Late Saxon to Early Medieval Salterns at Lynnsport 1: Land South of Aconite Road, King's Lynn, Norfolk. Post-Excavation Assessment and Updated Project Design

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Prepared by:	Kathryn Blackbourn (Project Officer)
Checked by:	Matt Brudenell (Project Manager)
Edited by:	Rachel Clarke (Post-Excavation Editor)
Approved for Issue by:	Elizabeth Popescu (Head of Post-Excavation & Publications)
Signature:	

OA South
Janus House
Osney Mead
Oxford
OX2 0ES

t. +44 (0)1865 263 800

OA East
15 Trafalgar Way
Bar Hill
Cambridge
CB23 8SQ

t. +44 (0)1223 850 500

OA North
Mill 3
Moor Lane Mills
Moor Lane
Lancaster
LA1 1QD
t. +44 (0)1524 880 250

e. info@oxfordarch.co.uk
w. oxfordarchaeology.com
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Late Saxon to Early Medieval Salterns at Lynnsport 1: Land South of Aconite Road, King's Lynn, Norfolk.

Post-Excavation Assessment and Updated Project Design

By Kathryn Blackbourn BA ACIfA

with contributions from Sue Anderson BA MPhil PGD MCIfA FSA Scot, Ro Booth PhD, Denise Druce BA PhD, Rachel Fosberry ACIfA, Ted Levermore BA MA, Mairead Rutherford MSc, Simon Timberlake MSc PhD, Zoe Ui Choileáin MA MSc BABAO and illustrations by Séverine Bézie BA MA

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Summary

From the 14th January to the 1st of February 2019 Oxford Archaeology East undertook an archaeological excavation at land south of Aconite Road (Lynnsport 1), King's Lynn, Norfolk. This project took place within a wider context of research into the salt-making industry of Gaywood, King's Lynn, which is being undertaken by OA East through a series of investigations for the Lynnsport development. This phase of works comprised four excavation areas across three saltern mounds (Salterns 10-12) which had previously been identified during evaluation work at the site.

Buried soils which probably represent land-surfaces upon which the saltern mounds formed within the saltmarsh were identified beneath Salterns 11 and 12, with Ipswich ware pottery (date range of late 8th to 9th century) recovered beneath Saltern 11. Each saltern mound consisted of layers of waste material resulting from brine filtration and boiling activity related to Mid/Late Saxon to early medieval salt production. A number of clay-lined tanks were also revealed directly related to the salt-making process. These features and deposits provided a few sherds of pottery, that in conjunction with radiocarbon dating, suggests continued salt production from the 9th/10th to 12th centuries. A layer of clay was observed to interrupt the deposit sequence within Saltern 12 to possibly indicate a marine or fluvial flood event. Importantly, a rare survival of incinerated peat from hearth waste deposits within Saltern 12 attests to this much postulated but often invisible fuel source within the archaeological record of this industry. The environmental samples also provided evidence for the wider saltmarsh environment within which the industry was focussed. The upper deposit sequence in each of the mounds also contained iron smithing slag to indicate a secondary use for these mounds during the early medieval period. Together, these salterns add to a growing corpus of Mid/Late Saxon and medieval saltern sites within the historical North Marsh of Gaywood, King's Lynn.

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1 INTRODUCTION

1.1 Background

1.1.1 Between the 14th January and 1st February 2019, Oxford Archaeology East (OA East) conducted the second phase archaeological excavations on the Lynnsport development (Lynnsport 1) on land south of Aconite Road, King's Lynn, Norfolk (TF 63371 21278; Fig. 1). The entire site comprises five development areas: Lynnsport 1-5. The current project was commissioned by Lovell Partnerships Ltd in advance of a proposed residential development (Planning Application: 16/00227/FM).

1.1.2 An archaeological evaluation was carried out prior to the excavation in order to establish the presence/absence of archaeological features and deposits (Clarke 2018b). Norfolk Heritage Environment Record (NHER) data and topographical survey of the site indicated that the remains of two saltern mounds (NHER 13785 and NHER 27895; Fig. 2) lay within the bounds of the proposed development. The evaluation confirmed the presence of saltern NHER 13785 (Saltern 12) and discounted the presence of saltern NHER 2795. In addition, the trenching work identified two further saltern mounds (Salterns 10 and 11). Significant (presumably) Late Saxon/medieval salt-making remains were encountered within each of these three areas of the site.

1.1.3 A Written Scheme of Investigation (WSI) was prepared by OA East (and approved by Norfolk County Council Historic Environment Service (NCC/HES)) detailing the further programme of four excavation areas required on the site to each mitigate the impact of the proposed development on each saltern mound revealed by the initial evaluation (Clarke 2016d). These four separate areas (Areas F, G, H and I) totalled an area of *c*.0.07ha.

1.1.4 This assessment has been conducted in accordance with the principles identified in English Heritage's guidance documents *Management of Research Projects in the Historic Environment*, specifically *The MoRPHE Project Manager's Guide (2006) and PPN3 Archaeological Excavation* (2008).

1.2 Geology and topography

1.2.1 The site is located within the urban reach of King's Lynn, *c*.2km east of the River Great Ouse (Fig. 1). The site covers 3.61ha on a flat area of ground lying approximately 3m OD. The site is bounded by the Bawsey Drain to the south and east (with recreational fields beyond), a minor drain to the north (with residential development on Aconite Road beyond), and Greenpark Road to the west.

1.2.2 The underlying geology of the site comprises Jurassic Kimmeridge Clay Formation mudstone overlain by layers of clay and silt, which were deposited by tidal action during the Quaternary period. British Geological Survey borehole data from site (TF 62900 20900 and TF 63060 20890) revealed a typical Flandrian sequence of deposits, with an amorphous peat horizon (1.60/1.88m-3.10/3.35m below the ground surface) overlain by saltmarsh deposits of brown fine-grained silts and sands of the Terrington Beds. An archaeological evaluation was carried out by OA East to the north of the site

at Marsh Lane (Webster 2015; Fig. 2, MNF42716). Peat uncovered during this work was radiocarbon dated to 790-540 cal BC (2499 BP =29; SUERC-61520).

1.2.3 A borehole survey, as part of the previous evaluation work of the site, demonstrated the basal horizon of the saltern mounds developed upon the upper horizon of the saltmarsh at a height of between 1.91-2.29m OD (Clarke 2018c). Previous archaeological excavation work as part of the Lynnsport project and neighbouring development work has determined the upper horizon of the natural saltmarsh deposits upon which the Gaywood salterns were placed lay at differing heights across this landscape: Marsh Lane – 1.5-2m OD (Clarke 2016); Lynnsport 4 and 5 – 2m OD (Clarke 2017b); Lynnsport 3 – 1.57-1.75m OD (Clarke 2018b); Greenpark Avenue – 1.19-1.71m OD (Clarke 2018a).

1.3 Archaeological and historical background

1.3.1 The following sections summarise the data obtained from the Norfolk Historic Environment Record (NHER; Fig. 2) for the WSI (Brudenell 2016; Clarke 2018a), in addition to the results of the previous phases of archaeological investigations at the current site (Clarke 2018b; ENF139745) and on Lynnsport 3 (Clarke 2018c; ENF 138254) and Lynnsport 4 and 5 (Clarke 2017a-b; ENF 139746 and ENF141949) to the southwest of the site.

1.3.2 Although the surrounding landscape provides evidence of prehistoric and Roman activity in the vicinity of the site (with stray finds of a Roman coin, c.350m to the northeast (NHER 11990), and a Late Neolithic/Early Bronze Age arrowhead c.380m to the southwest (NHER 5494), much of this area was unsuitable for occupation during the later prehistoric and Romano-British periods, with any earlier traces of activity sealed beneath thick marine and freshwater Flandrian deposits (the arrowhead was recovered from a drain cutting these deposits). Whilst not discounting the importance of these deposits, and the potential buried prehistoric land surfaces/shore-lines they protect, the immediate archaeological significance of the area falls largely within the Anglo-Saxon, medieval and post-medieval periods when the area was a saltmarsh environment.

1.3.3 Of particular significance are the traces of a former salt-making industry that flourished between the Anglo-Saxon and post-medieval periods around the Wash coastline. The remains of this industry are primarily revealed in the form of saltern mounds, some of which still survive as earthworks, or are visible as pale oval or floriform soilmarks. The mounds, which can be up to 200m across, were formed by the piling up of waste sand from salt filtration in the 'sand washing' or 'sleeching' process of salt extraction.

1.3.4 An extensive swathe of saltern mounds is recorded around North Lynn, first identified by the National Mapping Programme (NMP) survey (Albone *et al.* 2007, 116). These not only reflect the importance of the salt industry, but the location and progressive land reclamation along the Anglo-Saxon and medieval coast line. Until recently, most of the saltern mounds were thought to be medieval or later in origin, particularly the western examples towards the current line of the Great Ouse. However, radiocarbon dating from the recent Lynnsport 4 and 5 excavations to the southwest of the site have

revealed that some of the mounds in this area have a Middle Saxon origin, pushing the date of the salt industry in this landscape back by several hundred years (Clarke 2017a-b; Fig. 2, ENF139746 and ENF141949). Mid to Late Saxon radiocarbon dates were also achieved for a saltern excavated at Marsh Lane, *c*. 250m to the north (Fig. 2, NHER 27899; Clarke and Clarke forthcoming; Clarke 2016), demonstrating that this was not a one-off, but evidence of a developed Anglo-Saxon saltworking landscape.

1.3.5 Clay-lined pits, filtration units and brine boiling hearths of various forms were found at both these sites, with differences in the size and shape of these features possibly indicating changes the manner and scale of production over time.

1.3.6 A sense of the extent of this industry is revealed by the fact that most records in the NHER recorded within a 500m radius of the site, relate to saltern mounds or salt-making activity (e.g. NHER 5524, 27886, 27893-6, 27899-902, 27906-912 and 38265). Saltern mounds are recorded on the north, west and south of the site. More significantly, two saltern mounds have been mapped on the site itself. The largest lies in the north (NHER 27895) and is recorded from 1947 RAF vertical aerial photographs. The low mound is described as sub-rounded in plan with a maximum diameter of 80m. Immediately north is a course of a former salt marsh channel (possibly an earlier course of the Gaywood River, see NHER 28800), the line of which is preserved in the shape of the site's meandering northern perimeter boundary. Along the north-eastern edge of the site, this channel skirts the second smaller saltern mound, described as being 40m in diameter (NHER 13785). The channel itself is/was banked, though this may have been destroyed (NHER 13785).

