



Northamptonshire Archaeology

Excavations at Warren Farm, land between
Flitwick Road and Abbey Lane, Amphill
Central Bedfordshire



Northamptonshire Archaeology

2 Bolton House
Wootton Hall Park
Northampton NN4 8BE
t. 01604 700493 f. 01604 702822
e. sparry@northamptonshire.gov.uk
w. www.northantsarchaeology.co.uk



Northamptonshire
County Council

Paul Clements & Jim Brown

Report 13/244

December 2013

Accession no.

BEDFM 2010.55



STAFF

Project Manager Jim Brown BSc PGDip MIfA
Text Jim Brown and Paul Clements BA
Fieldwork Paul Clements
Oily Dindoll BA
Amy Talbot BA
Brick Pat Chapman BA AlfA
Charred plant remains Val Fryer BA MIfA
Fuel ash slag Andy Chapman BSc MIfA FSA
Illustrations Jim Brown & Amir Bassir BSc

QUALITY CONTROL

	Print name	Signed	Date
Checked by	Pat Chapman		
Verified by	Jim Brown		
Approved by	Andy Chapman		

OASIS REPORT FORM

PROJECT DETAILS		Oasis No: 166408	
Project title	Excavations at Warren Farm, land between Flitwick Road and Abbey Lane, Ampthill, Central Bedfordshire		
Short description	Further archaeological investigations were undertaken in October 2013 on land between Flitwick Road and Abbey Lane, Ampthill, following geophysical survey and trial trench excavation in 2010. The new works comprised additional trial trench excavation within the poplar plantation on the north side of the A507, where no archaeological features were present and further excavation in the vicinity of middle Iron Age pits and a post-medieval lime kiln. The known features were further investigated, but no additional archaeological features were identified.		
Project type	Further trial trench evaluation and open area excavations		
Previous work	Desk-based assessment, geophysical survey and trial trench evaluation		
Current land use	Woodland plantation and arable		
Future work	None		
Monument type and period	Post-medieval		
Significant finds	Lime kiln with associated structural debris and residues		
PROJECT LOCATION			
County	Central Bedfordshire		
Site address	Warren Farm, Ampthill		
Easting Northing	TL 0360 3680		
Area (sq m/ha)	14.3 ha		
Height aOD	66-70m above Ordnance Datum		
PROJECT CREATORS			
Organisation	Northamptonshire Archaeology (NA)		
Project brief originator	Martin Oake, Central Bedfordshire Council		
Project Design originator	Jim Brown, Northamptonshire Archaeology		
Director/Supervisor	Paul Clements, Northamptonshire Archaeology		
Project Manager	Jim Brown, Northamptonshire Archaeology		
Sponsor or funding body	Denison Investments		
PROJECT DATE			
Start date	9/10/2013		
End date	22/10/2013		
ARCHIVES	Location (Accession no.)	Contents	
Physical	Bedford Museum BEDFM 2010.55	Site records (1 archive box)	
Paper		Client report PDF. Survey Data, Photographs	
Digital			
BIBLIOGRAPHY			
Title	Excavations at Warren Farm, land between Flitwick Road and Abbey Lane, Ampthill, Central Bedfordshire		
Serial title & volume	Northamptonshire Archaeology report 13/244		
Author(s)	Paul Clements & Jim Brown		
Page numbers	21		
Date	10th December 2013		

Contents

- 1 INTRODUCTION

- 2 BACKGROUND
 - 2.1 Location and geology
 - 2.2 Historical and archaeological background
 - 2.3 Lime kilns and the lime burning process

- 3 OBJECTIVES AND METHODOLOGY
 - 3.1 Objectives
 - 3.2 Methodology

- 4 THE EXCAVATED EVIDENCE
 - 4.1 Trial trench excavations within the poplar plantation
 - 4.2 Further investigation of middle Iron Age pits, Area A
 - 4.3 Further investigation of the post-medieval lime kiln, Area B

- 5 THE KILN BRICKS by Pat Chapman

- 6 THE KILN RESIDUES
 - 6.1 Plant remains by Val Fryer
 - 6.2 Fuel ash slag by Andy Chapman

- 7 DISCUSSION

- BIBLIOGRAPHY

- APPENDIX TRIAL TRENCH CONTEXT INVENTORY

Tables

Table 1:	Historic Environment Record (HER) data
Table 2:	Bricks from kiln lining 215
Table 3:	Plant macrofossils with fuel ash and lime layers of Kiln 2016

Figures

Front cover:	Kiln 2016, part-excavated, Area B, looking south-east
Fig 1:	Site location and Historic Environment Record data
Fig 2:	Trench locations and open areas A and B
Fig 3:	Excavated area, Kiln 2016, Area B
Fig 4:	Excavated sections and plan of Kiln 2016, Area B
Fig 5:	Kiln 2016, Section 4, Area B, looking south-west
Fig 6:	Kiln 2016, part-excavated, Area B, looking south-east
Fig 7:	Kiln 2016, fully excavated, Area B, looking north-west
Fig 8:	Kiln 2016, fully excavated showing brick lining, Area B, looking south-west
Fig 9:	Kiln 2016, fully excavated, Area B, looking south-east
Back cover:	Kiln 2016, fully excavated, Area B, looking south-east

**EXCAVATIONS AT WARREN FARM
LAND BETWEEN FLITWICK ROAD AND ABBEY LANE
AMPTHILL, CENTRAL BEDFORDSHIRE
October 2013**

Abstract

Further archaeological investigations were undertaken in October 2013 on land between Flitwick Road and Abbey Lane, Ampthill, following geophysical survey and trial trench excavation in 2010. The new works comprised additional trial trench excavation within the poplar plantation on the north side of the A507, where no archaeological features were present and further excavation in the vicinity of middle Iron Age pits and a post-medieval lime kiln. The known features were further investigated, but no additional archaeological features were identified.

