoenvironmental assessment was carried out on 20 bulk samples, taken from the fills of ditches, pits, postholes, fence lines and wall slots, associated with three roundhouse plots (Archaeological Services 2017). Subsequent radiocarbon dating shows that occupation of the settlement occurred during the early-middle Iron Age. An analysis of selected charcoal assemblages was recommended in order to give an idea of the tree species exploited and to establish the composition of the local woodland during the later prehistoric period. A comparison of the results in relation to the dating evidence will highlight any contrasting palaeoenvironmental evidence and provide useful information for the archaeological record.

Methods

7.2 The study was carried out in accordance with the palaeoenvironmental research aims and objectives outlined in the regional archaeological research framework and relevant resource agendas (Petts & Gerrard 2006; Huntley 2010). The analysis addresses several key research priorities, including an improved understanding of Iii:

Late Bronze Age and Iron Age Settlement, liii: Landscapes, AG13 Charcoal analysis and SEii Palaeoenvironmental evidence. Updated results have been incorporated with existing data from the site (Archaeological Services 2017).

7.3 Charcoal samples were taken from short-term 'primary' *in situ* waste and long-term 'secondary' rubbish deposits. Analysis concentrated on fragments from the >4mm dry-sieved fraction, as smaller fractions may contain too many unidentifiable remains, although a limited number of fragments from the 2mm fraction were examined for twiggy material and small woods or shrubs (Asouti & Hather 2001; Asouti & Austin 2005). Twigs are defined as <10mm in diameter including pith and bark (Huntley 2010).

7.4 Charcoal analysis involved four samples and follows Marguerie & Hunot (2007), which in addition to species identification, included examining and recording the roundwood diameter, tree ring curvature, tree ring growth, the number of tree rings, and the presence of pith, bark, tyloses, insect degradation, radial cracking, reaction wood and alteration by vitrification. The number of fragments considered a reasonable minimum for analysis is 100-400 per context (Huntley 2010). As the selected samples contain large charcoal quantities, they were sub-sampled using a riffle box and a minimum of 100 fragments was analysed. A few fragments from the remaining samples were selected for species identification in order to provide frequency and presence/absence data. Fragment selection from these contexts was based on morphological characteristics such as the type of fracturing along the ring/ray boundaries and distinctive surfaces caused by specific vessel arrangements.

7.5 For species identification, the transverse, radial and tangential sections were examined at up to x500 magnification using a Leica DMLM microscope. Identifications were assisted by the descriptions of Gale & Cutler (2000), Hather (2000) and Schweingruber (1990), and modern reference material held in the Palaeoenvironmental Laboratory at Archaeological Services Durham University. Weights and fragment counts were obtained for each species.

7.6 Where comparable anatomical properties and poor preservation prevent secure identification, charcoal remains are recorded to genus level or assigned to family groups. Maloideae is a subfamily of the Rosaceae (rose family), comprising hawthorn, apple, pear, and whitebeams. A few fragments of Maloideae charcoal from the fill [13] of pit [14] and the fill [7] of fence line [8] are recorded as cf. rowan (*Sorbus aucuparia*), which is a member of the whitebeams (*Sorbus*) genus. Anatomical characteristics collectively used for this identification are a diffuse porous vessel arrangement, solitary vessels that are more thin-walled and densely clustered in the earlywood, and frequent fine tertiary spiral thickening.

Results

7.7 Updated palaeoenvironmental results are presented in Table 1.2. Detailed analysis results of the charcoal record are presented in Tables 1.3 and 1.4.

7.8 Contexts [11], [13], [19] and [25] were considered to have sufficient charred material to warrant further analysis of the charcoal assemblages. The first two contexts are primary deposits from a hearth and an associated pit. Evidence comprising abundant fragments of nutshell (up to 1cm in size) and calcined bone suggests these features were used to cook meat and hazelnuts (see below). The latter two contexts are secondary fuel waste deposits associated with two separate curvilinear features.

7.9 The fuel debris from contexts [11], [13] and [19] contains a similar broad range of tree species in the charcoal record. Apart from a single hazel twig in fill [13], the charcoal evidence indicates the use of larger branchwood and small stemwood. Overall, the charcoal quantities recovered from the site are relatively small, which limits the interpretation of the archaeological record.

Discussion

7.10 Radiocarbon evidence suggests features [F12] and [F14] represent the earliest activity at the site, ranging from 760-400 cal BC. The precise date for this activity is hampered by a large plateau (Hallstatt) on the calibration curve around 2450BP, although the calibrated dates (68.2% probability) indicate this activity probably occurred towards the end of the plateau at 540-410 cal BC. The charcoal assemblages for features [F12] and [F14] are remarkably similar, in terms of the range of species present, the proportions of each species and the predominance of large branchwood and small stemwood. This particular evidence implies the features are contemporary and supports the comparable radiocarbon dates.

7.11 Fuel waste from the fill [11] of feature [F12] is very fragmented, which is typically evidence of an open hearth with an ample supply of oxygen, whereas large charcoal fragments in the fill [13] of pit [F14] are produced when burning occurs in reducing conditions with a restricted supply of oxygen. This implies [F14] involved the use of a temporary cover during burning, possibly using grassland turves considering the presence of charred grassland seeds and root fragments (Hall 2003). Evidence such as this is associated with earth ovens, which were used for prolonged slow cooking of meat and plant foods such as hazelnuts. Pit fill [13] evidently contains a large quantity of charred hazel nutshells and has the largest quantity of calcined bone recovered from the site. Fragments of fired clay recovered from [13] are probably remnants of a lining acting as a moisture barrier (Black & Thoms 2014).

7.12 Alder charcoal from the fill [7] of palisade [F8] provided a similarly earlier date (760-410 cal BC). However, the matrix of this small flot and the charcoal assemblage differ from features [F12] and [F14]. The notable difference is the lack of hazel and holly charcoal in [7]. In fact, evidence of holly charcoal only occurs in contexts [11], [13], [19] and [21], which may represent earlier occupation of the site. Holly charcoal from the fill [21] of ditch [F22] produced a date of 410-200 cal BC (95.4% probability). The charcoal assemblage for ditch fill [19] has a similar broad range of species as fills [11] and [13]. The exception for fill [19] is the presence of birch charcoal, which is absent from [11] and [13], but present in deposits [9], [15], [25], [27], [31] and [49]. Birch charcoal provided four slightly later radiocarbon dates between 390-170 cal BC. The prevalence of birch in association with these later dates may reflect a change in the local availability of certain tree species following woodland clearance.

7.13 The charcoal record at Arcot shows oak and alder as the most frequently occurring species. The preferential selection of these trees is not surprising considering they regularly occur together, particularly in charcoal assemblages of prehistoric origin. Oak is an efficient slow burning firewood with lasting heat, whereas alder is quick burning and produces little heat. However, adding faster burning alder logs will liven up an oak fire (Boulton & Jay 1946). Both of these woods also produce excellent steady burning charcoal (*ibid*.).

7.14 Traces of hammerscale in the fill [43] of feature [F44] provides evidence of small-scale metalworking. Apart from a few fragments of magnetised alder and oak charcoal, the flot matrix is predominantly made up of fragmented (<8mm) coal and cinder. This is the only feature on the site comprising this evidence.

7.15 The charcoal assemblages show the local woodland primarily comprised oaks, alder, birches and ash, with an understorey containing hazel, holly, rowan and blackthorn. The palaeoenvironmental evidence is consistent with a lowland oak woodland, probably a riparian woodland associated with minor valleys and river terraces. Recent archaeobotanical work suggests there was a similar riparian woodland at Dipton in County Durham, during the late Bronze Age (Archaeological Services 2019).

7.16 Alder is a moisture and light-demanding tree, naturally found in damp low-lying areas or in linear stands along stream and river margins (Claessens *et al.* 2010; Preston *et al.* 2002). Birch represents silver birch (*Betula pendula*) or downy birch (*Betula pubescens*). The latter is a species often found in association with alder, as it prefers wetter conditions. Oak probably represents Pedunculate or common oak (*Quercus robur*), as it is tolerant of waterlogged conditions and is found on wet margins in alder woodland (Preston *et al.* 2002). Rowan, or mountain ash, is native to cooler areas and common in the north and west of the UK. It is a small to medium-sized tree of moorland, rocky riversides or an understorey component of oak and alder woods, particularly if inaccessible to grazing livestock (Preston *et al.* 2002; Raspé *et al*. 2000). Hazel and holly are common in the understorey of an oak-birch woodland, and blackthorn is often present.

7.17 The 1860 OS map of the site shows a stream called Sandy's Letch, a tributary of Seaton Burn, flowing south from the site. A letch is a stream in boggy land, which is the ideal conditions for a riparian woodland dominated by alder. The site itself lies on a ridge of higher land. The charred plant macrofossil record, although limited, indicates this higher land was open rough grassland. Plant species such as redshank, ribwort plantain and dock are regarded as indicators of pastoral farming. This may explain the scant evidence for arable farming in the plant macrofossil record.

8. Radiocarbon dating

8.1 ANS radiocarbon dating and calibration were carried out by the Scottish Universities Environmental Research Centre (SUERC), East Kilbride, Scotland. The charred macrofossil material selected for fourteen individual dates provided adequate carbon for accurate measurement in each case, and analyses proceeded normally. Sample information and results are summarised in Table 1.5, and details of the results and calibrations are presented in Appendix 3.

9. Discussion

9.1 A worked flint of Mesolithic-Bronze Age date, and a Bronze Age radiocarbon date from residual material, indicates that there may have been pre-Iron Age activity on the site. Reuse of Bronze Age settlement sites in the Iron Age is very common in the region. For example, at the later prehistoric enclosure site at East Wideopen, a

Bronze Age flint thumbnail scraper was recovered, and a Mesolithic radiocarbon date was obtained from residual material within a roundhouse ditch (Archaeological Services 2014). Late Bronze Age radiocarbon dates indicate probable occupation at Blagdon Park 2 (Hodgson *et al* 2013, 15; 123-4) and the earliest palisaded enclosure at East Brunton was out of use by the mid Iron Age but potentially originated much earlier (ibid., 185).

9.2 Two features were recorded outside the enclosure. These comprised a probable open hearth and an earth oven, and similarities in their burnt organic content and radiocarbon dates indicate that they are contemporary. As the content, dates and location are different from the other features, they may indicate a phase of occupation pre-dating the enclosure. Radiocarbon dates range from 760-400 cal BC. The precise date for this activity is hampered by a large plateau (Hallstatt) on the calibration curve around 2450BP, although the calibrated dates (68.2% probability) indicate this activity probably occurred towards the end of the plateau at 540-410 cal BC. A similar date occurs close by from material within the palisade, although this may be from residual material, given the later dates recovered from the palisade and its contemporary interior features.

9.3 This timeframe is however consistent with the start of settled occupation at similar settlements in the area, included palisaded sites. A palisade slot at East Wideopen (5km south of the site) was radiocarbon dated to 780-425 cal BC (Archaeological Services 2014). At East Brunton (6.75km south) the palisade produced a date of 770-400 cal BC, believed to be in the earliest phase in the sequence of occupation (Hodgson *et al* 2012, 49). A small palisade at West Brunton (7k south-west) also belonged to the earliest phase of settlement. Here the palisade was considered to date to *c.*400-200 cal BC, although radiocarbon analysis of charred barley grain from an associated feature produced a date of 770-380 cal BC (*ibid,* 70).

9.4 Evidence for the palisade comprised a single trench cut into the subsoil without postholes, implying a contiguous timber wall. The palisade may have been free-standing. However, truncation of the site through later ploughing may have removed any evidence for an associated embankment.

9.5 The second group of radiocarbon dates range from 410-50 cal BC, with most of the dates broadly around 350-200 cal BC. These dates are from the three roundhouse plots, the palisade and its entrance, and the isolated ditch in Area 2. These features may all be contemporary, with all the roundhouses laid out within the single phase of enclosure. The two entrances to the roundhouses that were identified and the entrance to the enclosure also all face in the same direction, to the south-west; this is another indication that the features are contemporary.

9.6 The larger of the roundhouses was the best-preserved and looks like it was situated in the centre of the enclosure, with its doorway directly facing the entrance to the enclosure. With an internal diameter of *c*.13.5m, in was noticeably larger than the other two (at *c*.9.m and *c*.8.5m), although these are also large enough to have a had a domestic function. Assuming that the concentric gullies of the northerly roundhouse reflect an internal wall and outer eaves-drip, there are no indications of any rebuilds to the structures. There are also no indications of any rebuilds or repairs to the enclosing palisade. This may reflect a relatively short-lived occupation span for the settlement, reflected in the radiocarbon date range. The radiocarbon dating range is centred around the later 4th and the 3rd centuries BC, and it is most probable that the site was abandoned in the 3rd century, and not subsequently reoccupied.

9.7 During its occupation, management of the wider landscape may be indicated by the contemporary date from the isolated boundary ditch to the north-west, further elements of which may have been removed by later agricultural activity. Later prehistoric field systems associated with enclosures are widespread in the uplands and lowlands in the region, although often obscured by medieval and modern ploughing. The charcoal assemblages show the local woodland primarily comprised oaks, alder, birches and ash, with an understorey containing hazel, holly, rowan and blackthorn. The evidence is consistent with a lowland oak woodland, probably a riparian woodland associated with minor valleys and river terraces in the vicinity. Whilst the nutshells and meat were consumed in the earlier phase of the site, there is also limited evidence for cereal crops, including wheat, being consumed, as would be anticipated. The occurrence of undiagnostic iron slag and hammerscale indicates that some small-scale iron working took place on the site.

9.8 Elements of the record for prehistoric settlement have been removed by the ridge and furrow regime identified on the site, which may be associated with the medieval village of Whitelawe, recorded in the 13th century, and by modern ploughing. The probable mine shaft identified is in line with three 'old shafts' depicted on the 1850s Ordnance Survey map in the fields to the west, and may reflect an attempt to exploit the same coal seam. The two parallel ditches cutting through the settlement are aligned with the modern field boundary and are probably associated with a track to the Stonewall Plantation (formally Alma Plantation) immediately to the north, which is 19th century in origin.

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Appendix 1: Data tables

Table 1.1: Context data

The • symbols in the columns at the right indicate the presence of artefacts of the following types: P pottery, B bone, S stone, F flint, I industrial residues, G glass, C fired clay.