1.3.7 The salt-making industry declined during the post-medieval period, however, several of the saltern mounds were put to other uses during this time, some being incorporated into the King's Lynn siege defences during the Civil War (e.g. NHER 13785, not illustrated). It has been suggested that the bank associated with the saltmarsh channel could represent an unfinished siegework (part of a bastion) dating to 1643 when the River Gaywood was fortified. However, this is unlikely as the feature is 1.1km from the Lynn town wall, which is beyond the effective range of mid-17th century cannon (NHER 13785).

1.3.8 The subsequent drainage of the Fens during the 17th century exposed a large area of land in the environs of the site and made it available for cultivation and extended permanent grazing pastures. Remnant ridge and furrow or 'lazybedding' agricultural features are recorded to the southeast of the site (NHER 2789-1), with further examples further south (NHER 27865). Earthworks of possible medieval banks, ditches and drains in the area also attest to the process of land reclamation which made the area habitable (e.g. NHER 13785 and 27891).

1.3.9 The Inclosure award map of 1810 shows the site as parcels of open farmland, traversed in the southwestern corner by the historical routeway of *Salters Lode* (Norfolk Records Office (NRO) BL14-41). This routeway is also indicated to have been named *Bullcote Waie* on a reproduction of a map of 1488 (NRO BL55-1). Part of the boundary for one of these plots of land corresponds with the course of the broadly north-south aligned drainage ditch traversing the western part of the site (Fig. 4).

1.3.10 The south-eastern part of the site was crossed by the route of the Midland and Great Northern Joint Railway, opened in 1864 and dismantled in 1886 (NHER 13581). This joined the King's Lynn to Hunstanton Branch line at the Gaywood Junction, to the southwest of the site, crossing the Bawsey Drain near the southeast corner of the current all weather sports pitch (the concrete support of the crossing still being present in the drain). The 1884 OS map of the area shows the route of the railway and the banked salt marsh channel at the north of the site. It also shows a road/track crossing the southwest corner of the site, corresponding to *Salters Lode/Bullcote Waie*, and a second drain running approximately north-south toward the western end of the site, corresponding to the pre-existing plot boundary described above.

1.3.11 The OS series maps from 1927- 1951 shows the site largely covered in trees, with the line of the dismantled railway marked. The course of the railway, road/track and drains traversing the site are also shown on a 1946 aerial photograph of the site. On the 1951 map, overhead power lines are shown along the line of the former railway. By 1974 the track that was once marked in the southwest corner of the site is now labelled a drain, and this is no longer present on the 1990 map. Lynnsport was opened in 1982, and the current site layout with the all weather sports pitch was established in the 1990s.

1.4 Previous work

1.4.1 The trial trenching in May 2018 (Clarke 2018c) confirmed the presence of saltern NHER 13785 (Saltern 12). However, the trench and test pit excavated within the footprint of saltern NHER 2795 only encountered a recent build-up of made ground overlying the natural tidal flat deposits. In addition, salt-making features and deposits comprising two further saltern mounds (Salterns 10 and 11) were identified, located wholly within the development area. As well as revealing waste deposits from the salt-making process constituting the mounds, the evaluation also uncovered *in-situ* remains of clay-lined tanks within Saltern 10 and a pit within Saltern 11. These remains are typical of the known later Saxon and medieval salt-making evidence previously excavated in the area by OA East. The evaluation also investigated the modern drainage channel traversing the western part of the site that was found, upon inspection of historical records, to have followed the course of a pre-existing plot boundary/land division. However, it is possible an earlier cut of this ditch alignment may potentially follow the course of a former creek related to the saltworking. In addition, two extensive areas of recent truncation of the underlying natural deposits in the northern and southeastern parts of the site were identified, with associated backfilling with modern material. This truncation was probably a result of the recent redevelopment of the site.

1.5 Original research aims and objectives

Introduction – the emerging historical salt-making landscape of Gaywood, King's Lynn, Norfolk

1.5.1 Whilst the general aim of the investigation is to preserve by record the archaeological evidence contained within the footprint of the mitigatory area, this project will take place within a wider context of research into the salt-making industry of Gaywood, King's Lynn, which is being undertaken by OA East through a series of investigations in the vicinity of the site.

1.5.2 The overarching objectives are:

- To establish the date of the industry. Both the overall date range of the salt-making industry at Lynn and the date that it was functioning at specific locations; and
- To obtain a better understanding of the salt-making process and identify any methodological or technological changes over time.

Site specific research aims

1.5.3 The specific goals of this wider investigation have been set out in the document 'Lynnsport 1-5: The emerging historical salt-making landscape of Gaywood, King's Lynn, Norfolk. Overarching Written Scheme of Investigation' (Brudenell and Clarke 2017). These goals are directly relevant to the current investigation at this site and will contribute to addressing the wider research themes/questions outlined below.

Saltern mounds and mound formation

1.5.4 What period did the mounds develop over? Can we retrieve sufficient material to date mounds sequences and bracket their chronology?

1.5.5 Were there periods of hiatus in mound formation, and can this be identified from soil stabilisation horizons?

1.5.6 Is there any evidence to support the hypothesis that mounds further east (landward) are earlier than those to the west (seaward)? In particular, are there further mid-late Saxon dates on eastern/landward salterns?

1.5.7 What evidence is there for the secondary use of the salt mounds and surround flats after the salt industry declined?

Saltern fixtures and fittings

1.5.8 What structures were associated with the salterns (salt-cotes) and what activities were conducted in them?

1.5.9 What are the forms of the brine boiling hearths and how did hearth technology change over time? Were different hearth forms linked to the production of different grades of salt? Can such variation be measured from the chemical composition of the salt slags?

1.5.10 Is there patterning in the layout of tanks and filtration units? Is there any evidence that they changed in form and size over time?

1.5.11 What clay was used for lining the filtration units and constructing the hearths? What fuel was being burnt in the hearths? What were the sources?

1.5.12 Is there any evidence that channels and creeks were being modified or lagoons created to improve the efficiency of the salt-making process?

Salt makers and social context

1.5.13 Can we gauge anything about the scale and duration of episodes of salt making from the refuse left behind by the salt makers (pottery, animal bone etc.)? Is there any associated settlement activity?

1.5.14 Is there any evidence to support the hypothesis that salt making was only a seasonal activity?

1.5.15 What other activities were taking place on the salt mound? Evidence for iron smithing was found at Marsh Lane, but how widespread is this?

1.5.16 Can historical sources help us to better understand the scale and organisation of salt-making in North Lynn?

Salterns and landscape change

1.5.17 Can the investigations help us to understand the natural environment and landscape in which the salt-making was taking place?

1.5.18 How do the salterns relate to the Gaywood River and the main channel of the Great Ouse, and what were their palaeoenvironments

1.5.19 How did the salt-making industry contribute to the reclamation of the saltmarsh and what can it tell us about the dating/phasing of that process?

Regional research frameworks

1.5.20 More broadly, the site investigation takes place within, and will contribute to the goals of Regional Research Frameworks relevant to this area.

- Research and Archaeology: A Framework for the Eastern counties: 2. Research Agenda and Strategy (Brown & Glazebrook 2000, East Anglian Archaeology Occasional Papers 8):

1.5.21 *'From the Middle Anglo-Saxon period onwards there is evidence of both urban and rural craft production and industry. Is there a relationship between the two? To what extent was urban production city-serving and rural production largely conducted by itinerant craftsmen?'*

1.5.22 *'The rich material culture of towns, often present in dense quantities, must continue to be assessed and the results analysed and synthesised in order to increase understanding of the economic foundations of towns. Research work must target: evidence for commercial and industrial activity; definition, specialisation, marketing and distribution of products; linkages between social and political development and economic activity; and communications between towns and with the hinterland*.'

1.5.23 *'Industrial output, either from craft industries or early modern large-scale processes, will affect the urban environment. The impact of the economy can therefore be explored by: examination of evidence for industrial zoning; study of the relationship of industrial and commercial sites to distribution routes; and correlation of evidence for status with product specialisation and output*.'

1.5.24 *'Within urban culture, as in the rural hinterland, the church with its organisation, its role in society and its economic power deserves special attention. The following areas of research need to be amplified: the economic influence of the church.'*

- Research and Archaeology Revisited: A Revised Framework for the East of England (Medlycott 2011, East Anglian Archaeology Occasional Papers 24):

1.5.25 '*The Norfolk Coast and Broads NMP projects recorded large numbers of saltern mounds within The Wash and, to a lesser extent, around Breydon Water and the former Great Estuary (Albone et al. 2007). This has made a significant contribution to the study of this important medieval industry, and represents the first comprehensive identification and analysis of such sites within the county. The recognition of evidence for the possible Late Saxon origins of some of the saltern mounds provides further evidence for the early development of this form of salt-making (i.e sand washing).*'

1.6 Fieldwork methodology

1.6.1 The methodology used followed that detailed in the WSI (Clarke 2018d) approved by James Albone of NCC/HET, which required that four areas of excavation (Areas F, G, H and I, totaling *c*.0.07ha) be machine stripped into the three identified saltern mounds (Salterns 10-12) in a phased approach:

Saltern 10

Area F: Two combined rectangular areas measuring c.24m x 10m & c.12m x 10m (331m2) covering the footprint of house plots on the southern part of Saltern 10 were proposed for machine excavation down to a maximum depth of 1m. For health and safety purposes, a 2m wide step would be created at a depth of *c*.0.50m, reducing the lower part of this strip in area to *c*.21m x 6m & *c*.8m x 6m (174m^2). Subsequent to the hand excavation and recording of this excavation, a single T-shaped trench: *c*.17m x2m by *c*.4m x 2m wide (8m^2) was proposed for the base of the strip to record the basal deposits of the saltern on the natural horizon, estimated to be *c*.1.7m below ground surface.

Area G: A rectangular area *c*.15m x 10m (157m^2) covering the footprint of the house plots on the northern part of Saltern 10 was proposed for machine excavation down to a maximum depth of 1m. For health and safety purposes, a 2m wide step would be created at a depth of *c*.0.50m, reducing the lower part of this strip in area to *c*.11 x 6m (66m^2). Subsequent to the hand excavation and recording of this excavation, a single *c*.7m x 2m wide trench (14m^2) was proposed for the base of the strip to record the basal deposits of the saltern on the natural horizon, estimated to be *c*.1.7m below ground surface.