1 INTRODUCTION

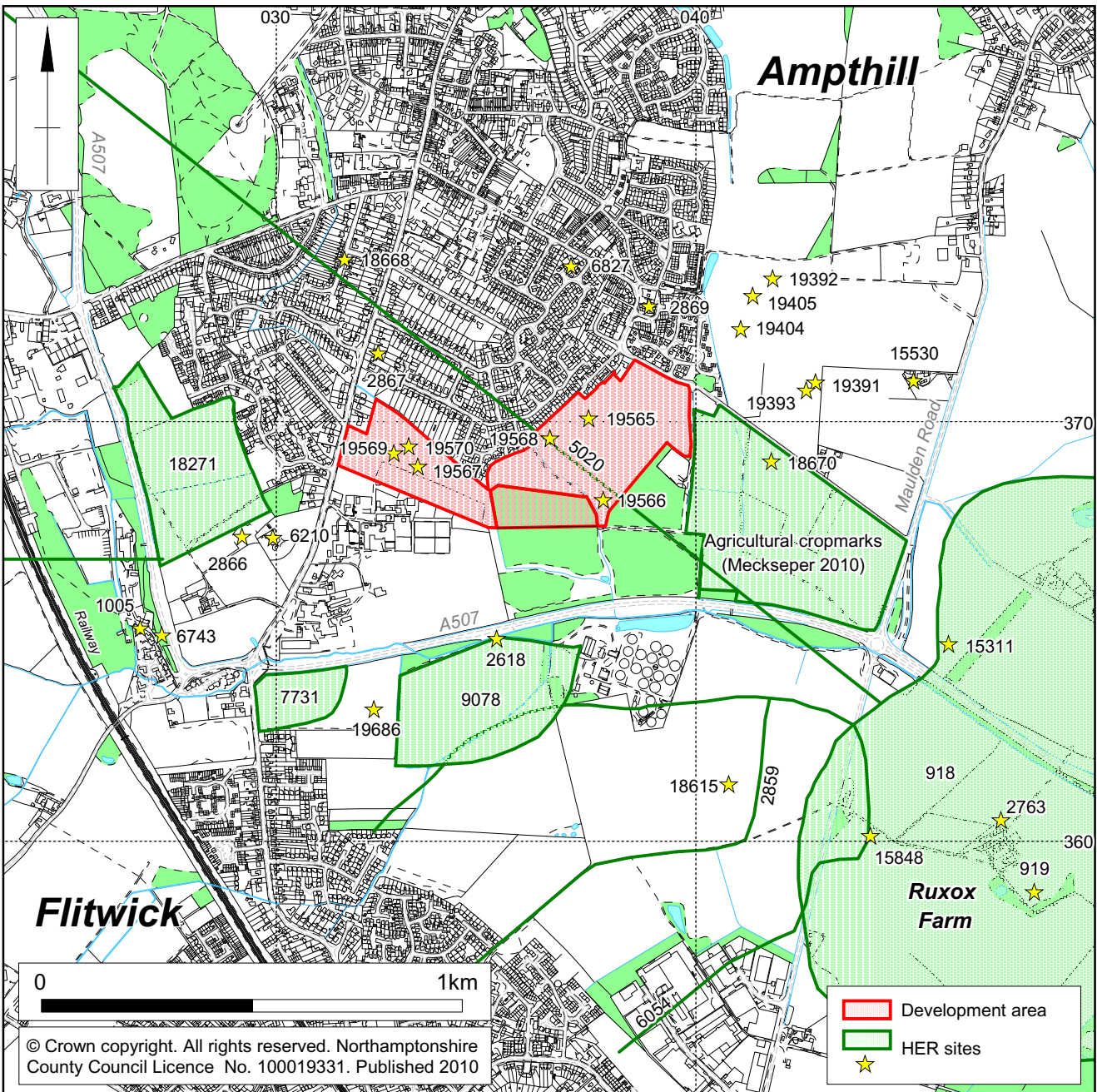
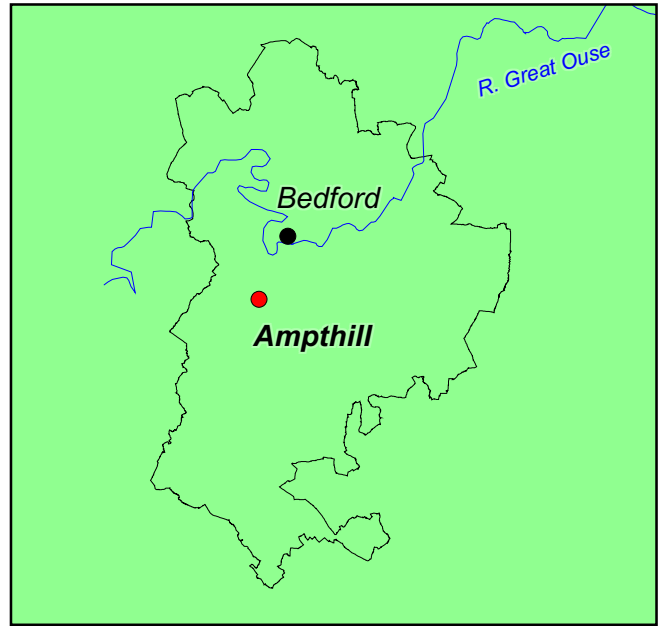
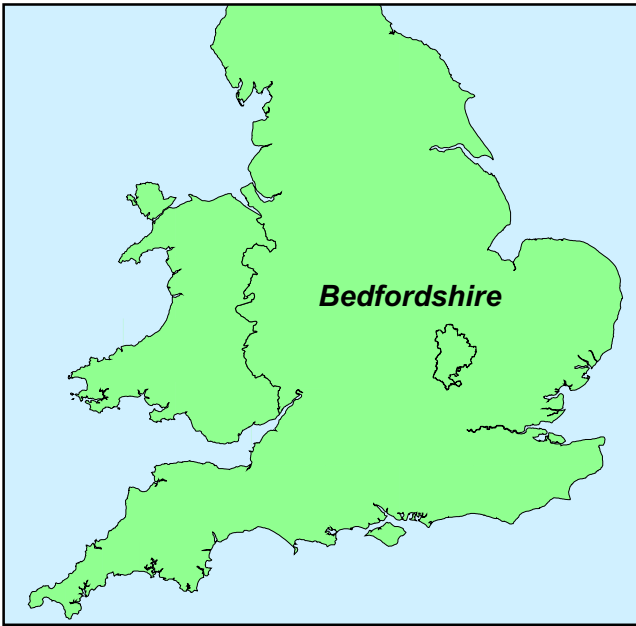
A further programme of archaeological investigation was undertaken in October 2013 by Northamptonshire Archaeology (NA) to mitigate the impact of the proposed residential development upon archaeological features and deposits on land between Flitwick Road and Abbey Lane, Warren Farm, Ampthill, Central Bedfordshire (NGR: TL 0360 3680; Fig 1). Archaeological trial trench excavations were conducted within the poplar plantation on the north side of the A507 and two open area excavations were conducted, centred on the middle Iron age pits and post-medieval lime kiln identified in the 2010 evaluation (Brown 2010a).

The work was conducted in response to a condition upon the planning consent that a Written Scheme of Investigation (WSI) be produced and implemented for the archaeological work (Condition 18: CB/12/01496/OUT). The conditions followed paragraph 141 of the *National Planning Policy Framework* (NPPF) to record and understand significant heritage assets before they are lost (DCLG 2012), and Policy 46 of the *Draft Development Strategy for Central Bedfordshire* (2012).

The development directly affects archaeological remains identified during preliminary geophysical survey and trial trench excavation (Brown 2010a). The WSI was prepared by Northamptonshire Archaeology to meet the requirements of the Central Bedfordshire Council (CBC) briefs (Oake 2013a-b). The WSI was approved by the planning authority in advance of the fieldwork, which was monitored by the CBC Archaeologist.

Northamptonshire Archaeology is an Institute for Archaeologists (IfA) registered organisation (IfA 2010). All works were conducted in accordance with the procedural documents of English Heritage (1991; 2006a; 2008a; 2011) and the appropriate standards and guidance for archaeological excavations and trial trench evaluation (IfA 2008a-b; Gurney 2003).

Bedford Museum agreed to the use of the accession code provided for the trial trench evaluation (BEDFM 2010.55), which was also used as the site code.



Scale 1:15,000

Site location and Historic Environment Record data Fig 1

2 BACKGROUND

2.1 Location and geology

The proposed development is located on the south-eastern edge of the town of Ampthill. The whole site encompasses 14.3ha area comprising arable and scrub, between Flitwick Road in the west and Abbey Lane in the north-east. Small pens are set aside for sheep and pigs, immediately to the north of Redbourne School and within the development area. There is an area to the south, which is woodland. A portion within this area, which is currently a poplar plantation, will contain the SUDS pond, which is 0.52ha in size. The Ampthill domestic waste recycling centre and its access road bounds the east of the site from arable fields on its opposite side.

The underlying drift geology of the site comprises Ampthill Clay and Lower Greensand with gravel patches, with the clay lying towards the base of the tributary valley (BGS 2001). The soils are of Evesham 3 association which tend to be more calcareous clayey soils *and are subject* to waterlogging (LAT 1983).

2.2 Historical and archaeological background

A search of the Historic Environment Record (HER) data was undertaken by Northamptonshire Archaeology and its findings were summarised during the trial trench evaluation (Brown 2010a). The evidence is tabulated below (Table 1; Fig 1). The data identified sites of prehistoric, Roman, medieval and post-medieval date. The only record of sites within the area was the tentative, projected line of a Roman Road (HER485), identified in the Viatores survey. No evidence for this road was found by trial trench excavation.

A more recent data search of the Historic Environment Record has been conducted as part of the evaluation of the poplar plantation. A search of records within 0.8km produced the following data; buildings within the historic core of the town have been largely excluded to simply the inventory. The Ampthill town Conservation Area lies to the north of the site, within the historic core of the settlement.

