ARCHAEOLOGICAL SERVICES
DURHAM UNIVERSITY

on behalf of
Great Place Wentworth & Elsecar
Barnsley Metropolitan Borough Council

Wentworth Woodhouse Gardens
Rotherham
South Yorkshire

community geophysical survey

report 4996
February 2019

Contents

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1. Summary

The project

1.1 This report presents the results of a geophysical survey conducted in advance of proposed garden reinstatement at Wentworth Woodhouse near Rotherham. An earth electrical resistance survey was conducted with pupils from nearby schools as part of a local community engagement project.

1.2 The works were commissioned by Barnsley Metropolitan Borough Council, on behalf of Great Place Wentworth & Elsecar, and conducted by Archaeological Services Durham University.

Results

1.3 The survey has identified several probable former stone paths within the garden, most of which broadly correspond to those depicted on old maps. A probable former surfaced area was also identified in the central part of the garden.

1.4 Two pipes have also been detected; both appear to be associated with the former sunken pond.

1.5 The project has fulfilled all its objectives, in terms of geophysical survey, engagement of local young people and in informing future works in the garden.

2. Project background

Location (Figure 1)

2.1 The study area comprised a small enclosed garden at Wentworth Woodhouse, near Rotherham in South Yorkshire (NGR centre: SK 39256 97776). Wentworth Woodhouse Gardens are on the Historic England 'Register of Historic Parks and Gardens of special historic interest in England'. The survey area lay approximately 290m west of the main house and 75m south of the stable block. An earth electrical resistance survey was conducted across the garden, which measured 0.2ha.

2.2 The community-based geophysical survey was conducted for Barnsley Metropolitan Borough Council (MBC), on behalf of Great Place Wentworth & Elsecar (WE), as part of the HLF-funded 'Great Place Scheme'.

Development proposal

2.3 The Wentworth Woodhouse Preservation Trust (WWPT) propose to reinstate the former pathways in the investigation area, based on the results of the survey.

Aims and objectives

2.4 The principal aims of the survey are Outreach and Archaeological Research, as follows:

Outreach and community engagement

2.5 One of the overarching objectives of the Great Place Wentworth & Elsecar project is to raise the aspirations of young people in the local area and help them achieve their potential using innovative channels of engagement, such as archaeological geophysical survey at a local heritage asset. Community engagement was therefore a key element of this project and young people were encouraged to take part in all aspects of the survey.

2.6 Specifically, the approved purposes and objectives of the wider project were:

- Delivery of a project to utilise the culture and heritage of Wentworth Woodhouse and Elsecar to establish a long-term vision for the area and embed culture and heritage at the heart of strategic plans for both Rotherham and Barnsley
- To engage local deprived communities, especially children and young people, in a programme centred around connections to local heritage and culture, including spurring interest in heritage and STEM subjects
- To develop destination management and establish a major new tourism product
- To build capacity by establishing new partnerships and collaborating in the sharing of learning and developing new ways of working; create case studies and a learning tool kit; and establish a volunteering programme
- Creation of a legacy by embedding culture and heritage in the regional plans for Sheffield City Region and the Local Enterprise Partnership
- To use the investment to lever additional resources to realise long-term ambitions for the economic regeneration of the area through culture and heritage

Archaeological Research

2.7 The specific aims of the geophysical survey were:

- To undertake a geophysical survey (earth resistance survey) on the specified area to assess location, extent and condition of the pathways within the investigation area
- To engage local young people with their local heritage, new archaeological skills and provide an enjoyable and engaging heritage-led experience
- To produce a report which will assist Wentworth Woodhouse Preservation Trust (WWPT) in reinstating the pathways in the investigation area

Methods statement

2.8 The survey has been undertaken in accordance with a 'Brief for Geophysical Survey in Wentworth Woodhouse Gardens', a 'Brief prepared for a Community Geophysics Project, Wentworth Woodhouse Garden, Wentworth' and with national standards and guidance (see para. 5.1 below).

