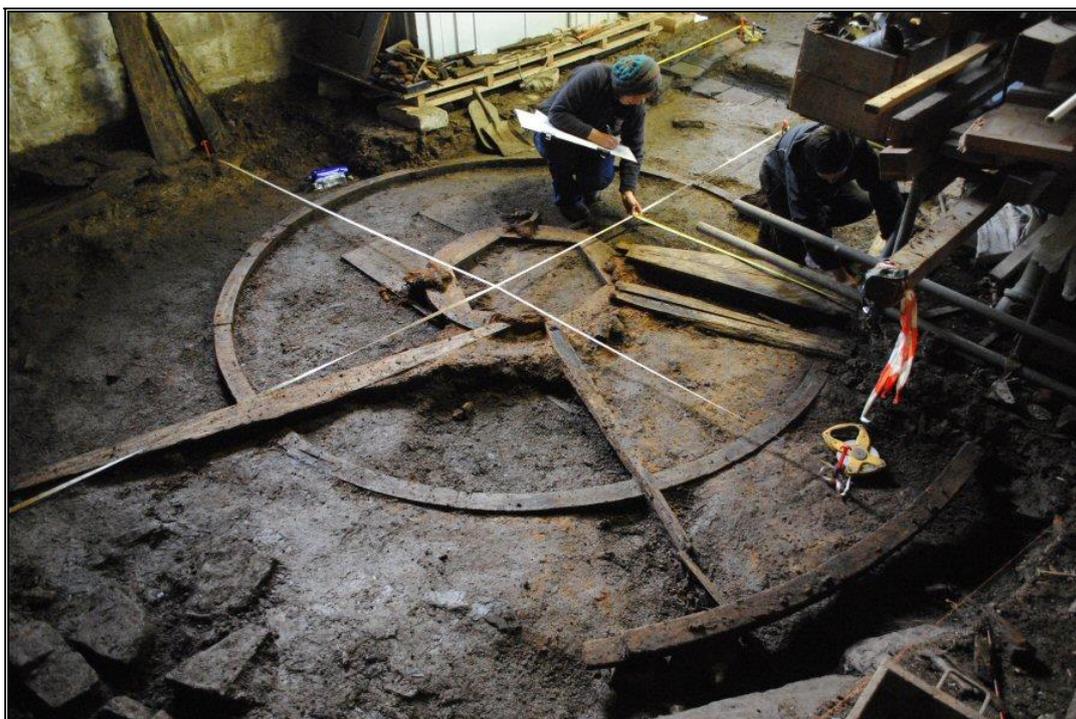


A SECOND PHASE OF FIELDWORK
AT THE KILLHOPE BUDDLE HOUSE,
KILLHOPE LEAD MINING MUSEUM
COUNTY DURHAM

REPORT ON AN ARCHAEOLOGICAL EXCAVATION
CARRIED OUT IN OCTOBER & NOVEMBER 2013



by

THE ARCHAEOLOGICAL PRACTICE LTD.

for

THE NORTH OF ENGLAND LEAD MINING MUSEUM

SUPPORTED BY

THE ALTOGETHER ARCHAEOLOGY PROJECT
NORTH PENNINES AONB

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SUMMARY

A second programme of archaeological evaluation trenching and historic buildings recording was conducted in October 2013 at the Buddle House, the most easterly existing building of the early modern industrial complex at Killhope, now a lead mining museum.

Building recording in 2012 showed the buddle house to be a complex structure, though largely rebuilt from mid-wall height. Excavations carried out in the building interior, also in 2012, provided evidence for good survival of sub-surface wooden features in three locations and it was considered likely that other such remains survive elsewhere within the building. It was recommended, following excavation in 2012, that the remains of the convex buddle uncovered in Trench 1 should be fully exposed by excavation in order to determine its full size and the nature of all its components, and that it should be preserved by controlled air drying in order to allow its eventual display.

Accordingly, excavations conducted within the Buddle House in October and November 2013 provided further evidence for surviving structures, fully exposing two circular structures interpreted as the remains of circular buddles of convex type, although that interpretation remains in some doubt due to their relatively small size.

The original appearance and modus operandi of the buddles remains somewhat obscure, but in Buddle 2, wooden slats arranged from segmental inner ring across the outer ring towards the possible extra outer ring suggest a possible floor structure and the direction and course of flow of the box drains uncovered between the buddles provides some interpretive evidence, the branch from Buddle 2 appearing to come directly from the centre of the buddle itself, suggesting that slurry from the Classifier may have fed this buddle, while it is suggested that the branch from Buddle 1 may have removed excess water from the putative west corner settling tank, the slurry from which feeds Buddle 1.

Other timber, stone and metal items recovered in the buddle interiors below roof slates and timbers from the original fallen roof are suggestive of items including joints and struts that would have been required in the construction of the buddle hub, slurry supply conduit, brush arm, super-structure, etc., but their distribution formed no observable pattern suggestive of their original form.

In addition to the remains of buddles, three sections of well-preserved box drains were uncovered, all apparently in situ, one of them related directly to Buddle 2.

It is considered highly likely that other well-preserved features relating to the original function of the Buddle House survive in areas not yet excavated, notably in the north (NW) corner which is considered highly likely to contain the remains of a fourth buddle. Further box drains are also likely to survive within the building floor deposits.

It is recommended that the remains of the convex Buddle 1, having been fully exposed and removed to a storage area, should be preserved using the methods recommended by Jenny Jones in her 2013 report, in advance of preservation and display – perhaps mounted on a wall of the building or in another suitable location - alongside interpretive material presented on a panel or in the form of a reconstructed model.

1. INTRODUCTION

1.1 Location and Purpose of Evaluation

A programme of archaeological evaluation trenching and historic buildings recording was conducted in November 2012 within the Buddle House, the most easterly existing building of the early modern industrial complex at Killhope, now a lead mining museum located in the north-west corner of County Durham (NGR NY 82699 42975) in Upper Weardale, close to the border with Cumbria at Nenthead.

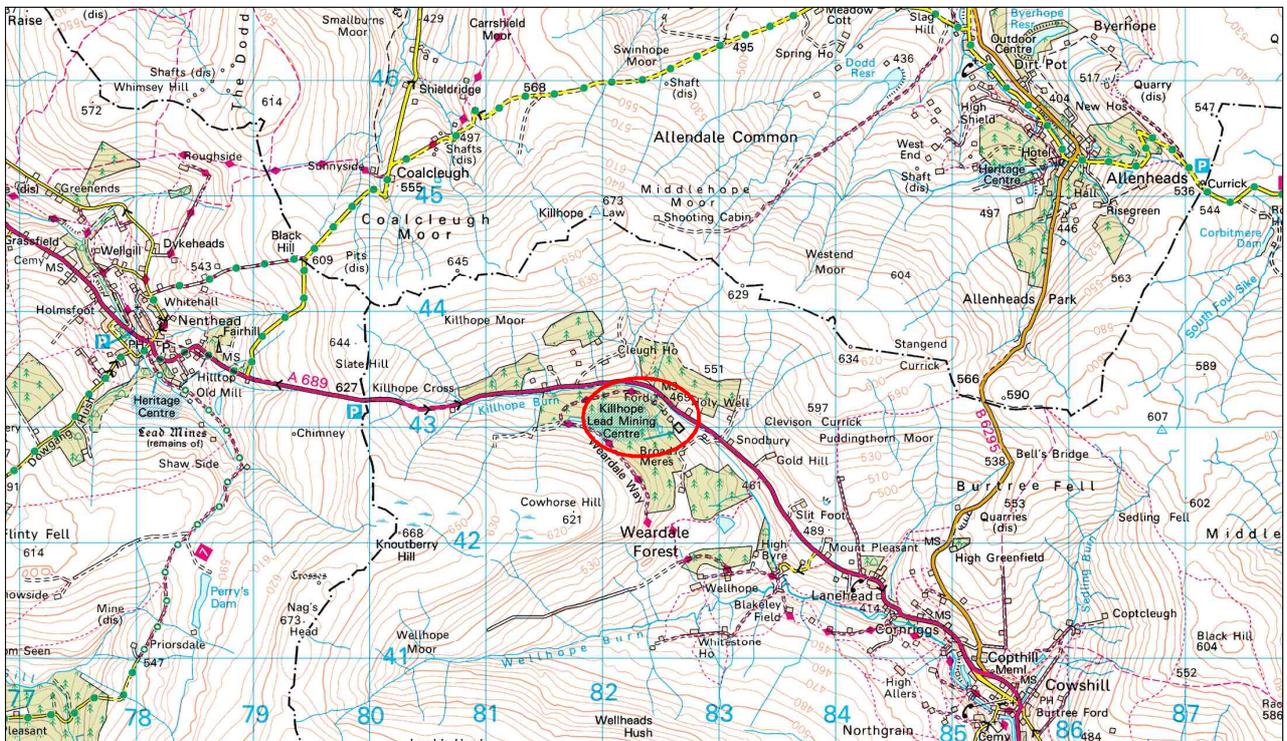
The Killhope complex, legally protected as a Scheduled Ancient Monument owned and managed as the North of England Lead Mining Museum by Durham County Council, is one of the most popular visitor attractions in the North Pennines, with a range of facilities and attractions including working components of a lead mine and ore processing facility, as well as display areas. Plans are currently being developed for the redevelopment of parts of the site, including the former Buddle House, currently used for general storage, as an education room. Prior to the evaluation, weathered timbers protruded from the earthen floor of the Buddle House close to its east door, suggesting that original machinery may survive buried beneath the present ground surface.