No	Area	Description	P	B	S	F	I	G	C	O
1	All	Topsoil								
2	All	Natural								
F3	2	Gully cut								
4	2	Fill of F3								
5	2	Fill of F3						•		
6	2	Primary fill of F3								
7	1	Fill of F8		•		•				
F8	1	Cut for palisade (south)								
9	1	Fill of F10								
F10	1	Cut for palisade (north)								
11	1	Fill of F12		•				•		
F12	1	Pit cut								
13	1	Fill of F14		•	•				•	
F14	1	Pit/posthole cut								
15	1	Fill of F16								
F16	1	Cut for pit/ditch								
17	1	Fill of F18							•	
F18	1	Cut for pit/ditch								
19	1	Fill of F20		•	•		•			
F20	1	Cut for ring-gully (north)								
21	1	Fill of F22								
F22	1	Cut for ring-gully (south)								
23	1	Fill of F24								
F24	1	Posthole cut								
25	1	Fill of F26	•	•		•				
F26	1	Cut for ring-gully								
27	1	Fill of F28	•							
F28	1	Cut for wall slot								
29	1	Fill of F30								
F30	1	Cut for partial ring-gully								
31	1	Fill of F32								
F32	1	Cut for partial ring-gully								
33	1	Fill of F34								
F34	1	Cut for wall slot								
35	1	Fill of F36								
F36	1	Ditch cut								
37	1	Fill of F38								
F38	1	Ditch cut								
39		Void								
40		Void								
41		Void								
42		Void								
43	1	Fill of F44	•				•			
F44	1	Cut for posthole								
45	1	Fill of F46								
F46	1	Cut for ring-gully								
47	1	Fill of F48								
F48	1	Cut for pit/shaft								
49	1	Fill of F50		•		•				
F50	1	Cut for posthole								

Table 1.2: Updated results from palaeoenvironmental assessment

Sample		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Context		**5**	**6**	**11**	**13**	**7**	**21**	**19**	**23**	**33**	**49**	**27**	**43**	**19**	**15**	**17**	**9**	**25**	**29**	**31**	**37**
Feature number		**3**	**3**	**12**	**14**	**8**	**22**	**20**	**24**	**34**	**50**	**28**	**44**	**20**	**16**	**18**	**10**	**26**	**30**	**32**	**38**
Feature		**G**	**G**	**H**	**P**	**Fl**	**D**	**D**	**Ph**	**Ws**	**Ph**	**Ws**	**Ph**	**D**	**D/P**	**D/P**	**Fl**	**D**	**D**	**D**	**D**
Material available for radiocarbon dating		✓	(✓)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	-	✓	✓	✓	✓	✓	✓	(✓)
Volume processed (l)		20	14	19	14	17	17	19	3	7	10	9	6	2	9	8	6	7	16	8	17
Volume of flot (ml)		280	60	150	1000	50	20	170	20	10	140	70	50	10	60	50	30	400	40	15	40
Residue contents																					
Bone (calcined)	indet. frags	-	-	(+)	++	(+)	-	(+)	(+)	-	(+)	(+)	(+)	-	(+)	(+)	-	+	-	-	-
Coal / coal shale		+++	++	+	(+)	+	+	+	(+)	+	(+)	+	++	+	+	+	(+)	+	+	+	+
Cracked stones (burnt)		-	-	+	+	(+)	-	(+)	-	(+)	+	(+)	-	-	+	(+)	-	+	-	-	-
Fired clay		-	-	(+)	+++	-	-	+	-	-	-	(+)	-	-	(+)	-	-	-	-	-	-
Flint		-	-	-	-	1	-	-	-	-	1	-	-	-	-	-	-	1	-	-	-
Hammerscale (ball / flake) / highly magnetic fuel waste		-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
Pot		-	-	-	-	-	-	-	-	-	-	2	1	-	-	-	-	1	-	-	-
Semi-vitrified fuel waste		-	-	-	-	-	-	++	-	(+)	+	-	+	(+)	-	-	-	-	-	-	-
Flot matrix																					
Bone (calcined)	indet. frags	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Charcoal		++	+	++	++++	+	+	+++	+	+	+++	++	+	(+)	++	++	++	+++	++	+	+
Clinker / cinder	vesicular	+	-	+	+	-	+	(+)	(+)	+	(+)	-	++	+	+	+	(+)	-	(+)	(+)	+
Heather twigs (charred)		(+)	(+)	-	(+)	-	-	(+)	-	-	-	-	-	-	-	-	-	-	+	(+)	+
Monocot stems (charred)		-	-	-	-	-	-	-	-	-	-	-	-	-	-	(+)	-	-	-	-	+
Roots / straw (modern)		-	-	++	-	+	+	+	+	+	+	+	++	+	+	+	+	+	+	+	++
Tuber / rhizome (charred)		(+)	(+)	-	(+)	(+)	-	(+)	(+)	-	(+)	(+)	-	-	(+)	(+)	-	-	-	-	+
Uncharred seeds		+	+	+	(+)	+	+	++	+	+	+	(+)	++	-	+	+	+	++	+	+	+
Charred remains (total count)																					
(c) Cerealia indeterminate	grain	-	-	-	1	-	-	1	-	-	1	-	-	-	-	-	-	1	-	1	-
(c) *Triticum* sp (Wheat species)	grain	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
(h) *Danthonia decumbens* (Heath-grass)	caryopsis	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1
(r) *Galium aparine* (Cleavers)	seed	-	-	-	-	-	-	-	2	-	-	-	1	1	-	-	-	-	-	-	-
(r) *Persicaria maculosa* (Redshank)	nutlet	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(r) *Plantago lancoelata* (Ribwort Plaintain)	seed	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-
(t) *Corylus avellana* (Hazel)	nutshell frag.	-	-	2	499	-	-	-	1	-	6	-	-	-	-	2	-	18	-	2	-
(x) Amaranthaceae (Goosefoot family)	seed	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(x) Poaceae undiff. (Grass family)	<1mm caryopsis	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
(x) *Rumex* sp (Docks)	nutlet	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-
(x) Ranunculaceae undiff. (Buttercup family)	achene	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(x) *Ranunculus* subgenus *Ranunculus* (Buttercup)	achene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
(x) *Vicia* sp (Vetches)	seed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
Identified charcoal (✓presence)																					
Alnus glutinosa (Alder)		-	✓	✓	✓	✓	-	✓	-	✓	✓	✓	✓	-	✓	✓	✓	✓	-	-	-
Alnus / Corylus (Alder / Hazel)		-	-	✓	-	-	✓	✓	-	-	-	-	-	-	-	-	-	✓	-	-	-
Betula sp (Birches)		-	-	-	-	-	-	✓	-	-	✓	✓	-	-	✓	-	✓	✓	-	✓	-
Corylus avellana (Hazel)		-	-	✓	✓	-	-	✓	✓	-	✓	-	-	-	-	-	✓	✓	-	-	-
Fraxinus excelsior (Ash)		-	-	✓	✓	✓	-	✓	-	-	-	-	-	-	-	-	✓	-	-	-	✓
Ilex aquifolium (Holly)		-	-	✓	✓	-	-	✓	-	-	-	-	-	-	-	-	-	-	-	-	-
Maloideae (Hawthorn, apple, pear, whitebeams)		-	-	✓	✓	✓	-	✓	-	-	-	-	-	-	-	-	-	✓	-	-	-
Maloideae (cf. Rowan)		-	-	-	✓	✓	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Prunus spinosa (Blackthorn)		-	-	-	✓	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Quercus sp (Oaks)		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	-	✓	✓	✓	✓	✓	✓	✓

[c-cultivated; h-heathland; r-ruderal; t-tree/shrub; x-wide niche. (+): trace; +: rare; ++: occasional; +++: common; ++++: abundant. (✓) may be unsuitable for dating due to size or species. D-ditch; Fl-fence line; G-gully; H-hearth; P-pit; Ph-posthole; Ws-wall slot]

Table 1.3: Detailed results from charcoal analysis

Sample	**3**	**4**	**7**	**17**
Context	**11**	**13**	**19**	**25**
Feature number	**12**	**14**	**20**	**26**
Feature	**Hearth**	**Pit**	**Ditch**	**Ditch**
Radiocarbon date (95.4%)	755-412 cal BC	750-404 cal BC	-	361-172 cal BC
Charcoal (g / number of fragments)				
Alnus glutinosa (Alder)	0.757 (10F)	3.951 (21F)	3.331 (42F)	4.064 (28F)
Betula sp (Birches)	-	-	0.389 (4F)	0.375 (3F)
Corylus avellana (Hazel)	1.066 (8F)	4.246 (9F)	0.347 (1F)	0.191 (3F)
Corylus avellana / Alnus glutinosa (Hazel / alder)	0.902 (12F)	-	1.789 (10F)	1.112 (11F)
Fraxinus excelsior (Ash)	1.588 (9F)	2.223 (24F)	0.675 (6F)	-
Ilex aquifolium (Holly)	0.133 (3F)	1.532 (19F)	0.062 (2F)	-
Maloideae (Hawthorn, apple, pear, whitebeams)	0.361 (2F)	1.364 (11F)	0.174 (1F)	0.749 (7F)
Prunus spinosa (Blackthorn)	-	0.252 (2F)	-	-
Quercus sp (Oaks)	4.598 (47F)	2.169 (15F)	1.827 (26F)	6.036 (42F)
Indeterminate	1.731 (15F)	1.414 (10F)	1.703 (11F)	1.786 (11F)
Weight of fragments in the >10mm fraction (g)	0.5	34.7	2.4	13.3
Weight of fragments in the >4mm fraction (g)	16.3	137.3	39.3	76.7
Weight of fragments > 4mm analysed (g)	11.136	17.151	10.297	14.313
Weight of fragments >4mm not analysed (g)	5.808	154.080	32.106	75.931
% of fragments > 4mm analysed	66	10	24	16
Number of fragments analysed	106	111	103	105
Total charcoal >4mm (g) / largest fragment (mm)	16.8 / 18.0	172.0 / 26.7	41.7 / 15.2	90.0 / 22.9

[F = number of charcoal fragments]

Table 1.4: Charcoal growth ring data

		Growth ring curvatures (%)				
Context	**Sample**	**Strong (s)**	**Moderate (m)**	**Weak (w)**	**Indet. (i)**	**Species (Ring curvatures represented)**
11	3	11	54	1	34	Alder (s/m), Hazel (s/m), Ash (m/w), Oak (s/m/i), Maloideae (s/m), Holly (s/m/i)
13	4	17	61	7	15	Alder (s/m/w), Hazel (s/m), Ash (m/w/i), Oak (s/m), Blackthorn (m), Maloideae (s/m), Holly (s/m/i)
19	7	9	47	6	38	Alder (s/m/w/i), Birch (s/m/i), Hazel (s), Ash (s/m), Oak (m/w/i), Maloideae (s), Holly (i)
25	17	16	30	9	45	Alder (s/m/i), Birch (m/i), Hazel (s/m), Oak (s/m/w/i), Maloideae (s/m/i)

[Indeterminate curvature was often due to small fragment size or radial fracturing producing narrow slivers.
Ring curvature is based on Marguerie & Hunot 2007]

Table 1.5: Summary of radiocarbon dating

Context	Sample	Laboratory code	Material	$\delta^{13}C$ ‰	$\delta^{15}N$ ‰	C/N ratio	Radiocarbon Age BP	Calibrated date 68.2% probability	Calibrated date 95.4% probability
5	1	SUERC-87916 (GU52069)	Charcoal : Quercus sp	-25.6			2212 ± 30	359 (7.1%) 347 cal BC 319 (27.9%) 273 cal BC 261 (33.2%) 207 cal BC	371 (95.4%) 200 cal BC
11	3	SUERC-87917 (GU52070)	Charcoal : Corylus avellana	-25.6			2452 ± 30	748 (25.5%) 685 cal BC 667 (9.5%) 641 cal BC 587 (1.8%) 580 cal BC 588 (28.2%) 477 cal BC 444 (3.3%) 432 cal BC	755 (27.3%) 680 cal BC 671 (16.4%) 607 cal BC 597 (51.7%) 412 cal BC
13	4	SUERC-87918 (GU52071)	Charred nutshell : Corylus avellana	-25.5			2428 ± 30	726 (2.0%) 721 cal BC 702 (2.6%) 696 cal BC 540 (63.6%) 413 cal BC	750 (18.8%) 683 cal BC 668 (6.2%) 639 cal BC 590 (1.3%) 576 cal BC 571 (69.1%) 404 cal BC
7	5	SUERC-87919 (GU52072)	Charcoal : Alnus glutinosa	-27.1			2445 ± 30	736 (20.1%) 688 cal BC 663 (6.2%) 647 cal BC 548 (41.8%) 430 cal BC	753 (25.1%) 682 cal BC 670 (13.3%) cal BC 593 (57.0%) 410 cal BC
21	6	SUERC-87920 (GU52073)	Charcoal : Ilex aquifolium	-24.0			2287 ± 30	400 (62.2%) 360 cal BC 271 (6.0%) 263 cal BC	405 (68.2%) 353 cal BC 293 (27.2%) 231 cal BC
23	8	SUERC-87921 (GU52074)	Charcoal : Corylus avellana	-27.0			2238 ± 30	377 (16.4%) 353 cal BC 295 (47.8%) 229 cal BC 220 (4.0%) 213 cal BC	389 (24.0%) 343 cal BC 324 (71.4%) 205 cal BC
33	9	SUERC-87925 (GU52075)	Charcoal : Quercus sp	-25.3			3285 ± 30	1611 (68.2%) 1529 cal BC	1629 (95.4%) 1500 cal BC
49	10	SUERC-87926 (GU52076)	Charred nutshell : Corylus avellana	-25.3			2265 ± 30	393 (39.5%) 357 cal BC 283 (21.9%) 256 cal BC 246 (6.8%) 236 cal BC	399 (44.4%) 350 cal BC 306 (51.0%) 209 cal BC
27	11	SUERC-87927 (GU52077)	Charcoal : Betula sp	-23.8			2187 ± 30	356 (45.9%) 286 cal BC 234 (22.3%) 197 cal BC	361 (95.4%) 175 cal BC

Context	Sample	Laboratory code	Material	$\delta^{13}C$ ‰	$\delta^{15}N$ ‰	C/N ratio	Radiocarbon Age BP	Calibrated date 68.2% probability	Calibrated date 95.4% probability
15	14	SUERC-87928 (GU52078)	Charcoal : Betula sp	-23.9			2241 ± 30	378 (18.6%) 354 cal BC 292 (49.6%) 231 cal BC	390 (25.4%) 346 cal BC 322 (70.0%) 206 cal BC
17	15	SUERC-87929 (GU52079)	Charred nutshell : Corylus avellana	-24.9			2141 ± 30	346 (12.2%) 321 cal BC 206 (41.8%) 149 cal BC 140 (14.2%) 112 cal BC	354 (20.5%) 294 cal BC 230 (71.9%) 87 cal BC 78 (3.1%) 57 cal BC
9	16	SUERC-87930 (GU52080)	Charcoal : Betula sp	-27.3			2193 ± 30	356 (46.5%) 286 cal BC 234 (21.7%) 200 cal BC	362 (95.4%) 183 cal BC
25	17	SUERC-87931 (GU52081)	Charcoal : Alnus glutinosa	-26.9			2185 ± 30	355 (45.7%) 288 cal BC 233 (22.5%) 196 cal BC	361 (95.4%) 172 cal BC
29	18	SUERC-87935 (GU52082)	Charcoal : Ilex aquifolium δ¹	-23.2			2179 ± 30	354 (44.2%) 291 cal BC 232 (24.0%) 191 cal BC	362 (95.4%) 197 cal BC

