



Final Archaeological Excavation Report

Cullenagh More

Co. Galway

Lime Kiln

Date: **June 2010**

Client: **Galway County Council and National
Roads Authority**

Project: **N18 Oranmore to Gort**

E No: **E3881**

Excavation Director: **Tori McMorran**

Written by: **Tori McMorran and John Tierney**

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Summary

This excavation revealed the extant remains of a late medieval, mixed feed, permanent lime kiln in the townland of Cullenagh More. The lime kiln consisted of a square structure with a kiln pot measuring, roughly, 3.5 m across and with a surviving depth of 1.5 m. There was a central flue in each of the four walls. In its later days the kiln was used as a storage shed and although disused, was known locally, into the 20th century. A late medieval date was returned from the kiln.

Townland	Cullenagh More
Parish	Ardrahan
Barony	Dunkellin
County	Galway
Ministerial Order Number	A045
E Number	E3881
OS Map Sheet	GA95
National Grid Reference	143654/211068
Elevation	30 m OD
Site Type	Lime kiln

Acknowledgements

The excavation director was Tori McMorran. The senior archaeologist was Finn Delaney and the post-excavation manager was Jacinta Kiely. Choryna Kiely, Fillip Debniak and Fiona Greene were involved with the administration of the project. Illustrations are by Ben Blakeman and Maurizio Toscano. Specialist analysis was carried out by Mary Dillon and the 14 Chrono Centre at Queen's University Belfast. Joseph O'Brien was the resident engineer for consultant engineers Hyder Tobins. The project was commissioned by Galway County Council and was funded by the National Roads Authority. The Project Archaeologist was Jerry O'Sullivan.

1 Introduction

This report constitutes the final excavation report of a previously unrecorded lime kiln in the townland of Cullenagh More, Co. Galway (Fig 1). The site was excavated as part of the archaeological excavation programme in advance of construction for N18 Gort to Oranmore road scheme. The site was located within the lands acquired for the scheme and was identified during the Environmental Impact Assessment (EIA) and was subject to archaeological testing at Phase 1 (E3708) which identified the remains of the lime kiln.

2 Background to the scheme

The N18 Oranmore to Gort (Glenbrack to Rathmorrissey) national road scheme was approved by An Bórd Pleanála on 7 June 2007. The development will consist of approximately 27 km of dual carriageway, and all associated works. The area of archaeological investigations lies within the footprint of the proposed scheme as defined by the Compulsory Purchase Order (CPO) published by Galway County Council on 1 August 2006. Eachtra Archaeological Projects was commissioned by Galway County Council and the National Roads Authority to undertake Phase 1 archaeological testing and Phase 2 excavation of sites directly impacted by the proposed development.

3 Topography, geology and hydrology

The underlying geology in the surrounding area is Carboniferous limestone of the Burren and Tubber formations bordered by Namurian shales and sandstones to the west, in Co. Clare and Devonian old red sandstone to the east, in the Slieve Aughty uplands. Glacial till overlies the bedrock to varying depths (0–5 m) and the soils derived from the till are generally deep well drained brown earths. The topsoils are characteristically deep and dry and, enriched by the limestone parent material, support moderately good grass pastures. There are boulder fields and expanses of bedrock exposure typical of karst limestone country.

4 Historical background

The townland in which the site is found forms a pair with Cullenagh Beg. The name Cullenagh More could be derived from a number of combinations of Irish words but the dominant interpretation of the word Cullenagh means a holly wood, indicating an abundance of holly (Joyce 1913, Vol 1 p 514). The last part of the name, More, is interpreted as *Mór* meaning big or great, while its neighbour is *Beg*, meaning small. Interestingly, Ardahan (the height of the bracken) townland is immediately east of Cullenagh Beg and it is tempting to interpret both placenames representing a contemporary medieval estate-