The current excavation, following evaluation excavation of three trenches in 2012, is subject to Scheduled Monument Consent granted by English Heritage and has been designed to record the remains of machinery associated with the buddling process surviving in the earthen floor of the building. The results of excavation are, therefore, of key importance to the future management of the site, as well as being of considerable research interest in its own right.

The 2013 excavation consisted of the excavation of the south-west part of the building (comprising about 30% of the entire interior space) and was directed by Richard Carlton of the Archaeological Practice with assistance from Paul Frodsham (North Pennines AONB Historic Environment Officer) and Marc Johnstone and Mick Coates from the Archaeological Practice team. Additional advice was provided throughout the course of excavation by Mike Bouse, current manager of the North of England Lead Mining Museum, and Ian Forbes, its former manager. Rob Young, English Heritage Inspector of Monuments arranged the SMC for the work and inspected the excavations immediately following the completion of work.

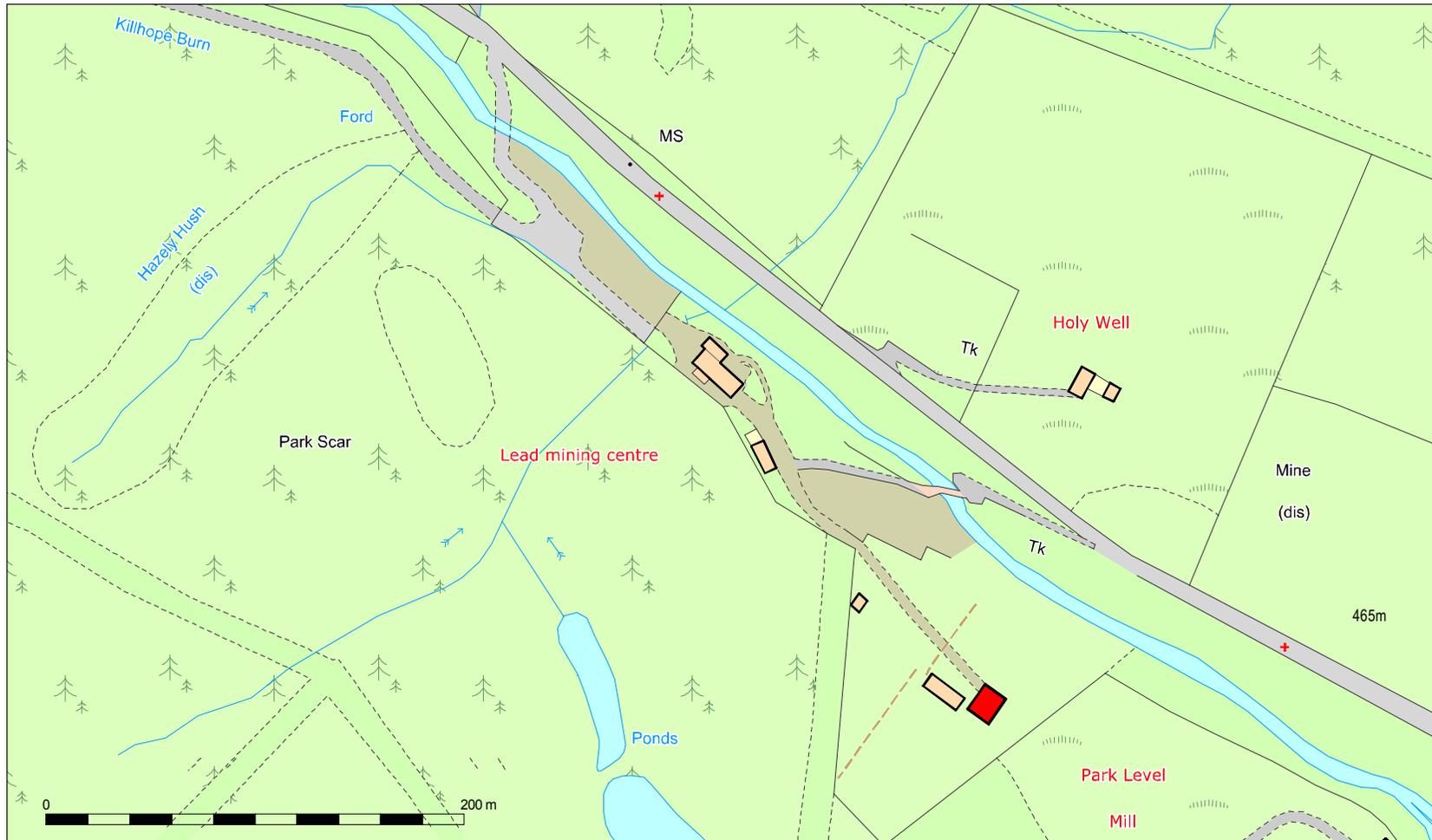


Illus. 01: Map showing the location of Killhope (circled in red) in north-east England.



0 Scale 1:80000 5 km

Illus. 02: Map showing the location of Killhope (circled in red) at the northwestern border of County Durham with Cumbria (to the west) and Northumberland (to the north).



Illus. 03:
Map showing the location of the Buddle House (infilled red) at the south-east end of the Killhope Lead Mining Museum complex.

2. KILLHOPE LEAD MINE AND BUDDLE HOUSE

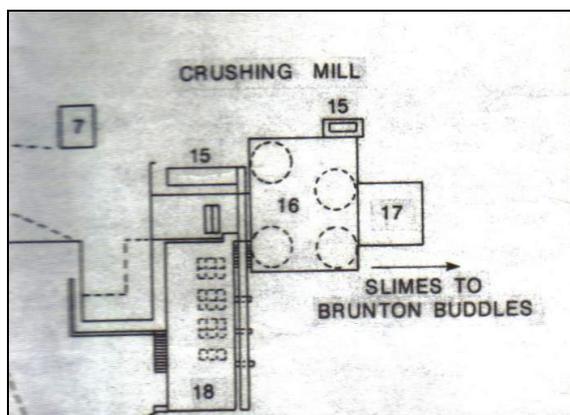
2.1 Introduction

Killhope lead Mining Museum is the best-preserved lead mining site in Britain, centred on a Victorian lead mining complex known as Park Level Mine and Park Level Mill. Opened in 1853, but deserted by the end of the First World War, the mine at Killhope was most prosperous in the late 1870s when was among the ten richest lead mines in Britain. After nearly 70 years of abandonment, Killhope opened as a visitor attraction in 1984, since when the museum has won many awards for its interpretation of the lead industry.