Table 1: Historic Environment Record (HER) data

Earliest period	HER Ref.	Event or monument
undated	9078	Ruxox Farm; cropmarks, linear/circular boundaries, trackways
	19566	pond, south-west of football ground
prehistoric	15311	cropmark, possible ?Neolithic ring ditch
Bronze Age	15848	Ruxox Farm; pottery
Iron Age	6743	Dolittle Farm; ?kiln, pottery
	19570	pit and postholes, middle Iron Age pottery
Roman	918	Ruxox Farm; settlement, cemetery, possible temple/villa
	5020	Roman road; Viatores 170b
	6743	Dolittle Farm; 3-5 pottery kilns
	18271	horticultural activity, possible ?vineyard
	18668	coin, silver denarius of Severus Alexander, 225-235
medieval	19391	coin, copper-alloy nummus of Valens, 364-378
	919	Ruxox Farm; moated grange belonging to Dunstable Priory
	2763	Ruxox Farm; pottery
	6054	greenway, possible medieval road, mapped c1800

Earliest period	HER Ref.	Event or monument
	18670	find, medieval badge in form of a boar, 1460-1485
	19392	coin, silver halfpenny of Henry VI, 1422-1461
	19393	coin, silver long-cross penny, 14th century
post-medieval	1005	Dolittle Mill; watermill
	2618	corn watermill, 1793-1886
	2859	road called 'Ridgeway', enclosure map 1808
	2866	clay pit, 2nd ed OS, Kelly's Directories 1924-1928
	2867	sand pit, OS 1901
	2869	clay pit, OS 1884-1901
	6210	Amphill Grange, 19th-century country house
	6827	Oliver Street, foundry, 19th century
	7731	place name, How Green, Jeffrey's map of 1765
	15530	Relley Farm; 17th-century farmhouse
	18615	coin, silver penny of Charles I, 1625-1649
	19404	find, copper-alloy gilt mount, 17th century
	19405	find, copper-alloy kite-shaped mount, 17th-18th century
	19565	boundaries, undated but largely mapped 1808
	19567	clay pit, north of Redbourne School, 17th-century
	19568	kiln, constructed from handmade bricks
	19569	quarry, east of Flitwick Road
	19686	drainage ditches, Amphill Road football pitches
recent work	not illus.	Excavation: watermill, Amphill bypass, 1982
		Excavation: Roman vineyard, Tavistock Avenue, 2010
		Geophysical survey & trial trench evaluation: present site at Warren Farm, 2010
		Trial trench evaluation: Maulden Road, 2012
		Trial trench evaluation: Amphill Road football pitches, 2013
		Geophysical survey: Maulden Road, 2012

Prehistoric to Roman and later medieval settlement at Ruxox Farm

The closest major known site to the development is at Ruxox Farm, to the south-east. This area is known to contain a complex multi-period settlement which includes prehistoric and later cropmarks, prehistoric finds, Roman settlement remains, a Roman cemetery, a possible Roman temple or villa and a medieval moated grange that once belonged to Dunstable Priory. The site is also recorded within the National Monument Record (NMR 659987). The site has produced a wide range of finds of all periods that include worked flint artefacts, flint debitage, pottery, coins and other artefacts. Roman finds date the settlement from the 1st to 4th centuries AD (Simco 1984), corroborated by more recent work that uncovered a small inhumation cemetery and metalworking evidence (Clark and Jackman 1992). The finds were substantial in quantity and included unusual items such as jewellery, clay votive figurines and objects of wealth indicative of a possible temple or high status settlement, such as a villa.

Other late Iron Age to Roman activity

A pottery kiln group was recorded to the south-west of the site (HER6743), which was discovered in 1982 by local archaeologists during the construction of Amphill bypass. There were three definite kilns and traces of two possible kilns, which may have been part of a larger group in the vicinity (Fadden pers comm).

Recent excavations to the west of the site have uncovered cultivation evidence for a possible vineyard or similar plantation-style cash crop, which covered the slopes of a small stream tributary valley (Brown 2010b).

Medieval and post-medieval remains

The historic medieval core of Ampthill is situated to the north of the application area. The town has its origins in the 12th to 13th centuries and was granted its market charter in 1219 from Henry III, confirming what by then would have already been a thriving economic centre.

The south side of town was bounded by marginal heathland and the application area lies within this region. From the 15th century the heathland was referred to as Ampthill Warren (Meckseper 2010). The name, Ampthill Warren, suggests the ground was possibly used for breeding rabbits (BCC 1996). Cropmarks within that location may support the hypothesis that pillow mounds were raised.

The area around Ampthill was enclosed from 1808 by Act of Parliament. Ordnance Survey maps subsequent to this show that the application area comprised rectangular-shaped fields.

A place-name reference is recorded to the south-west from Jeffrey's Map of Bedfordshire, 1725, for How Green (HER7731). This may be a field name for lush pasture or it may refer to a lost village green, although no known settlement is recorded nearby. The Russell estate map of 1773 indicates the presence of a house.

Geophysical survey and trial trench excavations in 2010

Geophysical survey and trial trench excavation were undertaken by Northamptonshire Archaeology (Brown 2010a). Area A contained a solitary Iron Age pit was found that contained burnt stone and parts of two or three pottery vessels. There were two possible postholes adjacent with no finds. The pottery was of middle Iron Age date.

The base of a post-medieval brick-built kiln or furnace was discovered in Area B. It contained large quantities of fuel ash slag. Of similar date to the kiln was a wide distribution of small post-medieval enclosures, many of which appear on early maps. The enclosures are thought to have been for horticulture or allotments and the kiln may have produced lime, which was used as a fertiliser.

2.3 Lime kilns and the lime burning process

Lime burning follows a process known as calcining during which limestone or chalk (calcium carbonate) is heated to a temperature of 900-1100°C. At this temperature carbon dioxide is driven off leaving calcium oxide, also known as quicklime. When mixed with water quick lime reacts violently and forms calcium hydroxide. This is also called slaked or hydrated lime.

It is known that lime burning has occurred in Britain since the Roman period, although relatively few Roman kilns have been excavated. When Roman influences in Britain declined the requirement for lime diminished. After the Norman Conquest a resurgence of lime burning in England occurred alongside the return of stone building methods, requiring vast amounts lime for mortar and plaster. Kilns were often built within close proximity to where the lime was needed.

In the 16th century Tudor building traditions shifted to building in brick, which still required quantities of lime for mortar and plaster, although it was still used to whitewash timber frame and cobb buildings. Lime wash helped to prevent infestation by insects; it was also used in the production of medicines, tanning leather and agriculture.

From the 16th century onwards, there was increasing use of lime as an agricultural soil improver by raising the pH level and increasing its fertility. By the 1520s landowners were often building their own kilns for lime burning for agricultural purposes (Johnson 2002).

A dramatic increase in the number of lime kilns occurred during the Napoleonic Wars and in some areas every farmer had a kiln. The increasing urban population between 1801 and 1851 brought demand for agricultural production. This was matched by an increasing use of lime and the expansion in the number of lime kilns. In many places, instead of a small single kiln producing sufficient lime for personal or localised use, production in double or multiple kilns increased with individuals becoming full time lime burners to meet demand.

Kiln structures

At Cotes Road, Barrow upon Soar, Leicestershire, an extensive area of medieval and post-medieval lime kilns were excavated. Five types of kiln were identified during two stages of fieldwork, including types similar to the kiln at Ampthill (McAree 2007; 2010).