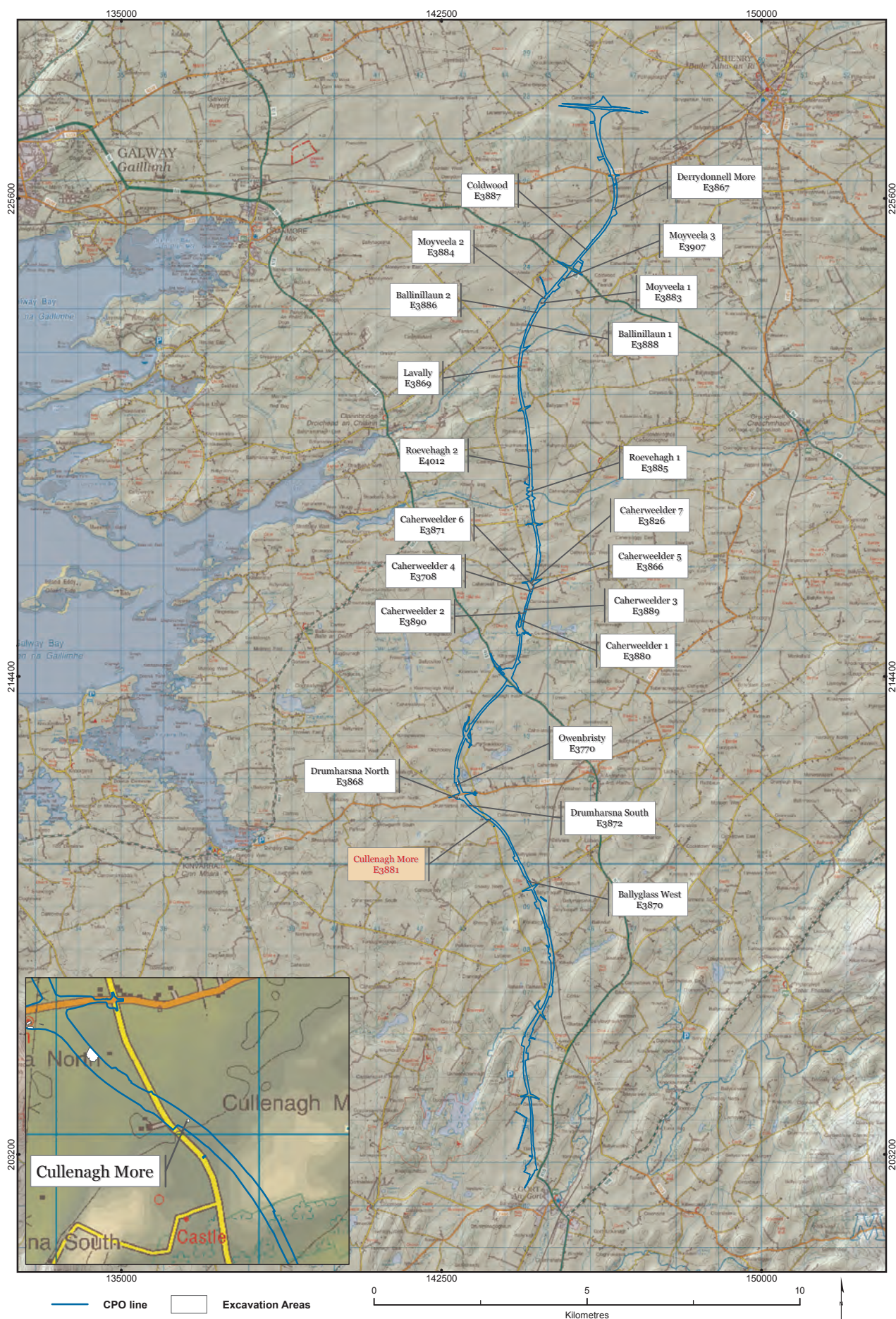


Figure 1: Discovery Series Ordnance Survey map showing the route of the new N18 Oranmore to Gort road and the location of all the excavation sites. The excavation site at Drumharsna North is highlighted.

naming episode. A burgh at Ardahan is listed in the historical sources as the manor of Maurice Fitzgerald and it was preceded by pre-Norman monastic estate.

Cullenagh More is situated within a landscape rich in recorded archaeological remains from various time periods. The site is located 500 m to the north-east of Drumharsna Castle (16th century) and around 500 m to the south-east of the cashels excavated as part of this road scheme at Drumharsna South and Owenbristly. A small group of stone built structures is depicted on the first edition OS 6" map within the field adjacent to the east side of the site at Drumharsna South. Only one of these structures remains extant and is a well preserved stone and lime-mortared building of probable early modern date.

The medieval settlement at Ardahan, notable today by the remains of a roundtower, church and towerhouse, is approximately 2 km to the east of Cullenagh More. As Cullenagh More, Cullenagh Beg and Ardahan are all contiguous it is tempting to envisage them forming part of a medieval estate. If the lime kiln at Cullenagh More did produce calcined stone intended for slaking and mortar/render/wash production it could have been for buildings related to the settlement at Ardahan, or the adjacent late medieval towerhouse or smaller scale vernacular buildings in Drumharsna South.

5 Site description

The excavated site is located towards the centre of Cullenagh More townland (NGR 143654/211068) (Fig 1 – 5). The site at Cullenagh More was previously unrecorded and was identified during field walking of the area of the proposed N18 route. During the course of the excavation local information regarding the site came to light. This knowledge suggested that the structure had been owned and used by the same family for several generations. Members of this family still reside close by, and recall the site being accessible although disused.

6 Methodology

An area measuring 144 sq m was stripped of sod and topsoil by hand. The site was then subjected to an intensive hand clean. The structure was excavated by hand and recorded using the single-context recording system with plans and sections being produced at a scale of 1:20 or 1:10 as appropriate. A complete photographic record was maintained throughout the excavation.

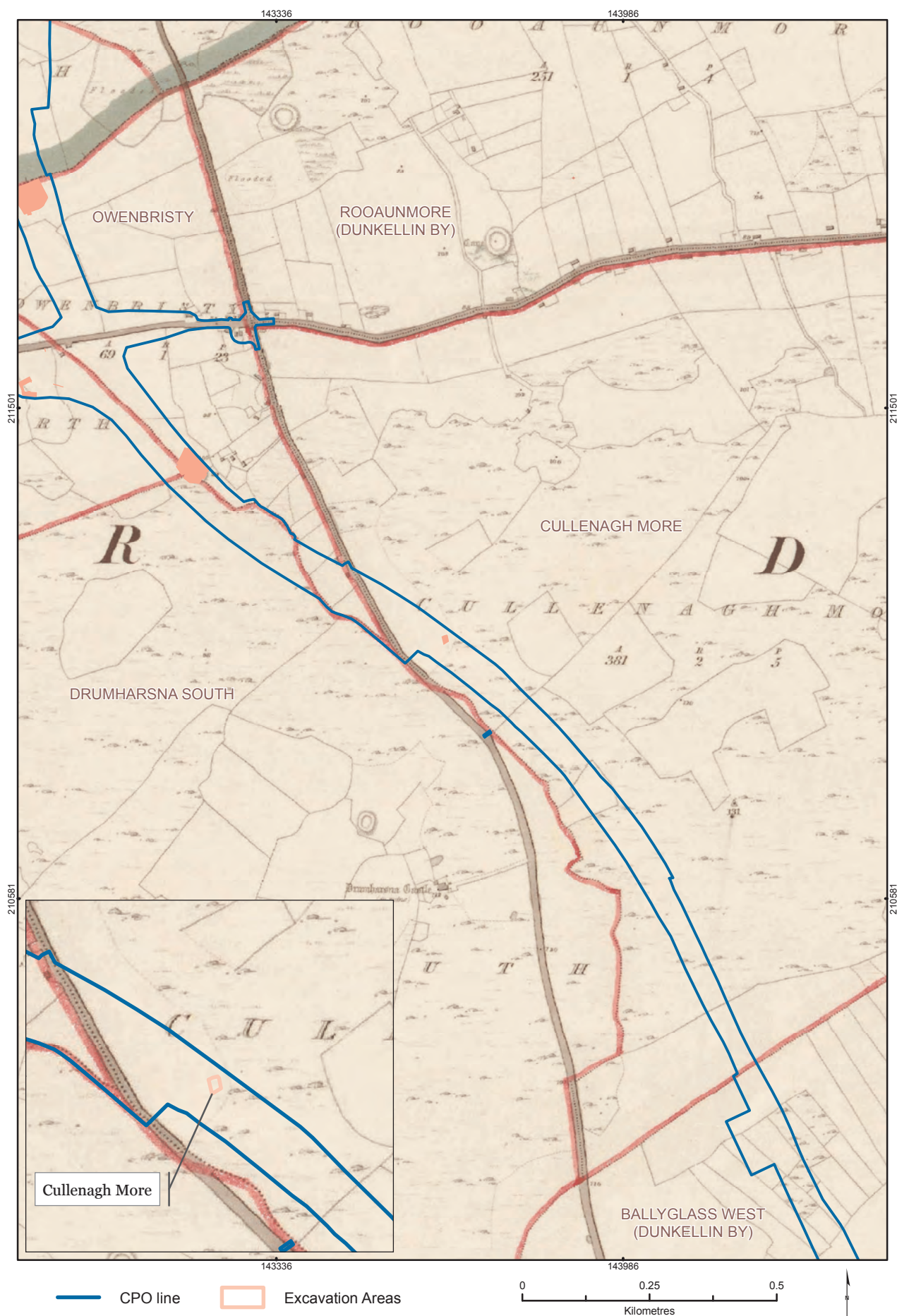


Figure 2: The route of the new N18 Oranmore to Gort road overlaid on the first edition Ordnance Survey map (Sheet GA113). The excavation site at Cullenagh More is also highlighted.