Appendix 2: Stratigraphic matrix

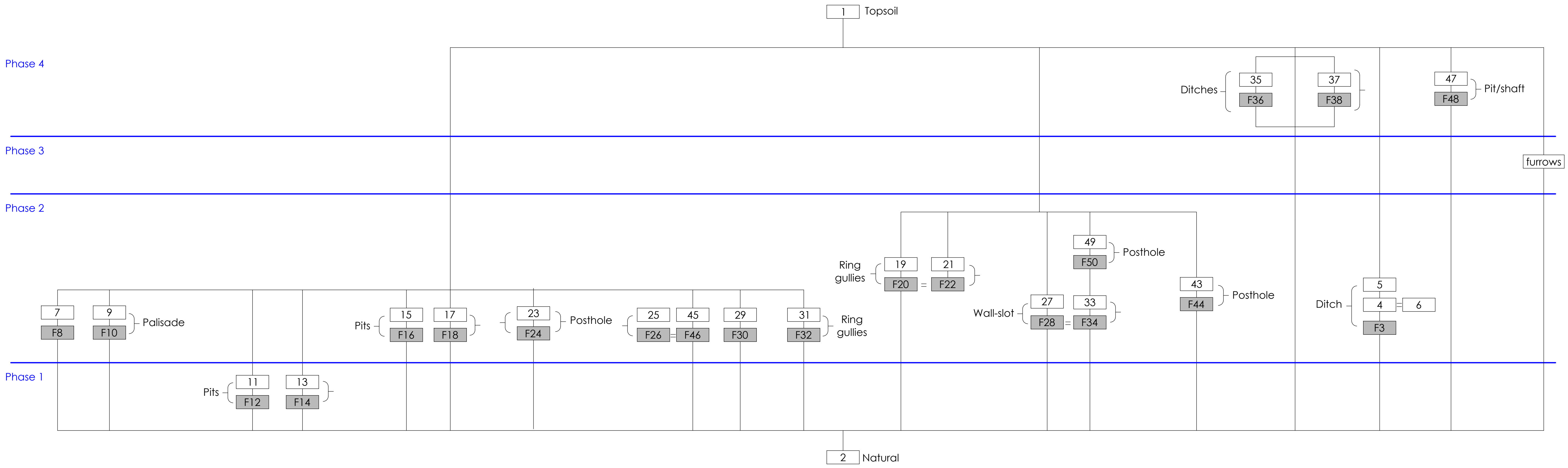
ARCHAEOLOGICAL SERVICES DURHAM UNIVERSITY

on behalf of
Persimmon Homes
and Bellway

Arcot Phase 1
Cramlington
Northumberland

post-excavation analysis
report 5184

Stratigraphic matrix



Appendix 3: Radiocarbon certificates

Scottish Universities Environmental Research Centre
Rankine Avenue, Scottish Enterprise Technology Park, East Kilbride, Glasgow G75 0QF, Scotland, UK
Director: Professor F M Stuart Tel: +44 (0)1355 223332 Fax: +44 (0)1355 229898 www.glasgow.ac.uk/suerc

RADIOCARBON DATING CERTIFICATE
14 August 2019

Laboratory Code	SUERC-87916 (GU52069)
Submitter	Charlotte O'Brien Archaeological Services Durham University South Road Durham DH1 3LE
Site Reference	Arcot, Cramlington, Northumberland (ACN17)
Context Reference	5
Sample Reference	1
Material	Charcoal : Quercus sp
$\delta^{13}C$ relative to VPDB	-25.6 ‰
Radiocarbon Age BP	2212 ± 30

N.B. The above ^{14}C age is quoted in conventional years BP (before 1950 AD) and requires calibration to the calendar timescale. The error, expressed at the one sigma level of confidence, includes components from the counting statistics on the sample, modern reference standard and blank and the random machine error.

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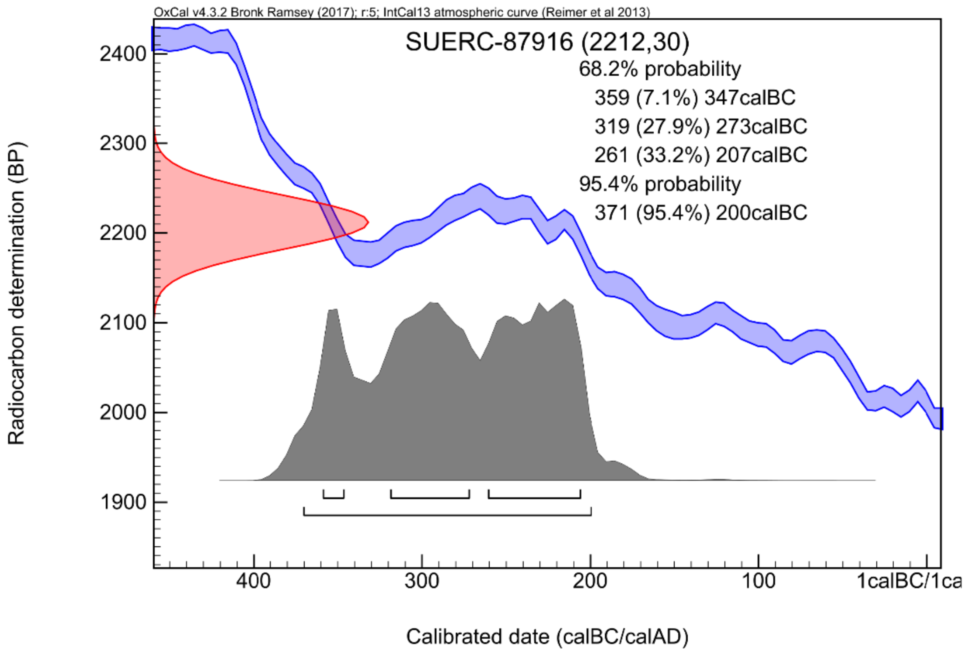
Detailed descriptions of the methods employed by the SUERC Radiocarbon Laboratory can be found in Dunbar et al. (2016) *Radiocarbon 58(1) pp.9-23.*

For any queries relating to this certificate, the laboratory can be contacted at suerc-c14lab@glasgow.ac.uk.

Conventional age and calibration age ranges calculated by :

Checked and signed off by :



The radiocarbon age given overleaf is calibrated to the calendar timescale using the Oxford Radiocarbon Accelerator Unit calibration program OxCal 4.*

The above date ranges have been calibrated using the IntCal13 atmospheric calibration curve†

Please contact the laboratory if you wish to discuss this further.

* Bronk Ramsey (2009) *Radiocarbon 51(1) pp.337-60*
† Reimer et al. (2013) *Radiocarbon 55(4) pp.1869-87*

Scottish Universities Environmental Research Centre
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Director: Professor F M Stuart Tel: +44 (0)1355 223332 Fax: +44 (0)1355 229898 www.glasgow.ac.uk/suerc

RADIOCARBON DATING CERTIFICATE
14 August 2019

Laboratory Code	SUERC-87917 (GU52070)
Submitter	Charlotte O'Brien Archaeological Services Durham University South Road Durham DH1 3LE
Site Reference	Arcot, Cramlington, Northumberland (ACN17)
Context Reference	11
Sample Reference	3
Material	Charcoal : Corylus avellana
$\delta^{13}C$ relative to VPDB	-25.6 ‰
Radiocarbon Age BP	2452 ± 30

N.B. The above ^{14}C age is quoted in conventional years BP (before 1950 AD) and requires calibration to the calendar timescale. The error, expressed at the one sigma level of confidence, includes components from the counting statistics on the sample, modern reference standard and blank and the random machine error.

Samples with a SUERC coding are measured at the Scottish Universities Environmental Research Centre AMS Laboratory and should be quoted as such in any reports within the scientific literature. The laboratory GU coding should also be given in parentheses after the SUERC code.

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For any queries relating to this certificate, the laboratory can be contacted at suerc-c14lab@glasgow.ac.uk.

Conventional age and calibration age ranges calculated by :

Checked and signed off by :

University of Glasgow
The University of Glasgow, charity number SC004401

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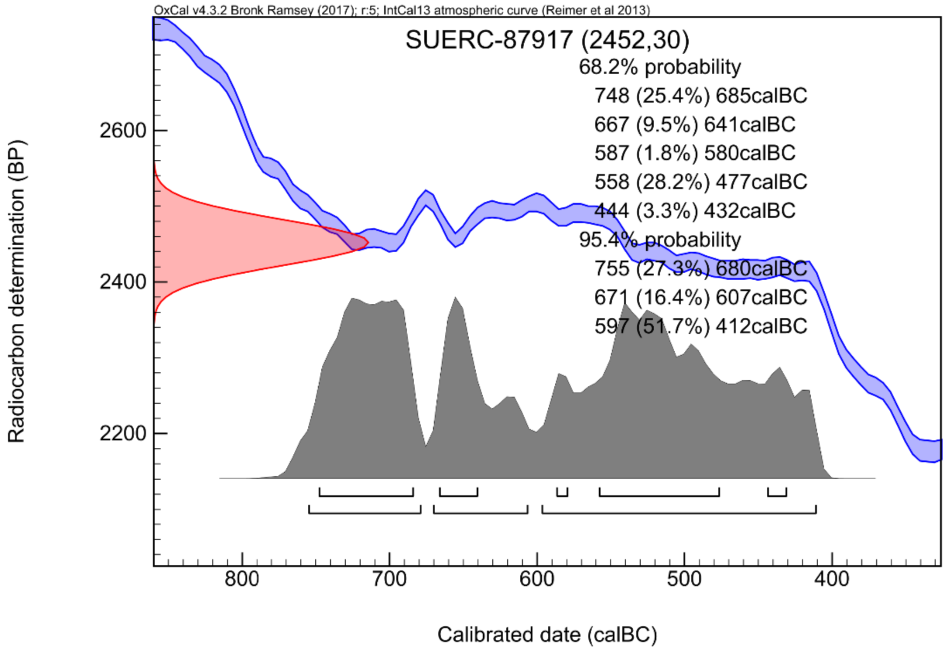

The radiocarbon age given overleaf is calibrated to the calendar timescale using the Oxford Radiocarbon Accelerator Unit calibration program OxCal 4.*

The above date ranges have been calibrated using the IntCal13 atmospheric calibration curve.†

Please contact the laboratory if you wish to discuss this further.

* Bronk Ramsey (2009) *Radiocarbon 51(1) pp.337-60*
† Reimer et al. (2013) *Radiocarbon 55(4) pp.1869-87*

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RADIOCARBON DATING CERTIFICATE
14 August 2019

Laboratory Code	SUERC-87918 (GU52071)
Submitter	Charlotte O'Brien Archaeological Services Durham University South Road Durham DH1 3LE
Site Reference	Arcot, Cramlington, Northumberland (ACN17)
Context Reference	13
Sample Reference	4
Material	Charred nutshell : Corylus avellana
$\delta^{13}C$ relative to VPDB	-25.5 ‰
Radiocarbon Age BP	2428 ± 30

N.B. The above ^{14}C age is quoted in conventional years BP (before 1950 AD) and requires calibration to the calendar timescale. The error, expressed at the one sigma level of confidence, includes components from the counting statistics on the sample, modern reference standard and blank and the random machine error.

Samples with a SUERC coding are measured at the Scottish Universities Environmental Research Centre AMS Laboratory and should be quoted as such in any reports within the scientific literature. The laboratory GU coding should also be given in parentheses after the SUERC code.

Detailed descriptions of the methods employed by the SUERC Radiocarbon Laboratory can be found in Dunbar et al. (2016) *Radiocarbon 58(1) pp.9-23.*

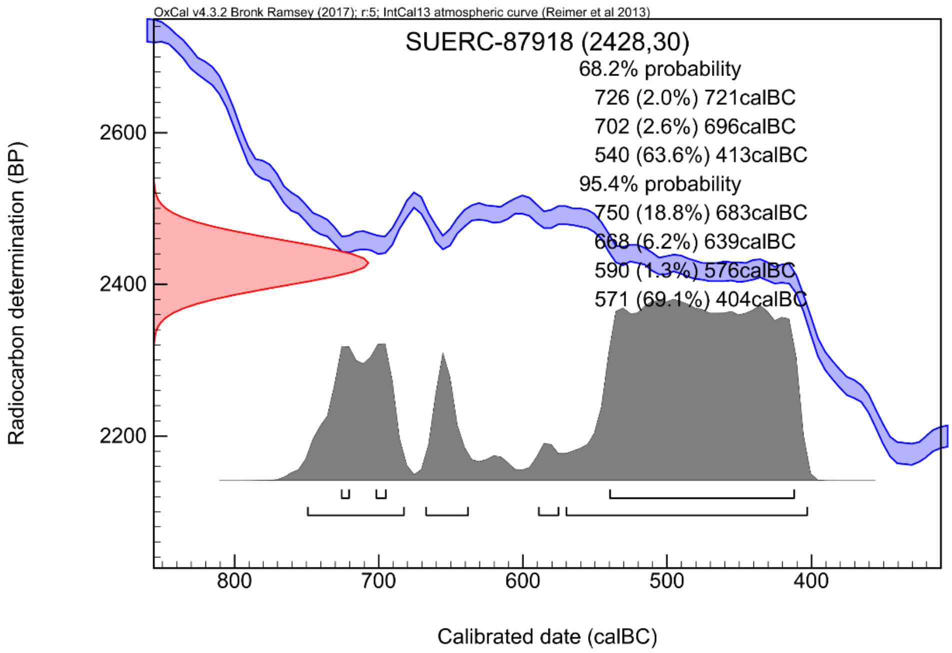
For any queries relating to this certificate, the laboratory can be contacted at suerc-c14lab@glasgow.ac.uk.

Conventional age and calibration age ranges calculated by :

Checked and signed off by : P. Naysmith

The University of Glasgow, charity number SC004401

The University of Edinburgh is a charitable body, registered in Scotland, with registration number SC005336



The radiocarbon age given overleaf is calibrated to the calendar timescale using the Oxford Radiocarbon Accelerator Unit calibration program OxCal 4.*

The above date ranges have been calibrated using the IntCal13 atmospheric calibration curve.†

Please contact the laboratory if you wish to discuss this further.