2.2 The Buddle House

To meet increased levels of production, a new crushing and separation plant was built in 1876-78 to deal with mixed ores from the washing rakes of Park Level and Killhopehead. This was fully-mechanised and powered by a large water wheel with two smaller ones, fed via a complex system of reservoirs and leats. Known as Park Level Mill, this complex, which includes the Buddle House, dominates the Killhope landscape.

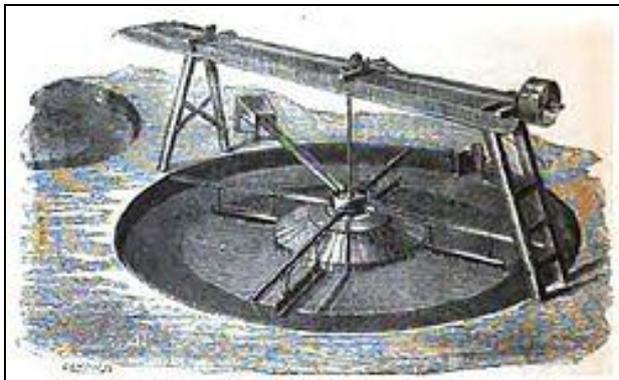
The purpose of the Buddle House was to house machinery through which the finest particles of lead ore were separated from waste materials and retained. Fine bouse, too small for 'jigging' within the neighbouring jigger house, flowed in a stream of water through an overhead trough to the Buddle house. On its way it passed through a 'classifier', a large cone-shaped stone structure into the top of which water and fine ore from the jigger house flowed at one side. Most of the water and some of the lighter waste was carried over the top at the other side, whilst the heavier ore-rich material sank to the bottom of the pyramid from where a pipe led it to the buddles. On the basis of plans for similar complexes of buildings elsewhere - notably at Groverake, between Allenheads and Rookhope in Weardale, where the lead mines were worked by the Beaumont Company – suggest that there were four buddles in operation, driven by their own small water wheel against the north wall of the Buddle House.



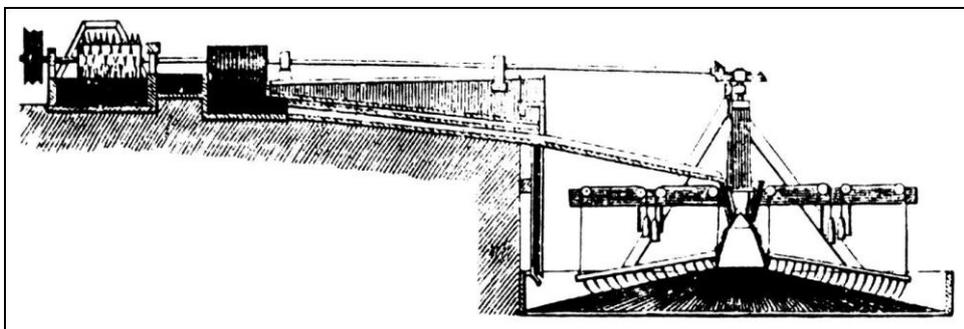
Illus. 04: Plan of Groverake with four buddles show in in the Buddle House [16] next to the Classifier [17] and Jigger House [18].

The buddles in use in the North Pennines during the middle and later part of the 19th century were of two designs, the earlier and most common type being convex, and the later, less common variant being the concave buddle. The early, convex buddle was designed with a wooden superstructure like a large upturned saucer, onto the high centre of which was fed a slurry of fine bouse, while revolving brushes distributed this evenly around the whole 'saucer'. The heavier ore settled out first, nearer the middle, whilst the lighter waste was carried towards the edge. After a time the machine was stopped and the different bands, of increasing purity towards the centre, were dug out. The water used in all the processes was led to the settling tanks where any remaining solids held in suspension were settled out. The late, concave variant operated more like the Classifier described above, with slurry entering at a point on the upper edge and solids settling on the sides and at the bottom of the apparatus, the water draining away through a central drain.

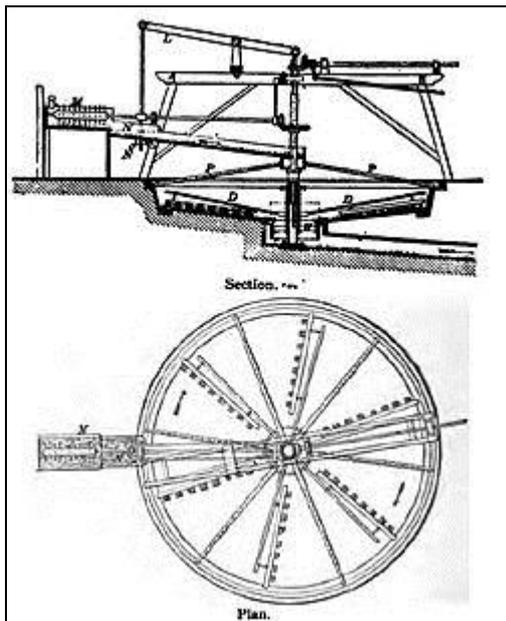
The above description and interpretations based on the results of excavation are informed by a description of the functioning of a convex buddle provided from *Machinery for Metalliferous Mines: A practical treatise for mining engineers, metallurgists and managers of mines*, by E. Henry Davies (1902), quoted at length in the results of the 2012 Buddle House excavations (Carlton 2013):



Illus. 05: Diagram of a working round buddle (Davies 1902)



Illus. 06: Cross-section of a working round buddle (<http://shropshiremines.org.uk/educpack/section4/separation.pdf>)



Illus. 07: Plan and Cross-section of a working concave buddle (Davies, 1902).

Prior to the current series of excavations it was not known which type of buddle was in operation at Killhope, nor if remains sufficient to determine that information could be uncovered and successfully recorded. A possible guide to the likely state of surviving remains was provided by illustrations of abandoned buddles elsewhere, such as in the illustration below shows an abandoned buddle with apparent traces of its removed machinery visible as pieces of wood, with signs of a possible central hub support.



Illus. 08: An abandoned buddle with apparent traces of removed machinery and signs of a possible central hub support.

No clues regarding the design or size of the buddles operating at Killhope are found in any of the documentation associated with the working history of the mine, although Ian Forbes has provided information on the date of construction and subsequent history of the Buddle House itself, much of it revealed in 19th century documentary records (see Carlton 2013).

3. EVALUATION PROGRAMME

2.1 Aims

The aims of the programme of excavation were to further investigate buried remains within the floor of the Killhope Buddle House, focussing on the south-west part of the building interior by excavating the remainder of the buddle in the west corner partially-exposed in 2012 and investigating the south corner where a further buddle structure was expected to survive. The overall aim of the excavation was to determine the character, date and phasing of those remains and, as far as possible, their function, extent, and state of preservation.

It was proposed to use the results of the excavation and interpretation programme to inform the future management of the Buddle House, including potential interpretation for the benefit of visitors. In that regard, the present report includes a brief assessment of the potential for further work, and observations regarding site management.

2.2 Methods

Fieldwork in October 2013 consisted of the excavation of a single, large trench extending across the south-west part of the building interior.