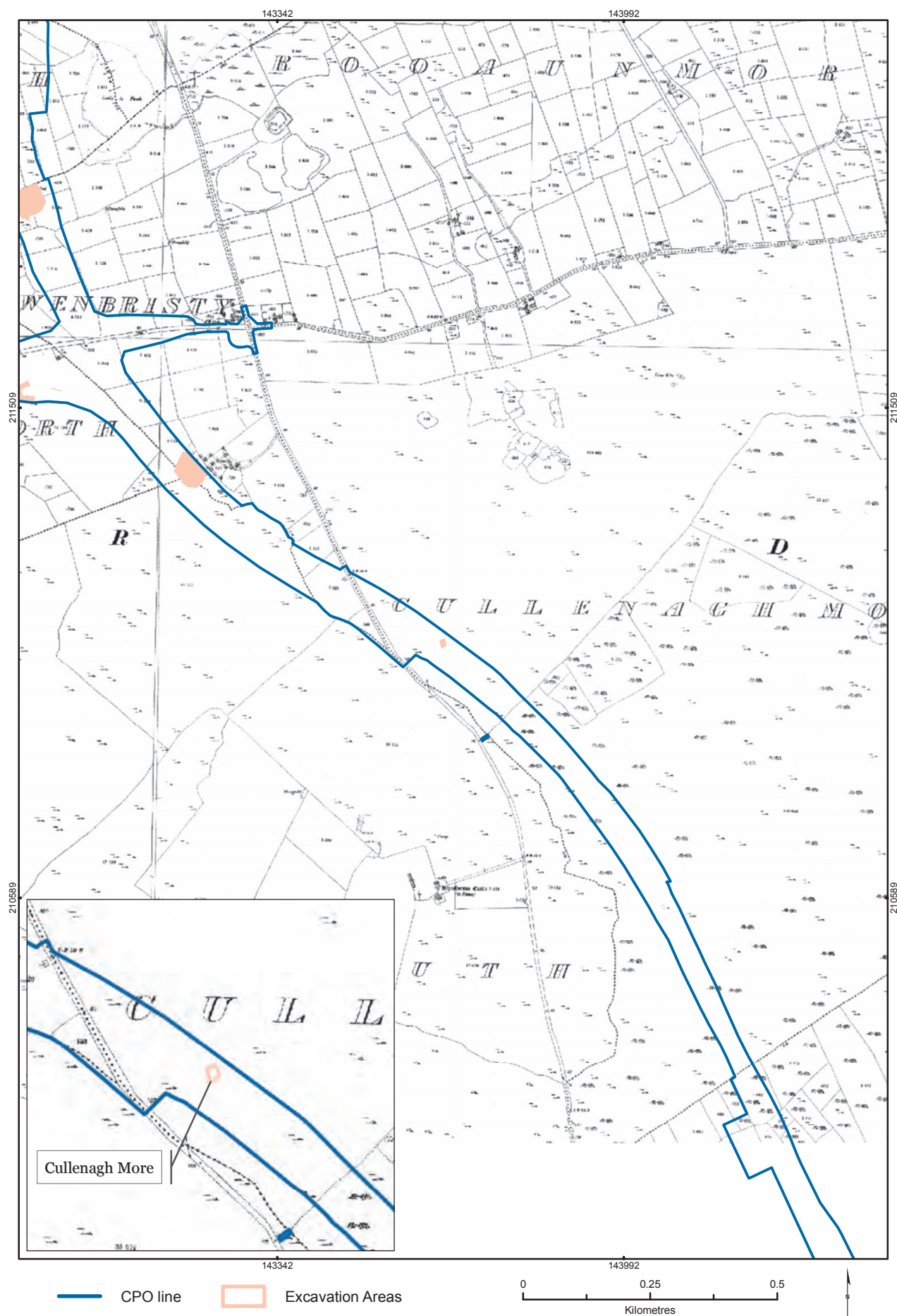


Figure 3: The route of the new N18 Oranmore to Gort road overlaid on the 25 inch Ordnance Survey map (Sheet GA113). The excavation site at Cullenagh More is also highlighted.