Dates

2.9 The survey was undertaken on the 23rd and 24th January 2019. This report was prepared for February 2019.

Community engagement

2.10 The engagement element of the project was undertaken over four half-day sessions on the 23rd and 24th January 2019. Each session began with short introductions to the garden restoration project and to archaeological geophysics in general. A fully illustrated introductory guide to archaeological geophysics was also provided to each participant. On site, each project member conducted survey with a range of geophysical instruments (electrical resistance, magnetic and ground-penetrating radar); this provided plenty of opportunity for questions and more informal discussion. The electrical resistance data were logged for subsequent analysis.

Personnel

2.11 The survey was conducted by Year 10 pupils from St Pius X Catholic High School in Wath-upon-Dearne and Year 6 pupils from Wentworth Primary School:

St Pius X Catholic High School

Mitchell Anya	Davis Jessica	Smith Will
Askew Thomas	Robinson McKenzie	Dobing Brandon
Cocking Harold	Hemingway Charlotte	Tansley Jacob
Mainon Jude	Kelly Declan	McGinnes Joshua
Wray Matthew	Davies Charlie	Golus Scarlett
Cassidy Charlie	Ward Ethan	Appleby Ella
Llewellyn Owain	Bufton Richard	Stacey Alex
Clegg Rosanna	Fieldsend Charlie	Brook Zak
Middleton Anais	Robinson Jack	Hathaway Alexander

Wentworth CofE Primary School

Billy D	Zackery B	Imogen H
Thomas F	Joshua W	Megan S
Samuel B	Jessica B	Sophie O
Joseph G	Isabella H	Sophie P
Joseph D	Evie F	
Maxwell S	Matilda W	

Training and supervision were provided by Duncan Hale (Senior Archaeologist) and Mark Woolston-Houshold (Archaeological Geophysicist) of Archaeological Services Durham University. The geophysical data were processed by Duncan Hale. This report was prepared by Duncan Hale, the Project Manager, with illustrations by Dr Helen Drinkall.

2.12 Overall project management and coordination was provided by Megan Clement of Great Place Wentworth & Elsecar.

Archive/OASIS

2.13 The site code is **WWG19**, for **W**entworth **W**oodhouse **G**ardens 20**19**. The survey archive will be retained at Archaeological Services Durham University and a copy supplied on CD to the client for deposition with the project archive in due course. Archaeological Services Durham University is registered with the **O**nline **A**cces**S** to the **I**ndex of archaeological investigation**S** project (**OASIS**). The OASIS ID number for this project is **archaeol3-342116**.

Acknowledgements

2.14 Archaeological Services Durham University is grateful for the assistance of Megan Clement (Great Place Wentworth & Elsecar) and Emily Vaughan (on student placement), Jean and Dave Shaw and other volunteers and personnel at WWPT in facilitating this scheme of works.

3. Historical and archaeological background

3.1 Much of the following background information is taken from the project Brief.

3.2 Wentworth Woodhouse was one of the largest private residences in Europe, comprising two houses in totally different architectural styles. Built by The First Marquis of Rockingham between 1725-1750, the west front of the house is in the Baroque style and the east front is in the later Palladian style. The Grade I listed house and gardens were bought by the WWPT for £7m in March 2017.

3.3 The garden and parkland surrounding Wentworth Woodhouse are an important part of the site. The house was owned by the Fitzwilliam family until the 1980s and much of the surrounding parkland is still owned by the Fitzwilliam Estates. Parts of the house are currently undergoing work through a programme of restoration.

3.4 The formal garden is on the western side of the house; part of it is leased and managed by Wentworth Garden Centre, but the rest is owned and managed by the WWPT. There are still some aspects of the original gardens in place including the Camellia House, the Ionic Temple and a 15 foot high urn, known as the Punch Bowl. Other parts of the garden are now within the garden centre, include the Japanese Garden, the Bear Pit, the Duck Houses and the Kitchen Garden.

3.5 The first record of a formal garden comes from a 15th-century painting of Thomas Wentworth but there are no written details of what the gardens contained. Much of the creation was done under the instruction of Lady Maud Fitzwilliam, the 7th Earl's wife, during the 1850s; there were 36 gardeners employed at that time.