* Bronk Ramsey (2009) *Radiocarbon 51(1) pp.337-60*
† Reimer et al. (2013) *Radiocarbon 55(4) pp.1869-87*

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RADIOCARBON DATING CERTIFICATE
14 August 2019

Laboratory Code	SUERC-87919 (GU52072)
Submitter	Charlotte O'Brien Archaeological Services Durham University South Road Durham DH1 3LE
Site Reference	Arcot, Cramlington, Northumberland (ACN17)
Context Reference	7
Sample Reference	5
Material	Charcoal : Alnus glutinosa
$\delta^{13}C$ relative to VPDB	-27.1 ‰
Radiocarbon Age BP	2445 ± 30

N.B. The above ^{14}C age is quoted in conventional years BP (before 1950 AD) and requires calibration to the calendar timescale. The error, expressed at the one sigma level of confidence, includes components from the counting statistics on the sample, modern reference standard and blank and the random machine error.

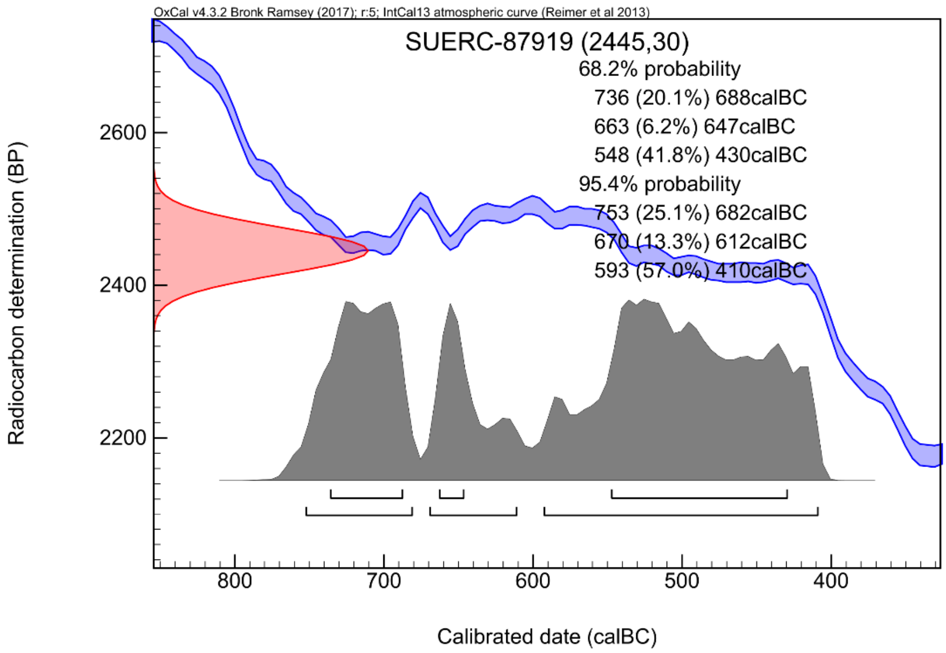
Samples with a SUERC coding are measured at the Scottish Universities Environmental Research Centre AMS Laboratory and should be quoted as such in any reports within the scientific literature. The laboratory GU coding should also be given in parentheses after the SUERC code.

Detailed descriptions of the methods employed by the SUERC Radiocarbon Laboratory can be found in Dunbar et al. (2016) *Radiocarbon 58(1) pp.9-23.*

For any queries relating to this certificate, the laboratory can be contacted at suerc-c14lab@glasgow.ac.uk.

Conventional age and calibration age ranges calculated by :

Checked and signed off by :



The radiocarbon age given overleaf is calibrated to the calendar timescale using the Oxford Radiocarbon Accelerator Unit calibration program OxCal 4.*

The above date ranges have been calibrated using the IntCal13 atmospheric calibration curve†

Please contact the laboratory if you wish to discuss this further.

* Bronk Ramsey (2009) *Radiocarbon 51(1) pp.337-60*
† Reimer et al. (2013) *Radiocarbon 55(4) pp.1869-87*

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RADIOCARBON DATING CERTIFICATE
14 August 2019

Laboratory Code	SUERC-87920 (GU52073)
Submitter	Charlotte O'Brien Archaeological Services Durham University South Road Durham DH1 3LE
Site Reference	Arcot, Cramlington, Northumberland (ACN17)
Context Reference	21
Sample Reference	6
Material	Charcoal : Ilex aquifolium
δ¹³C relative to VPDB	-24.0 ‰
Radiocarbon Age BP	2287 ± 30

N.B. The above ^{14}C age is quoted in conventional years BP (before 1950 AD) and requires calibration to the calendar timescale. The error, expressed at the one sigma level of confidence, includes components from the counting statistics on the sample, modern reference standard and blank and the random machine error.

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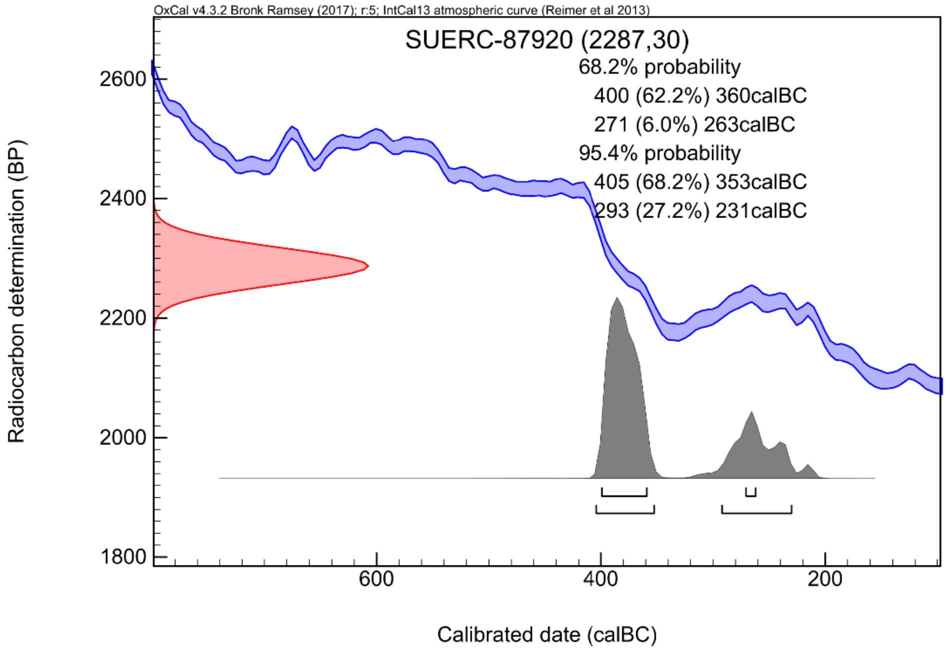
Detailed descriptions of the methods employed by the SUERC Radiocarbon Laboratory can be found in Dunbar et al. (2016) *Radiocarbon 58(1) pp.9-23.*

For any queries relating to this certificate, the laboratory can be contacted at suerc-c14lab@glasgow.ac.uk.

Conventional age and calibration age ranges calculated by : B Tagney

Checked and signed off by : P. Naysmith



The radiocarbon age given overleaf is calibrated to the calendar timescale using the Oxford Radiocarbon Accelerator Unit calibration program OxCal 4.*

The above date ranges have been calibrated using the IntCal13 atmospheric calibration curve.†

Please contact the laboratory if you wish to discuss this further.

* Bronk Ramsey (2009) *Radiocarbon 51(1) pp.337-60*
† Reimer et al. (2013) *Radiocarbon 55(4) pp.1869-87*

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RADIOCARBON DATING CERTIFICATE
14 August 2019

Laboratory Code	SUERC-87921 (GU52074)
Submitter	Charlotte O'Brien Archaeological Services Durham University South Road Durham DH1 3LE
Site Reference	Arcot, Cramlington, Northumberland (ACN17)
Context Reference	23
Sample Reference	8
Material	Charcoal : Corylus avellana
$\delta^{13}C$ relative to VPDB	-27.0 ‰
Radiocarbon Age BP	2238 ± 30

N.B. The above ^{14}C age is quoted in conventional years BP (before 1950 AD) and requires calibration to the calendar timescale. The error, expressed at the one sigma level of confidence, includes components from the counting statistics on the sample, modern reference standard and blank and the random machine error.

Samples with a SUERC coding are measured at the Scottish Universities Environmental Research Centre AMS Laboratory and should be quoted as such in any reports within the scientific literature. The laboratory GU coding should also be given in parentheses after the SUERC code.

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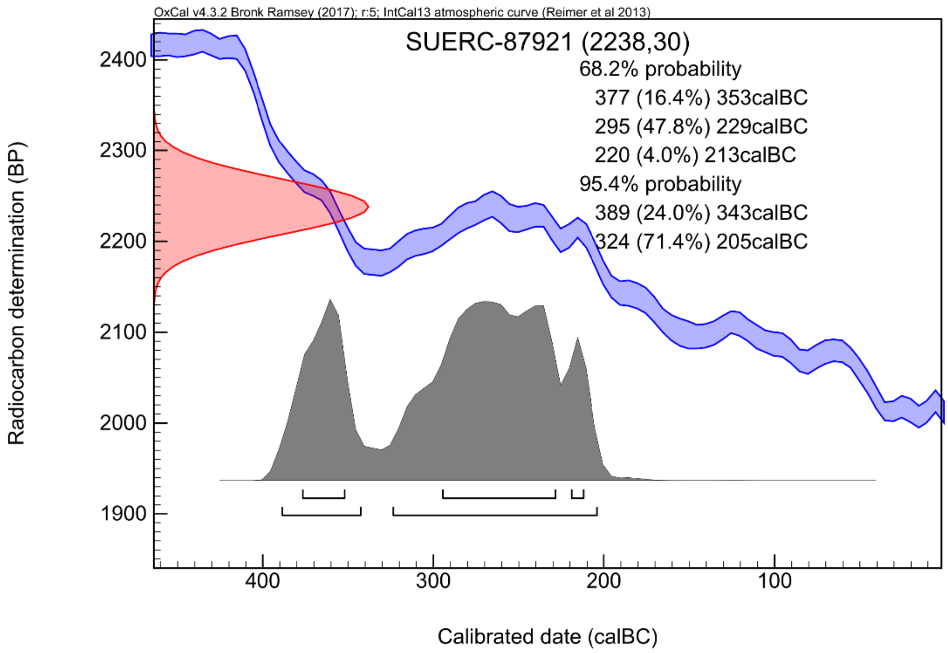
For any queries relating to this certificate, the laboratory can be contacted at suerc-c14lab@glasgow.ac.uk.

Conventional age and calibration age ranges calculated by : B Tagney

Checked and signed off by : P. Naysmith



The radiocarbon age given overleaf is calibrated to the calendar timescale using the Oxford Radiocarbon Accelerator Unit calibration program OxCal 4.*

The above date ranges have been calibrated using the IntCal13 atmospheric calibration curve†

Please contact the laboratory if you wish to discuss this further.

* Bronk Ramsey (2009) *Radiocarbon 51(1) pp.337-60*
† Reimer et al. (2013) *Radiocarbon 55(4) pp.1869-87*

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RADIOCARBON DATING CERTIFICATE
14 August 2019

Laboratory Code	SUERC-87925 (GU52075)
Submitter	Charlotte O'Brien Archaeological Services Durham University South Road Durham DH1 3LE
Site Reference	Arcot, Cramlington, Northumberland (ACN17)
Context Reference	33
Sample Reference	9
Material	Charcoal : Quercus sp
δ^{13}C relative to VPDB	-25.3 ‰
Radiocarbon Age BP	3285 ± 30

N.B. The above ^{14}C age is quoted in conventional years BP (before 1950 AD) and requires calibration to the calendar timescale. The error, expressed at the one sigma level of confidence, includes components from the counting statistics on the sample, modern reference standard and blank and the random machine error.

Samples with a SUERC coding are measured at the Scottish Universities Environmental Research Centre AMS Laboratory and should be quoted as such in any reports within the scientific literature. The laboratory GU coding should also be given in parentheses after the SUERC code.

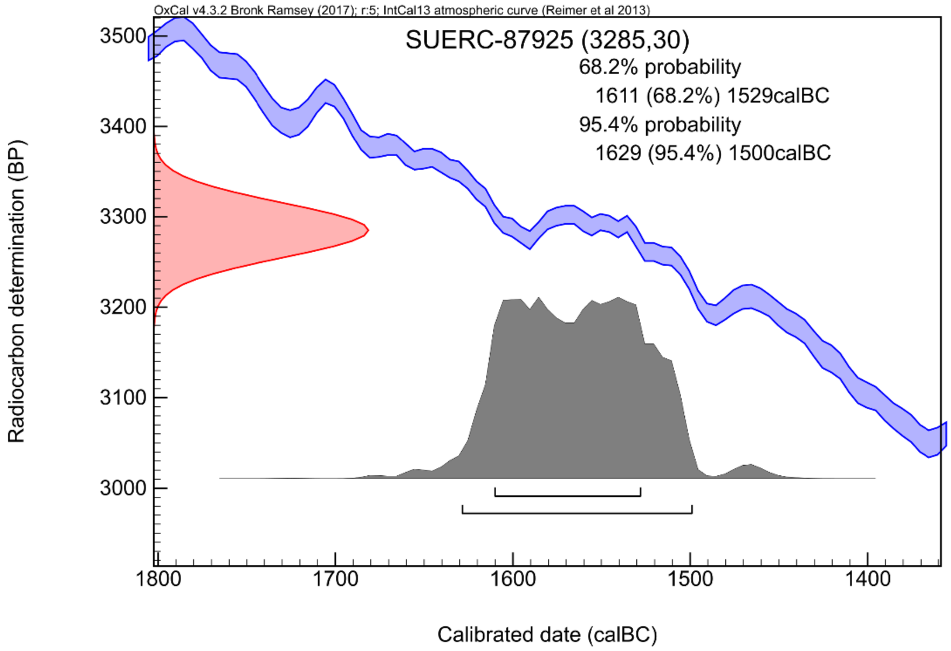
Detailed descriptions of the methods employed by the SUERC Radiocarbon Laboratory can be found in Dunbar et al. (2016) *Radiocarbon 58(1) pp.9-23.*

For any queries relating to this certificate, the laboratory can be contacted at suerc-c14lab@glasgow.ac.uk.

Conventional age and calibration age ranges calculated by : B Tagney

Checked and signed off by : P. Naysmith

University of Glasgow



The radiocarbon age given overleaf is calibrated to the calendar timescale using the Oxford Radiocarbon Accelerator Unit calibration program OxCal 4.*

The above date ranges have been calibrated using the IntCal13 atmospheric calibration curve†

Please contact the laboratory if you wish to discuss this further.