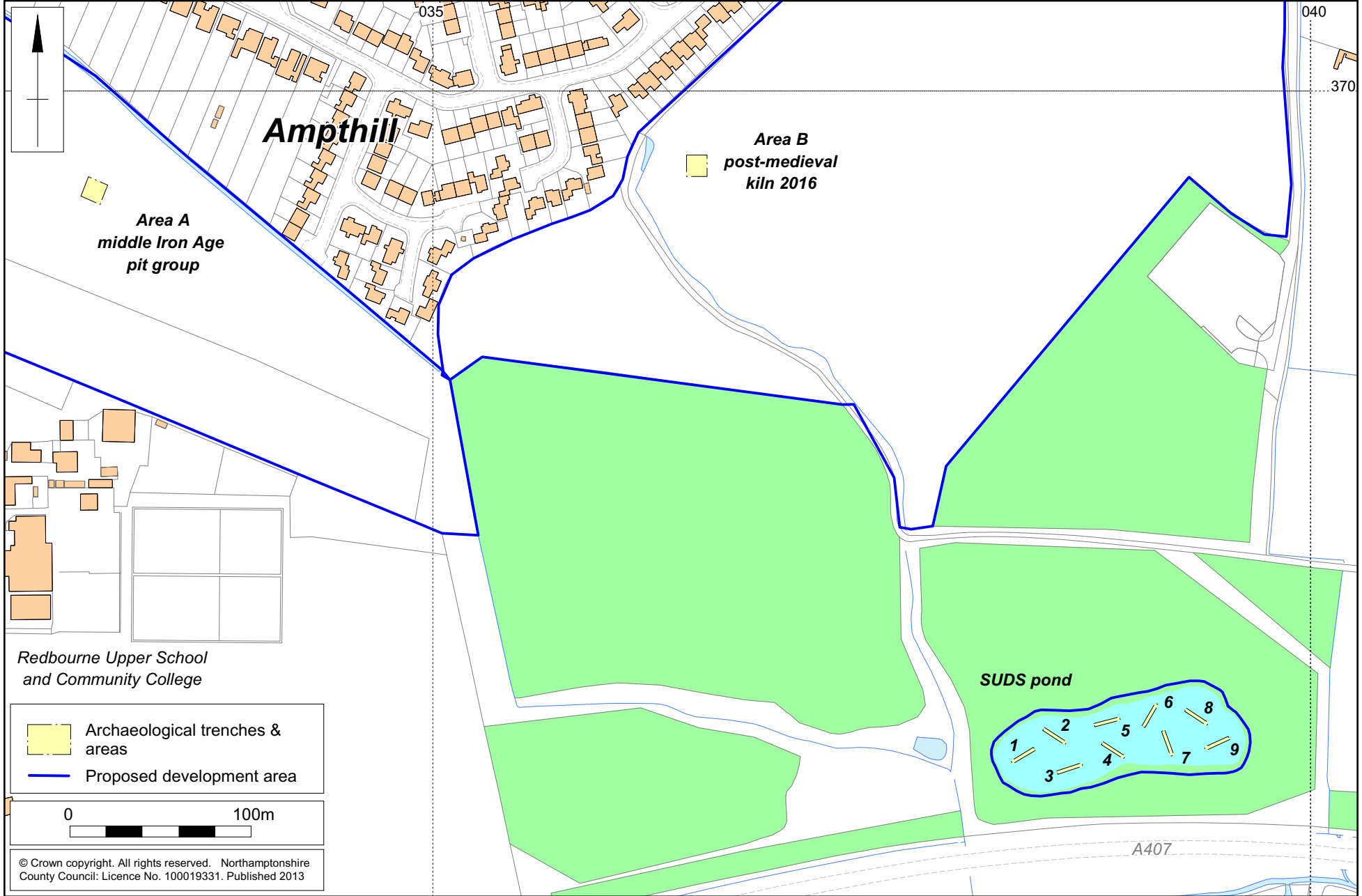
The earliest kilns, dated to 15th-16th centuries, were clamp or sod kilns. These were the most basic type of kiln, round or rectangular, and their size was based upon the amount of lime being processed. They comprised a shallow pit, sometimes lined with stone, and were fired with alternate layers of fuel and limestone, covered with turf (sods). The larger kilns were narrow and elongated, but these simple kilns tended to serve well in later periods for small scale or non-commercial production.

Industrial brick built kilns of the 18th-19th centuries, were circular in plan with an attached oval working space. The kiln was lined with a brickwork structure at the base and sides. Similar to these were kilns with internal flues at the base, which helped to circulate air, heat and gases and date to the 19th-20th centuries.

Kilns types are often grouped depending on loading and usage styles rather than date. Most clamp kilns can be classified as intermittent or periodic kilns. These were cooled after each firing before emptying and being reloaded. Larger brick-lined kilns were continuous, running or draw kilns. The kiln was kept burning while supplies of fuel and limestone were replenished and the lime was drawn off. These are more often associated with industrial production of lime. Kilns where the fuel and stone were kept out of contact were known as flare kilns, whilst mixed feed kilns were loaded using alternate layers of fuel and stone.

Scale 1:3000 (A4)

Trench locations and open areas A and B Fig 2



Redbourne Upper School and Community College

Archaeological trenches & areas
 Proposed development area

0

 100m

© Crown copyright. All rights reserved. Northamptonshire County Council: Licence No. 100019331. Published 2013

3 OBJECTIVES AND METHODOLOGY

3.1 Objectives

There were two broad aims to this work:

- Provision of an archaeological trial trench evaluation within the area of the poplar plantation, which was not covered previously owing to dense vegetation, and;
- The further investigation of middle Iron Age pits and the post-medieval kiln discovered during the forerunning trial trench excavations in order to meet requirements for their appropriate mitigation.

The trial trench excavations within the poplar plantation were hoped to provide the following data:

- The location, extent, nature and date of any archaeological features or deposits,
- The integrity and state of preservation of any archaeological features or deposits.

Area A was focused upon a middle Iron Age pit group and Area B was focused upon a post-medieval lime kiln. The objective of the more detailed archaeological investigation of these known heritage assets was to:

- establish their date, nature and extent of activity or occupation within the development area;
- establish their relationship with any other remains found with the surrounding contemporary landscapes;
- recover palaeo-environmental remains to determine local environmental conditions.

The excavation was carried out within the parameters suggested by the published research priorities for the East of England and its wider region (EH 1997; Glazebrook 1997; Brown and Glazebrook 2000; Oake *et al* 2007; Medlycott and Brown 2008; Medlycott 2011).

Although it was not possible to comment further on the nature of the middle Iron Age pit group, particular attention was paid towards the study of post-medieval agriculture in Bedfordshire (Oake *et al* 2007, 16) in the broader context of investigating economically significant farm structures, such as the lime kiln (Gilman *et al* 2000, 42; Medlycott 2011, 70).

3.2 Methodology

Nine trial trenches were excavated to provide a general coverage of the area of the proposed SUD pond and two 15m by 15m areas were opened around the middle Iron Age pit group and the post-medieval lime kiln (Fig 2). The trial trenches measured 15m long by 1.8m wide, creating a total excavated area of 243 square metres. The trenches and open areas were positioned using a Leica system 1200 GPS.

The trial trenches were excavated using a JCB 3CX mechanical excavator and the open areas were conducted with a 360° tracked excavator. A toothless ditching bucket was used to remove overburden to the archaeological level or the natural substrate, where this was absent. All areas were cleaned sufficiently to enable the identification and definition of archaeological features. Deposits were described on *pro-forma* sheets to include measured and descriptive details of the context, its relationships and interpretation and a checklist of associated finds and samples (NA 2011). Digital photography was supplemented with 35mm black and white film for archive purposes. Sections were drawn at scale 1:10, or 1:20, and plans at a scale of 1:20 and 1:50, as appropriate, and related to Ordnance Survey datum.

The lime kiln was fully excavated and recorded. The project manager discussed its sample potential with the CBC Archaeologist on site and samples were retrieved from each significant deposit in accordance with published guidance (EH 2011). Environmental samples were collected from dated and sealed industrial residues of clear archaeological origin. Bulk sample sizes were 40 litres per context, collected and stored in sealable buckets.

All samples were processed using the flotation technique to retrieve seed, charcoal and vitrified remains. All the resultant residues were hand sorted for other finds. Finds were washed, sorted by type, marked with the museum accession code and context, bagged by context and boxed in accordance with best conservation practise (Watkinson & Neal 1998). A fully cross-referenced archive of the results has been compiled to English Heritage standards (EH 2008b) and in accordance with recognised best practise (Walker 1990; AAF 2007), and the requirements of Bedford Museum (BM 2010). The archive will be stored in stable conditions pending deposition with the Bedford Museum at the next available opportunity.