Saltern 11

Area H: A rectangular area *c*.11m x 11m (119m^2) covering the footprint of the house plots on the site of Saltern 11 was proposed for machine excavation down to a maximum depth of 1m. For health and safety purposes, a 2m wide step would be created at a depth of *c*.0.50m, reducing the lower part of this strip in area to *c*.7m x 7m (49m^2). Subsequent to the hand excavation and recording of this excavation, a *c*.3m x 3m wide test pit (9m^2) was proposed for the base of the strip to record the basal deposits of the saltern on the natural horizon, estimated to be *c*.1.2m below ground surface.

Saltern 12

Area I: A rectangular area *c*.10.5m x 10.5m (110m^2) covering the footprint of the house plots on the site of Saltern 12 was proposed for machine excavation down to a maximum depth of 1m. For health and safety purposes, a 2m wide step would be created at a depth of *c*.0.50m, reducing the lower part of this strip in area to *c*.6.5m x 6.5m (42m^2). Subsequent to the hand excavation and recording of this excavation, a *c*.2.5m x 2.5m wide test pit (6.25m^2) was proposed for the base of the strip to record the basal deposits of the saltern on the natural horizon, estimated to be *c*.1.7m below ground surface.

1.6.2 This strategy was modified during the works to allow for safe working at depth due to the unstable nature of the excavation baulks. This reduced the footprint of the lower part of the strips in Areas F and H. The extent of each phase of excavation is shown on Figure 3. Areas F and G covered an area of 331m^2 and 157m^2 respectively. Area H extended over a 119m^2 area and Area I measured 110m^2. Due to the exposure of the underlying natural deposits, and the high water-table, the proposed further trenches into the base of these excavations were confined to machine dug test pits in Areas G, H and I.

1.6.3 Machine excavation was carried out by a tracked 360^o type excavator using a 2m-wide flat bladed ditching bucket under constant supervision of a suitably qualified and experienced archaeologist.

1.6.4 The site survey was carried out using a Leica GPS GS08 with SmartNET.

1.6.5 Spoil, exposed surfaces and features were scanned with a metal detector. All metal-detected and hand-collected finds were retained for inspection, other than those which were obviously modern.

1.6.6 Sufficient excavation was carried out in line with the proportions of each feature class to be excavated outlined in the WSI (Clarke 2018d, 12-13).

1.6.7 All archaeological features and deposits were recorded using OA East's pro-forma sheets. Plans and sections of features were recorded at appropriate scales and colour and monochrome photographs were taken of all relevant features and deposits.

1.6.8 A total of 21 bulk samples were taken from a range of excavated features. These each totalled between 10-40L and were processed by flotation at OA East's environmental processing facility at Bourn.

1.6.9 Site conditions were good, with rain at times.

1.7 Project scope

1.7.1 The previous phase of archaeological evaluation work at the site has been reported on in full (Clarke 2018c), however, this report will draw some of the information from this evaluation together with the excavation results during the assessment where appropriate.

2 FACTUAL DATA AND STATEMENT OF POTENTIAL: STRATIGRAPHY

2.1 General

2.1.1 The following stratigraphic records were created:

Record type	Number
Context Registers	5
Context Numbers	280
Plan Registers	1
Plans	1
Section Registers	1
Sections	27
Sample Registers	4
Samples	24
Photo Registers	4
Photos	170

2.1.2 As described above, this site forms part of a wider context of research into the salt-making landscape of Gaywood currently being undertaken for the Lynnsport development by OA East (Brudenell and Clarke 2017). Salterns 1-9 were identified during earlier phases of evaluation and excavation work at both the Lynnsport development and neighbouring school site at Greenpark Avenue (Clarke 2018a) to the west (Fig. 2, ENF141949, ENF139746, ENF138254, ENF143325). Consequently, the salt-making deposits encountered on this site are described numerically as Salterns 10-12, with Salterns 1-9 lying wholly outside the current investigation area.

2.1.3 An overview of the results is presented below by area and these are discussed stratigraphically. Feature (cut) numbers in the text are written in **bold**. Further context descriptions with dimensions are given in Appendix A, Tables 10 and 11. Reports on the finds and environmental remains recovered from the site are presented in Appendices B and C respectively. An overall site layout plan is given as Fig. 4. Feature locations for excavation Areas F and G are presented in Fig. 5. Detailed plans of silt filtration tanks **405**, **408** and **414** within Saltern 10 are shown as Figs 6-8 respectively. Feature locations for excavation Area H is given as Fig. 9 and each stage of the excavation strip of Area I is shown on Figs 10 and 11. Selected sections are presented as Figs 12 and 13.

2.1.4 The chronological site phasing is largely based on the stratigraphic sequence of each saltern mound along with any dating evidence from stratified pottery and radiocarbon dates that have been recovered from features and deposits.

2.1.5 Three main periods of activity have been identified at this stage:

- Period 1: Natural features
- Period 2: Late Saxon to early medieval (AD 850-1200)
- Period 3: Post-medieval to modern (AD 1500-present)

2.2 Period 1: Natural Deposits

2.2.1 Natural deposits on the site consisted of tidal flat deposits (Group 675) which were partially identified in all four areas. These were equivalent to the tidal flat deposits of Group 350 excavated during the evaluation phase of the investigation. These deposits largely consisted of mixed light yellow grey silty sandy clays, which were often identified in conjunction with reaching the water table.

2.3 Period 2: Late Saxon to early medieval

Area F and G (Saltern 10; Fig. 5)

Summary

2.3.1 The earliest evidence for salt production in these two areas came from successive layers of filtration waste silt (Group 404) spread across the entirety of the area. Within Area G these layers of filtration waste silt had a number of clay-lined features, some of which were identifiable as filtration tanks, cutting into them (Plate 1; Fig. 5). Above these was a series of layers comprising hearth and filtration waste (Group 403) after which salt production ceased in this area.

2.3.2 This part of the site has suffered a high level of truncation (Fig. 4), not only with the water channel to the west but also with the construction of a hockey pitch immediately to the east, which meant very little protective topsoil survived above Saltern 10.

Filtration waste silt (Group 404)

2.3.3 Overlying the natural deposits of tidal silts (675) were layers of filtration waste silts of Group 404 (404, 434, 446 and 447; Fig. 12, Section 136). This consisted of a light yellow brown sandy silt and represented the resultant waste from silt filtration activity, although no filtration tanks were identified stratigraphically below this layer within the excavation area.

Clay-lined features

2.3.4 Within Area G, cutting the filtration waste silts belonging to Group 404, direct evidence for salt making was identified in the form of seven partial or complete clay-lined features located on the northern side of the saltern mound. These features (summarised in Table 1) represent the remains of filtration units for the production of concentrated brine as part of the salt making process. Three of the filtration tanks (**405**, **408** and **414**; Figs 6-8) were present in their entirety, comprising both the tank (usually sub-square or sub-rectangular in plan) and pit element (circular or sub-circular) of the feature. However, there were some variations to this plan, with filtration unit **414** have a more 'spade shaped' pit element. These units were positioned on varying alignments indicating no single axis in their arrangement was favoured. Filtration tanks **405** and **414** both contained evidence for turves, which were placed in the sub-rectangular tank, through which the salt rich silt would be washed to filter out the silt particles. The resulting brine solution would have percolated through the turves to drain through a narrow clay-lined channel to the deeper clay-lined circular pit.

2.3.5 At the northern end of Area G lay filtration tank **405** (=**506**=**507**) on a north-east to south-west orientation, with the pit element at the north-east end (Fig. 6; Plate 3). This filtration tank measured 3.1m long, 1.58m wide and 0.48m deep and comprised a shallow sub-rectangular and flat-based tank which was connected via a channel that measured 0.5m wide to a circular pit (**507**) with a concave base (Fig. 6, Section 151). The entirety of the filtration tank was lined with a mid-blue grey clay lining (406=513=516). Poorly preserved evidence for turves was identified in the sub-rectangular part of the filtration unit. A further eight fills (407, 514, 515, 517-521) were identified throughout the feature related to filtration waste which had infilled the feature after its disuse. A bulk environmental sample from fill 515 contained foraminifera (forams) and ostracods (defined in Sections 4.5.1-2).

2.3.6 To the east lay filtration tank **408** (=**508**=**511**) on a north-west to south-east orientation, with the pit element at the north-west end (Fig. 7). This filtration tank measured 3m long, 1.58m wide and 0.73m deep and comprised a shallow sub-rectangular and flat based filtration tank (**408**) which was connected via a 0.7m wide channel to a circular pit (**508**) with a concave base (Fig. 7, Section 152). This filtration tank was lined with a mid-blue grey clay (409=509). The remaining fills within this feature (410, 510, 512, 632 and 633) consisted of filtration waste deposited once the feature had gone out of use.

2.3.7 To the south lay filtration tank **414** on a north-east to south-west orientation with the pit element at the south-west end (Fig. 8; Plate 2). This filtration tank measured 2.4m long, 1.5m wide and 0.28m deep and comprised a shallow sub-rectangular and flat based tank which was connected via a narrow channel that measured 0.1m wide to a 'spade shaped' and concave pit (Fig. 8, Section 133). A mid-blue grey clay (415) lined the filtration tank, upon which lay the remains of 12 circular turves (including **419**, 420; **421**, 422) that measured between 0.25m and 0.3m wide and 0.05m-thick. Fills 416 and 418 consisted of filtration waste which had accumulated over the turves within the filtration tank once it had gone out of use.

2.3.8 The environmental bulk sample from the main pit fill (416) contained unidentifiable seeds and seeds of brambles, rush and spike rush, forams, ostracods, algae (*Chara oogonia*), snails and sparse charcoal. Similarly, a sample of tank fill 418 yielded seeds of rush, forams, ostracods, snails, *Chara oogonia* and sparse charcoal. The ostracods and forams recovered from fill 418 included species indicative of brackish water, marginal brackish water, saltmarsh/estuarine mudflat, freshwater and estuarine/marine habitats.

2.3.9 A further four small circular clay-lined pits (**411**, **423**, **426** and **629**) were also present, two of which (**426** and **629**) were identified along the edges of the excavation area and may have formed parts of filtration tanks which extended outside the limits of excavation. Pit **426** was identified along the southern edge of Area G and measured 0.5m wide and 0.08m deep with shallow vertical sides and a flat base (Fig. 12, Section 135). This pit was lined with a light blue grey clay (427) and contained a single fill (428) which consisted of mid brown grey silty sand that was environmentally sampled and contained forams. Pit **629** was located along the eastern edge of Area G and measured 0.93m wide and contained a lining (630) consisting of a light blue grey clay which was in turn overlain by fill 631 which consisted of a light yellowish grey clayey silt.