3.6 The survey area for this project lay to the west of the main house, next to the main drive from the west of the house. The garden is shown in some detail on several early Ordnance Survey maps (below). On the 1892 and 1903 editions, several paths are indicated. By the time of the 1930 edition, most of the paths are no longer depicted but a rectangular pond is shown in the west of the garden. By 1957 all the paths have gone but the pond remains. There are also some historic images of the site showing the sunken pond and the pathways (below).

Early photographs, undated

1892 OS map

1903 OS map

1930 OS map

1957 OS map

3.7 The pond was recently cleared out by a group of National Citizen Service students, aged 16-18 years old, from Rotherham schools.

4. Landuse, topography and geology

4.1 At the time of fieldwork the survey area comprised a small garden, enclosed by hedges and a ruined wall. The garden was primarily lawn, with two mature trees in the central area and a sunken pond in the west. Occasional stone flags were noted within and beneath the turf.

4.2 The area was predominantly level with a mean elevation of 110m OD.

4.3 The underlying solid geology of the area comprises Mid Pennsylvanian Barnsley Rock sandstone, with no overlying deposits recorded. Much of the surrounding land was mined for coal in the mid-20th century.

5. Geophysical survey

Standards

5.1 The surveys and reporting were conducted in accordance with Historic England guidelines, *Geophysical survey in archaeological field evaluation* (David, Linford & Linford 2008); the Chartered Institute for Archaeologists (CIfA) *Standard and Guidance for archaeological geophysical survey* (2014); the CIfA Technical Paper No.6, *The use of geophysical techniques in archaeological evaluations* (Gaffney, Gater & Ovenden 2002); and the Archaeology Data Service & Digital Antiquity *Geophysical Data in Archaeology: A Guide to Good Practice* (Schmidt 2013).

Technique selection

5.2 Geophysical survey enables the relatively rapid and non-invasive identification of sub-surface features of potential archaeological significance and can involve a suite of complementary techniques such as magnetometry, earth electrical resistance, ground-penetrating radar, electromagnetic survey and topsoil magnetic susceptibility survey. Some techniques are more suitable than others in particular situations, depending on site-specific factors including the nature of likely targets; depth of likely targets; ground conditions; proximity of buildings, fences or services and the local geology and drift.

5.3 In this instance, it was known that pathways had previously crossed the garden and it was considered likely that the remains of other garden features such as planting beds, drains or ornamental features might also be present.

5.4 Given the anticipated depth of targets, an electrical resistance survey was considered appropriate. Earth electrical resistance survey can be particularly useful for mapping stone and brick features. When a small electrical current is injected through the earth it encounters resistance which can be measured. Since resistance is linked to moisture content and porosity, stone and brick features will give relatively high resistance values while soil-filled features, which retain more moisture, will provide relatively low resistance values.

Field methods

5.5 A 20m grid was established across the survey area and related to the Ordnance Survey (OS) National Grid using a Leica GS15 global navigation satellite system (GNSS) with real-time kinematic (RTK) corrections typically providing 10mm accuracy.

5.6 Measurements of earth electrical resistance were determined using Geoscan RM15D Advanced resistance meters with MPX15 multiplexers and a mobile twin probe separation of 0.5m. A zig-zag traverse scheme was employed and data were logged in 20m grid units. The instrument sensitivity was 0.1ohm, the sample interval was 0.5m and the traverse interval was 1m, thus providing 800 sample measurements per 20m grid unit.

5.7 Data were downloaded on site into a laptop computer for initial processing and storage and subsequently transferred to a desktop computer for processing, interpretation and archiving.

Electrical resistance

Data processing

5.8 Geoplot v.4 software was used to process the geophysical data and to produce a continuous tone greyscale image of the raw (minimally processed) data. The greyscale image is presented in Figure 2; the interpretation is provided in Figure 3. In the greyscale image, high resistance anomalies are displayed as dark grey and low resistance anomalies as light grey. A palette bar relates the greyscale intensities to anomaly values in ohm.