* Bronk Ramsey (2009) *Radiocarbon 51(1) pp.337-60*
† Reimer et al. (2013) *Radiocarbon 55(4) pp.1869-87*

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RADIOCARBON DATING CERTIFICATE
14 August 2019

Laboratory Code	SUERC-87926 (GU52076)
Submitter	Charlotte O'Brien Archaeological Services Durham University South Road Durham DH1 3LE
Site Reference	Arcot, Cramlington, Northumberland (ACN17)
Context Reference	49
Sample Reference	10
Material	Charred nutshell : Corylus avellana
$\delta^{13}C$ relative to VPDB	-25.3 ‰
Radiocarbon Age BP	2265 ± 30

N.B. The above ^{14}C age is quoted in conventional years BP (before 1950 AD) and requires calibration to the calendar timescale. The error, expressed at the one sigma level of confidence, includes components from the counting statistics on the sample, modern reference standard and blank and the random machine error.

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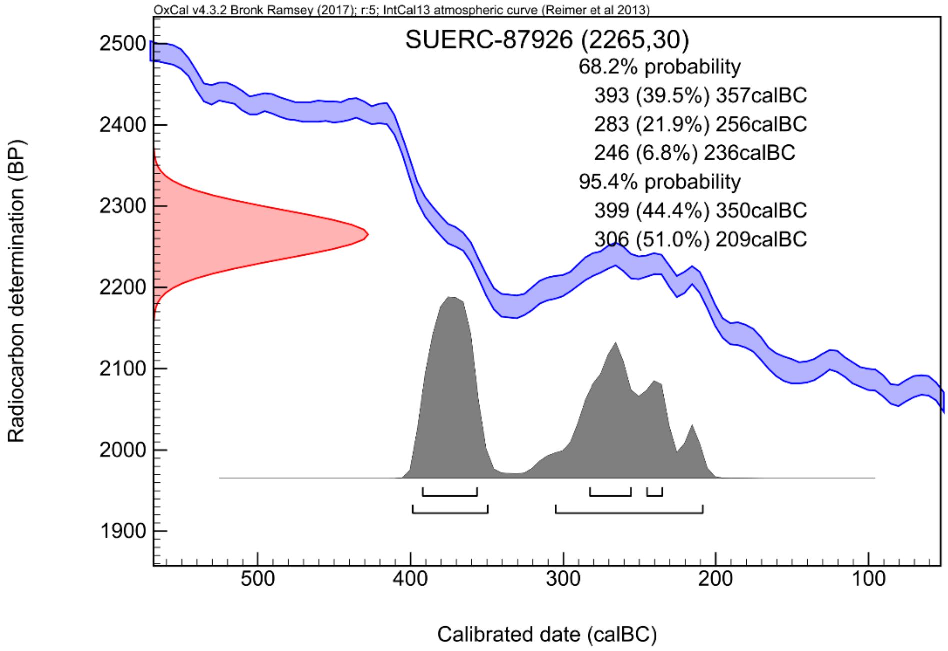
For any queries relating to this certificate, the laboratory can be contacted at suerc-c14lab@glasgow.ac.uk.

Conventional age and calibration age ranges calculated by :

Checked and signed off by :



The radiocarbon age given overleaf is calibrated to the calendar timescale using the Oxford Radiocarbon Accelerator Unit calibration program OxCal 4.*

The above date ranges have been calibrated using the IntCal13 atmospheric calibration curve†

Please contact the laboratory if you wish to discuss this further.

* Bronk Ramsey (2009) *Radiocarbon 51(1) pp.337-60*
† Reimer et al. (2013) *Radiocarbon 55(4) pp.1869-87*

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RADIOCARBON DATING CERTIFICATE
14 August 2019

Laboratory Code	SUERC-87927 (GU52077)
Submitter	Charlotte O'Brien Archaeological Services Durham University South Road Durham DH1 3LE
Site Reference	Arcot, Cramlington, Northumberland (ACN17)
Context Reference	27
Sample Reference	11
Material	Charcoal : Betula sp
$\delta^{13}C$ relative to VPDB	-23.8 ‰
Radiocarbon Age BP	2187 ± 30

N.B. The above ^{14}C age is quoted in conventional years BP (before 1950 AD) and requires calibration to the calendar timescale. The error, expressed at the one sigma level of confidence, includes components from the counting statistics on the sample, modern reference standard and blank and the random machine error.

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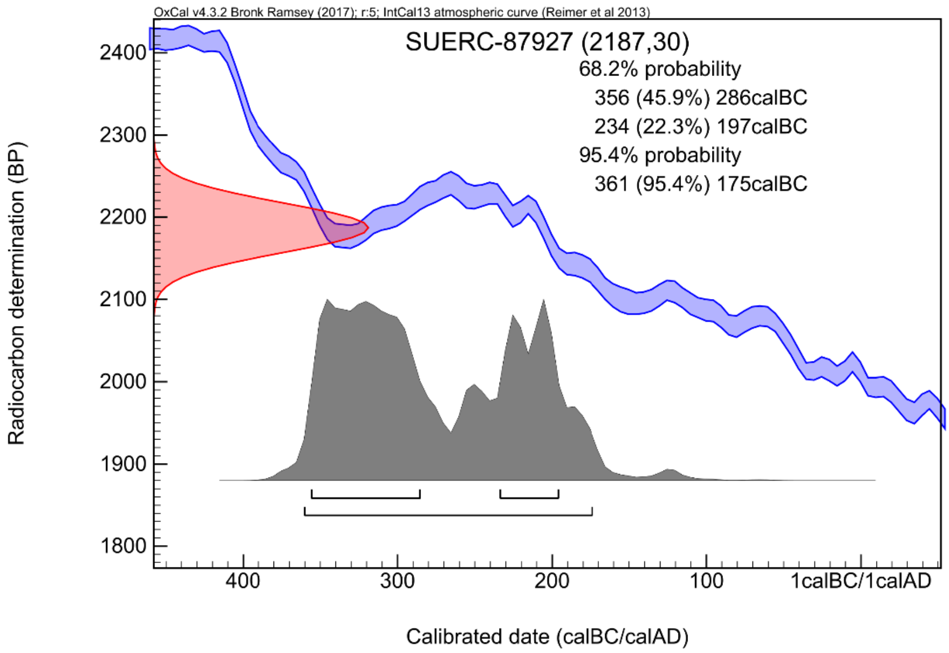
For any queries relating to this certificate, the laboratory can be contacted at suerc-c14lab@glasgow.ac.uk.

Conventional age and calibration age ranges calculated by :

Checked and signed off by :



The radiocarbon age given overleaf is calibrated to the calendar timescale using the Oxford Radiocarbon Accelerator Unit calibration program OxCal 4.*

The above date ranges have been calibrated using the IntCal13 atmospheric calibration curve†

Please contact the laboratory if you wish to discuss this further.

* Bronk Ramsey (2009) *Radiocarbon 51(1) pp.337-60*
† Reimer et al. (2013) *Radiocarbon 55(4) pp.1869-87*

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RADIOCARBON DATING CERTIFICATE
14 August 2019

Laboratory Code	SUERC-87928 (GU52078)
Submitter	Charlotte O'Brien Archaeological Services Durham University South Road Durham DH1 3LE
Site Reference	Arcot, Cramlington, Northumberland (ACN17)
Context Reference	15
Sample Reference	14
Material	Charcoal : Betula sp
δ^{13}C relative to VPDB	-23.9 ‰
Radiocarbon Age BP	2241 ± 30

N.B. The above ^{14}C age is quoted in conventional years BP (before 1950 AD) and requires calibration to the calendar timescale. The error, expressed at the one sigma level of confidence, includes components from the counting statistics on the sample, modern reference standard and blank and the random machine error.

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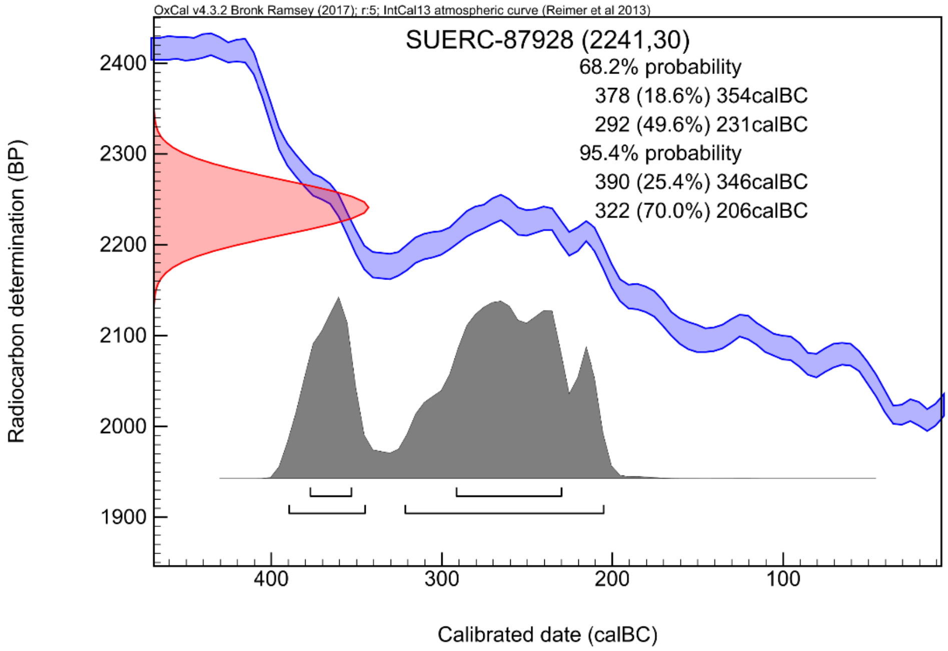
For any queries relating to this certificate, the laboratory can be contacted at suerc-c14lab@glasgow.ac.uk.

Conventional age and calibration age ranges calculated by :

Checked and signed off by :



The radiocarbon age given overleaf is calibrated to the calendar timescale using the Oxford Radiocarbon Accelerator Unit calibration program OxCal 4.*

The above date ranges have been calibrated using the IntCal13 atmospheric calibration curve†

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* Bronk Ramsey (2009) *Radiocarbon 51(1) pp.337-60*
† Reimer et al. (2013) *Radiocarbon 55(4) pp.1869-87*

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RADIOCARBON DATING CERTIFICATE
14 August 2019

Laboratory Code	SUERC-87929 (GU52079)
Submitter	Charlotte O'Brien Archaeological Services Durham University South Road Durham DH1 3LE
Site Reference	Arcot, Cramlington, Northumberland (ACN17)
Context Reference	17
Sample Reference	15
Material	Charred nutshell : Corylus avellana
$\delta^{13}C$ relative to VPDB	-24.9 ‰
Radiocarbon Age BP	2141 ± 30

N.B. The above ^{14}C age is quoted in conventional years BP (before 1950 AD) and requires calibration to the calendar timescale. The error, expressed at the one sigma level of confidence, includes components from the counting statistics on the sample, modern reference standard and blank and the random machine error.

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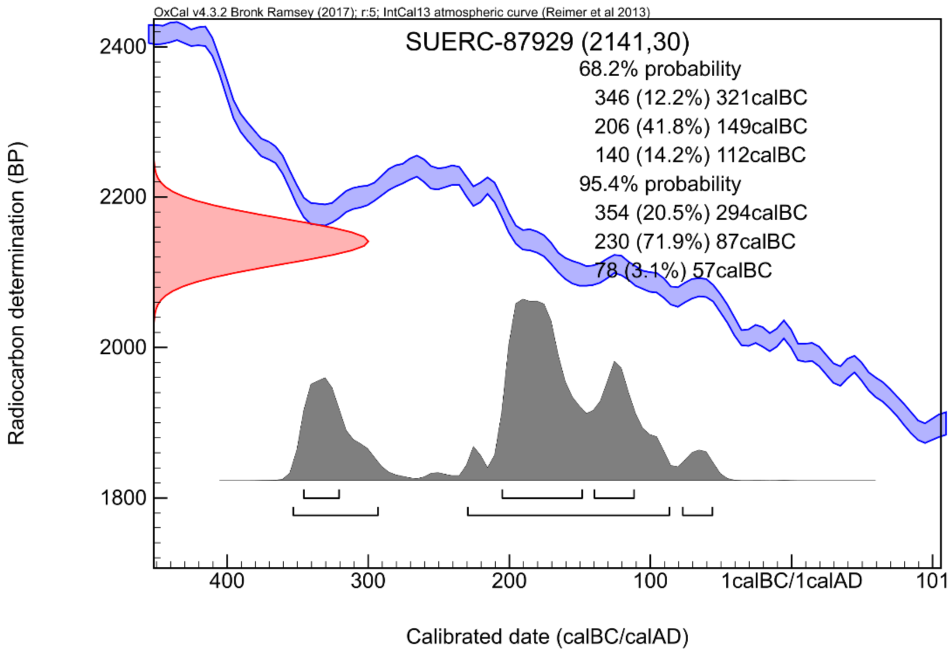
Conventional age and calibration age ranges calculated by :

Checked and signed off by : P. Naysmith



The radiocarbon age given overleaf is calibrated to the calendar timescale using the Oxford Radiocarbon Accelerator Unit calibration program OxCal 4.*

The above date ranges have been calibrated using the IntCal13 atmospheric calibration curve†

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* Bronk Ramsey (2009) *Radiocarbon 51(1) pp.337-60*
† Reimer et al. (2013) *Radiocarbon 55(4) pp.1869-87*

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RADIOCARBON DATING CERTIFICATE
14 August 2019

Laboratory Code	SUERC-87930 (GU52080)
Submitter	Charlotte O'Brien Archaeological Services Durham University South Road Durham DH1 3LE
Site Reference	Arcot, Cramlington, Northumberland (ACN17)
Context Reference	9
Sample Reference	16
Material	Charcoal : Betula sp
$\delta^{13}C$ relative to VPDB	-27.3 ‰
Radiocarbon Age BP	2193 ± 30

N.B. The above ^{14}C age is quoted in conventional years BP (before 1950 AD) and requires calibration to the calendar timescale. The error, expressed at the one sigma level of confidence, includes components from the counting statistics on the sample, modern reference standard and blank and the random machine error.