2.3.10 The remaining two clay-lined pits (**411** and **423**) were both sub-circular in plan, possibly representing the remains of truncated filtration pits. Pit **411** lay immediately west of filtration tank **414** and measured 0.58m wide and 0.11m deep with sloped sides and a flat base (Plate 4). Pit **423** lay to the south of filtration tank **414** and measured 0.58m wide and 0.16m deep with sloped sides and a flat base (Fig. 12, Section 134). In both cases these features were lined with a light blue grey clay (412 and 424) above which were disuse fills (413 and 425) consisting of light yellowish brown to mid brown grey clayey silt which were probably filtration waste from nearby salt production. The environmental bulk sample from fill 413 contained forams, snails, sparse charcoal and stem fragments and fill 425 contained forams, ostracods, *Chara oogonia*, snails and sparse charcoal. The ostracods and forams recovered were indicative of species from brackish water, marginal brackish water, saltmarsh/estuarine mudflat, fresh water and estuarine/marine habitats.

2.3.11 Three clay-lined features were identified in this area during the evaluation phase of work (Clarke 2018c), thought to be contemporary with those clay-lined features identified during the excavation. A clay-lined pit (**365**) was sub-circular in plan and measured 1.86m long, 1.05m wide and 0.15m deep. As well as having been lined with a light blue grey clay (366), it also contained fill 367 which consisted of a mid yellow brown sandy silt with charcoal inclusions, which produced a single fragment (6g) of burnt/fired clay. To the north of pit **365** lay a further sub-circular clay-lined pit (**368**) that measured up to 1m in diameter. Although not excavated, this clay-lined pit was observed to contain fragments of fired clay and charcoal. Several metres to the south of pit **365**, lay a further heavily truncated sub-square pit (**374**), with only the basal clay-lining (375) surviving. This shallow feature measured up to 0.65m in diameter and 0.18m deep. This pit was truncated by ditch **371** (Clarke 2018b).

Cut	Fills	Dimensions (LxWxD)	Shape in plan	Finds	Enviro
365	366, 367	1.86m x 1.05m x 0.15m	Sub-circular	6g burnt/fired clay	-
368	369, 370	1m x 1m	Sub-circular	-	-
374	375	0.65m x 0.65m x 0.18m	Sub-square	-	-
405=506=507	406=513=516 407, 514, 515, 517, 518, 519, 520, 521	3.1m x 1.58m x 0.48m	Circular and sub-rectangular	-	Untransformed seeds, forams and ostracods
408=508=511	409=509 410, 510, 512, 632, 633	3m x 1.58 x 0.73m	Circular and sub-rectangular	-	-
411	412, 413	0.93m x 0.58m x 0.11m	Sub-circular	-	Forams, stem fragments, snails

Cut	Fills	Dimensions (LxWxD)	Shape in plan	Finds	Enviro
414	415, 416, 418, 420	2.4m x 1.5m x 0.28m	Sub-circular and sub-rectangular	-	Untransformed seeds, forams, ostracods, algae (*Chara oogonia*), snails, sparse charcoal and seeds
423	424, 425	0.78m x 0.58m x 0.16m	Sub-circular	-	Forams, *Chara oogonia*, snails and sparse charcoal
426	427, 428	? x 0.5m x 0.08m	Sub-circular	-	Forams
629	630, 631	? x 0.93m x ?	Sub-circular	-	-

Table 1: Summary of clay-lined features in Area G

Hearth waste and filtration waste deposits (Group 403)

2.3.12 The clay-lined features were in part overlain by burnt deposits (403, 435, 444, 445, 448 and 452) of Group 403, which represented tips of hearth waste and provided evidence for the presence of clay-constructed hearths nearby, used to boil the concentrated brine being produced by filtration tanks (Fig. 12, Section 136). These deposits often consisted of a dark grey/red brown sandy silt with occasional charcoal inclusions. Layer 444 was found to contain 20 fragments (69g) of fired clay thought to relate to hearth structures. Eight fragments (12g) of fired clay were also recovered from layer 448.

2.3.13 From the sections recorded in both Areas F and G (Fig. 12, Sections 136 and 150) further deposits of filtration waste (431-433, 440, 441, 449 and 450) of Group 403 also extended to the top of the sequence of deposits constituting the saltern mound, to the lower horizon of the Period 3 overburden layers. This upper group of deposits indicated the continuation of salt production activity, even though further clay-lined filtration tanks were not identified. A single fragment (91g) of metalworking debris and a fragment of cattle bone (13g) were recovered from layer 432. The latest layers of filtration and hearth waste seen in Area F was later truncated by Period 3 ditch to the west.

*Pit **442**=**453***

2.3.14 A single feature was observed along the northern baulk section of Area F within the sequence of hearth and filtration waste deposits that comprised Group 403 (Fig. 12, Section 136). This possible pit (**442**=**453**) measured 0.9m wide and 0.44m deep with steep sides and a flattish base and cut hearth waste deposit 444. The pit contained a single fill (443=454/455) which consisted of a mottled dark brown grey and light brown grey sandy silt. This feature was overlain by filtration waste deposit 440.

Area H (Saltern 11)

Summary

2.3.15 Prior to the excavation of Area H, it was clear that the area had been severely truncated due to the construction of the hockey pitch to the west (Fig. 4). Therefore, the tidal silt deposits (480 within Group 675) were identified at the western side of the excavation area at only 0.5m below ground level. These natural deposits were overlain by a possible buried soil (481) upon which were deposited a complex series of layers resulting from salt production (Group 676), largely consisted of hearth waste material, that formed the bulk of the saltern mound (Plate 5; Fig. 9).

2.3.16 The hearth waste deposits that comprised Group 676 were cut by a single clay-lined feature (**463**) that signified a later phase of salt production. This pit was in turn overlain by substantial deposits of filtration waste (Group 677) which constituted the upper deposit mound sequence.

Possible buried soil (481)

2.3.17 Overlying the tidal silts within this area was a layer of possible buried soil (481=628) that may represent a former land surface (Fig. 12, Section 142). This layer, which measured between 0.19m and 0.26m thick and consisted of a mottled grey blue and orange blue grey sandy clay, produced two sherds (55g) of Ipswich ware pottery (Late 8th to 9th century). This possible buried soil was overlain by hearth waste Group 676.

Hearth waste (Group 676)

2.3.18 The layers of hearth waste comprising Group 676 survived exceptionally well within Area H (Fig. 12, Section 143). This complex series of tipping events indicated that the centre of the saltern was located within the north-east corner of the area. The majority of the deposits appeared to relate to hearth material and consisted of a mix of red, black and white ashy deposits (summarised in Table 2; Plate 6) likely to have accumulated from the rake out of spent fuel and other waste products from a nearby hearth. Layer 476 (not illustrated) produced four fragments (18g) of small cindery pieces of iron smithing slag and an environmental sample identified charcoal of oak and possible heather. A fragment of charcoal from this fill also produced a radiocarbon date of AD 1018-1155 (95.4% probability; SUERC-87794; 965±26). Layer 673 (not illustrated) contained evidence for a grain of barley and charcoal of oak, heather and holly and layer 674 (not illustrated) contained seeds of spike rush, sedges, Great Fen sedge, anthropod fragments and frequent charcoal of oak, elm, alder/hazel, heather and Maloideae.

Layer	Thickness (m)	Description
476	N/A	Mid red orange silty clay
477	N/A	Dark brown silty clay
478	N/A	Light brown grey ashy silt with occasional charcoal

Layer	Thickness (m)	Description
479	N/A	Light yellow orange silty clay
482	0.02	Mid to dark orange brown silty clay
483	0.05	Dark grey brown sandy silt with frequent charcoal
484	0.03	Mid grey red sandy silt
485	0.05	Dark red brown sandy silt with rare charcoal
486	0.09	Dark brown grey sandy silt
487	0.09	Dark mottled grey with white flecks sandy silt
488	0.06	Mid grey orange silty clay
532	0.12	Light to mid orange red silt with occasional fired clay
533	0.09	Mid brown red silt with rare fired clay
539	0.18	Dark mixed orange red black silt with occasional charcoal
540	0.13	Mid black red orange silt with occasional fired clay
545	0.14	Mid white grey ashy silt with rare charcoal
548	0.1	Light grey orange silt
551	0.02	Light grey orange silt
552	0.04	Dark grey silt with occasional charcoal
553	0.11	Light mixed white grey black ashy silt with occasional charcoal
555	0.27	Light to mid mixed white grey ashy silt with occasional charcoal
561	0.1	Mid red orange silt with rare fired clay
581	0.1	Dark mixed orange black silt with occasional charcoal
584	0.17	Mid red orange silt with rare fired clay
591	0.07	Mid mixed grey white ashy silt with occasional charcoal
605	0.1	Mid orange red silt with occasional charcoal
609	0.18	Dark mixed orange red black silt with occasional charcoal
611	0.15	Mid orange red silt
619	0.16	Light to mid mixed white orange silt with occasional charcoal
624	0.1	Very dark grey silt
673	-	Dark brown grey silty sand

Layer	Thickness (m)	Description
674	-	Dark brown red sandy silt

Table 2: Summary of hearth waste deposits (Group 676)

Clay-lined features

2.3.19 Only a single sub-circular pit (**463**) was partly revealed during the excavation phase of work, which cut through the underlying hearth waste deposits of Group 676, along the eastern baulk of this excavation area. This clay-lined feature measured 1.2m wide and 0.2m deep with shallow sides and a flattish base (Fig. 12, Section 141; Plate 7). It contained a light blue grey clay lining (464) measuring 0.1m thick which was overlain by a disuse fill (465) consisted of light yellow grey silty clay, 0.1m thick. The environmental bulk sample of this fill produced sparse charcoal, forams, ostracods, *Chara oogonia* (algae) and seeds of cleavers. Ostracods and forams recovered from this fill were indicative of marine/estuarine and saltmarsh/estuarine mudflat habitats.