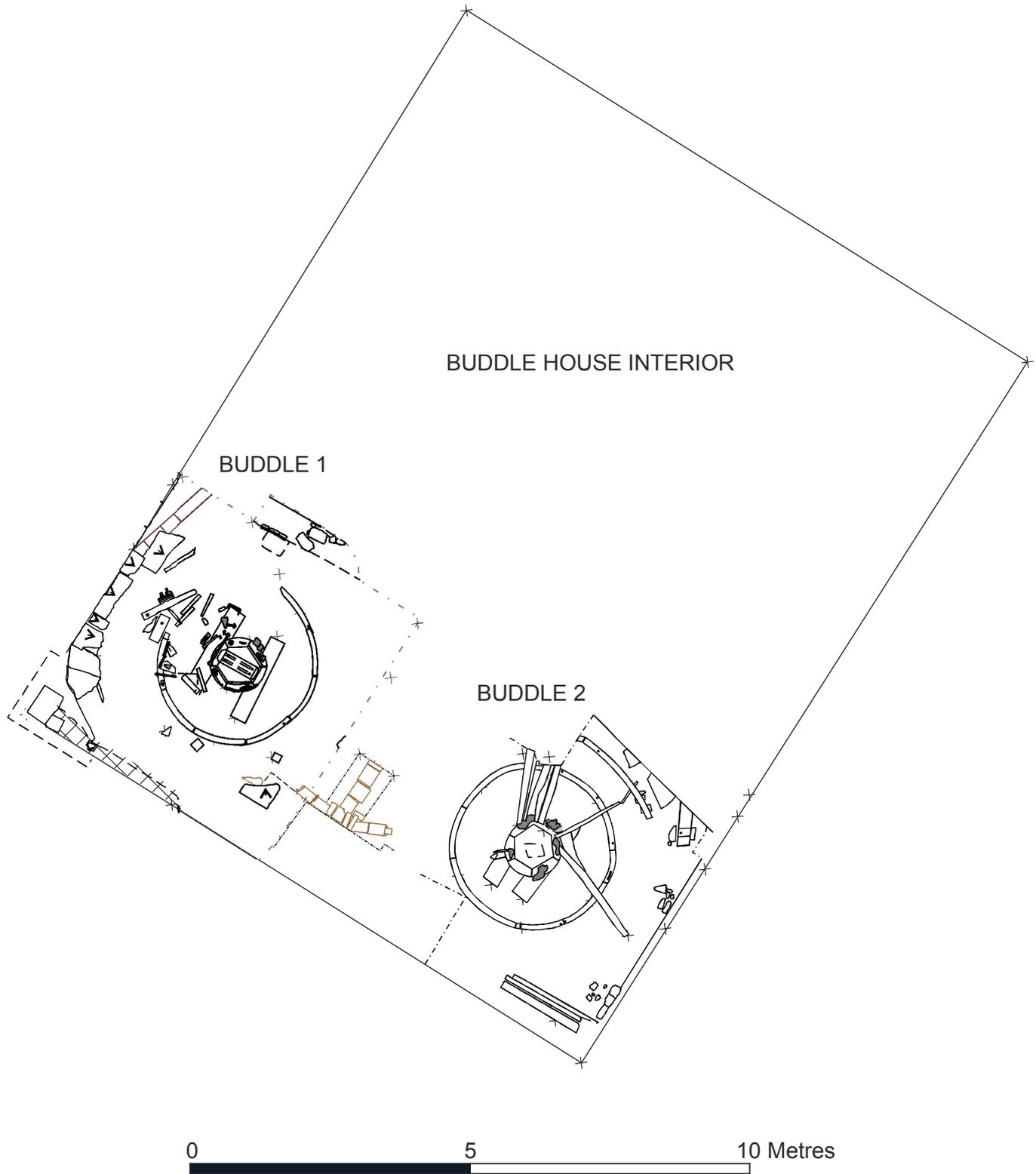
The work was carried out using core staff of the Archaeological Practice Ltd., supplemented by specialists in relevant and assisted by over 20 volunteers, co-ordinated by Paul Frodsham from the North Pennines AONB - *Altogether Archaeology* project, who were guided by the professional personnel and provided reciprocal specialised knowledge in a range of relevant fields.

2.2.1 Archaeological Excavation

Prior to excavation, the excavation site was cleared of workshop equipment and the upper layers of overburden, comprising the most recent working floor levels, were removed by hand. The spoil excavated from the trenches was stored outside the building.

The excavations were carried out by hand to the top of archaeological deposits, with all trench faces subsequently cleaned and features revealed investigated and recorded as deemed appropriate. All excavated contexts were recorded in plan and section (where appropriate), with plans and sections drawn at approximate scales of 1:20. The trenches were accurately tied into the OS national grid and accurately levelled using a total station. The finds from the excavations were retained and recorded by context.

The area covered by excavation was 11.7 m (length) x 5.8 m (width), of which only the area between the two buddles, north-east of the box drain junction, remained unexcavated.



Illus. 09: Survey of excavations carried out at Killhope Buddle House in 2013.

4. RESULTS OF EXCAVATION

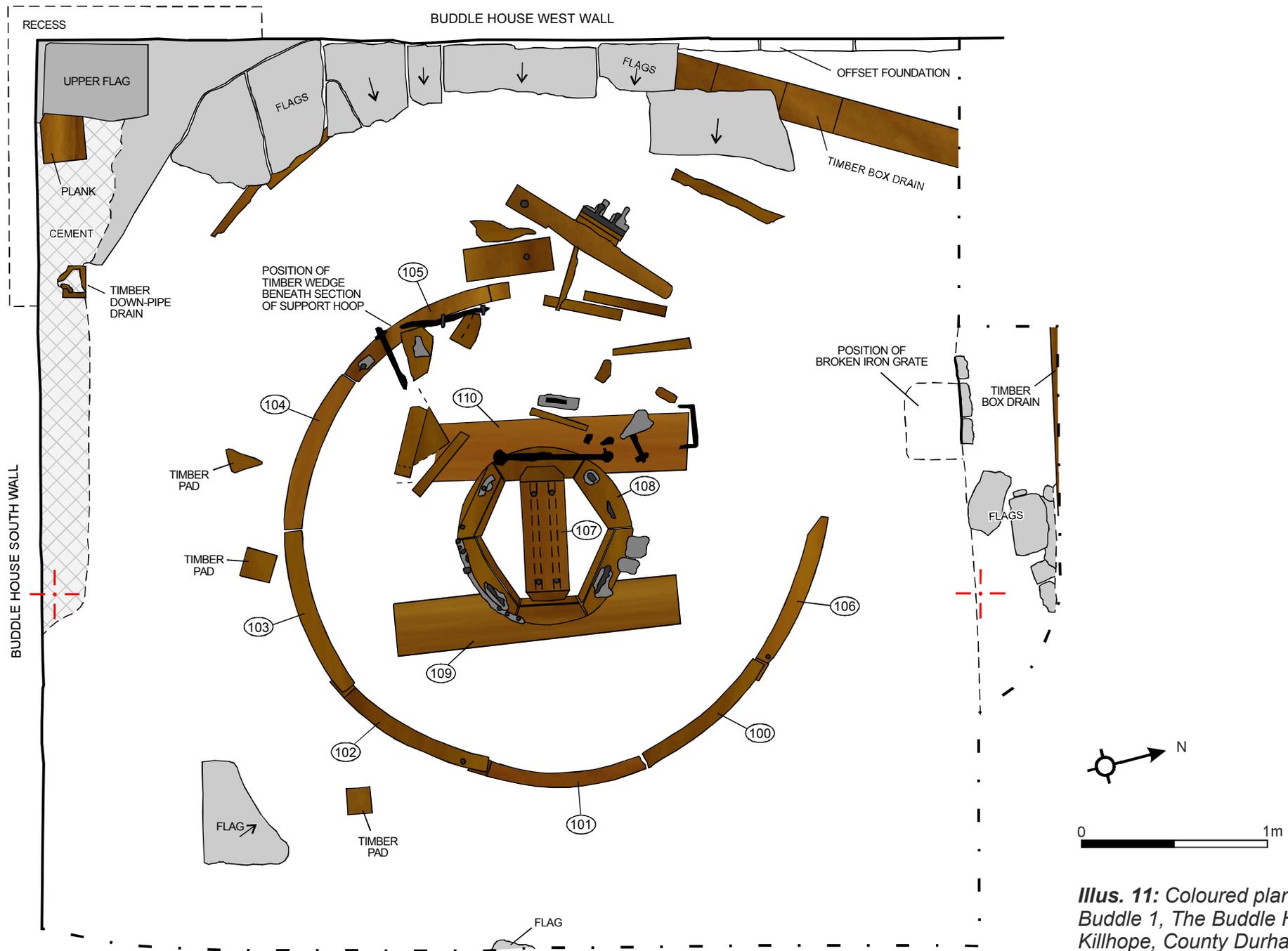
4.1 'Buddle 1' Description (*Illus. 09-11 & 16-31*)

The excavation was sited to further expose a buddle structure in the west corner of the building partially-exposed in 2012 and to investigate the suspected site of another buddle in the adjacent south corner, as suggested by the arrangement shown on a plan of the buddle house at Killhope's sister site, Groverake, near Rookhope in Weardale (see *Illus. 04*). The trench was rectangular in plan, aligned north-west to south-east and positioned along the internal face of the south-west wall of the Buddle House.