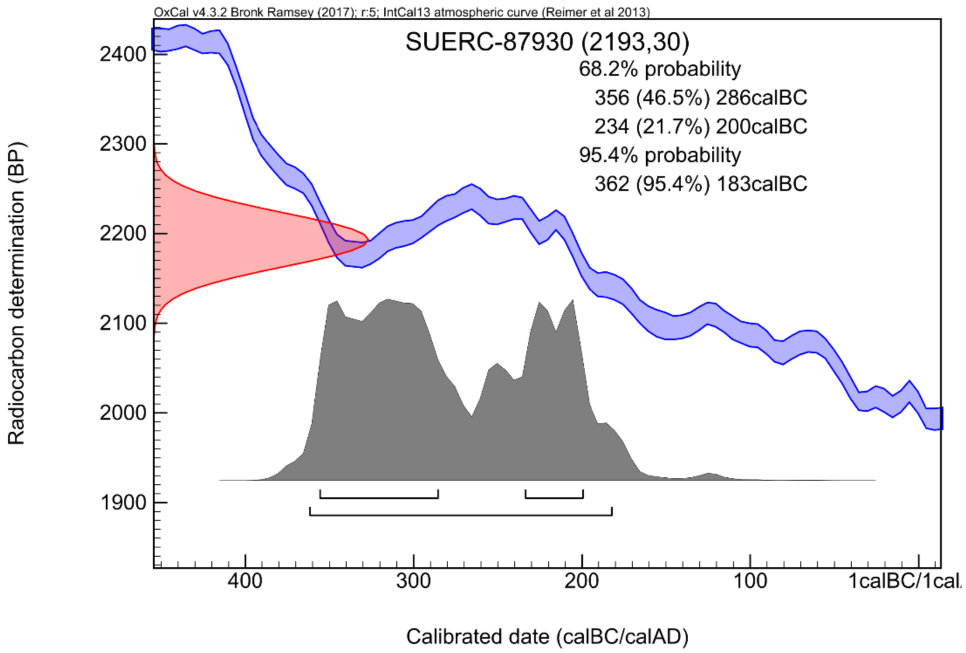
Samples with a SUERC coding are measured at the Scottish Universities Environmental Research Centre AMS Laboratory and should be quoted as such in any reports within the scientific literature. The laboratory GU coding should also be given in parentheses after the SUERC code.

Detailed descriptions of the methods employed by the SUERC Radiocarbon Laboratory can be found in Dunbar et al. (2016) *Radiocarbon 58(1) pp.9-23.*

For any queries relating to this certificate, the laboratory can be contacted at suerc-c14lab@glasgow.ac.uk.

Conventional age and calibration age ranges calculated by :

Checked and signed off by : P. Naysmith



The radiocarbon age given overleaf is calibrated to the calendar timescale using the Oxford Radiocarbon Accelerator Unit calibration program OxCal 4.*

The above date ranges have been calibrated using the IntCal13 atmospheric calibration curve†

Please contact the laboratory if you wish to discuss this further.

* Bronk Ramsey (2009) *Radiocarbon 51(1) pp.337-60*
† Reimer et al. (2013) *Radiocarbon 55(4) pp.1869-87*

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RADIOCARBON DATING CERTIFICATE
14 August 2019

Laboratory Code	SUERC-87931 (GU52081)
Submitter	Charlotte O'Brien Archaeological Services Durham University South Road Durham DH1 3LE
Site Reference	Arcot, Cramlington, Northumberland (ACN17)
Context Reference	25
Sample Reference	17
Material	Charcoal : Alnus glutinosa
$\delta^{13}C$ relative to VPDB	-26.9 ‰
Radiocarbon Age BP	2185 ± 30

N.B. The above ^{14}C age is quoted in conventional years BP (before 1950 AD) and requires calibration to the calendar timescale. The error, expressed at the one sigma level of confidence, includes components from the counting statistics on the sample, modern reference standard and blank and the random machine error.

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For any queries relating to this certificate, the laboratory can be contacted at suerc-c14lab@glasgow.ac.uk.

Conventional age and calibration age ranges calculated by :

Checked and signed off by :

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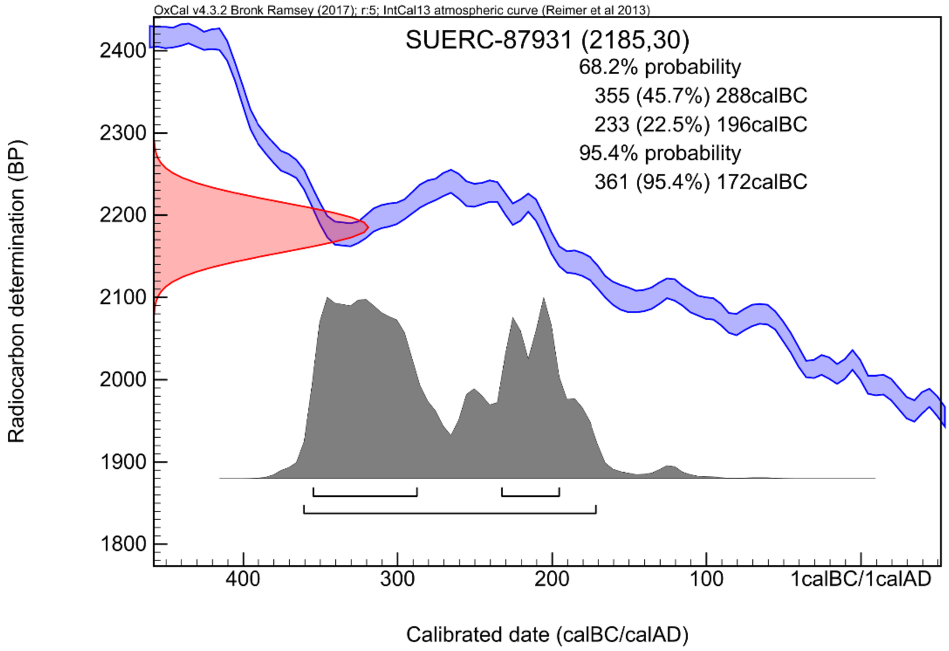


The radiocarbon age given overleaf is calibrated to the calendar timescale using the Oxford Radiocarbon Accelerator Unit calibration program OxCal 4.*

The above date ranges have been calibrated using the IntCal13 atmospheric calibration curve†

Please contact the laboratory if you wish to discuss this further.

* Bronk Ramsey (2009) *Radiocarbon 51(1) pp.337-60*
† Reimer et al. (2013) *Radiocarbon 55(4) pp.1869-87*

Scottish Universities Environmental Research Centre
Rankine Avenue, Scottish Enterprise Technology Park, East Kilbride, Glasgow G75 0QF, Scotland, UK
Director: Professor F M Stuart Tel: +44 (0)1355 223332 Fax: +44 (0)1355 229898 www.glasgow.ac.uk/suerc

RADIOCARBON DATING CERTIFICATE
14 August 2019

Laboratory Code	SUERC-87935 (GU52082)
Submitter	Charlotte O'Brien Archaeological Services Durham University South Road Durham DH1 3LE
Site Reference	Arcot, Cramlington, Northumberland (ACN17)
Context Reference	29
Sample Reference	18
Material	Charcoal : Ilex aquifolium
$\delta^{13}C$ relative to VPDB	-23.2 ‰
Radiocarbon Age BP	2179 ± 30

N.B. The above ^{14}C age is quoted in conventional years BP (before 1950 AD) and requires calibration to the calendar timescale. The error, expressed at the one sigma level of confidence, includes components from the counting statistics on the sample, modern reference standard and blank and the random machine error.

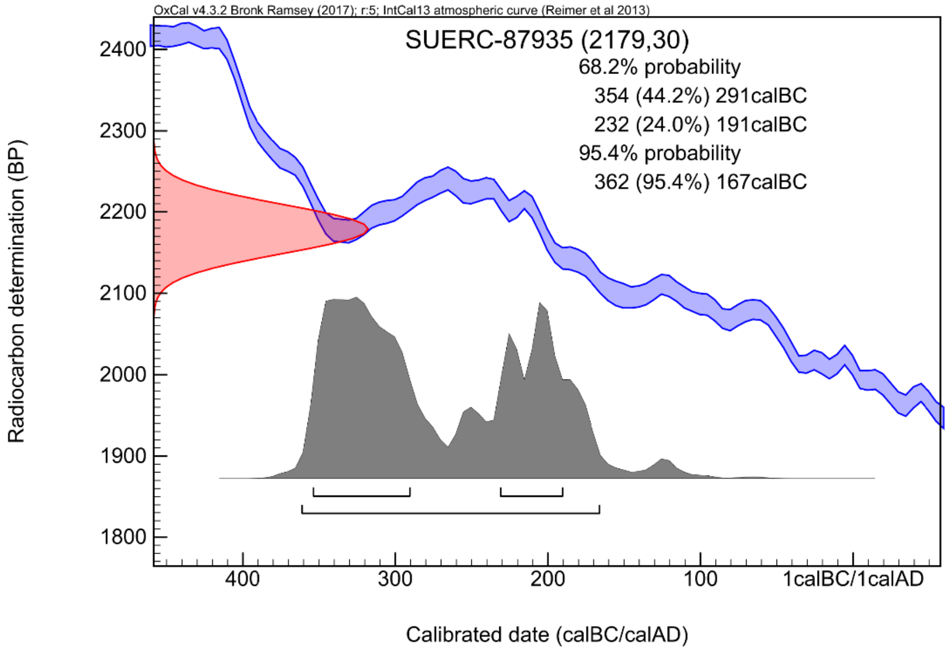
Samples with a SUERC coding are measured at the Scottish Universities Environmental Research Centre AMS Laboratory and should be quoted as such in any reports within the scientific literature. The laboratory GU coding should also be given in parentheses after the SUERC code.

Detailed descriptions of the methods employed by the SUERC Radiocarbon Laboratory can be found in Dunbar et al. (2016) *Radiocarbon 58(1) pp.9-23.*

For any queries relating to this certificate, the laboratory can be contacted at suerc-c14lab@glasgow.ac.uk.

Conventional age and calibration age ranges calculated by : B Tagney

Checked and signed off by : P. Naysmith



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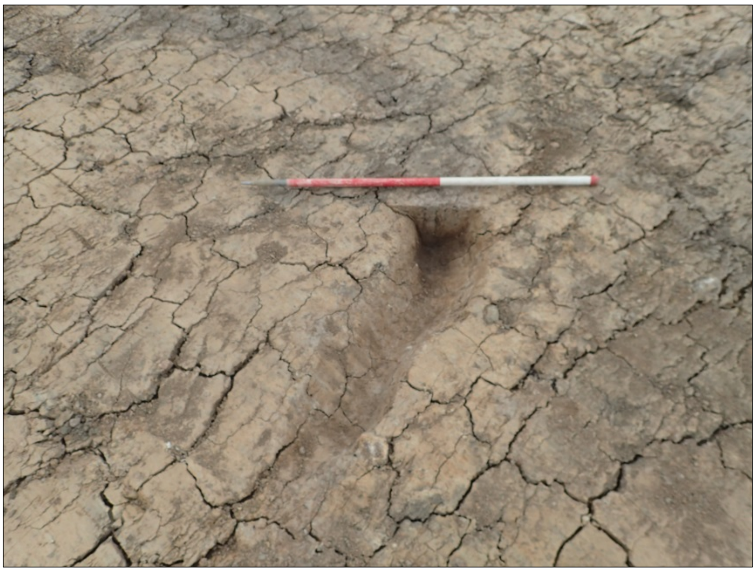
† Reimer et al. (2013) *Radiocarbon 55(4) pp.1869-87*

Photograph 1: Phase 1, Area 1, pit F14 & hearth F12, looking south



Photograph 2: Phase 2, Area 1, entrance terminal F8, looking south-west

Photograph 3: Phase 2, Area 1, F16, looking south-east

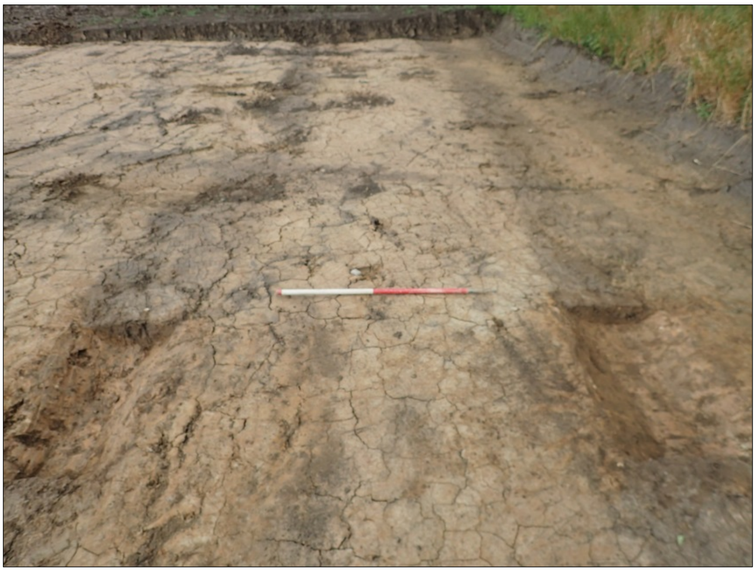
Photograph 4: Phase 2, Area 1, ring-gully F22, looking south-east