2.3.20 A further pit which truncated the hearth waste deposits was identified during the evaluation phase of work (Clarke 2018c). Sub-circular pit (**379**) measured up to 0.8m in diameter and 0.3m deep. The cut, with no apparent clay-lining, contained a total of six backfills. Layers of light greyish/brownish yellow sandy silt (380, 382 and 384) were separated by thin lenses of mid grey sandy silt (381, 383 and 385) with charcoal inclusions. Fill 385 produced a fragment (2g) of edible mussel shell. Fill 384 contained foraminifera that suggests the yellow sandy silt deposits may originate from waste filtration silts whereas fill 385 contained charcoal and charred seeds of common dogwood and may therefore represent (along with the other grey sandy silt fills) the disposal of hearth waste material.

Filtration waste (Group 677)

2.3.21 Clay-lined pit **463** was overlain by a thick layer of filtration waste (Group 677) which comprised deposits of light orange yellow clayey silt (523, 576, 604 and 677). These waste deposits measured up to 0.7m thick and were seen to continue to the southern end of the excavation area (Fig. 12, Sections 142 and 143).

Area I (Saltern 12)

Summary

2.3.22 Saltern mound 12 was the largest within the site and could clearly be seen as the earthwork monument recorded as NHER 13785 (see Section 1.3.6). Two phases of activity were identified in this area (Figs 10 and 11), comprising clay-lined feature relating to salt production, which were separated stratigraphically by a thick sequence of both hearth and filtration waste deposits (Group 644).

2.3.23 Lying directly above the tidal silts (658-660, 680 within Group 675) appears to have been a buried soil (654/661) representing a former land surface which was seemingly truncated by earliest clay-lined filtration tank **662** (Plate 8; Fig. 10). This feature was overlain by a *c*.0.9m-thick sequence of hearth and filtration waste deposits that made-

up the saltern mound (Group 644). A number of salt production features were exposed at the top of the mound sequence, uncovered directly below the two remaining hearth waste (678) and filtration waste (679) silts beneath the topsoil/subsoil overburden. This upper group comprised clay-lined features along with possible post-holes or small unlined pits (Plate 9; Fig. 11).

Buried soil

2.3.24 Overlying the natural tidal silts (675) at the base of the sequence was a 0.02m-thick layer (654) that consisted of dark brown sandy silt with charcoal inclusions, which was in turn overlain by a 0.08m thick deposit (661) of white blue grey sand (Fig. 13, Section 155; Plate 10). These deposits are thought to represent an early buried soil, a pre-existing land surface in the saltmarsh upon which salt production commenced. These layers tipped steeply downward to the north-west between 2.4-1.9m OD, towards the possible former course of Gaywood River (see Section 1.3.6; Fig. 2, NHER 13785). This deposit was cut by filtration tank **662** at the base of the saltern mound.

*Filtration Tank **662***

2.3.25 A single clay-lined filtration tank was seen cutting into buried soil 654/661 in the north-east corner of the excavation area. Filtration tank **662** was only partially revealed due to the stepped sides of the excavation area (Fig. 13, Section 156). The filtration tank had an east-west orientation with the pit element at the east end. This measured at least 3.4m long, 1.48m wide and 0.7m deep and comprised a shallow sub-square or rectangular tank with a narrow channel leading to a deeper, concave pit (Fig.13, Sections 153/154 and 156). This filtration tank was lined with a light bluey grey clay (663) which measured 0.1m thick that contained a number of disuse fills (664, 666 and 669-671) which appeared to represent tips of filtration and hearth waste. The environmental sample of fill 664 contained forams.

Hearth and Filtration waste (Group 644)

2.3.26 Tank **662** was overlain by a c.0.9m-thick sequence of both hearth (636, 648, 669, 673, 674, 676, 681, 683, 684 and 686-688) and filtration (634, 635, 637-647, 649-652, 655-657, 667, 668, 677, 682, 685 and 689) waste deposits, with a large proportion exposed by west-facing Section 153/154 of the excavation area (Fig. 13). The filtration waste generally consisted of a light brown yellow silty sand, whereas the hearth waste deposits were often a mixed dark brown grey with mid brown orange sandy silt. Layer 687=648 contained 54 fragments (213g) of metal working debris. Layer 644 was environmentally sampled for the recovery of pollen and yielded a single grain of hazel type, dandelion type and fern spore. The uppermost filtration waste layer (679) was cut by a number of clay-lined features which represents the latest phase of salt production features.

Grey clay layer 653

2.3.27 In the western part of the excavation, a layer of light grey blue clay (653) was observed between waste filtration silts of Group 679 that measured up to 0.26m thick and tipped downward to the north between 2.6-2.2m OD (Fig. 13, Section 155). This

uneven clay horizon was possibly laid down as a result of a marine or alluvial flood event.

Clay-lined features

2.3.28 Four clay-lined features were identified as part of the latest phase of salt production within saltern mound 12 cutting filtration waste layer 644 (Fig. 11, summarised in Table 3).

2.3.29 Within the centre of Area I were two large sub-circular pits (**451** and **453**) with their long-axes on a roughly north-south alignment. The western pit (**451**) measured 2.5m long, 1.3m wide and 0.57m deep with steep sides and a flat base (Fig. 13, Section 138; Plate 12). This pit had a narrow gully which extended 0.7m westwards from its western edge. The tank was lined with a light blue grey clay (505) and backfilled with a total of seven deposits (452, 466-471) which comprised tips of hearth and filtration waste probably resulting from surrounding salt production activity. The environmental sample of fill 452 produced seeds of the grass family and spike rush, charred stems and charcoal of oak, elm, alder/hazel, heather and *Maloideae*. A fragment of charcoal from this fill produced a radiocarbon date of AD 994-1152 (95.4% probability; SUERC-87796; 984±26). Fill 466 contained two sherds (32g) of Grimston Thetford-type ware pottery dated to the 11th century and a single fragment (1g) of animal bone. An environmental sample of fill 466 also yielded charred stems and sparse charcoal of oak and heather. Fill 470 contained a residual worked narrow flint flake dating to the Late Mesolithic to Early Neolithic.

2.3.30 Immediately to the east was pit **453** which measured 2.5m long, 0.9m wide and 0.74m deep with steep sides and a flat base (Fig. 13, Section 139). The pit's lining (456) consisted of a mid blue grey clay which was overlain by two further filtration waste backfills (455 and 454). Fill 455 contained a single sherd (17g) of Grimston Thetford-type ware dated to the 11th century, and fill 454 contained environmental evidence for untransformed seeds of bramble and charcoal of oak and heather.

2.3.31 The partial remains of a filtration tank (**489**) were identified along the northern edge of the excavation area. Only the circular pit element could be easily identified during excavation, however photogrammetry revealed this filtration tank had a north-west to south-east orientation, with the pit element at the south-east end. Pit **489** measured 1.1m wide and 0.6m deep with a concave base (Fig. 13, Section 144) and contained a mid blue grey clay lining (490) and a single disuse fill (491) which consisted of mid yellow brown silt. This produced forams from an environmental sample.

2.3.32 A sub-rectangular pit (**457**) was partly revealed on the western edge of the area, broadly on an east-west orientation. This pit measured at least 2.3m long, 1.25m wide and 0.66m deep with steep sides and a concave base (Fig. 13, Section 146; Plate 13). The clay lining (458) of this feature was quite fragmentary but where present it consisted of a light blue grey clay. Of the eight fills, the three lowers fills (496, 495 and 498) consisted of tips of filtration waste which were overlain by two layers of dumped clay (459 and 494). A fragment of charcoal from fill 495 produced a radiocarbon date of AD 963-1029 (91% probability; SUERC-87795; 1045±26).

2.3.33 The upper sequence of backfills consisted of further tips of accumulated filtration waste (460 and 461). Fill 460 contained three sherds (21g) of Grimston Thetford-type ware and Early medieval ware pottery (date range of 11th-12th century) and three fragments (11g) of animal bone from a medium mammal. Fill 461 contained evidence for unidentifiable seeds, *Chara oogonia*, snails, flax seed, charred stems, peat and charcoal of oak. The uppermost fill (462) consisted of a dark brown silty sand that may represent the end of the saltern's use. This contained a single sherd (3g) of Early medieval ware pottery (date range of 11th to 12th century), a fragment (3g) of metal working debris and three fragments (24g) of animal bone including sheep/goat, fish and medium mammal.

Cut	Fills	Dimensions (LxWxD)	Shape in plan	Finds	Enviro
451	452, 466-471, 505	2.5m x 1.3m x 0.47m	Sub-circular with a gully	2 sherds (32g) 11th C pot, 1g of animal bone, worked flint	Seeds, rhizomes and charcoal of oak, elm, alder/hazel, heather and Maloideae
453	454-456	2.5m x 0.9m x 0.74m	Sub-circular	1 sherd (17g) 11th C pot	Untransformed seeds and charcoal of oak and heather
457	458-462, 494-498	2.3m x 1.25m x 0.66m	Sub-circular	4 sherds (24g) 11th to 12th C pot, 6 frags (35g) of animal bone =sheep/goat, fish and medium mammal, 3g of slag	*Chara oogonia*, snails, flax seed, rhizomes, peat and charcoal of oak
489	490, 491	1.1m x 0.6m	Circular	-	Forams

Table 3: Summary of clay-lined features in Area I

Other features

2.3.34 A further six unlined features were identified cutting into the upper filtration waste deposits. These consisted of four small pits (**472**, **499**, **501** and **503**), a single post-hole (**474**) and a possible gully (**492**). These features are summarised below (Table 4).

Cut	Fill	Feature type	Dimensions (W x D)	Finds	Enviro
472	473, 690, 691	Pit	0.4m x 0.35m	-	-
474	475, 691	Post-hole	0.29m x 0.22m	-	-
492	493	Gully	0.24m x 0.25m	1 sherd (1g) unidentifiable pot and 17g of slag	Wood charcoal
499	500	Pit	0.47m x 0.2m	-	-
501	502	Pit	0.52m x 0.08m	-	-

503	504	Pit	0.38m x 0.12m	-	-

Table 4: Summary of other (unlined) features in Area I

2.3.35 Pit **472** and post-hole **474** were located immediately to the north of clay-lined pit **451** (Fig. 13, Section 138) and may possibly have been related to this feature in some way. Both features were circular in plan with a concave base and were backfilled with a mix of filtration and hearth waste (473 and 475).

2.3.36 The remaining three small pits (**499**, **501** and **503**) were located to the south-east of clay-lined pit **453** and were arranged in a line with a north-east to south-west alignment. The edges of these features were difficult to determine although measured between 0.38m to 0.52m wide and 0.08m to 0.2m deep with sloped sides and a concave base (Fig. 13, Section 147). These features all contained a single fill (500, 502 and 504 respectively) which consisted of a mid grey brown silty sand.