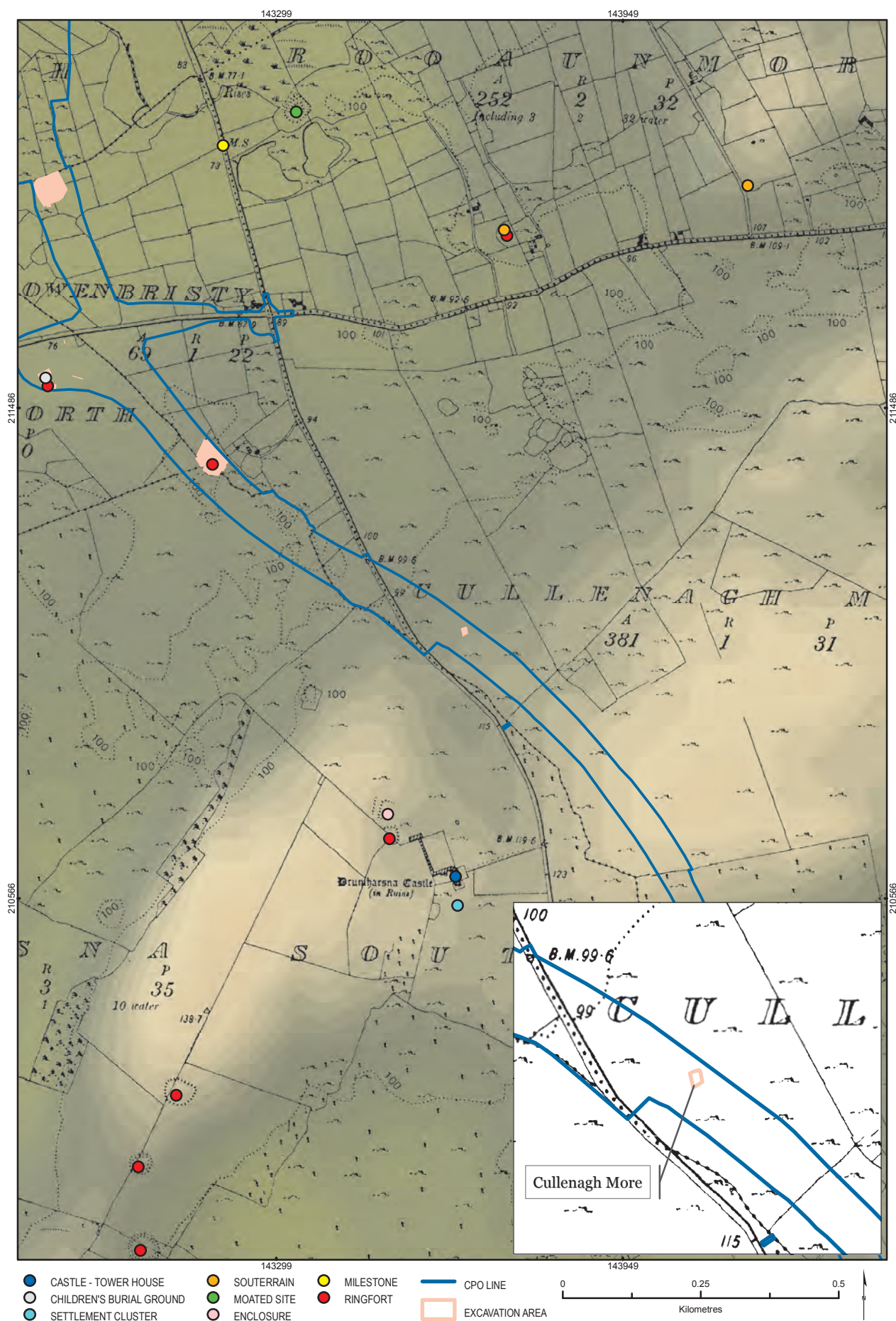


Figure 4: The route of the new N18 Oranmore to Gort road overlaid on the Record of Monuments and Places map which is based on second edition Ordnance Survey map (Sheet GA113).

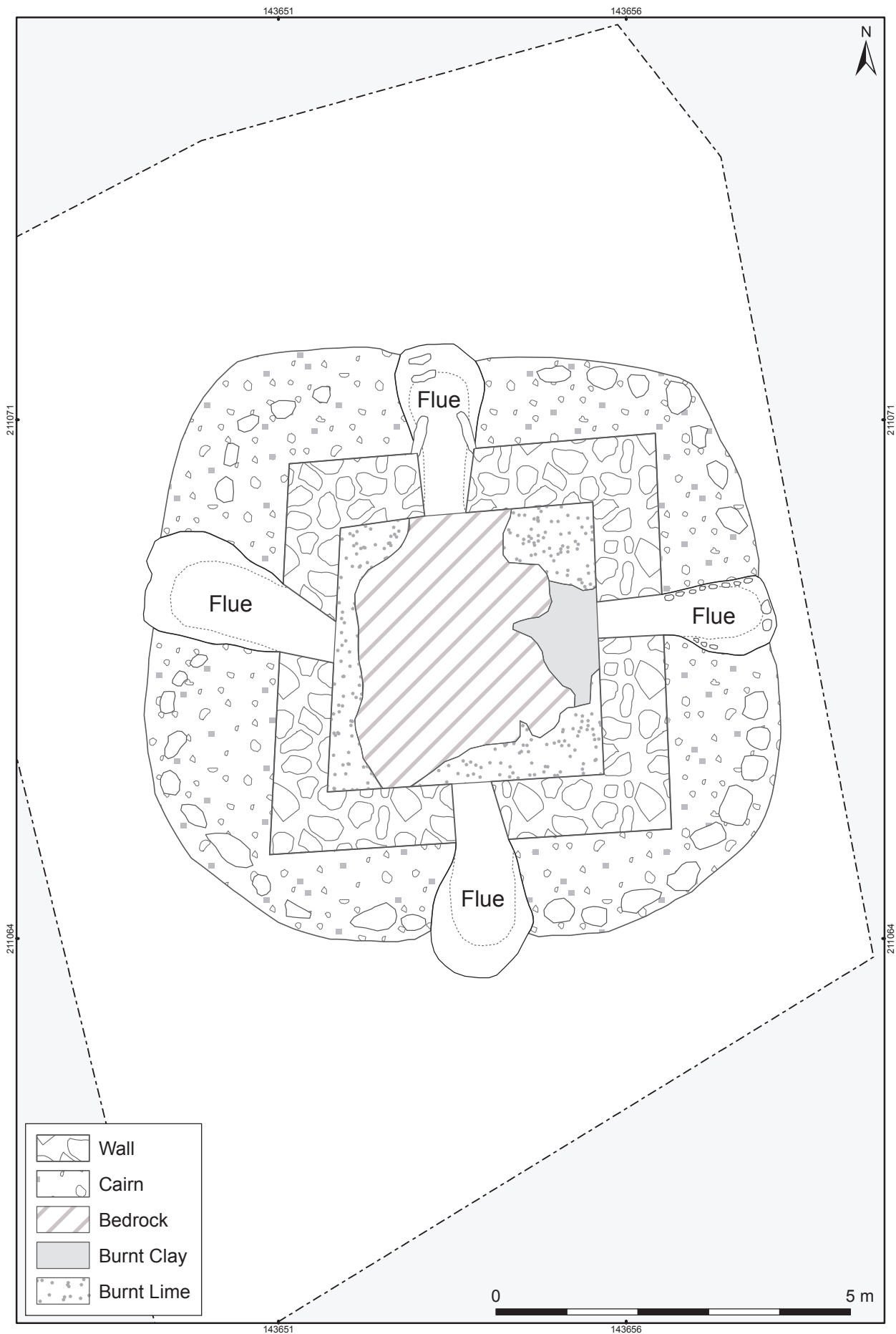


Figure 5: Post-excavation plan of the site at Cullenagh More.