4 THE EXCAVATED EVIDENCE

4.1 Trial trench excavations within the poplar plantation

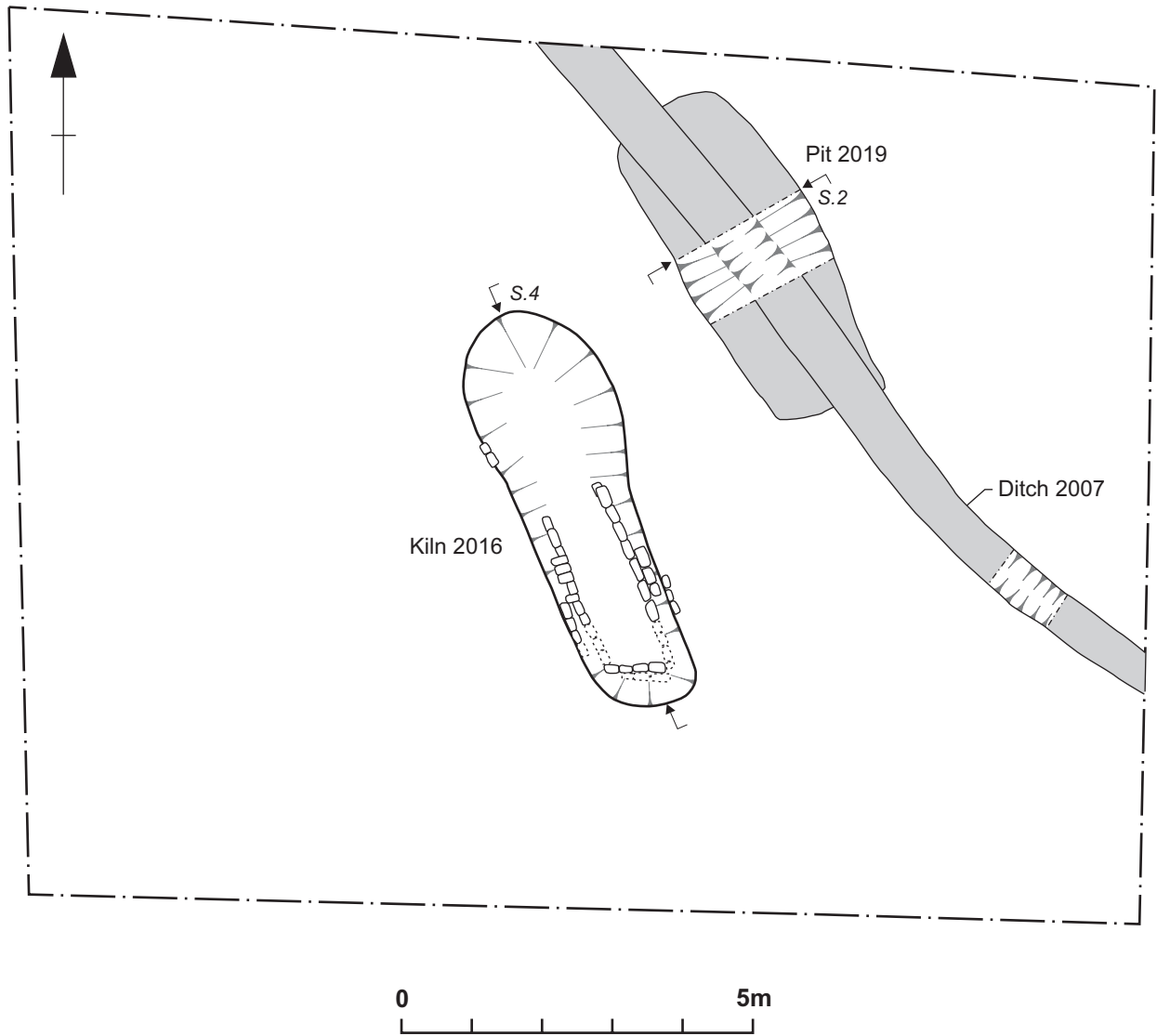
The natural substrate was encountered at a depth of between 0.30m and 0.40m and consisted of dark orange sand with patches of grey sandy clay. Evidence for subsoil was generally absent. The topsoil was dark grey sandy clay with an average depth of 0.35m. An inventory of trenches is provided in the appendix.

No archaeological features were identified within any of the trenches, but modern land drains were encountered on east to west and north-west to south-east alignments cutting vertically well below the surface of the natural substrate.

4.2 Further investigation of middle Iron Age pits, Area A

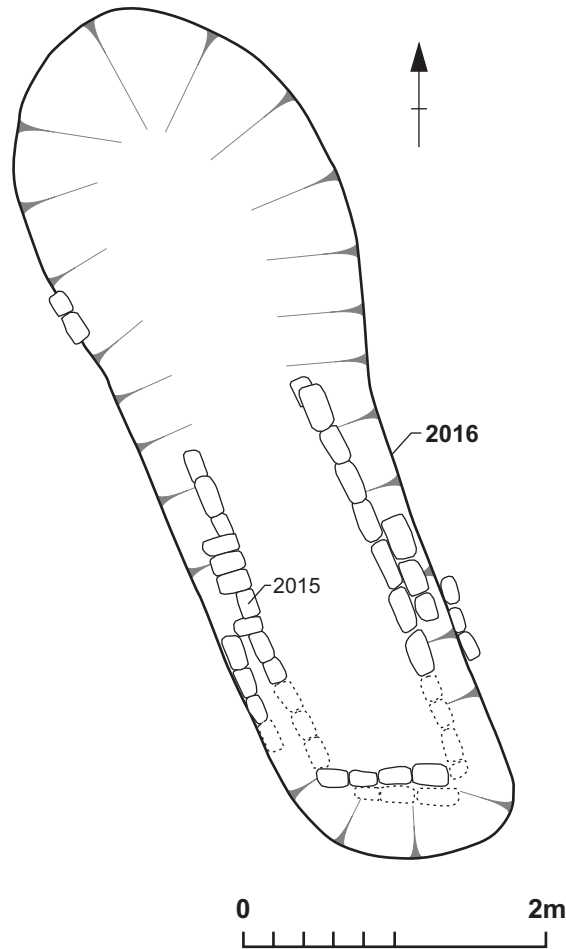
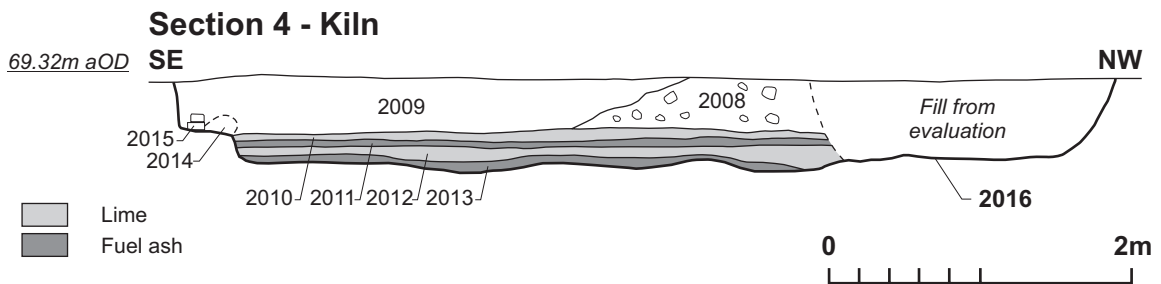
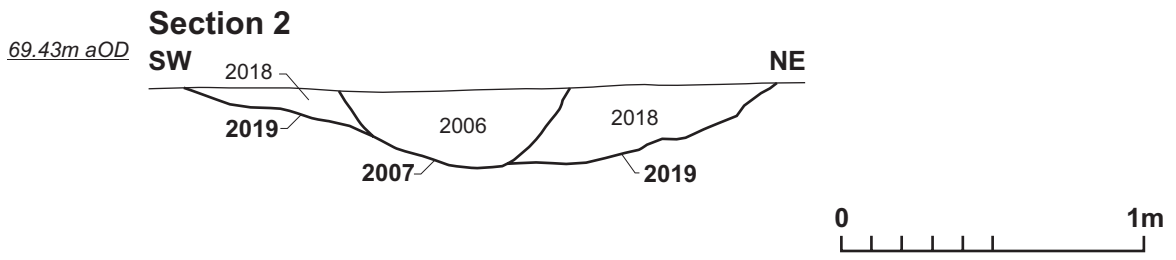
Area A was excavated around three Iron Age pits identified during earlier trial trench works (Brown 2010a). The natural substrate was encountered at a depth of 0.50m and overlain by dark yellowish-brown sandy clay subsoil, 0.25m thick. The topsoil was dark greyish-brown sandy loam 0.25 m thick.