2.3.37 Possible gully **492** was seen extending for 1.36m in a north-east direction from the western baulk of the excavation area before terminating. The gully measured 0.24m wide and 0.25m deep with vertical sides and a flat base. Its single fill (493) consisted of a light brown yellow silty sand with charcoal inclusions and contained a single sherd (1g) of unidentifiable pottery and two fragments (17g) of iron smithing slag. An environmental sample from this fill included wood charcoal.

Filtration and Hearth waste

2.3.38 These features were overlain by deposits representing hearth and filtration waste (678 and 679; Fig. 13, Sections 153 and 154). Hearth waste deposit 678 consisted of lenses of mixed mid yellow red brown and grey brown orange red silt often with charcoal inclusions. An environmental sample identified seeds of spike rush, bramble and elder, forams, anthropod fragments, peat and charcoal of coniferous wood and oak. Filtration waste deposit 679 consisted of a light to mid grey yellow brown sandy silt that measured between 0.12-0.26m thick.

2.4 Period 3: Post-medieval to modern

2.4.1 Within Area F, located to the west of Saltern 10, was a ditch which was recorded in section that cut through the latest layers of filtration waste in this area (Fig. 12, Section 150). This cut equated to ditch cuts **390** and **394**, revealed in Trench 11 during the evaluation phase, immediately to the north of the excavation area (Fig. 5; Table 10; Clarke 2018c, 13). Although no dating evidence was recovered, the evaluation trench work recovered two sherds of early modern pottery from this feature, dating from between the 17th-19th century. This ditch corresponds to the alignment of a pre-existing land division shown on a historical map (Section 1.3.9).

3 FACTUAL DATA AND STATEMENT OF POTENTIAL: ARTEFACTS

3.1 General

3.1.1 The following finds were recovered:

Material	Number	Weight (g)
Metal Working Debris	61	249
Flint	1	2
Pottery	10	129
Fired Clay	8	12

Table 5: Summary of finds recovered

3.2 Metal working debris (App B.1)

Summary

3.2.1 Seven pieces of iron slag (36g) and 54 pieces of mixed (contaminated) salt slag/ iron slag (213g) were recovered from this site. All the slag shows little sign of abrasion and therefore has not travelled a great distance. The assemblage includes iron smithing slag consisting of vitrified hearth lining and solid slag drip. These pieces were recovered from deposits constituting the upper/later groups of two saltern mounds (Saltern 10, Group 403; Saltern 11, Group 676) and from two features cutting the top of the profile of Saltern 12 (pit **457** and ditch **492**).

3.2.2 Although the assemblage is small in size, the recovery of metal working debris at this saltern site suggests the re-use of the salt pan hearths as iron smithing hearths; presumably for the mending or re-forging of iron tools/horseshoes etc.

Statement of potential

A.1.1 The most interesting evidence recovered from the assemblage is that for the fuel used, as a small lump of preserved (yet incinerated) peat as an inclusion was identified from a layer of hearth waste (Group 644) within Saltern 12. It has always been assumed that locally cut peat was used in salt production – as attested by the dark peaty stains and the absence of coal, wood or charcoal from the site – but little direct evidence of this has been previously identified.

3.3 Flint (App. B.2)

Summary

3.3.1 A single small narrow flake of Late Mesolithic to Early Neolithic date was recovered from the fill of clay-lined tank **451** in Area I.

Statement of potential

3.3.2 This single worked flint is residual and only suggests that there may have been some low-level activity during the Late Mesolithic to Early Neolithic periods, a period when the sea level was markedly lower than the present day, with the shoreline having lain many kilometres to the north.

3.4 Pottery (App. B.3)

Summary

3.4.1 A small assemblage (10 sherds weighing 129g) of Middle Saxon to medieval pottery was recovered from layers and fills from two of the excavated areas. The earliest sherds date to the late 8th to 9th century and were recovered from a buried soil layer (481/628) uncovered beneath the base of Saltern 11 in Area H. Area I yielded the remainder of the pottery from three clay-lined features cut into the top of Saltern 12 which dated to the 11th to 12th centuries.

Statement of potential

3.4.2 Although the assemblage is relatively small, the presence of pottery sherds dating to the 8th and 9th centuries from stratigraphically early contexts beneath the saltern suggests a potential Late Saxon date for commencement of salt production at the site. The presence of 11th to 12th century pottery in the fills of the later features on the site, combined with radiocarbon dating, suggests that salt production most likely ceased at the site at this time. This assemblage has potential to identify when salt production in this part of King's Lynn was taking place and can be examined further with the other assemblages across the other excavated Lynnsport sites.

3.5 Fired clay (App. B.4)

Summary

3.5.1 A very small assemblage of fired clay (55 fragments, 229g) was recovered from features related to Saltern 10 in Area F. The assemblage contains no diagnostic objects, however, some fragments possess structural features; indicators of hand forming and flattened surfaces. Two fragments possess a mineral crust on the surviving surface, probably derived from salt production.

Statement of potential

3.5.2 This assemblage is uninformative without any diagnostic objects. The assemblage does however indicate the presence of industrial activity, namely salt production, and corresponds with other examples of this kind of material in the vicinity.

4 FACTUAL DATA AND STATEMENT OF POTENTIAL: ENVIRONMENTAL AND FAUNAL EVIDENCE

4.1 General

4.1.1 Environmental bulk samples were collected from a representative cross-section of feature types and locations. Bulk samples were taken to analyse the preservation of micro and macro botanical remains. A small number of samples were also specifically taken for pollen, micromorphology and ostracod analysis. Animal bone refers to the hand-collected assemblage and any fragments recovered from environmental samples.

4.1.2 The numbers of samples processed from each feature type are listed below

Sample Type	Filtration Tank	Clay-lined pit/tank	Filtration waste	Hearth waste	Soil horizon	Other features	TOTAL
Flotation	7	8	-	5	-	1	**21**
Pollen	-	-	2	1	-	-	**3**
Ostracods and Forams	1	2	-	-	-	-	**3**
C14 Dating	1	1	-	1	-	-	**3**
Micromorphology	-	-	-	-	1	-	**1**

Table 6: Summary of environmental samples taken

4.2 Environmental remains and charcoal identification (App. C.1)

Summary

4.2.1 Twenty-one samples were taken across the three saltern mounds and their associated features. Plant remains are present in many of the samples and include a single charred barley grain, grains and seeds of wetland plants such as sedges and a single charred seed of flaxseed. Charcoal was also recorded in a number of features, including species of oak, heather, holly, alder/hazel, elm and *Maloideae*. Filtration tanks and deposits contained frequent evidence for forams, ostracods, snails and algae (*Chara oogonia*). Waterlogged seeds have also been recovered from the site.

4.2.2 The presence of heather and charred stems/rhizomes may suggest their use as fuels in addition to oak and other wood present within the charcoal assemblage.

Statement of potential

4.2.3 The poor diversity of the plant taxa produced from the samples precludes the potential for further study. It is considered that the assemblage has little potential to aid the local, regional or national research priorities beyond the record of the taxa present.

4.3 Faunal remains (App. C.2)

Summary

4.3.1 A total of eight fragments (weighing 49g) of animal bone was recovered from two clay-lined features (**451** and **457**) cut into the top of Saltern 12 in Area I and a layer of filtration waste (432) in the upper mound sequence of deposits (Group 403) within Saltern 10 in Area G. Fragmentation levels are high and the species identified include cattle, sheep/goat, medium mammal and fish.

Statement of potential

4.3.2 Although the animal bone assemblage from the site is small, it is one of the largest assemblages from similar sites excavated in the area. However, bar being able to identify species the assemblage has no further potential.

4.4 Pollen remains (App. C.3)

Summary

4.4.1 Three sub-samples were taken through layers of filtration and hearth waste of Group 644 within Saltern 12. Layers 647 and 648 were devoid of pollen, however, filtration waste layer 644 yielded a single pollen grain of hazel type, dandelion type and a fern spore.

Statement of potential

4.4.2 The preservation of pollen at the site is clearly poor and therefore its recommended that no further samples be tested for pollen.

4.5 Ostracods and foraminifera (App. C.4 and C.5)

4.5.1 Foraminifera are marine single-celled organisms (such as simple alga) found in habitats ranging from saltmarshes to the deep oceans. They secrete a shell called a test, which is the part that survives. Foraminifera survive best in non-acidic conditions (Heritage England 2011, 24).

4.5.2 Ostracods are small (normally <2mm) bivalve crustaceans with calcareous shells which inhabit nearly all types of aquatic environment from freshwater to marine. The robustness of their shells means that they survive in almost any non-acidic, water-lain deposit. Like foraminifera, the shells of most species have unique shapes and sculpturings, making them readily identifiable (Heritage England 2011, 25).

Summary

4.5.3 Three sediment samples from filtration tank **414** and clay-lined pit **423** in Saltern 10 and clay-lined pit **463** in Saltern 11 were processed and examined for ostracods and forams. Ostracods were present in all three samples, although in low numbers. These included mostly brackish water-marine forms, rare truly marine species, and just a few non-marine (freshwater) types. However, small numbers of carophytes suggest the presence of freshwater sources such as ponds or rivers close by. Abundant forams within the sediments most likely indicate the source of the silts being processed at the saltern sites, which would appear to be the nearby saltmarsh and tidal mud flats.

4.5.4 An explanation for the low numbers recorded may be due to these sub-rectangular flat-bottomed pits not having been sleeching or filtration tanks, or if they were, they had been totally emptied of any waste left *in situ*.

Statement of potential

4.5.5 Although the numbers of ostracods and forams were comparatively low compared to other Lynnsport sites both the ostracod and foraminiferal evidence confirms the idea that the silts used in sleeching were collected from the Lower Saltmarsh/ Upper Tidal Mudflats zone of the tidal creeks which lay closest to the salterns and also identifies the presence of freshwater waterbodies such as ponds within the vicinity of the salterns.

4.5.6 Brought together with the information gained from the other Lynnsport sites helps build a picture of this landscape whilst the salterns were in use.

4.6 Radiocarbon dating (App. C.6)

Summary

4.6.1 Four samples were sent for radiocarbon dating comprising a seed and charcoal recovered from hearth waste and the fill of a filtration tank and clay-lined feature. Insufficient carbon was present within the seed which led to a failed sample. The three fragments of charcoal produced dates spanning the Late Saxon and into the very early medieval period.