Plate 1: Pre-excitation photograph of sunken chamber.

7 Results of excavation

The structure comprised a roughly square, earth-dug, subterranean chamber, revetted with coursed random rubblestone with small angular pinnings (Plate 1). Small mounds of lime were discovered in the corners and along the floor edges. The floor is now irregularly stepped and slightly sloping limestone bedrock. However, it seems that this may have been levelled using a thin layer of gravel and grit and small flat 'flagstones', a small number of which survive *in situ*. At the base of each wall near the centre point is a small lintelled flue. The opening in the north wall was slightly larger and of different construction to the other three flues. The upper courses appear to have been rebuilt at some point and now protrude slightly from the ground surface. The exterior of the upper part of the wall is revetted with a low roughly circular 'cairn' of earth and stone now covered in a thin layer of sod and moss. The interior was filled with large limestone slabs and boulders, rubblestone and earth. A large hawthorn tree and off-shoots were embedded in the northeast corner.

7.1 Walls & flues

All of the subterranean walls were of similar construction. Roughly coursed rubble stones, of varying size, laid on their horizontal planes. The intervening gaps were packed with small to medium sized angular pinning stones. The walls were of drystone construction. Although some possible lime mortar or plaster was recovered from the lower face it was thought this might be residue from the use of the kiln rather than part of the structure.



Plate 2: Blocked up flue in east wall.

The flues were all keyhole-shaped in plan, with a linear straight-edged cut and a rounded bowl-shaped end. The south, east and west flues within the wall were covered with stone slab lintels and the walls of the flues were partly stone lined. Each flue had been blocked up small rubble; and infilled with stone, lime (C.10) and redeposited natural soils (C.6), presumably when the function of the structure altered. Each external flue entrance showed signs of intense *in situ* burning, indicating that the reducing fire may have been lit and maintained at the flue opes.

The north wall (C.5a) was 3.48 m in length, 0.54 m wide and 1.35 m at its highest point. The opening in this wall was defined by squared limestone blocks and was 0.67 m in width. The opening was splayed to the north. The flue (C.7a) itself had a 'keyhole' shape in plan, being rounded at its north end (1.30 m width). The base sloped gently in towards the centre of the stone structure. Two large flat slabs (C.9) were discovered, standing upright. These were originally thought to be collapsed lintels, however their placement and shape suggested something different. The first, on the west side was larger (0.81 m height, 0.55 m width, 0.09 m depth) and rested on a flat base with vertical sides and a rounded top. The second slab was smaller (0.61 m height, 0.56 m width, 0.10 m depth). They mostly stood at a slight angle to the boulder behind and were embedded within a deep deposit of white lime (C.3). Below this basal layer was the underlying natural gravel with no indication of burning or scorching. The opening in the structure wall was blocked up with stone rubble and the flue behind filled with redeposited subsoil (C.6)

The east wall (C.5b) was 3.63 m in length, 0.56 m in width and 1.60 m at its highest point. The opening (0.50 m) in this wall was again defined by squared blocks and a large slab lintel (Plate 2). The flue (C.7b) was 'keyhole' shaped in plan and splayed from 0.50

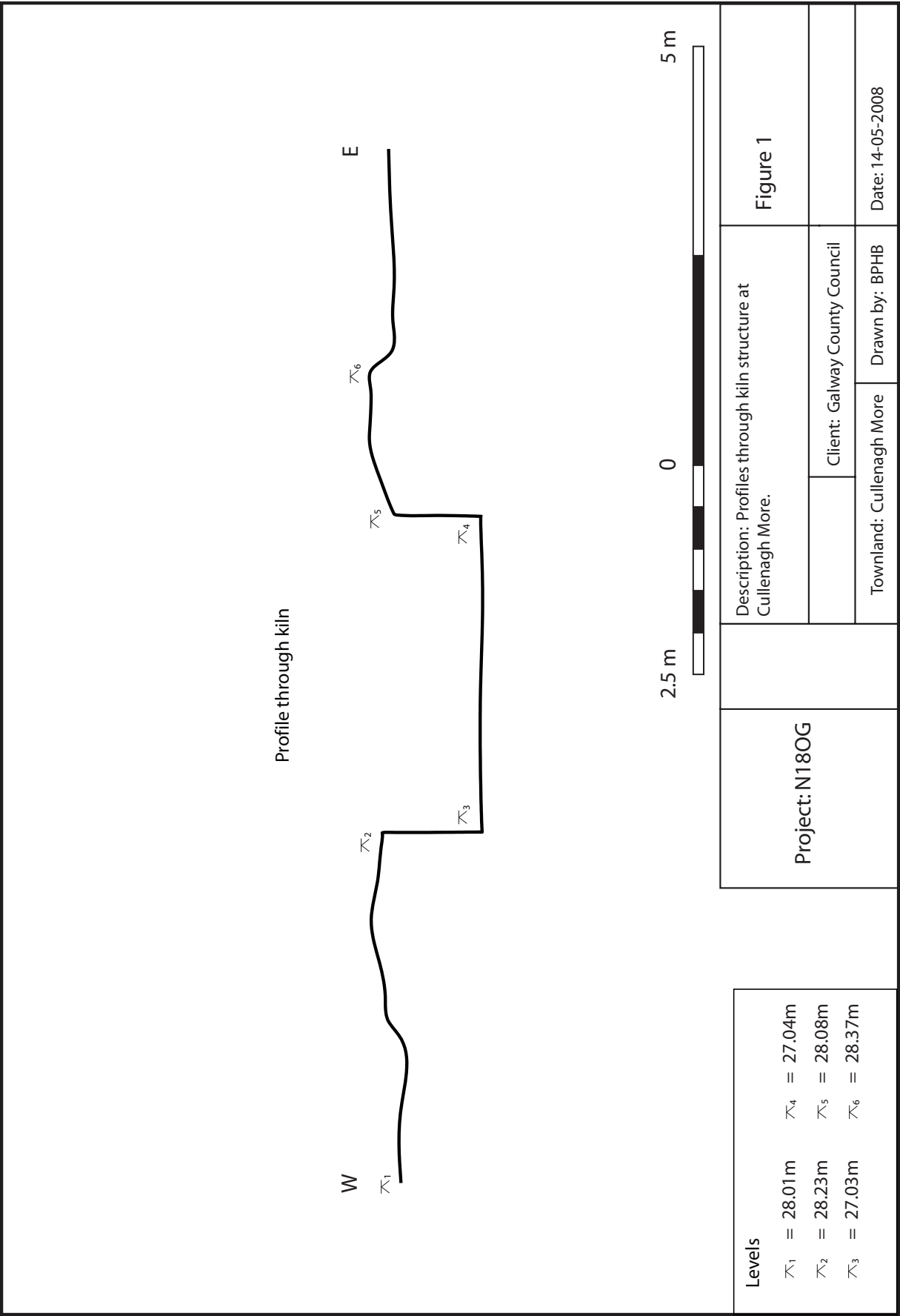


Figure 6: E-W Profile of lime kiln.