Photograph 5: Phase 2, Area 1, ring-gullies F30 & F32, looking east

Photograph 6: Phase 2, Area 1, ring-gully F26, looking south-east

Photograph 7: Phase 2, Area 2, ditch F3, looking north-east

Photograph 8: Phase 4, Area 1, pit / shaft F48, looking north



Photograph 9: Phase 4, Area 1, ditches F36 & F38, looking west

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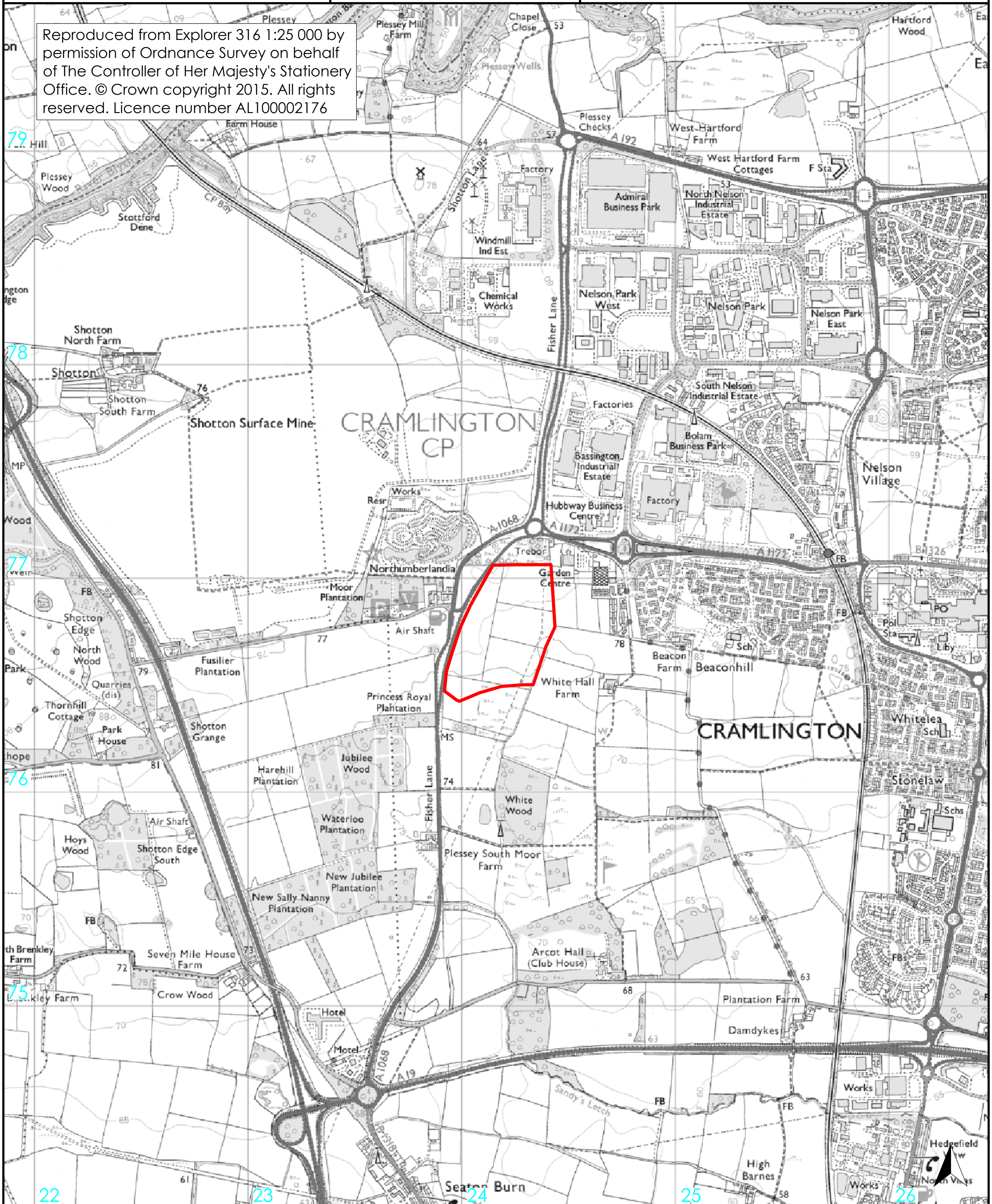
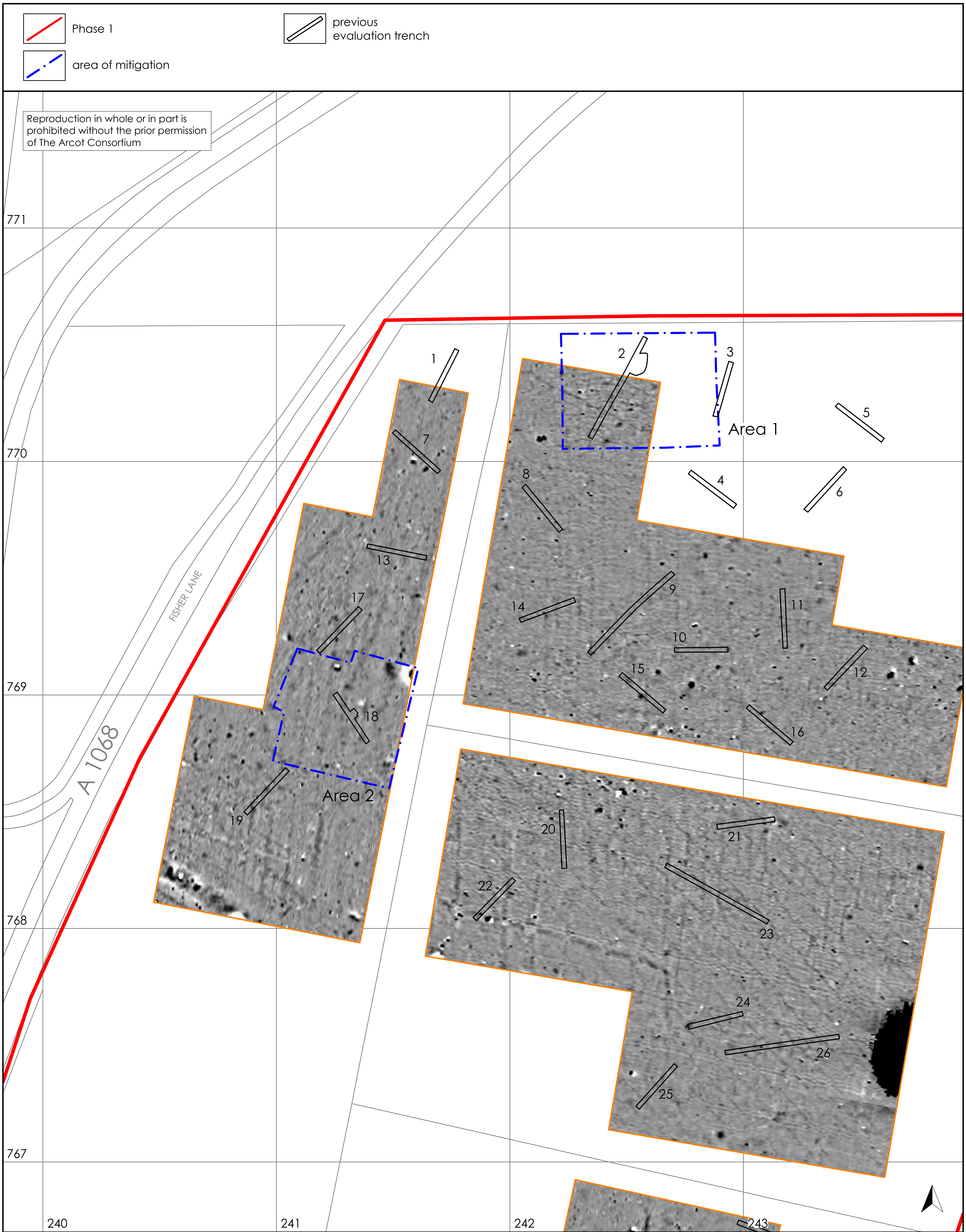
Figure 1: Site location



Phase 1

0 1km
scale 1:25 000 for A4 plot



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0 75m
scale 1:1500 for A3 plot

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Figure 2: Location of geophysical surveys, evaluation trenches and area excavations

Area 1

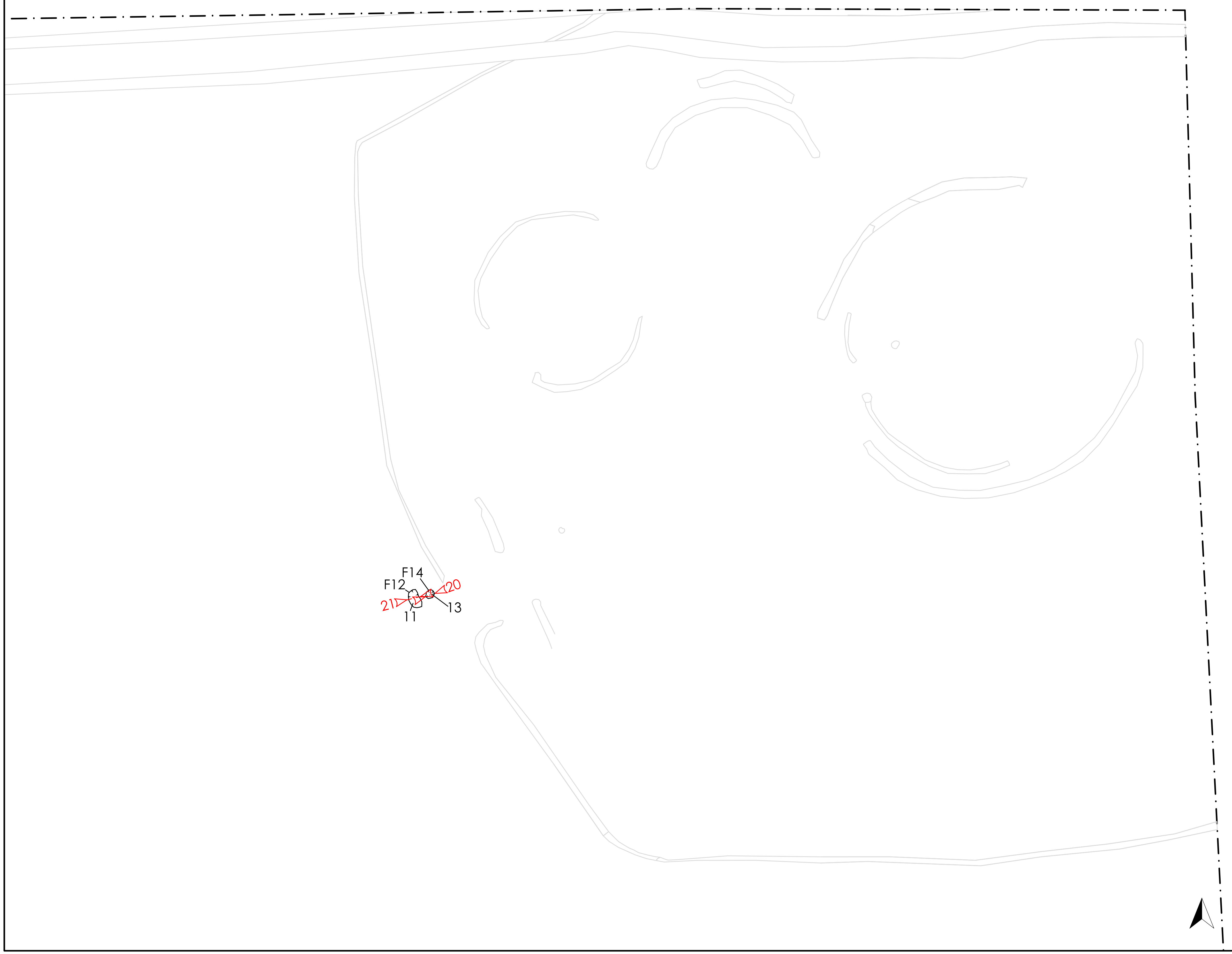

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Figure 3: Area 1, Phase 1 plan

0 10m
scale 1:200 for A3 plot

- extent of excavation
- 2 section
- other phases

Area 1

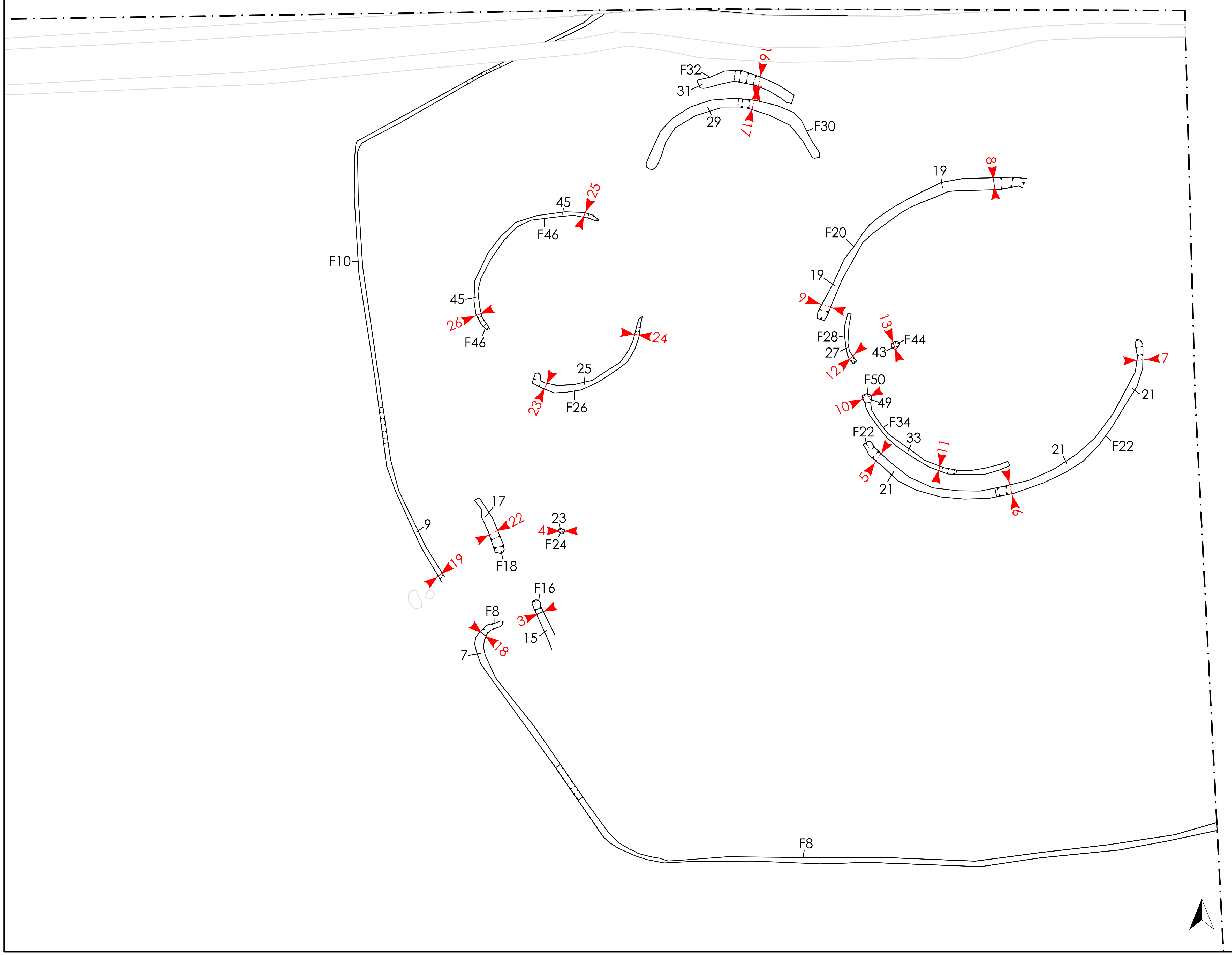

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Figure 4: Area 1, Phase 2 plan

0 — 10m
scale 1:200 for A3 plot

- extent of excavation
- section
- other phases

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Figure 5: Area 2, Phase 2 plan