5.9 The following basic processing functions have been applied to the resistance data:

clip	clips data to specified maximum or minimum values; to eliminate large noise spikes; also generally makes statistical calculations more realistic

de-spike	locates and suppresses spikes in resistance data caused by poor electrode contact with the ground
interpolate	increases the number of data points in a survey to match sample and traverse intervals; in this instance the data have been interpolated to 0.5m x 0.5m intervals

Interpretation: anomaly types

5.10 Two types of resistance anomaly have been recorded in the data:

high resistance	regions of anomalously high resistance, which may reflect paths, foundations, tracks and other concentrations of stone or brick rubble
low resistance	regions of anomalously low resistance, which may be associated with soil-filled features such as pits and ditches

Interpretation: features

5.11 A colour-coded archaeological interpretation plan is provided.

5.12 Several linear high resistance anomalies have been detected across the garden. These anomalies almost certainly reflect the former stone paths. Occasional stone flags were noted at the ground surface during survey, and other sub-surface probable flags hindered the insertion of steel electrodes in places.

5.13 One former path lies parallel to the hedge along the northern boundary of the garden, another was present parallel to the hedge at the eastern end. A third former path crossed the garden obliquely, though this is also broadly parallel to a former garden boundary. At least two, and possibly three, probable former paths have also been detected crossing the garden perpendicular to the long northern boundary.

5.14 In many cases the anomalies are discontinuous; there appear to be occasional gaps in the paths, perhaps where stone flags have been removed for use elsewhere.

5.15 The paths recorded in the resistance survey generally correspond well with those shown on the early OS maps.

5.16 The survey has also recorded a large area of high resistance in the central part of the garden. This became evident to the students during survey and it was postulated that this could be due to the uptake of water by the two large mature trees in this part of the garden; this phenomenon is often recorded in resistance surveys around large trees. The two earlier OS maps do show an area with clearly defined edges or paths spanning this central part of the garden and it is likely that this area may have contained a ‘hard’ surface at the end of the 19th century, probably gravel or stone flags, or even brick paving, any of which would give rise to high resistance readings, as well as water absorption by the trees.

5.17 Occasional small patches of low resistance were also detected. These are generally quite irregular in shape and may reflect soil-filled spaces where trees have been removed, rather than formal planting beds.

5.18 A linear series of small low resistance anomalies was detected parallel to and south of the former oblique path. Such anomalies can reflect ferrous pipes and this was confirmed here by a quick check with a magnetometer whilst on site. The pipe appears to be associated with the sunken pond, perhaps the outlet pipe. A similar, possibly ferrous, pipe was almost certainly detected at the south-western corner of the pond too, approaching the pond from the slightly higher ground on that side.

6. Conclusions

6.1 An earth electrical resistance survey was undertaken in an enclosed garden at Wentworth Woodhouse, near Rotherham, with students from local schools, prior to proposed restoration of the garden.

6.2 The survey has identified several probable former stone paths within the garden, most of which broadly correspond to those depicted on old maps. A probable former surfaced area was also identified in the central part of the garden.

6.3 Two pipes have also been detected; both appear to be associated with the former sunken pond.

6.4 The project has fulfilled all its objectives, in terms of geophysical survey, engagement of local young people and in informing future works in the garden.

7. Sources

CIfA 2014 *Standard and Guidance for archaeological geophysical survey*. Chartered Institute for Archaeologists

David, A, Linford, N, & Linford, P, 2008 *Geophysical Survey in Archaeological Field Evaluation*. Historic England

Gaffney, C, Gater, J, & Ovenden, S, 2002 *The use of geophysical techniques in archaeological evaluations*. CIfA Technical Paper **6**, Chartered Institute for Archaeologists

Schmidt, A, 2013 *Geophysical Data in Archaeology: A Guide to Good Practice*. Archaeology Data Service & Digital Antiquity, Oxbow