m at the wall to 1.30 m wide with a rounded bowl shaped end (2.50 m in length). Three large boulders with their flat planes facing inwards are situated at the end of the flue. It appears that the largest (0.84 m x 0.42 m x 0.42 m) is *in situ* while the others (one adjacent and one overlying the first) have shifted somewhat. The north side of this flue was revetted with coursed small rubble stone while the south side was partly revetted. The base of the flue, which comprised bedrock sloping inwards, was covered in a thin layer of lime (C.3/C.11) below which, at the entrance, was a dense concentration of charcoal (C.12) lying on scorched earth (C.8) indicating the location of a fire. Once the opening had been blocked a layer of small and medium size stone had been deposited within the flue (C.11) over which was deposited a deep layer of redeposited natural (C.6).

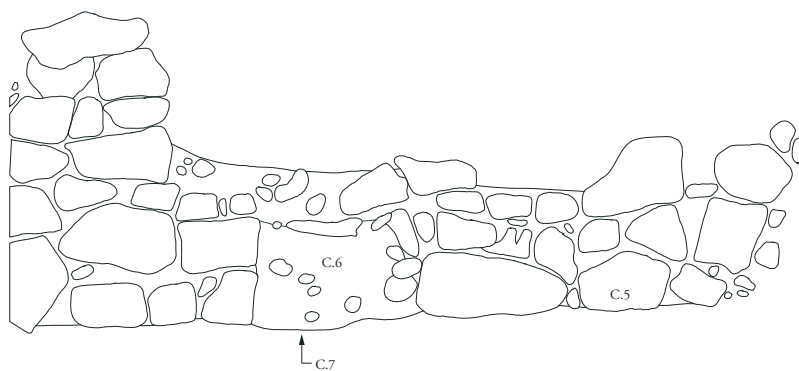
The south wall (C.5c) of the kiln was 3.82 m in length, 0.56 m in width and 1.35 m at its highest point. The opening (0.62 m wide) in this wall was defined by squared blocks and a large slab lintel. The flue (C.7c) was keyhole-shaped in plan and splayed from 0.62 m to 1.30 m wide with a rounded bowl-shaped end. The bedrock at the base of the flue sloped gently inwards and was covered in successive layers of charcoal and burnt/scorched clay (C.14), lime (C.3/C.13) and charcoal (C.12). The opening in the wall was blocked up with rubble stone and similar stone filled the bowl shaped flue end. Behind the blocked opening the flue is filled with stone (C.11) and redeposited natural (C.6).

The west wall (C.5d) of the kiln was 3.62 m in length, 0.55 m in width and 1.45 m at its highest point. The opening (0.77 m wide) was defined by square blocks and two smaller lintels (C.17) (0.52 m x 0.30 m x 0.10 m). The flue (C.7d) was keyhole-shaped in plan and splayed from 0.77 m to 1.39 m with a bowl shaped end. The base of the flue comprised bedrock gently sloping inwards. This bedrock was covered by a thin layer of natural gravel (C.15) over which lay a deposit of lime (C.3) and charcoal (C.12).

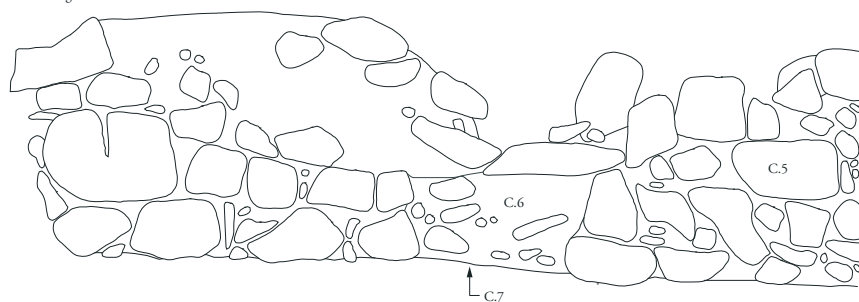
Interior

The basal layer (C.8) was confined to the corners and along the edges of the interior of the structure and was particularly concentrated at the openings of each flue except the northern one. The layer comprised orange-brown clay with frequent charcoal flecks and lumps of reddened scorched clay. There was no disturbance of this context due to the cemented nature of the overlying burnt lime fill. This fill (C.3) comprised cemented deposits of burned lime and limestone fragments and was built up in each corner of the interior, where the layer had a maximum depth of 0.32 m (Plate 3). From the base of this deposit a number of large burned wood fragments were recovered. Both these lower layers (C.8 & C.3) lay on relatively level limestone bedrock (Plate 4). Within the layer (C.3) a small group of possible flagstones (C.4) was discovered. These were located in the south-east quadrant of the interior and were resting on a thin layer of pebbles, small stones and grit. They appeared to have been laid to level the interior ground surface. It is possible they relate to a later phase of activity as they partly overlay the lime deposit (C.3). The stones themselves comprise small slabs (0.47 m x 0.35 m and 0.39 m x 0.24 m) lying flat and tightly packed together.