Initial excavations revealed a very shallow layer of apparent mortar-based material [01] forming a rough surface just beneath the present ground level, and extending throughout the trench. Beneath this layer, a substantial deposit of collapsed roof timbers and associated roofing slates [02], were encountered throughout the trench. These were initially interpreted as a possible floor or buddle surface, but this interpretation was subsequently dismissed in favour of their identification as fallen roof slates subsequently partially-crushed by post-abandonment activities. The most substantial deposit encountered throughout the trench was a firm but friable, dark grey, shale-gravel mixed with loam [03] observed below the modern collapse and probably associated with made ground from the original construction of the building. Flagging [04] around the west side of the buddle structure, sitting upon [03], probably represents the remains of an original flagged floor, documented in historic documents but subsequently largely robbed out. The flags generally tilted inwards towards the building interior, suggesting slumping into soft deposits associated with the buddle.

The substantial remains of buddle workings [05], cutting into [03], remained exposed from the 2012 excavations and were further exposed on its north-west side. This feature comprised of two distinct elements; the first took the form of a partial ring of timber (the north-west quarter, formed by two or three segments, being absent), segmentally formed by seven curved timber batons. Each baton measured around 0.90m (length) x 0.08m (width) and had overlapping joints secured with broad iron nails. Heavily corroded iron fittings seemed to be attached to the exterior of the most easterly of these timber batons, and a socketed iron fitting containing a large bolt appeared just inside the north-eastern part of the suspected buddle. Just over three-quarters of this circular structure was exposed, with a diameter between 2.94 and 3.01 m (approx. 9 foot 9 inches).

Within the parameters of the original trench dimensions, the second element of the suspected buddle feature (the cone or hub-support, labelled as the 'inner buddle') was only just visible in the south-east facing trench section, but was regarded of sufficient archaeological importance to explore in further detail by extending the 2012 trench, and was fully exposed prior to removal in 2013. This feature constituted four components. The first were two sets of two wooden piles driven into the soft ground to form a solid base onto which the second component of the 'inner buddle', a platform of two substantial timber planks, could be supported. The wooden piles were of 0.15 – 0.17 m diameter, while the planks they supported measured 1.55 m (length) x 0.30 m (width). Third of the components of the 'inner buddle', sitting on the plank & pile foundation, was an elevated 'inner' wheel, measuring exactly 1 m in diameter, constructed with two jointed skins of timber batons. The first skin of timber was curved on the outside, strengthened with sheet metal casing and squared off on



Illus. 11: Coloured plan of Buddle 1, The Buddle House, Killhope, County Durham.

the inside from where a second skin of narrower timber batons was joined to it. Two heavily eroded, linear, cast iron fittings resembling handles, were observed to project vertically from the centre of two batons from the first outer skin of the inner buddle wheel, along with other possible iron fittings observed at the edge of the northern baton. This 'inner wheel' had been propped up on the north-east side by the insertion of thin wooden wedges between it and the underlying wooden plank platform (an observation consistent with actions designed to counteract the subsidence documented in the building, probably caused by settling of the infilled floor deposits, in early 1880). The fourth component of the buddle inner wheel, comprised of an upper timber plank, positioned upon the top of the timber wheel and almost at 90° to the lower foundation plank. This plank measured 0.50m (maximum length within parameters of trench) x 0.24m (width) and had a bevelled south-eastern face.

Excavation within the buddle (between outer and inner rings) revealed a narrow lens of iron panning [06] above deposits of fine, reddish and grey silts [07], interpreted as waste products of the sorting process, which extended within and outside the outer wooden ring of Buddle 1. In places where test pits were excavated, a deposit of dark peat-based material [10] was observed at depths over 0.65 m, but it was unclear whether these were natural deposits or related to the same depositional episodes as the overlying silts [07].

Two sections of box drain were recorded just outside the buddle feature. One [08], running SE-NW was just visible in the south-west trench section facing Buddle 1; the other [11], running NE-SE between the north-east side of Buddle 1 and the north-west wall of the Buddle House was revealed when flags against north-west wall were taken up. Both were of standard construction and well-preserved.

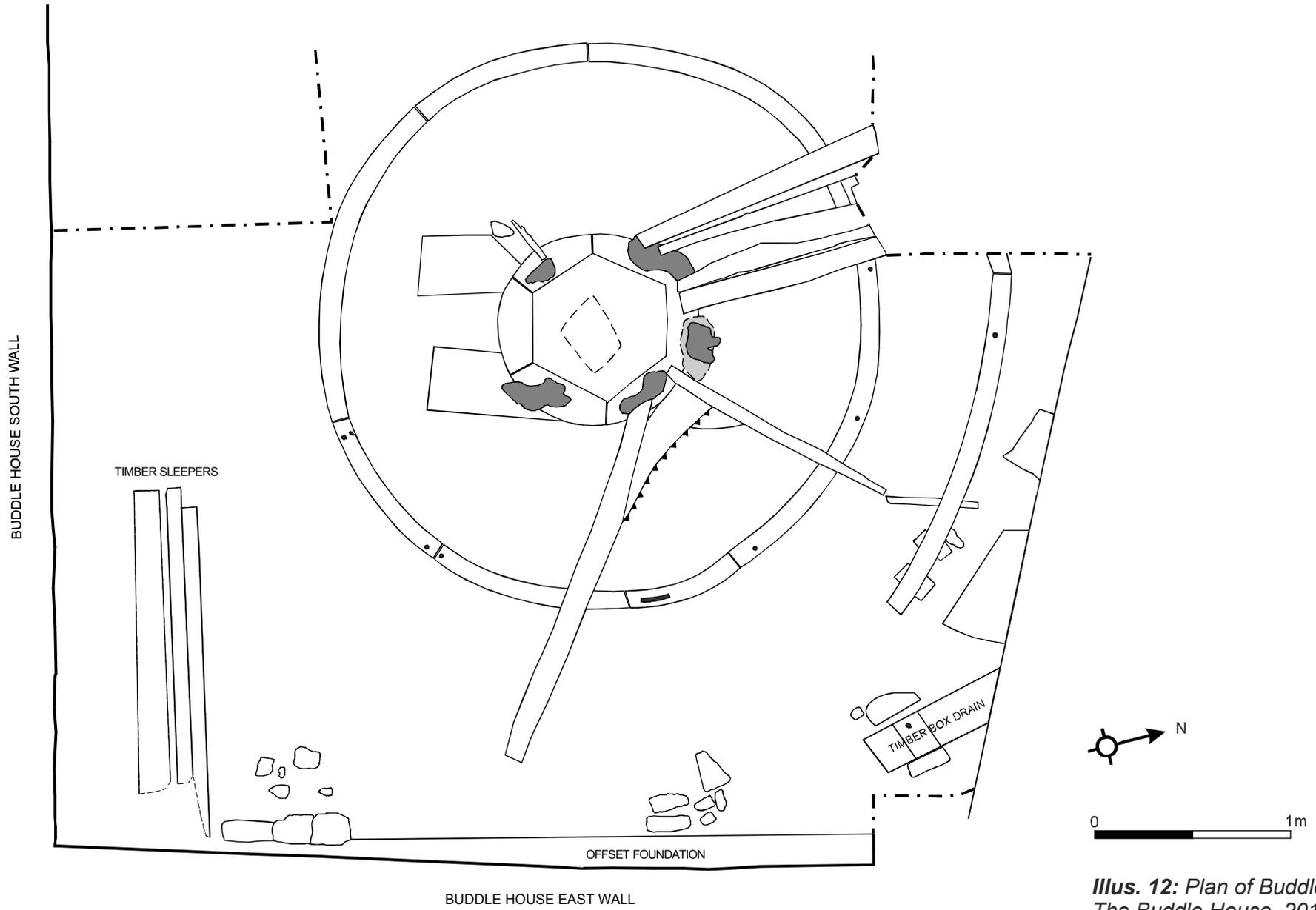
4.2 'Buddle 2' Description (Illus. 09, 12-13 & 32-36)

A second buddle structure [13] of identical design to the first, was exposed below deposits of sand- [11] and gravel-based [12] material (similar to those observed over Buddle 1) in the south corner of the building, south-east of Buddle 1. The outer ring of timber was complete, with a consistent diameter of 2.95 m (9 foot 8 1/8 inches), segmentally formed by eight curved timber batons, each with overlapping joints secured with broad iron nails and iron fittings on the exterior of the batons.