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Figure 1: Site location

site location

0 1km
scale 1:20 000 for A4 plot

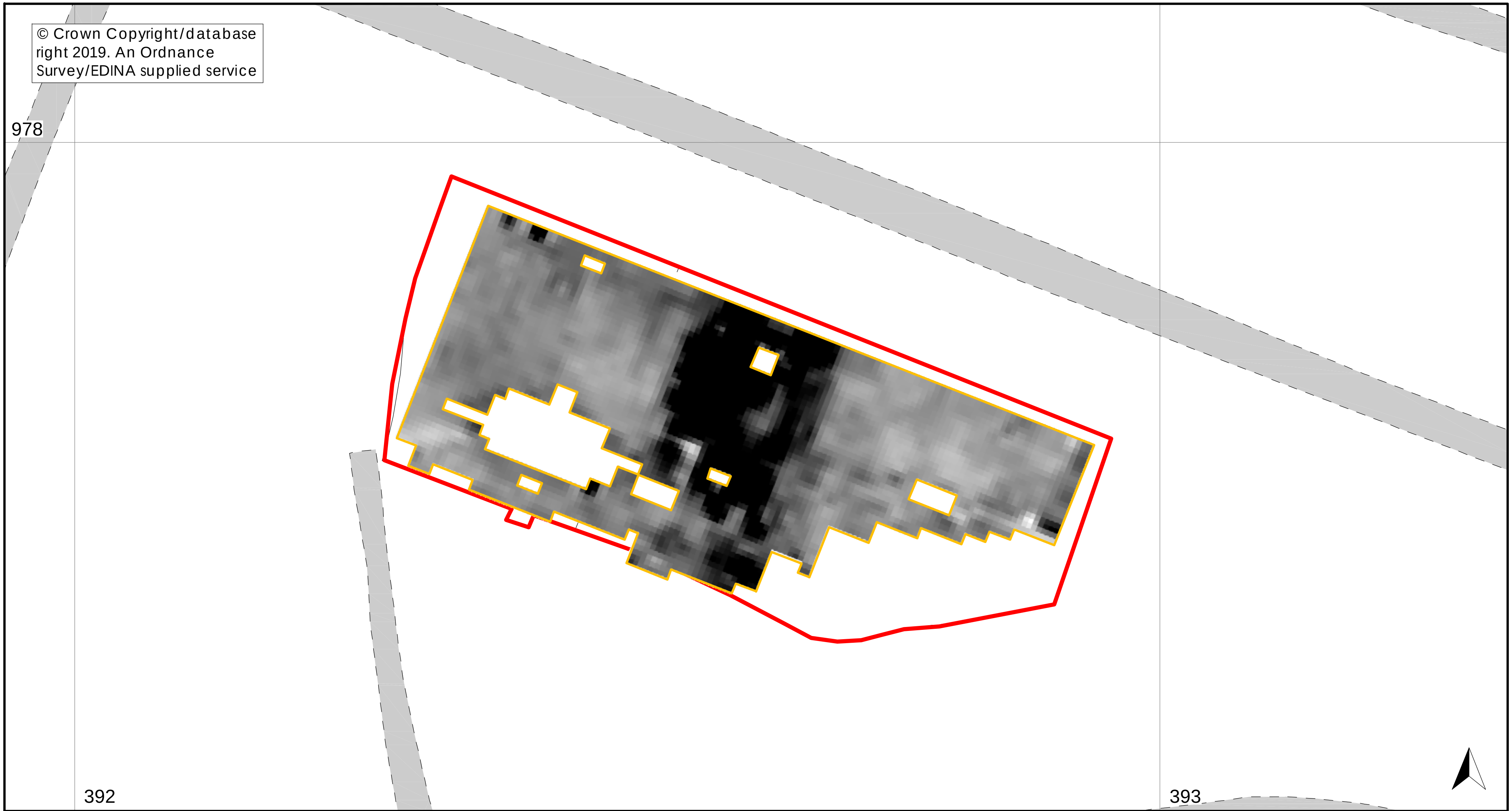

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Figure 2: Resistance survey