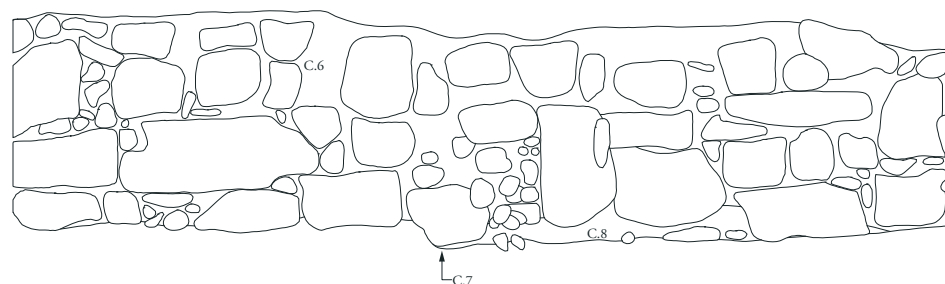
Cullenagh More
North facing elevation



Cullenagh More
West facing elevation



Cullenagh More
South facing elevation



Cullenagh More
East facing elevation

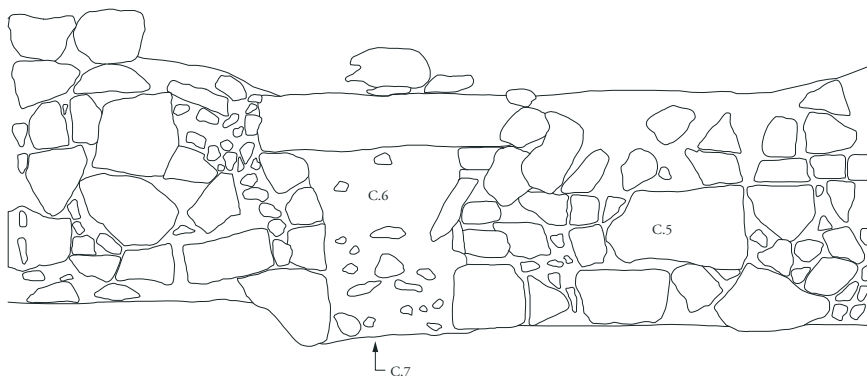


Figure 7: Elevations of lime kiln.



Plate 3: Burnt lime deposit in south-east corner.



Plate 4: Floor and east wall.

Exterior

The upper two to three courses of each of the subterranean walls appear to have been rebuilt at some point. The stones were rounder and more loosely set and there were fewer or no pinning stones present. Parts of this upper level protrude from the ground surface. Partly covering and revetting this wall is a large circular ‘cairn’ (C.16) of small to medium sized boulders, gravel and earth. This material is defined around its outer perimeter by a kerb of small boulders (C.18).

7.2 Radiocarbon dates

Radiocarbon analysis was carried out by the 14 Chrono Centre in Queen’s University Belfast. Dates were calibrated using Calib Rev5.0.2 (©1986–2005 M.Stuiver & P.J. Reimer) and in conjunction with Stuiver & Reimer 1993 and Reimer et al. 2004.

Dates were obtained from the southern flue fill. A late medieval date was returned which, if combined with local information, suggests the site was, potentially, in use from the fifteenth to the twentieth century, albeit with different functions.

Lab. Code	Context	Sample	Material	Years BP	δ 13 C	2 sigma calibrated AD	Period
UB-11510	14	17	Pomoideae	2009+/-25		1469–1633	Medieval/ Postmedieval

8 Conclusion

A lime kiln was found at Cullenagh More, Co. Galway. There was a square, stone-lined subterranean main chamber with flues to the north, south, east and west. In form and dimensions it generally conforms to the pattern expected from relatively early Irish lime kilns and charcoal from the eastern flue produced a late medieval/post-medieval radiocarbon date. No evidence for a lime-slaking pit was found during the excavation and it seems more likely that the lime kiln was built here to process the limestone at source and the calcined limestone was transported to the building site after burning when it would have been almost half its former weight.

The possibility does exist for the limestone being calcined for lime manure. Although this might seem unlikely in such a limestone dominated landscape it has been shown that lime manuring was practiced and needed in such areas (Walsh et al 1957), albeit, probably not starting until the 18th century, at the earliest.

Lime kilns were fired at high temperatures to produce calcined lime or quicklime ($\text{CaCO}_3 + \text{heat} \rightarrow \text{CaO} + \text{CO}_2$). The process was only permanent if temperatures exceeded 900° C (Stowell 1963), and once the fire in the kiln was lit it required several days of burning before the limestone was calcined. Quicklime is an alkaline crystalline solid. It is caustic but it has several uses: in building work as a bonding agent (an ingredient in mortar), in render, in whitewash, and as fertiliser. Rynne (1999, 29) notes that most small lime kilns were probably used only intermittently for the production of small quantities of lime for agricultural purposes. The lime burning was often done in Autumn and the calcined stone stored in slaking pits (mixed with aggregate) until the spring (Eric Kingston, modern lime product specialist, pers comm.).

Large, keyhole shaped lime kilns of similar date were excavated at Harristown Little and Bricketstown, Co. Wexford (Tierney, M. 2006). The Harristown Little kiln was a key-hole shaped kiln. Two similar kilns were excavated in Bricketstown townland (licence nos. 00E0476 and 00E0626). The radiocarbon date from this kiln (cal AD 1460–1660) was very close to the date of use at Bricketstown (cal AD 1450–1650). Channels were cut into the bases of both the Bricketstown kilns and these acted as wind tunnels which distributed air evenly through the kiln, as it was burning and ensuring an even burning of lime within the kiln pit, but these were not present at Harristown Little. These channels may have been based on the same principle as the stone-built flues in the Cullenagh More lime kiln. An earlier (13th/14th century), urban, lime kiln was excavated at Mill Street in Drogheda and this had two, possibly three, flues to control heat dispersal (Campbell 2007). Recent work in Devon has highlighted the regional variation in agricultural innovation throughout the medieval period (Turner, 2007, 63) in Britain and it may be that the early dates for the lime kilns in Wexford and here at Cullenaghmore may indicate a similar medieval improvements innovation.

In conclusion, the primary function of this site was probably as a late medieval lime kiln. As its radiocarbon date precedes the 18th century agricultural improvements which championed liming perhaps the initial purpose was for the production of lime mortar

and render for construction purposes. To view the Cullenagh More lime kiln in context we should view it as being built at the source of the raw material, being linked by paths or road to the construction site, perhaps the adjacent tower houses, and complimented by slaking pits dug at the construction site.

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Appendix 1 Context register

Please see attached CD for Context Register.

Appendix 2 Groups and subgroups

Natural Deposits – Group 1

Topsoil – Subgroup 1001

Context Number – C.1

Description

This deposit was a dark orangish brown silty clay with frequent pebbles and medium to large angular to sub rounded stones.

Interpretation

This was the topsoil encountered across the excavation area.