The three Iron Age pits were identified, and had been fully excavated in 2010 (Brown 2010a, fig 11). No further archaeological features were identified within the stripped area. A single modern service trench was aligned north to south across the area.



Scale 1:100 (A4)

Excavated area, Kiln 2016, Area B Fig 3



Scales 1:25 & 1:50 (A4)

Excavated sections and plan of kiln [2016], Area B Fig 4

4.3 Further investigation of the post-medieval lime kiln, Area B

Area B targeted the lime kiln identified by the previous geophysical survey and trial trench work (Brown 2010a). The natural geology was encountered at a depth of 0.60m and consisted yellow sand with patches of dark orange and red sand and sandstone. The dark orange brown sandy clay subsoil was 0.30m thick and all of the features cut this deposit, advocating their post-medieval origin.

Pit 2019 was a large, slightly rectangular feature, aligned north-west to south-east (Figs 3-4). The pit had rough, irregular edges, pock-marked with dark patches in the sand. The profile was generally gentle, shallow, and sloped at 30-45° with no distinct uniform cut. The fill comprised loose dark brownish-grey sandy clay with orange patches. The pit was of similar size, shape and alignment with that of the kiln but no other evidence was found to corroborate an association between the features.

A post-medieval boundary ditch, 2007, cut pit 2019, and lay east of the kiln (Fig 2). The boundary is depicted by the 1808 enclosure map, dividing the allotment of William Exton from land to the east (Brown 2010a, fig 5). The ditch was 0.77m wide by 0.25m deep, it was generally rounded with steep sloping sides, with a fill of loose dark brownish-grey sandy loam.

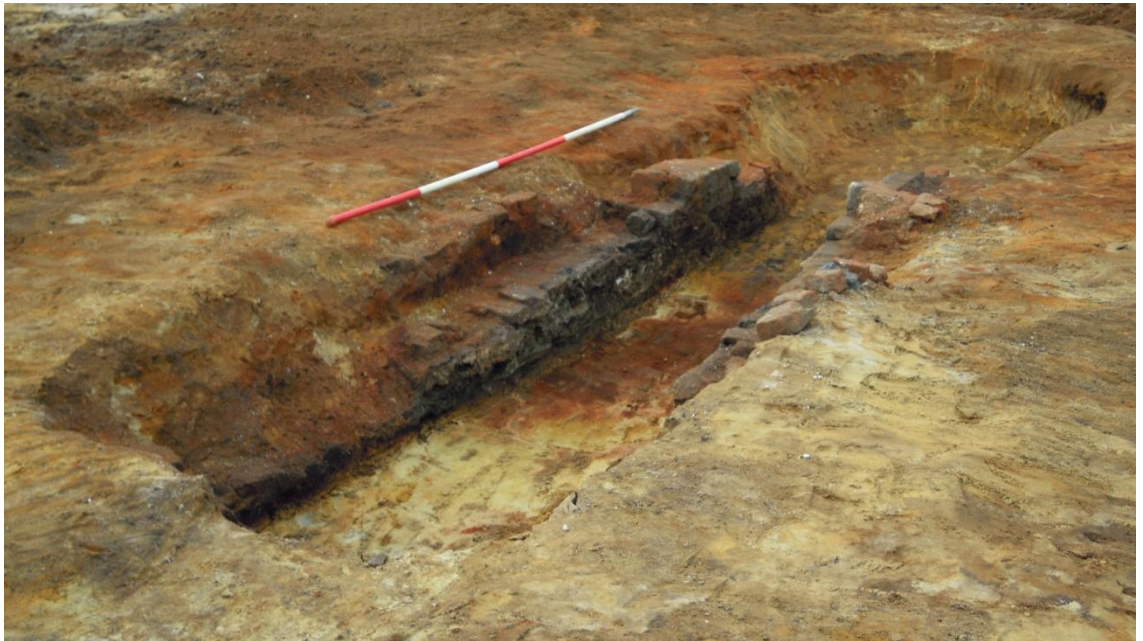
The kiln lay on a north-west to south-east alignment, parallel with the boundary ditch to east (Figs 3-4). The rectangular pit was 6.30m long by 1.80m wide and 0.50m deep, with a bulbous north-west end from which the kiln was loaded. The main structure of the kiln comprised hand-made bricks in a stretcher bond up to five courses high and, in places, two bricks wide. The structure was extant around the east, west and southern edges of the pit (Figs 5-9). On the east and west sides several bricks indicated that it would have had a further course of stretchers since in parts the brick had badly degraded, leaving a dark bluish sand brick shape in the soil. Most of the internal facing edges were encrusted with firing waste or were vitrified indicating extremely high temperatures. The base of kiln was not lined, but left as natural sand. Over this lay compact greyish-green fuel, slag and clinker layer 2013. This was overlain by a 0.10m thick layer of creamy white lime, 2012, with infrequent charcoal flecks. A second layer of compact fuel, slag and clinker, 2011, formed a band that was 0.05m thick and then a second layer of creamy white lime, 2010, was laid on top. These four layers were *in-situ* deposits left behind after the final use of the kiln.



Kiln 2016, Section 4, Area B, looking south-west Fig 5



Kiln 2016, partially excavated, Area B, looking south-east Fig 6



Kiln 2016, fully excavated, Area B, looking north-west Fig 7



Kiln 2016, fully excavated showing brick lining, Area B, looking south-west Fig 8



Kiln 2016, fully excavated, Area B, looking south-east Fig 9

Above the *in situ* layers the remainder of the fill comprised demolition debris. There were two large blankets of dark orange-brown sandy silt, 2008 and 2009, which contained large quantities of brick rubble mixed with charcoal, but largely devoid of limestone. The kiln demolition was overlain by dark greyish-brown sandy clay topsoil, 0.30m thick.

5 THE KILN BRICKS by Pat Chapman

One complete brick and 15 partial bricks or fragments, all overfired due to usage, come from the kiln lining, 2015. They are all plain, unfrogged, and made from fine sandy friable orange clay with occasional inclusions of small sub-rounded gravel c5mm long, large gravel up to 30mm long and small to medium grog. The original orange colour has become, for most of the bricks, varying degrees of red, brown, mauve or black with some surfaces vitrified to glassy green (Table 2).

The complete brick, 225mm long by 110mm wide and 60mm thick (8⁷/₈ x 4¹/₄ x 2³/₈ inches), is orange except for one header with a vitrified skin of slaggy appearance. Six partial bricks have the same width and thickness, 110mm by 60mm (4 x 2³/₈ inches): five are orange to red and brown in colour, one is also blackened, another has a partially vitrified white stretcher and a surviving header is cindery black with a glassy green vitrified end. Another two partial bricks, 110mm wide, but slightly thinner at 55mm (4¹/₄ x 2¹/₈ inches), are orange to pale brown and pale brown to black

Two very bloated half bricks are 100mm wide by 65mm thick (4 x 2¹/₂ inches), but have expanded to 120mm by 70mm (4³/₄ x 2³/₄ inches). One is blackened and the broken end vitrified to glassy green, the other is black towards the header which is glassy green. There are two more partial bricks, also 100mm wide, but only 60mm thick (4 x 2³/₈ inches), one has a blackened end with a glassy green header, and the other is mauve-brown. Three fragments are very friable, fired to black and disintegrating, each vitrified to glassy green on one surface.

Table 2: Bricks from kiln lining 215

The bricks	Dimensions mm (inches)	Description
1 complete	225 x 110 x 60 (8 ⁷ / ₈ x 4 ¹ / ₄ x 2 ³ / ₈)	Orange, vitrified header
6 partial	---- x 110 x 60 (---- x 4 ¹ / ₄ x 2 ³ / ₈)	5 orange, red, brown-1 white vitrified stretcher; 1 black with glassy green header
2 partial	----x 110 x 55 (---- x 4 ¹ / ₄ x 2 ¹ / ₈)	1 orange-brown; 1 brown-black
2 partial	----x 100 x 65 (---- x 4 x 2 ¹ / ₂)	2 bloated to 120x70mm; black, glassy green ends
2 partial	----x 100 x 60 (---- x 4 x 2 ³ / ₈)	1 glassy green header; 1 mauve-brown
3 fragments	-	Black, friable, glassy green surfaces

The bricks are all part of the kiln construction, the exposed headers or stretchers being vitrified by the intense heat. These bricks are similar to the examples recovered from the trial trench evaluation (Chapman 2010b), except that those bricks were longer, 230mm by 100-115mm by 60mm (9 x 4-4¹/₂ x 2³/₈ inches). They are also comparable to the bricks taken from the limes kilns at Barrow-upon-Soar, Leicestershire (Chapman 2007), which were dated to the late 18th and 19th centuries. The use of bricks as a lining would be consistent with this date.