Laboratory number	Radiocarbon age (BP)	δ13C (‰)	Calibrated date range (AD)	Confidence %	Material	Context	Cut	Saltern
SUERC-87794	965±26	-28.4	1018-1059 1065-1155	33.9 61.5	Charcoal	476	(Grp 676)	11
SUERC-87795	1045±26	-28.2	902-920 963-1029	4.4 91	Charcoal	495	**457**	12
SUERC-87796	984±26	-28.1	994-1052 1081-1152	53.4 42	Charcoal	452	**451**	12
FAIL					Seed	461	**457**	12

Table 7: Radiocarbon dates

Statement of potential

4.6.2 The radiocarbon dates retrieved at this stage have securely dated charcoal recovered from three contexts across two salterns. Further radiocarbon dates could provide additional dates which would aid in identifying the earliest and latest use of this particular group of saltern mounds and how they relate to the sequence of salt-working identified at other Lynnsport sites.

4.7 Micromorphology

Summary

4.7.1 Sample 321 taken across the buried soil layers 654 and 661 at the base of Saltern 12, Area I was sent for Micromorphology analysis. The results of which will be presented within the archive report for this project and incorporated in future publication.

Statement of potential

4.7.2 It is expected that this work will characterise the nature of the sediments of this possible land-surface within the saltmarsh at the time the salt-making activity commenced at this site (Charles French *pers comm*.)

4.8 Overall statement of potential

4.8.1 Although small, the research potential of these assemblages is increased when considering their eventual incorporation into the wider research on the salt-making industry of Gaywood as a result of the Lynnsport 1-5 developments and attendant excavations. The artefact and ecofact assemblages from Lynnsport 1 add to the corpus of material being gathered from this work that is considered to be of sufficient quality to address the majority of the project's Research Objectives (see Section 5 below) and helps provide a firm base on which to progress publication work.

5 UPDATED PROJECT DESIGN

5.1 Revised research aims

5.1.1 This project is part of a wider study into the salt-making industry of Gaywood, King's Lynn and the specific goals of these investigations have been set out in the document 'Lynnsport 1-5: The emerging historical salt-making landscape of Gaywood, King's Lynn, Norfolk. Overarching Written Scheme of Investigation' (Brudenell and Clarke 2017). The following aims have been broken into a variety of categories relating to the salt-making industry.

Saltern mounds and mound formation

5.1.2 What period did the mounds develop over? Can we retrieve sufficient material to date mounds sequences and bracket their chronology?

5.1.3 These saltern mounds often produce very little in the way of material and a total of nine sherds of pottery was recovered from Salterns 11 and 12. This pottery tentatively suggests (based on two Ipswich ware sherds from Area H (Saltern 11, context 481=628) that the earliest use of the saltern mounds formed over a former land surface within the saltmarsh dated to the late 8th to 9th century AD. The remainder of the pottery (seven sherds) was recovered from features and layers located later within the stratigraphic sequence (within Area I) and seemingly dated to the 11th to 12th century AD. Although the pottery assemblage is small, three radiocarbon dates recovered from three contexts across these two saltern mounds support this initial dating, producing dates from AD 963-1155.

5.1.4 It seems sensible to suggest that the mounds developed from the 9th to 10th century AD and continued in use until no later than the 12th century AD. Although no further dating or phasing can be obtained from the small pottery assemblage, further radiocarbon dates retrieved from material across all three saltern mounds and throughout the stratigraphic sequence would be worthwhile. This would allow for a more secure date for when these saltern mounds originated and went out of use to be established. Two distinct phases of salt production are evident at Saltern 12 where a stratigraphic sequence was identified, secure radiocarbon dates from these two phases would aid in understanding how long each period of salt production may have lasted for.

5.1.5 Were there periods of hiatus in mound formation, and can this be identified from soil stabilisation horizons?

5.1.6 The buried soil encountered beneath the base of Saltern 12 (654/661) is evidence for a riverbank location with the land-surface dipping northwards towards the former course of Gaywood River (see Section 1.3.6; Fig. 2, NHER 13785).

5.1.7 The clay soil layer (653) observed in the lower part of the mounds profile, between layers of filtration waste, probably represents a break in salt-making caused by a marine inundation or freshwater flooding from the adjacent river.

5.1.8 Large layers of filtration and hearth waste were observed related to all three salterns at the site, indicating periods of salt production. The lack of dating from these layers

makes it difficult to ascertain how long these mounds were in use for. Saltern mound 12 produced the only significant evidence for two phases of use based purely on stratigraphic relationships between layers and features present, although again it is uncertain how much time passed between these two phases of salt production. Further radiocarbon dating may help establish a better understanding as to how quickly these saltern mounds formed, whether it was one quick use or a number of uses over a period of time.

5.1.9 Is there any evidence to support the hypothesis that mounds further east (landward) are earlier than those to the west (seaward)? In particular, are there further Mid-Late Saxon dates on eastern/landward salterns?

5.1.10 Datable evidence from the saltern mounds is rare: in terms of Lynnsport 1 the small quantity of pottery recovered would not have been sufficient to accurately test this theory. The earliest pottery (8th to 9th century) was recovered from Saltern 11 and later pottery (11th to 12th century) was recovered from Saltern 12 to the east. The three radiocarbon dates recovered is also a small dataset, however these produced dates spanning the Late Saxon to early medieval periods and tentatively suggest that Saltern 12 may have been slightly earlier than Saltern 11.

5.1.11 Radiocarbon dates have been retrieved from a number of other saltern sites within this part of King's Lynn. Of these four sites (including Lynnsport 1), the radiocarbon dates show no pattern with regards to the eastern sites dating earlier. The sites at Marsh Lane and Lynnsport 4 and 5 (Clarke 2016; 2017b) originated in the Mid Saxon period with the latter ceasing in the Late Saxon period and the former continuing into the early medieval period. The Primary School site (to the west, Knight forthcoming) produced very similar dates to Lynnsport 1, spanning the Late Saxon to early medieval period. In order to test this theory accurately, the dating for all saltern sites in King's Lynn would need to be collected and collated.

5.1.12 What evidence is there for the secondary use of the salt mounds and surrounding flats after the salt industry declined?

5.1.13 The recovery of metal working debris related to iron smithing at the site suggests that the hearths used during salt production may have later been re-used within the iron working industry (App. B.1). Many of the animal bone fragments also came from these slag bearing deposits. The mounds themselves appear to have been left *in-situ*, with Saltern 12, in particular, still visible in the landscape today. There was a notable lack of later finds and features encountered upon these mounds, suggesting they lay largely undisturbed until relatively recently.

Saltern fixtures and features

5.1.14 What structures were associated with the salterns (salt-cotes) and what activities were conducted in them?

5.1.15 Post-holes and a possible gully were identified cutting into the upper deposits of Saltern 12, which may suggest some type of post-built structure may have been present surrounding the later phase of clay-lined tanks at this saltern. As only small

areas were excavated around the three salterns it may be possible that structures lie outside the limits of excavation.

5.1.16 What are the forms of the brine boiling hearths and how did hearth technology change over time? Were different hearth forms linked to the production of different grades of salt? Can such variation be measured from the chemical composition of the salt slags?

5.1.17 There were no remains of hearth structures identified at this site although the presence of hearth waste within each of the three saltern mounds suggest that these structures must have been located nearby. A small assemblage of fired clay was also recovered (55 fragments, weighing 229g) and although no identifiable objects were noted, two fragments possessed a mineral crust on their surface supporting their probable use as the lining of a hearth or oven used within the salt production process.

5.1.18 Is there patterning in the layout of tanks and filtration units? Is there any evidence that they changed in form and size over time?

5.1.19 Clay-lined features were identified in three of the four excavation areas, many of these were identified simply as clay-lined pits, although some larger clay-lined tanks were present as well as filtration tanks. Within Area G (Saltern 10) four clay-lined sub-circular pits were recorded alongside three filtration tanks. All of the three filtration tanks present were located on the northern side of the saltern mound with differing alignments and largely conformed to the same form and size. Filtration tank **414** had a slightly 'spade shaped' pit as opposed to the more circular examples seen on the other two filtration tanks. Two of the filtration tanks also contained evidence for turves, similar to those excavated at Marsh Lane (Clarke 2016). All of the clay-lined features, including the complete filtration tanks are thought to be broadly contemporary.

5.1.20 Within Area H (Saltern 11) only a single clay-lined pit was identified cutting into earlier hearth waste. The excavation areas position on the top of the saltern mound may mean that any filtration tanks lie outside the limits of excavation. Area I (Saltern 12) was the only area that contained two phases of clay-lined features. The earliest evidence comprised the partial remains of a filtration tank which appeared to conform to the standard type seen across the site. The later phase comprised two large clay-lined sub-circular tanks and the partial remains of a possible third tank and a filtration tank. The two clay-lined sub-circular tanks were roughly aligned, although pit **451** had a small gully extending from its western side, clearly a product of the feature's use, possibly for feeding water into the pit.

5.1.21 In all cases the differences identified between clay-lined features across the entire site relates to the feature's use rather than their date. It is difficult to establish whether wider distribution patterns occur due to the small excavation areas which do not allow for the saltern mounds to be seen in their entirety. It may be possible to draw further conclusions of the layout and form of tanks and filtration units at publication stage once the results of all the excavations in the area are looked at as a whole.

5.1.22 What clay was used for lining the filtration units and constructing the hearths? What fuel was being burnt in the hearths? What were the sources?

5.1.23 All clay-lined features identified during this excavation used the same light to mid blue grey clay which was probably sourced inland as seen at Lynnsport 4 and 5 (Clarke 2017b).

5.1.24 Charcoal was well preserved at the site compared to those sites which have previously been excavated in the area. Environmental samples taken from across the site have indicated that oak and heather (charred stems indicative of peat (App. C.2.15)) were the most common charcoal identified and therefore the most likely species used as fuel within the nearby hearths. However, charcoal of holly, alder/hazel, elm and fruit trees were also present and may have been utilised as fuel (Appendix C.1).

5.1.25 The dark, peaty stains associated with the hearth waste material attests to the use of peat, always assumed to have been a fuel source from its mention in historical documents (App. B.1.6-7). Importantly, this assumption is aided by the recovery of a small preserved (yet incinerated) lump of peat from a hearth waste deposit (687) within Group 644 of Saltern 12.

5.1.26 Is there any evidence that channels and creeks were being modified or lagoons created to improve the efficiency of the salt-making process?