Subsoil – Subgroup 1002

Context Number – C.15

Description

This was a light greyish white silty sand (C.15) with frequent angular and sub-angular pebbles and moderate amounts of angular and sub-angular medium stones.

Interpretation

This was the underlying boulder clay which was present across the excavation area.

Primary construction and use of the lime kiln – Group 2

Construction Elements – subgroup 2001

Context Numbers – C.19, C.5, C.17, C.9, C.7

Description

A roughly square pit (C.19) with steep smooth sides was dug into the topsoil and underlying boulder clay. At the mid point of the four sides a key-hole shaped cut (C.7) was identified with its bowl shaped end extending beyond the edge of the main pit (C.19). The base of the four projections corresponded with the base of the main pit (C.19). The width of the circular end of the four projections ranged from 1.3 – 1.5 m and they extended beyond the edge of the main pit by between 2.3 – 2.8 m.

Four sections of wall (C.5) composed of roughly coursed rubble stone of varying size, laid on their horizontal plane were built directly against the side of the large pit (C.19). The wall was of dry stone construction and the gaps between the larger stones were packed

with small to medium sized angular pinning stones. The lower half of each wall was well built with larger stones while the upper section was of looser construction. The walls ranged in length from 3.48 – 3.82 m and in width from 0.54 – 0.56 m. The maximum upstanding height of the wall prior to excavation was 1.6 m.

There were four blocked-up flues at the mid point of each wall which were defined by squared limestone blocks and which corresponded to the square end of the key-hole shaped cuts. The four gaps ranged in width from 0.56 – 0.77 m. The gaps in the eastern and southern walls were covered by a single large lintel, while two smaller lintels covered the gap in the western wall. The sides of the eastern key-holed shaped cut were reveted with small rubble coursed stone. The gap in the northern wall was different to the other three in that it did not have a surviving, covering lintel. Two large limestone slabs (C.9) set on edge were positioned against the squared stones forming the inner edge of the wall on either side of the northern flue. The stones splayed slightly towards each other and projected back into the key-holed shape cut. The northern key-holed shape cut had a shallower slope than the other three examples and a number of stones were set into the underlying boulder clay (C.15) along its northern circular edge.

Interpretation

The sunken structure once functioned as a lime kiln. The eastern, western, southern and northern key-hole shaped cuts were used as flues to convert limestone into lime by directing heat into the chamber. The recovery of charcoal in the chamber also indicates there was a mixture of limestone and fuel within the chamber. The lime and other residues would have been sorted in the chamber, it being accessed from above.

Residual deposits – Subgroup 2002

Context Numbers – C.11, C.12, C.13, C.14, C.3 and C.8

Description

A fire scorched orange brown sandy clay (C.8) was identified just above the underlying bedrock at the mouth of the eastern flue opening. A yellowish white strongly cemented sand (C.3) with occasional charcoal flecking was identified along the base of the wall and particularly towards the four corners of the sunken structure. Towards the base of the eastern flue a series of deposits were identified. The lowest deposit was a dark brownish black clayey silt (C.14) with a large concentration of charcoal. This was overlain by a strongly cemented light greyish white stony silt (C.13) which was in turn overlain by another charcoal rich soft mid greyish black sandy silt (C.12). A deposit of burnt limestone (C.11) overlay all the other deposits. The western and southern flue also contained the charcoal rich sandy silt (C.12) and the upper burnt limestone deposit (C.11).

Interpretation

Alternating layers of scorched earth, charcoal, lime and burnt limestone represent the residual deposits associated with the use of the sunken structure as a lime kiln.

Adaptation – Group 3

Context Numbers – C.4, C.6, C.10, C.16 and C.18

Description

Rough limestone blocks were identified between the three flue openings and the possible entrance gap. A soft grey sandy silt (C.10) mixed with occasional pebbles and an upper layer of yellowish brown sandy silt (C.6) mixed throughout with small to medium stones was recorded in the upper levels of the flue bowls and entrance hollow.

A small group of possible flagstones (C.4) was recorded above the lime deposits (C.3) at the base of the sunken structure. These were located in the south-east quadrant of the interior and were resting on a thin layer of pebbles, small stones and grit. The stones themselves were small slabs less than 0.5 m in length lying on their level planes and tightly packed together. The upper two to three courses of each of the subterranean walls was composed of rounder stones which were more loosely set and with fewer pinning stones. Parts of these upper courses protruded above the exterior ground level. Partly covering and revetting the upper courses of the walls was a large cairn (C.16) of small to medium sized boulders, gravel and earth. This material is defined around its outer perimeter by a kerb of small boulders (C.18).

Interpretation

The lime kiln appears to have been adapted and re-used at a later date possibly as an agricultural storage shed or shelter. The flue openings and possible entrance were blocked up and the flue bowls and entrance hollow were backfilled with redeposited subsoil. A flagstone floor was laid above the residual lime deposits and the uneven bedrock surface and the side walls were extended upwards and possibly incorporated into the outer revetment cairn which may have supported a roof structure.

Abandonment – Group 4

Context Number

Description

The interior was filled with large limestone slabs and boulders, rubblestone and earth. A hawthorn tree was growing in the north east corner.

Interpretation

After the sunken structure went out of use the interior was filled with limestone blocks and slabs. This was probably done to reduce the risk of livestock being injured if they fell into the sunken structure.

Appendix 3 Charcoal report

By Mary Dillon

Introduction

In all, one sample from Cullenagh More (E3881) was submitted for charcoal analysis in advance of dating. Charcoal from trees with a short life-span is suitable for dating while charcoal from trees with a long life-span is not.

Methodology

Charcoal fragments of 2 mm or greater were identified. Each fragment was prepared for microscopic examination by fracturing it by hand and thereby exposing a clean surface along transverse, radial and tangential planes. All three planes were examined at a range of magnifications (x100 to x400) under a Nikon microscope. For reference literature Schweingruber was consulted (1990). The number and weight of fragments were recorded for each wood type. Note - As the ideal weight of charcoal for standard radiometric dating is 8 to 12g, the sample is recommended only for AMS dating.

Results

Sample 17 from context 14 had pomoideae charcoal (1 fragment, 0.05g) that is suitable for AMS dating.

Context	Sample	Identification	Suitable for AMS dating?
17	14	Pomoideae (1 frag, 0.05g)	Yes

Table 1. Charcoal from Cullenagh More

References

Schweingruber F.H. (1990) Anatomy of European woods. Haupt, Bern