6 THE KILN RESIDUES

6.1 Plant remains by Val Fryer

The four *in situ* layers of fuel and lime were sampled for environmental remains. The samples were bulk floated and the flots were collected in a 300 micron mesh sieve. The dried flots were scanned under a binocular microscope at magnifications up to x16 and the plant macrofossils and other remains noted are listed in Table 3. Nomenclature within the table follows Stace (1997). Both charred and un-charred plant remains were noted. Modern roots, seeds, chaff elements and straw fragments were also recorded along with small pieces of organic twine.

Results

The assemblages are small (c0.1 litres in volume or less) and relatively limited in composition. Seeds are scarce, with all specimens occurring in sample 2, fill 2011. Taxa include goosegrass, dock and a possible cinquefoil seed. Sample 2 also contains fragments of charred heather stem and floret. Small pieces of bracken frond are present throughout, and un-charred elderberry seeds are recorded from samples 2 and 4, fill 2013. As the latter are particularly durable woody seeds, it is entirely probable that all may be contemporary with the use of the kiln. Other plant macrofossils include fragments of charcoal, charred wood and small pieces of charred root or stem.

Table 3: Plant macrofossils with fuel ash and lime layers of Kiln 2016

Sample no.	1	2	3	4
Layer	210	211	212	213
Plant macrofossils				
Goosegrass	-	x	-	-
<i>Potentilla</i> sp.	-	xcf	-	-
Dock	-	x	-	-
Common Bracken	x	xxx	x	xx
Heather (stem)	-	x	-	-
Heather (florets)	-	x	-	-
Heather (capsules)	xcffg	xcffg	-	-
Elder	-	xxnc	-	xxnc
Charcoal <2mm	xx	xxx	xxx	xx
Charcoal >2mm	x	xx	-	x
Charred root/stem	x	xxx	x	x
Other seeds	-	x	-	-
Other remains				
Black porous 'cokey' material	-	x	-	-
Black tarry material	x	x	-	x
Small coal fragment	-	-	-	x
Vitreous material/globules	xx	xxxx	x	xxx
White mineral concretion	xxxx	-	xxxx	-
Sample volume (litres)	40	40	40	40
Volume of flot (litres)	<0.1	0.1	<0.1	<0.1
% flot sorted	100%	100%	100%	100%

x = 1 – 10 specimens xx = 11 – 50 specimens xxx = 51 – 100 specimens xxxx = 100+ specimens
 cf = compare fg = fragment nc = un-charred

Vitreous globules, all of which are derived from either the very high temperature combustion of organic remains or the fusion of silica rich ash, are present throughout, being particularly abundant within the assemblages from samples 2 and 4. In contrast, the assemblages from sample 1, fill 2010, and sample 3, fill 2012, are largely composed of friable concretions of lime. A single small fragment of coal is present within the assemblage from sample 4.

Conclusion

The assemblages are largely composed of either fuel residues or bi-products of the high temperature firing of the kiln. Heather and bracken both appear to have been favoured as fuel, presumably because they ignited easily and maintained an even, high temperature throughout combustion. Dried herbage may have been used as tinder/kindling, and although it is assumed that wood/charcoal were also utilised as fuel, remains derived from these materials are surprisingly scarce. Kilns were frequently cleaned after use, both as a means of preventing accidental fires and to facilitate future usage, however, in this instance the kiln was not cleaned after its final firing and the use of wood/charcoal seems improbable.

As none of the current assemblages are particularly comprehensive, analysis of the recovered plant macrofossils is not recommended. However, if further interventions are planned within the immediate area, it is suggested that additional samples are taken, particularly if any evidence of ancillary structures is recorded.

6.2 Fuel ash slag by Andy Chapman

From the back (south-east end) of the brick-lined lime kiln, context 2014, there is an elongated block of fuel ash slag, 340mm long by 110mm high and 100mm thick, weighing 2.8kg. On the back of the block there are remnants of bricks from the kiln lining, against which the full ash slag had accumulated. The slag comprises small vesicular globules which are bound together to form the larger mass. The surface is brown to grey-brown, and in broken section the interior is grey. The presumed face and underside of the block is convoluted and frothy, while the upper surface is smoother and in places glassy, particularly adjacent to the bricks.

Several large lumps of fuel ash slag, weighing 6.4kg, with the same characteristics were recovered during the trial trench evaluation (Chapman 2010a). The additional material, recovered through full excavation, includes a flat oval plate of dense glassy slag, 160mm long by 140mm wide and up to 20mm thick, which is probably molten slag that had accumulated in a shallow depression on the floor of the kiln.

7 DISCUSSION

Further trial trench investigations within the area of the SUDS pond identified no archaeological deposits and in Area A, where the group of three middle Iron Age pits had been found, this was also devoid of further archaeological features.

The principal feature of archaeological interest was the post-medieval lime kiln. The full extent of the kiln was revealed within Area B and it was fully excavated. The kiln form in plan is indicative of the linear-style kilns found at Barrow-upon-Soar, which date to the 15th to 16th centuries (McAree 2007, 16, figs 4 and 6, plate 9). However, the practise of lining the kiln with a brick structure is suggestive of the later 18th-19th centuries when lime burning became a commercial venture. Here, however, the use of

an older linear kiln form suggests that the level of production was fairly moderate and simply employs 16th-century technology with late 18th-century improvements. The period was subject to increased demand for corn during the Napoleonic wars and led to the practise of liming the soils to improve crop yields.

The bricks are handmade and are likely to have been reused, the orientation of the kiln parallel to an early 19th-century boundary, mapped in 1808, would be consistent with the later date of the kiln. It may be coincidental that the boundary curves very lightly east to avoid the kiln. The two *in situ* fuel ash and lime deposits conclusively show that the kiln was used for the production of lime. The method of firing the lime was to stack fuel and stone in alternate layers, which is consistent with the method of constructing a clamp or sod kiln on an intermittent basis. The fuel residues contained bracken and heather as primary high temperature fuel sources, such plants would have been readily available on the scrubland heath of Ampthill Warren, but perhaps less so once it had been turned to agriculture. The superstructure would likely have been mainly constructed from turf, and completely removed to recover the lime.

Overall, the suggestion is that the kiln was constructed in the late 18th century at a time when there was an increased demand for arable land, and its purpose was to produce lime to improve the scrubland of Ampthill Warren and convert this underused land to a productive arable state. This appears to be verified as the marginal land of Ampthill Warren was enclosed and acquired by new landowners who had set about improving the soil for cultivation, documented elsewhere (Meckseper 2010).