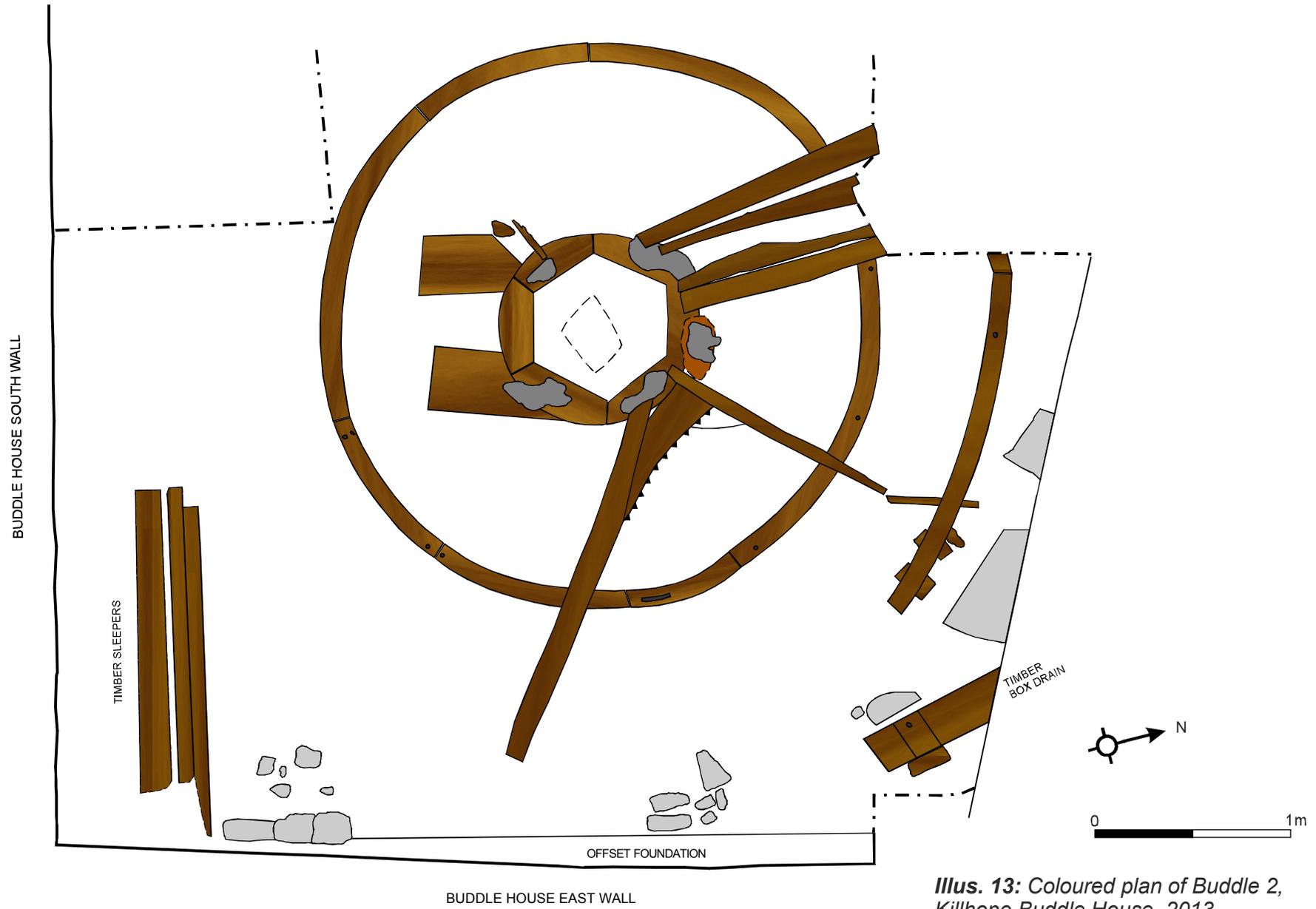
Within the outer ring was the segmental inner ring of exactly 1 m in diameter, as described in Buddle 1, with corroded ironwork fittings on its surface, sitting on two substantial timber planks, also as described above. This feature was left *in situ* after exposure, so it was not possible to examine the foundations of this 'inner ring', but since in all other respects it appeared identical with first buddle, it is considered likely that its piled foundation arrangement was also the same.

Additional features not noted in Buddle 1 included an additional outer buddle segment positioned outside and roughly concentric with the north-east section of the original outer ring. Assuming it is in a concentric arrangement, its arc suggests a diameter for a projected, putative 'extra outer' ring of about 6.9 m, although its position only about 0.6 m outside the outer ring suggests a possible diameter of 4.12 m, which would allow it to fit within the confines of the building.

Also associated with this second buddle were a series of long timbers extending from the segmental inner ring across the 'outer' ring and towards the (putative) 'extra outer' ring. A



Illus. 12: Plan of Buddle 2, The Buddle House, 2013.



Illus. 13: Coloured plan of Buddle 2, Killhope Buddle House, 2013.

section of well-preserved box drain [16] of standard construction was uncovered running north-south on the north-east side of the Buddle.

4.3 Wooden Box Drains (Illus. 09, 14 & 31-41)

Wooden box drains were found in four places. The most substantial [12] was uncovered between the two buddles, comprising a NE-SW arm, of which five segments were exposed, attached to a branch running east towards the centre of Buddle 2 and another branch running north-west towards the south-west part of Buddle 1. Height readings taken during EDM survey of the site indicate that the direction of drainage is from the direction of the two buddles to the junction of the drains, then north-eastwards towards the centre of the Buddle House. Below the box drains was a deposit of creamy white silt [09] at a depth of 0.63m – 0.64m bgl, and below that was natural peat [10]

Other sections of box drain were found, as described above [16], [08] & [11], respectively, on the north-east side of Buddle 2 close to the south-east wall of the building, running SE-NW on the north-east side of Buddle 1 and running NE-SE between the north-west side of Buddle 1 and the north-west wall of the Buddle House.