0 10m
scale 1:200 for A3 plot

extent of excavation
2 section
other phases

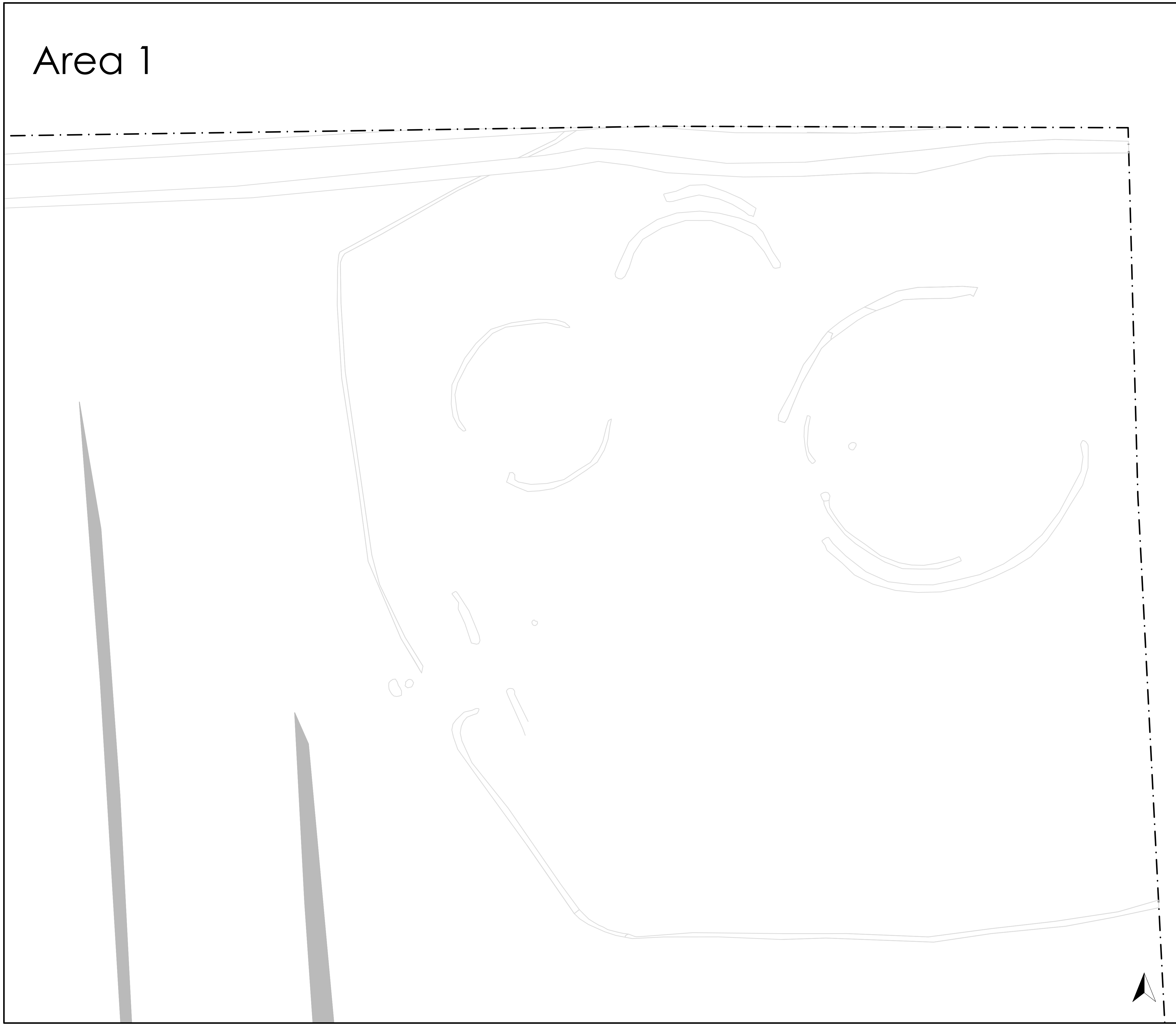

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Figure 6: Area 1, Phase 3 plan

0 10m
scale 1:200 for A3 plot

extent of excavation

section

furrow

other phases

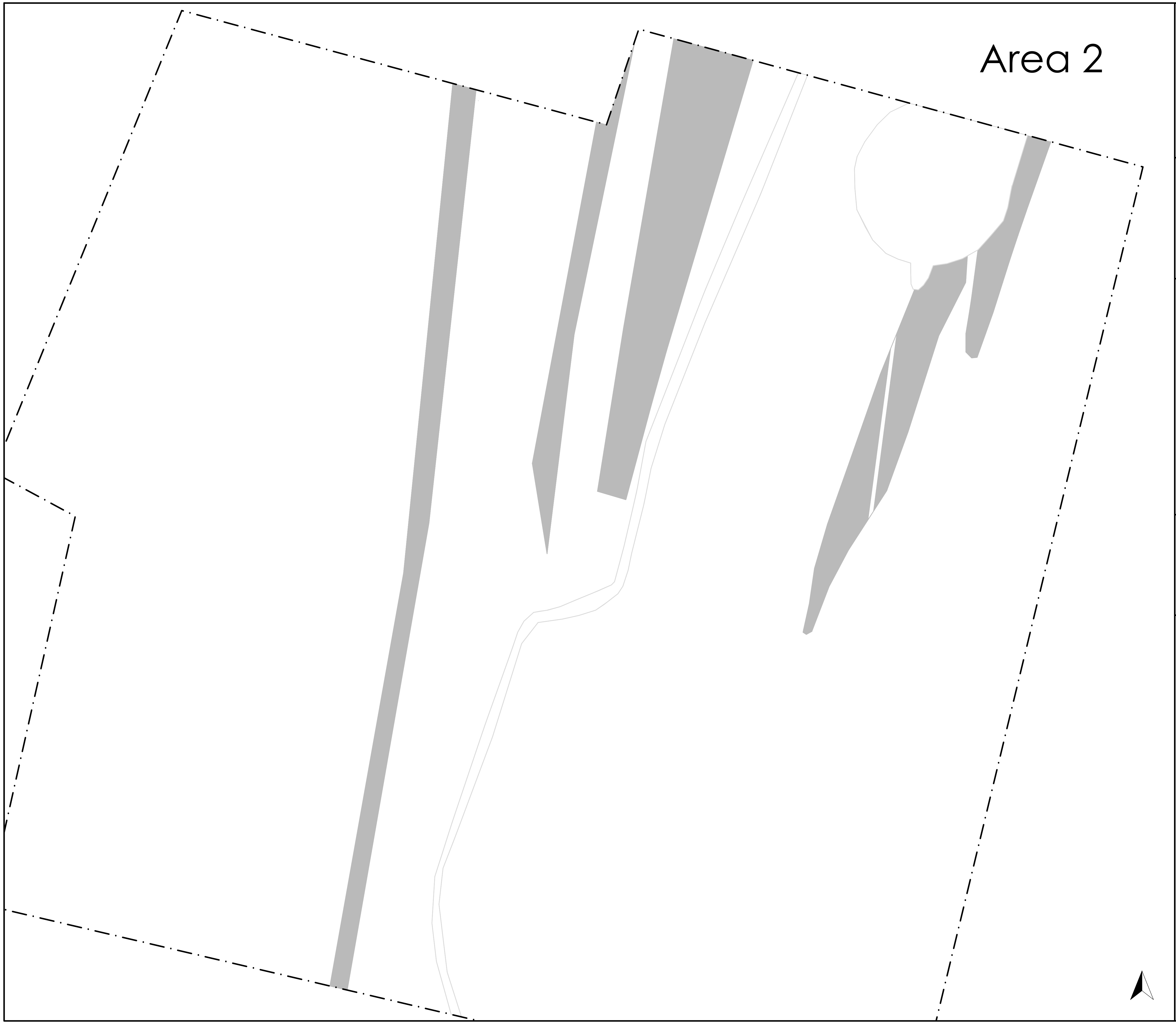

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Figure 7: Area 2, Phase 3 plan

0 10m
scale 1:200 for A3 plot

extent of excavation
2 section
furrow
other phases

Area 1

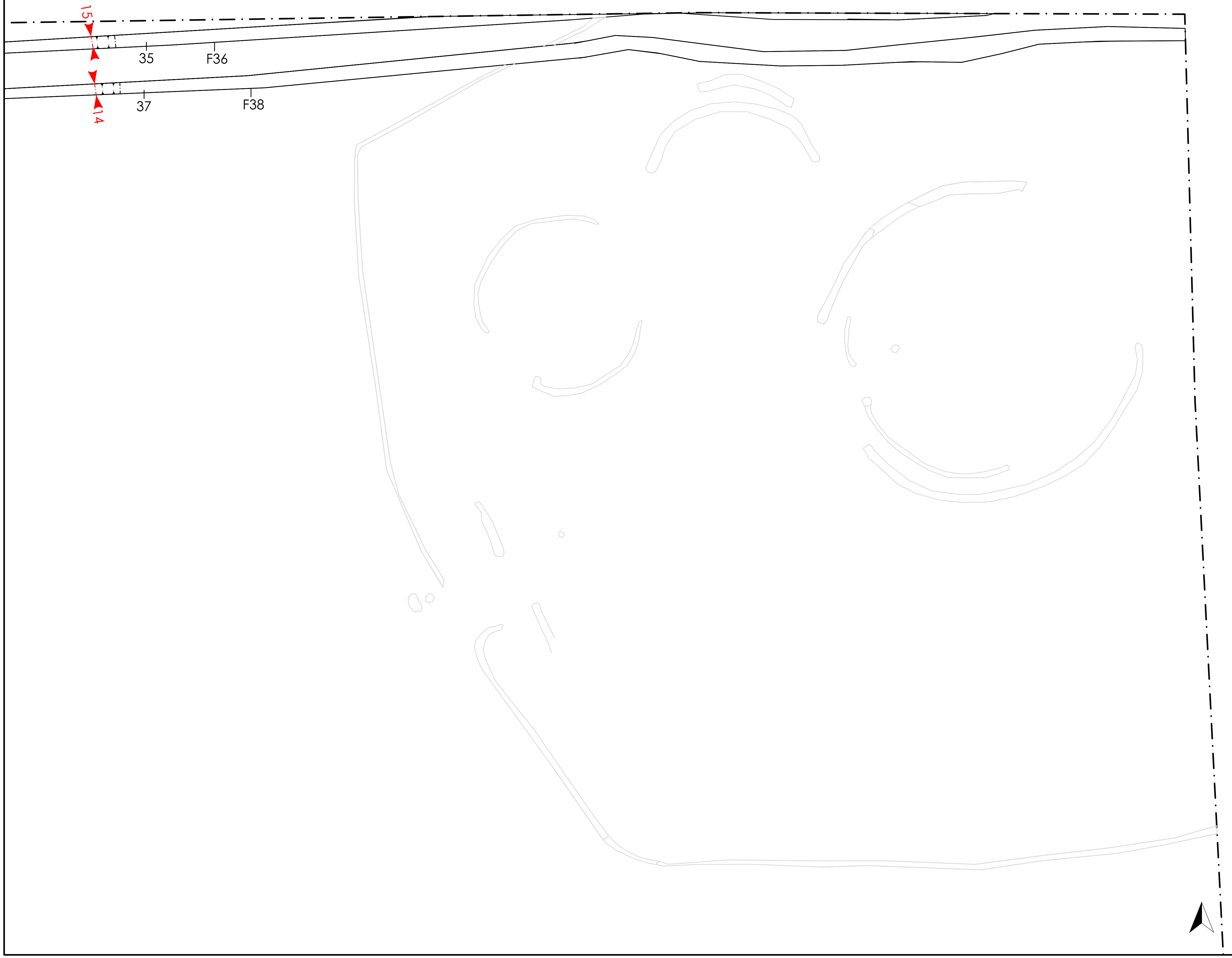

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Figure 8: Area 1, Phase 4 plan

0 10m
scale 1:200 for A3 plot

extent of excavation

section

other phases

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Figure 9: Area 2, Phase 4 plan

0 10m
scale 1:200 for A3 plot

extent of excavation

section

other phases

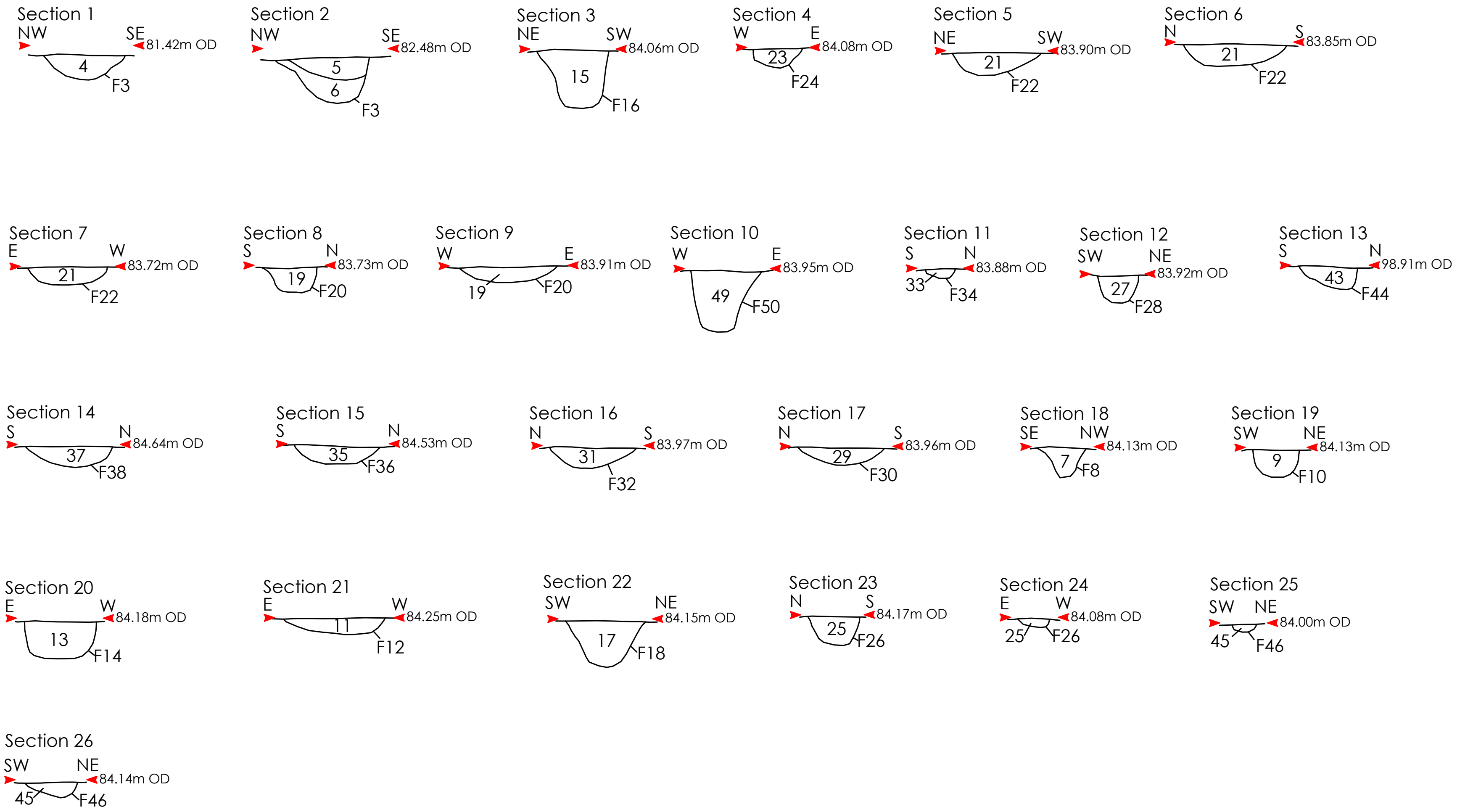

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Figure 10: Sections

0 2m
scale 1:40 for A4 plot