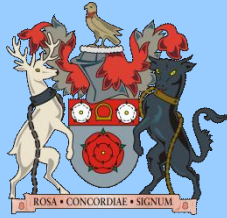
BIBLIOGRAPHY

- AAF 2007 *Archaeological Archives: a guide to best practice in creation, compilation, transfer and curation*, Archaeological Archive Forum
- BCC 1996 *Ampt Hill's Historic Environment*, Heritage Group Bedfordshire County Council Planning Department
- BGS 2001 *Solid Geology Map, UK South Sheet*, British Geological Society
- BM 2010 *Procedure for preparing archaeological archives for deposition with registered museums in Bedfordshire*, Bedford Museum
- Brown, J, 2010a *Geophysical survey and trial trench excavations on land between Flitwick Road and Abbey Lane, Ampt Hill, Bedfordshire*, Northamptonshire Archaeology report, **10/209**
- Brown, J, 2010b *A possible Roman vineyard on land off Tavistock Avenue, Ampt Hill, Bedfordshire*, Northamptonshire Archaeology report, **10/132**
- Brown, J, 2013 *Written Scheme of Investigation for archaeological investigation, recording, analysis and publication of land at Warren Farm, Ampt Hill, Central Bedfordshire*, Northamptonshire Archaeology
- Brown, N, and Glazebrook, J, (eds) 2000 *Research and Archaeology, A Framework for the Eastern Counties: 2, Research Agenda and Strategy*, East Anglian Archaeology, Occasional Paper, **8**
- Bryant, S, 2000 *The Iron Age*, in Brown and Glazebrook 2000, 14-18
- Chapman, A, 2010a *Fuel Ash slag*, in J Brown 2010, 35
- Chapman, P, 2007 *Appendix B3 The bricks*, in D McAree 2007
- Chapman, P, 2010b *Ceramic building material*, in J Brown 2010, 33-35
- Clark, R H, and Jackman, T A, 1992 *Ruxox*, *South Midlands Archaeology*, **22**, 5-6
- DCLG 2012 *National Planning Policy Framework*, Department of Communities and Local Government
- EH 1991 *Exploring our past*, English Heritage
- EH 1997 *English Heritage Archaeology Division Research Agenda*, English Heritage
- EH 2006a *Management of Research Projects in the Historic Environment: The MoRPHE Project Managers Guide*, English Heritage
- EH 2006b *Science for Historic Industries: Guidelines for the investigation of 17th- to 19th-century industries*, English Heritage
- EH 2006c *Archaeomagnetic Dating: Guidelines on producing and interpreting archaeomagnetic dates*, English Heritage
- EH 2007 *Geoarchaeology: Using earth sciences to understand the archaeological record*, English Heritage
- EH 2008a *Management of Research Projects in the Historic Environment, PPN3: Archaeological Excavation*, English Heritage
- EH 2008b *Luminescence Dating: Guidelines on using luminescence dating in archaeology*, English Heritage
- EH 2011 *Environmental Archaeology: A Guide to Theory and Practice for Methods, from sampling and recovery to post-excavation*, English Heritage
- Gilman, P, Gould, S, and Green, S, 2000 *Post-medieval and modern*, in Brown and Glazebrook 2000, 33-43
- Glazebrook, J, 1997 *Research and Archaeology, A Framework for the Eastern Counties: 1, Resource Assessment*, East Anglian Archaeology Occasional Paper, **3**
- Gurney, D, 2003 *Standards for Field Archaeology in the East of England*, East Anglian Archaeology Occasional Paper, **14**
- IfA 2008a *Standard and guidance for archaeological excavation*, Institute for Archaeologists
- IfA 2008b *Standard and guidance for an archaeological trial trench evaluation*, Institute for Archaeologists

- IfA 2008c *Standards and guidance for the collection, documentation, conservation and research of archaeological materials*, Institute for Archaeologists
- IfA 2010 *Code of Conduct*, Institute for Archaeologists
- Johnson, D, 2002 *Limestone industries of the Yorkshire Dales*, Stroud: Tempus
- McAree, D, 2007 *Archaeological excavation at Cotes Road, Barrow-upon-Soar, Leicestershire*, Northamptonshire Archaeology report, **07/148**
- McAree, D, 2010 *Archaeological excavation at Cotes Road, Barrow-upon-Soar, Leicestershire*, Northamptonshire Archaeology report, **10/11**
- Meckseper, C, 2010 *Warren Farm, Ampthill, Bedfordshire: Archaeological desk-based assessment*, Albion Archaeology report, **2010/42**
- Medlycott, M, 2011 *Research and Archaeology Revisited: A Revised Framework for the East of England*, East Anglian Archaeology, Occasional Papers, **24**
- Medlycott, M, and Brown, N, 2008 *Revised Research Framework for the Eastern Region*, East Anglian Archaeology
- MGC 1992 *Standards in the Museum care of Archaeological Collections*, Museums and Galleries Commission
- NA 2011 *Archaeological Fieldwork Manual*, Northamptonshire Archaeology
- Oake, M, 2007 Research Agenda and Strategy, in M Oake et al 2007, 7-18
- Oake, M, 2013a *Brief for a programme of archaeological investigation, recording, analysis and publication of land at Warren Farm, Flitwick Road, Ampthill, Bedfordshire*, Central Bedfordshire Council
- Oake, M, 2013b *Brief for a programme of archaeological investigation, recording, analysis and publication of land at Warren Farm, Flitwick Road, Ampthill, Bedfordshire: Stage 1 evaluation*, Central Bedfordshire Council
- Oake, M, Luke, M, Dawson, M, Edgeworth, M, and Murphy, P, 2007 *Bedfordshire Archaeology, Research and Archaeology: Resource Assessment, Research Agenda and Strategy*, Bedfordshire Archaeology monograph, **9**
- Simco, A, 1984 *Survey of Bedfordshire: The Roman Period*, Bedfordshire County Council and Royal Commission on Historical Monuments of England
- Stace, C, 1997 *New flora of the British Isles*, 2nd edition, Cambridge University Press
- Walker, K, 1990 *Guidelines for the preparation of excavation archives for long term storage*, United Kingdom Institute for Conservation
- Watkinson, D, and Neal, V, 1998 *First Aid for Finds (revised edition)*, United Kingdom Institute of Conservation
- Williams, R, 2004 *Limekilns and limeburning*, Shire Publications

APPENDIX TRIAL TRENCH CONTEXT INVENTORY

Context	Type	Description	Thickness or depth (m)
<i>Trench 1</i>			
101	topsoil	Dark greyish-brown sandy clay with frequent flecks of charcoal and small stone	0.25
102	Sub-soil	Dark orange-brown sandy clay	0.05
103	Natural	Dark orange and yellow sandy clay with infrequent small angular flint fragment and small rounded stone.	
<i>Trench 2</i>			
201	topsoil	Dark greyish-brown sandy clay with frequent flecks of charcoal and small stone	0.30
202	natural	Dark orange and yellow sandy clay with infrequent small angular flint fragment and small rounded stone	
<i>Trench 3</i>			
301	topsoil	Dark greyish-brown sandy clay with frequent flecks of charcoal and small stone	0.30
302	natural	Dark orange and yellow sandy clay with infrequent small angular flint fragment and small rounded stone	
<i>Trench 4</i>			
401	topsoil	Dark greyish-brown sandy clay with frequent flecks of charcoal and small stone	0.30
402	natural	Dark orange and yellow sandy clay with infrequent small angular flint fragment and small rounded stone with patches of mixed rounded gravels	
<i>Trench 5</i>			
501	topsoil	Dark greyish-brown sandy clay with frequent flecks of charcoal and small stone	0.35
502	natural	Dark orange and yellow sandy clay with infrequent small angular flint fragment and small rounded stone	
<i>Trench 6</i>			
601	topsoil	Dark greyish-brown sandy clay with frequent flecks of charcoal and small stone	0.35
602	natural	Dark orange and yellow sandy clay with infrequent small angular flint fragment and small rounded stone and several small patches of orange clay.	
<i>Trench 7</i>			
701	topsoil	Dark greyish-brown sandy clay with frequent flecks of charcoal and small stone	0.35
702	natural	Dark orange and yellow sandy clay with infrequent small angular flint fragment and small rounded stone, with patches of yellow-grey clay	
<i>Trench 8</i>			
801	topsoil	Dark greyish-brown sandy clay with frequent flecks of charcoal and small stone	0.35
802	natural	Dark orange and yellow sandy clay with infrequent small angular flint fragment and small rounded stone, with patches of yellow-grey clay	
<i>Trench 9</i>			
701	topsoil	Dark greyish-brown sandy clay with frequent flecks of charcoal and small stone	0.30
702	natural	Dark orange and yellow sandy clay with infrequent small angular flint fragment and small rounded stone, with patches of yellow-grey clay	



Northamptonshire County Council

Northamptonshire Archaeology



Northamptonshire Archaeology
2 Bolton House
Wootton Hall Park
Northampton NN4 8BE
t. 01604 700493 f. 01604 702822
e. sparry@northamptonshire.gov.uk
w. www.northantsarchaeology.co.uk



Northamptonshire
County Council