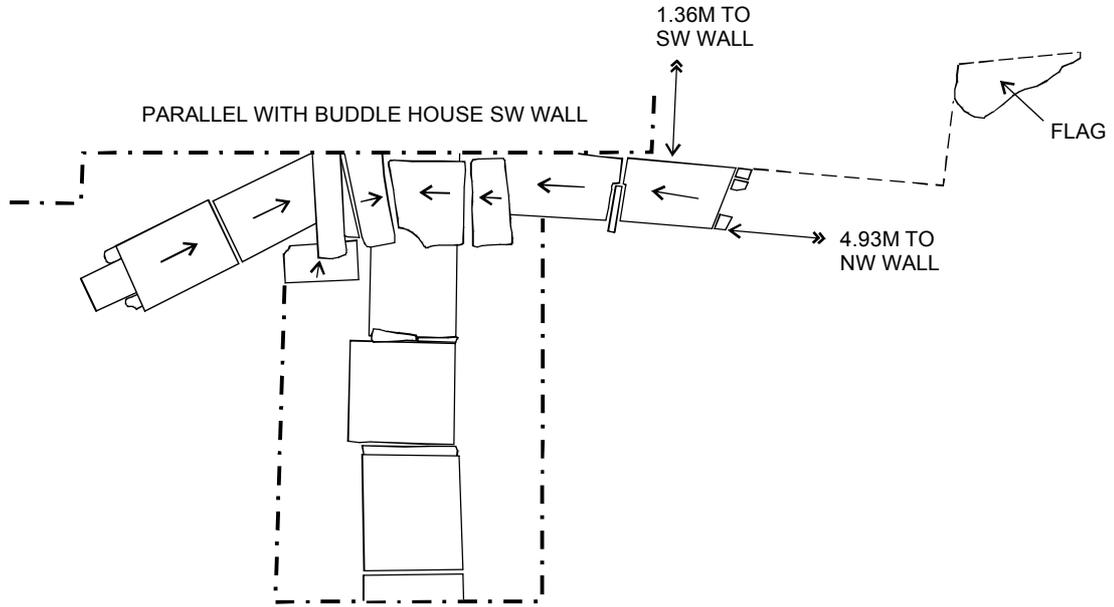
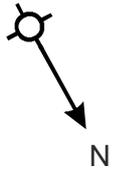
4.1.2 Interpretation

The excavations carried out in 2013 enable an enhanced interpretation of features revealed by excavation and historic buildings survey in 2012. A plan of all the features revealed during these two phases of fieldwork is provided (Illus. 15) in order to serve as the basis for continuing interpretations of the buddle house and the various features now known to have been present within it.

The two circular structures (or complexes of concentric circular features) appear to be the remains of circular buddles of convex type, although that interpretation remains in some doubt due to their relatively small size – the 10ft diameter of the ‘outer’ circles is considerably smaller than the figure of 15 ft normally considered to be the smallest for such features, while there is no evidence in the form of construction for the walls of a circular pit, as shown in drawings of such features. It is possible that the scale of the features could be greater, with the outer circular feature being intermediary, as suggested by the ‘extra outer’ ring segment found in Buddle 2 – allowing for expansion up to 13 ft 6 inches – but no such evidence was found in relation to Buddle 1 where, in any case, the space available for outward expansion is more restricted, especially to the north-west, although the slightly curved nature of surviving flags against this wall hints at the possible presence of a curved structure here.

In Buddle 2, the wooden slats arranged from segmental inner ring across the outer ring towards the possible extra outer ring suggest a possible floor structure (see Davies (1902, above: “... *the floor, which has an inclination outwards of 1 in 30, is made either of smooth planed boards or cement run upon a layer of concrete*”), although the evidence for this is far from secure.

The direction and course of flow of the box drains uncovered between the buddles provides some interpretive evidence, with two branches converging to flow towards the centre of the Buddle House. The branch from Buddle 2 appears to come directly from the centre of the buddle itself, suggesting that slurry from the Classifier may have fed this buddle (perhaps via



0 Scale 1:20 1m

Illus. 14: Line drawing plan of Central Box Drain, excavated in *The Buddle House*, 2013.

the box drain found *extra situ*(?) nearby). The branch from Buddle 1, however, appears to come from the edge of the buddle 'outer ring', its projected course running from the north-west wall just north-east of the putative tank set in the west corner, adjacent to the Jigger House. A suggested function of this drain, therefore, is to remove excess water from the putative west corner settling tank, the slurry from which feeds Buddle 1.

It is suggested that the remains uncovered in 2013 are those of convex type buddles, of small size, perhaps experimental to a degree, Buddle 1 supplied by a pipe entering near the west corner of the Buddle House - where the remains of a corner recess suggest the possibility of a tank for agitating the slurry mixture before feeding it into the buddle – Buddle 2 supplied from the Classifier. Other than the possible, partial remains of a wooden floor found in Buddle 2, other timber, stone and metal items recovered in the buddle interiors below roof slates and timbers from the original fallen roof recalled the view of an abandoned buddle seen in *Illus. 08* (above), suggestive of items including joints and struts that would have been required in the construction of the buddle hub, slurry supply conduit, brush arm, super-structure, etc., but their distribution formed no observable pattern suggestive of their original form. Within and outside the outer wooden ring of Buddle 1 were deposits of fine silts, presumably waste products of the sorting process, but flooding prevented their close inspection and in Buddle 2 they were not exposed.

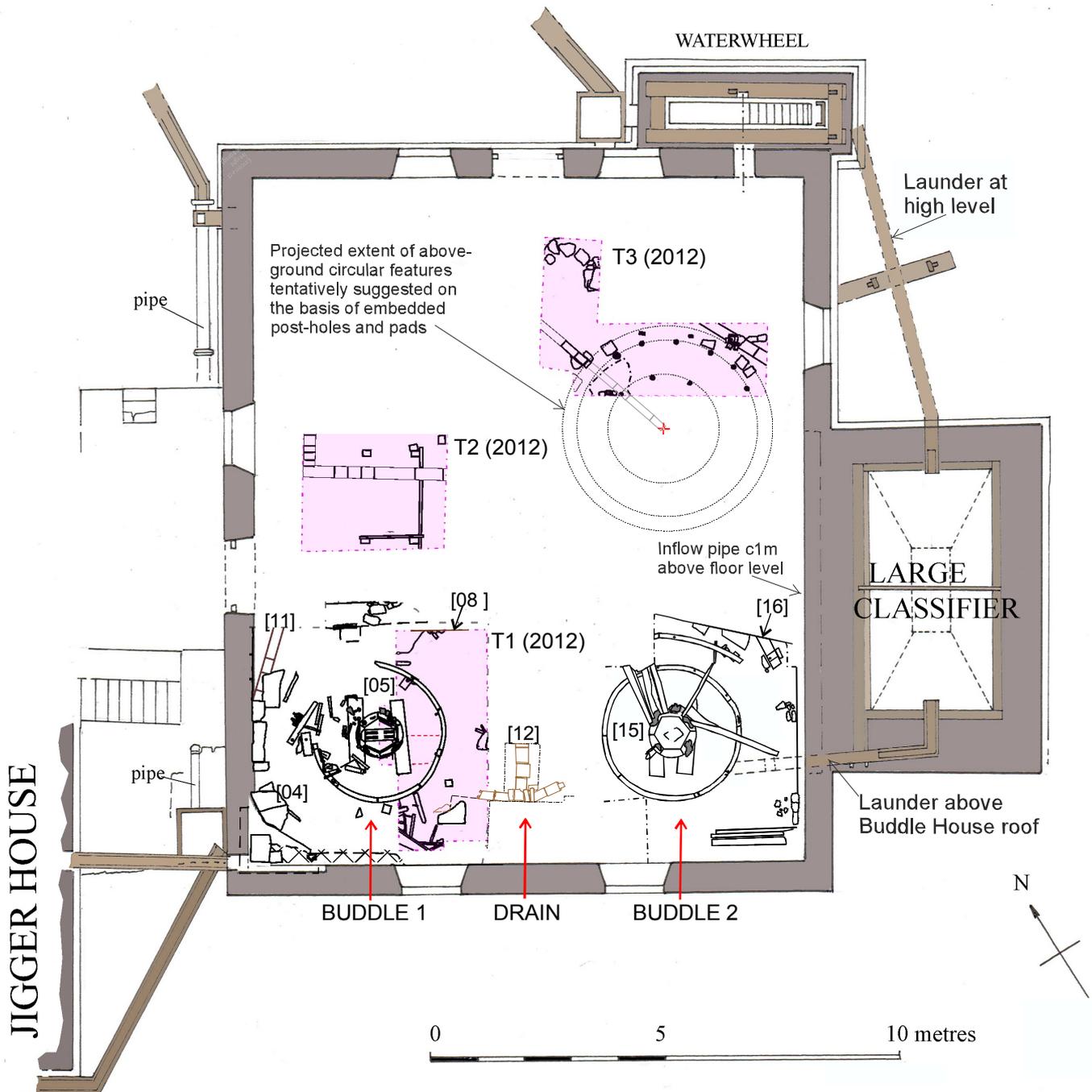
4.1.3 Context Descriptions (keyed to *Illus 15*).