site boundary
resistance survey

30 ohm 80

0 25m
scale 1:500 for A4 plot

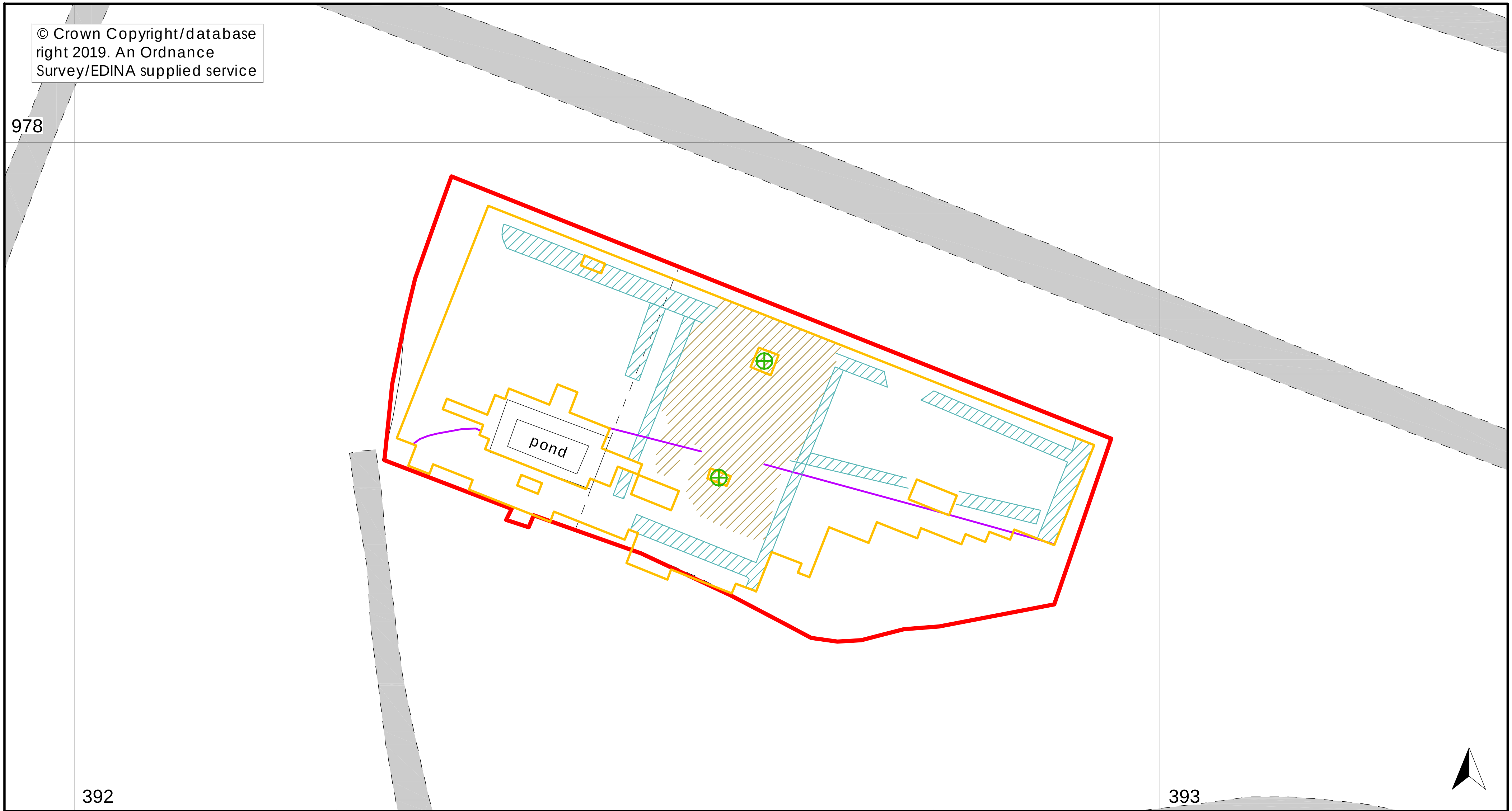

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Figure 3: Archaeological Interpretation