- [01] Compact floor surface, stony and mixed with a grey sandy loam, and with lime inclusions. Observed at a depth of 0 – 0.1m bgl.
- [02] Deposit of broken roofing slates, in places forming a compact layer arranged parallel with the ground surface, also containing roofing slats.
- [03] Layer of gravelly gritty stone, with inclusions of dark grey/black angular quartz. Observed at a depth of 0.1m – 0.23m bgl.
- [04] Sandstone flags, most tilting inwards towards the building interior.
- [05] Circular wooden structure comprising two main components:
 - [05A] Ring of timber (ave. diam. approx. 2.97 m or 9 foot 9 inches) formed by curved timber baton, each c. 0.90m (length) x 0.08m (width) and with overlapping joints secured with iron nails and other iron fittings.
 - [05B] 'Inner buddle ring' of four elements: two sets of two wooden piles 0.15 – 0.17 m diam., supporting planks 1.55 m (length) x 0.30 m (width), I turn supporting an elevated, segmental 'inner' wheel of 1 m diam., with an upper timber plank, 0.90m (length) x 0.24m (width) on top of the timber wheel.
- [06] Narrow lens of iron panning, rusty orange-brown. Observed at a depth of 0.23m – 0.33m bgl.
- [07] Deposits of fine silts within the buddle outer ring, reddish and grey in colour, soft and extending up to 0.65 m bgl. - presumably waste products of the sorting process.
- [08] The side of a timber box drain running SE-NW, observed at a depth of 0.45m – 0.63m bgl.
- [09] Deposit of fairly soft and spongy, creamy white silt. Observed at a depth of 0.63m – 0.64m bgl.
- [10] Organic peat, black and humic, firm but spongy. Observed at a depth of 0.64m + and suggested as a natural deposit.
- [11] The upper surface of a well-preserved timber box drain running NE-SE between the north-east side of Buddle 1 and the north-west wall of the Buddle House.

- [12] Timber box drain, comprising a NE-SW arm attached to a branch running east towards the centre of Buddle 2 and another branch running north-west towards the south-west part of Buddle 1.

(Buddle 2)

- [13] Deposit of sand, mainly orange-yellow with lenses of panning, grey to black, soft but with areas of compaction. This deposit sealed the whole of Buddle 2, and was itself overlain by the wooden skirt of Buddle 2.
- [14] Deposit of gravel, very gritty and consistent, loose, dark grey/black. Observed directly below [01] and sealed the whole of Buddle 2. Also observed beyond the outer ring of Buddle 2, extending approx. 0.90m around the entire circumference. Additionally, a thin layer of slate was observed within the deposit and may represent earlier roof collapse.
- [15] Circular wooden structure comprising two main components, similar or identical in all respects to Buddle 1 [05, above) except for the absence of element 4 of the 'inner buddle ring' and with the addition of an additional, outer buddle segment, roughly concentric with the original outer ring and a series of long timbers extending from the segmental inner ring across the 'outer' ring and towards the (putative) 'extra outer' ring.
- [16] Timber box drain running north-south, on the north-east side of Buddle 2 close to the south-east wall of the Buddle House.



Illus. 15: Plan of the Buddle House showing the position of internal features revealed by excavation (2012 trenches marked by pink infill).

5. CONCLUSIONS AND RECOMMENDATIONS

4.1 CONCLUSIONS

The excavations conducted within the Buddle House in October and November 2013 provided further evidence for surviving structures below floor level in the south-west part of the building.

Two circular structures (or complexes of concentric circular features) revealed there appear to be the remains of circular buddles of convex type, although that interpretation remains in some doubt due to their relatively small size.

The original appearance and modus operandi of the buddles remains obscure, to a degree, although in Buddle 2, wooden slats arranged from segmental inner ring across the outer ring towards the possible extra outer ring suggest a possible floor structure and the direction and course of flow of the box drains uncovered between the buddles provides some interpretive evidence, the branch from Buddle 2 appearing to come directly from the centre of the buddle itself, suggesting that slurry from the Classifier may have fed this buddle, while it is suggested that the branch from Buddle 1 may have removed excess water from the putative west corner settling tank, the slurry from which feeds Buddle 1.

Other than the possible, partial remains of a wooden floor found in Buddle 2, other timber, stone and metal items recovered in the buddle interiors below roof slates and timbers from the original fallen roof are suggestive of items including joints and struts that would have been required in the construction of the buddle hub, slurry supply conduit, brush arm, super-structure, etc., but their distribution formed no observable pattern suggestive of their original form.

Within and outside the outer wooden ring of Buddle 1 were deposits of fine silts, presumably waste products of the sorting process, but flooding prevented their close inspection and in Buddle 2 they were not exposed.

In addition to the remains of buddles, two sections of well-preserved box drains were uncovered, one of which was clearly in situ and could be related directly to Buddle 2.

It is considered highly likely that other well-preserved features relating to the original function of the Buddle House survive in areas not yet excavated, notably in the north (NW) corner which is considered highly likely to contain the remains of a fourth buddle. Further box drains are also likely to survive within the building floor deposits.

4.2 RECOMMENDATIONS

It is recommended that the remains of the convex Buddle 1, having been fully exposed and removed to a storage area, should be preserved using the methods recommended by Jenny Jones in her 2013 report, in advance of preservation and display – perhaps mounted on a wall of the building or in another suitable location - alongside interpretive material presented on a panel or in the form of a reconstructed model.



*Illus. 16:
The commencement of excavations on the site of Buddle 1.*



*Illus. 17:
Wooden structural remains revealed on the site of Buddle 1.*



Illus. 18: View from the south of further excavations on the site of Buddle 1, revealing more of the segmental, outer wooden ring and internal segmental ring/plinth support.



Illus. 19: Excavations against the NW wall showing a length of box drain revealed under flagging.



Illus. 20: Broken tile and wooden slats in the area between outer ring of Buddle 1 and flagging against the NW wall.



Illus. 21: Vertical oblique view from the north-east of Buddle 1 following excavation.



Illus. 22: View from the south of Buddle 1 following excavation.



Illus. 23: View from the north of Buddle 1 following excavation, with Buddle 2 visible to the rear.



Illus. 24: Buddle 1 following removal of the outer ring and elements 3 & 4 of the inner ring, with one of the two basal planks lifted to reveal piles below.



Illus. 25: Vertical view of one of the piles supporting the foundation planks of the buddle inner ring (note nail hole used to fix the plank).



Illus. 26: Components of the inner ring of Buddle 1 following their removal.



Illus. 27: Lifting the second supporting plank from the site of Buddle 1 to reveal piles below.



Illus. 28: Buddle 1 following removal of the inner ring and its two basal planks, revealing piles below.



Illus. 29: Piles below the inner ring of Buddle 1 (within an imprint left by the inner ring).



Illus. 30: Components of Buddle 1 following their removal.



Illus. 31: View of the south-west facing trench section north-east of Buddle 1, showing part of box drain revealed there.



Illus. 32: An early stage in the excavation of Buddle 2.



Illus. 33: The excavation of Buddle 2 - inner and outer rings revealed, together with wooden slats extending from the inner ring to beyond the outer ring.



Illus. 34: Buddle 2 viewed from the east following excavation.



Illus. 35: Vertical oblique view from the north-west of the excavated remains in Buddle 2.



Illus. 36: Segment of extra outer ring revealed on the north-east side of Buddle 2.



Illus. 37: Wooden box drain junction between excavated buddles 1 and 2, viewed from the north-east.



Illus. 38: Vertical view of the wooden box drain junction between excavated buddles 1 and 2.



Illus. 39: Wooden box drain junction between excavated buddles, viewed from the south-east.



Illus. 40: View from the west along box drain branch running towards the centre of buddle 2 (projected line suggested by ranging pole).



Illus. 41: Vertical oblique view from the south of the wooden box drain revealed on the east side of buddle 2.

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