5.1.27 It had originally been thought that the natural channel seen at the western side of the site may have been contemporary with Saltern 10 due to it being seen to run around the base of the saltern. Excavation through this channel identified that it cut through the saltern mound and was therefore later in date. No other channels or creeks were identified on the site.

Salt makers and social context

5.1.28 Can we gauge anything about the scale and duration of episodes of salt making from the refuse left behind by the salt makers (pottery, animal bone etc.)? Is there any associated settlement activity? Is there any evidence to support the hypothesis that salt making was only a seasonal activity?

5.1.29 As with the other Lynnsport sites that have previously been excavated, the finds assemblage recovered from the salterns and their related features is poor. Both pottery (ten sherds weighing 129g) and animal bone (eight fragments weighing 49g) were present. These low quantities of finds, paired with the environmental evidence which suggests that the area in which salt making was taking place would not have been suitable for occupation, both support the idea that the salt makers lived some distance from the salterns and that any finds recovered from these sites represent accidental loss from the salt makers themselves. The assemblage of fired clay (55 fragments, weighing 229g) is considered to have all related to salt making industry. The quantity of refuse material recovered from features at the site therefore provide no indication as to the scale of salt making taking place. The pottery assemblage can not solely be relied on to ascertain the duration of salt making at the site and radiocarbon dates recovered from charcoal should be considered as a far more accurate indicator. It is interesting to note that duckweed seeds are not present at this

site whereas they were present at Lynnsport 4 and 5 (in the clay-lined tanks), possibly as an indicator of seasonality (App. C.2.16).

5.1.30 The excavation areas were small in size and did not allow for the full saltern mounds to be excavated, therefore the material and features uncovered at the site have to be considered as merely a 'snap shot' into the salt making industry at the site. It is therefore possible that useful dating and stratigraphic evidence lie outside of the limits of excavation which would have potentially aided greater in answering questions regarding the scale and duration of salt making activity.

5.1.31 What other activities were taking place on the salt mound? Evidence for iron smithing was found at Marsh Lane, but how widespread is this?

5.1.32 A small quantity of metal working debris related to iron smithing was recovered from contexts related to all three salterns at the site. This has been interpreted as direct evidence for the re-use of the salt pan hearths as iron smithing hearths; presumably for the mending or re-forging of iron tools/ horseshoes which must have been located very close to the salterns, although not seen within the areas excavated (Appendix B.1).

5.1.33 Can historical sources help us to better understand the scale and organisation of salt-making in North Lynn?

5.1.34 See Section 5.4 below.

Salterns and landscape change

5.1.35 Can the investigations help us to understand the natural environment and landscape in which the salt-making was taking place?

5.1.36 The environmental evidence from this excavation has been remarkably better preserved than that from the previously excavated sites. Not only have a number of tree and plant species been identified (oak, heather, holly, alder/hazel, elm and fruit trees) as potentially being used for fuel with relation to salt making but other species, which were present within the area have also been identified (Appendix C.1). Seeds indicative of wetland species were present alongside waterlogged seeds and ostracods, all indicators of the wet landscape we would expect to see at the site.

5.1.37 Analysis of the ostracods and forams present within the environmental samples taken from three clay-lined features, including a definite filtration tank has identified mostly brackish water-marine forms, rare truly marine species, and just a few non-marine (freshwater) types. However, small numbers of carophytes suggest the presence of freshwater sources such as ponds or rivers close by (Appendix C.4). Abundant forams within the sediments most likely indicate the source of the silts being processed at the saltern sites, which would appear to be the nearby saltmarsh and tidal mud flats (Appendix C.5). The minor presence of fully-freshwater ostracods as well carophytes serves to confirm the complexity of the saltern mound environment; the presence of permanent/ temporary freshwater waterbodies and the use also perhaps of non-saline water during the 'sleeching' process. Surrounding the salterns may also have been a mixture of both fresh and saltwater marshland, as is suggested by the mollusc evidence.

5.1.38 The preservation of ostracods and forams has been fruitful in providing a wealth of information at the Lynnsport 1 site and the results along with those from the other excavated Lynnsport sites should aid in understanding the natural environmental and landscape that these salterns were located within.

5.1.39 How do the salterns relate to the Gaywood River and the main channel of the Great Ouse, and what were their palaeoenvironments

5.1.40 The salt making activity on the site clearly pre-dates the diversion of the Great Ouse to King's Lynn in the 13th century. Documentary evidence demonstrates that prior to its diversion along the southern margins of Gaywood's North Marsh in 1425, the Gaywood River flowed through the central part of the North Marsh immediately to the north of the site (see Section 1.3.6; Fig. 2, NHER 28800). The northwards downward dip in the natural land surface (654/661) observed beneath Saltern 12 (and the presence of a possible flood deposit (653)) perhaps supports this.

5.1.41 How did the salt-making industry contribute to the reclamation of the saltmarsh and what can it tell us about the dating/phasing of that process?

5.1.42 The date range for these 'landward' salterns on the southern margins of Gaywood's historical North Marsh, adjacent to Salters Way, complement the date range for the 'landward' saltern excavated at Marsh Lane. The evidence points towards a possible late 8th century date for the commencement of salt-making activity in the North Marsh. Documentary evidence (see Section 8.3 below) provides evidence for 'seaward' salterns still being in-use on the western margins of the North Marsh in the 15th century. A bracket of reclamation of the North Marsh for pasture between the later *c.*8th century and *c.*15th century may therefore be postulated for the salt-making industry. This reclamation may also have gradually converged on the pre-existing course of the River Gaywood.

Research frameworks

5.1.43 More broadly, the site investigation takes place within, and will contribute to the goals of Regional Research Frameworks relevant to this area.

5.1.44 Research and Archaeology: A Framework for the Eastern counties: 2. Research Agenda and Strategy (Brown & Glazebrook 2000, East Anglian Archaeology Occasional Papers 8):

5.1.45 'From the Middle Anglo-Saxon period onwards there is evidence of both urban and rural craft production and industry. Is there a relationship between the two? To what extent was urban production city-serving and rural production largely conducted by itinerant craftsmen?'

5.1.46 *'The rich material culture of towns, often present in dense quantities, must continue to be assessed and the results analysed and synthesised in order to increase understanding of the economic foundations of towns. Research work must target: evidence for commercial and industrial activity; definition, specialisation, marketing and distribution of products; linkages between social and political development and economic activity; and communications between towns and with the hinterland*.'

5.1.47 *'Industrial output, either from craft industries or early modern large-scale processes, will affect the urban environment. The impact of the economy can therefore be explored by: examination of evidence for industrial zoning; study of the relationship of industrial and commercial sites to distribution routes; and correlation of evidence for status with product specialisation and output*.'

5.1.48 'Within urban culture, as in the rural hinterland, the church with its organisation, its role in society and its economic power deserves special attention. The following areas of research need to be amplified: the economic influence of the church.'

5.1.49 Research and Archaeology Revisited: A Revised Framework for the East of England (Medlycott 2011, East Anglian Archaeology Occasional Papers 24):

5.1.50 '*The Norfolk Coast and Broads NMP projects recorded large numbers of saltern mounds within The Wash and, to a lesser extent, around Breydon Water and the former Great Estuary (Albone et al. 2007). This has made a significant contribution to the study of this important medieval industry, and represents the first comprehensive identification and analysis of such sites within the county. The recognition of evidence for the possible Late Saxon origins of some of the saltern mounds provides further evidence for the early development of this form of salt-making (i.e sand washing).*'

5.2 Interfaces

5.2.1 This project forms part of a larger area of works across King's Lynn in which a number of medieval saltern sites have been excavated in the last five years.

5.3 Methods statement

Stratigraphy

5.3.1 The stratigraphic text included within this report is detailed and a context inventory has also been included. A focus is needed on the grouping and phasing of features and layers not only by site but also across all of the Lynnsport sites to allow for a more detailed discussion. Context, finds and environmental data will be analysed using an MS Access database. The specialist information from all sites will be integrated (utilising the site database, GIS and/or CAD software programmes) to aid dating and complete more detailed phasing and spatial consideration of the site. Final phase plans will be produced and illustrations prepared in Adobe Illustrator.

Metal working debris

5.3.2 No further work is required on the metal working debris. This assemblage will be considered and discussed within the wider context of the Lynnsport sites at publication stage.

Flint

5.3.3 This site produced a single flint and no further work is required on its analysis. Evidence for worked flint pre-dating the saltern activity shall be discussed at publication stage.

Pottery

5.3.4 Although no further work is needed in cataloguing or reporting on the current assemblage, it is suggested that all pottery assemblages from the Lynnsport sites

should be brought together in order to summarise them and place them in context at the publication stage.

Fired clay

5.3.5 No further recording is required of this assemblage. This material should be included, alongside the other saltern material excavated as part of Lynnsport by OA East, in any future synthetic publication on the local salt making industry.

Environmental samples and charcoal

5.3.6 All the bulk samples taken during the excavation have been processed and have provided some insight into the use of the site. No further identification can take place with regards to the charcoal recovered. At publication stage it is suggested that the information gained from all environmental sampling on site be drawn together and compared to the other Lynnsport sites.

Faunal remains

5.3.7 Due to the small size of the animal bone assemblage from the site no further work is required. Faunal remains have been scarce across the saltern sites and this material should be brought together at publication stage.

Pollen

5.3.8 Of the three contexts samples for pollen only one yielded three pollen grains. The poor preservation of pollen at the site leads to no further work needing to take place on processing further samples for the recovery of pollen. The pollen recovered from all the Lynnsport sites should be discussed together at publication stage.

Radiocarbon dating

5.3.9 The charcoal recovered from a variety of contexts across the site should be reviewed with further samples selected for radiocarbon dating to refine further the dating for the saltern mounds origins and use. These dates should then be compared across the Lynnsport sites to further identify how these sites were used in the landscape and ascertain whether more than one mound was in use at the same time.

Ostracods and Forams

5.3.10 It is suggested that a more in-depth analysis could take place with regards to completing a count of all the fractions studied and attempting a revision of the species identification and their significance. The results of this analysis will need to be studied as a group along with the ostracods and forams identified at the other excavated Lynnsport sites to test any theories on how these sites were used and to build up a picture of the landscape present.

Micromorphology

5.3.11 The results of the micromorphology sample will be incorporated into the archive report for the project and any future publication.

5.4 Documentary Research

5.4.1 Primary and published sources will be consulted where appropriate using the Norfolk Historic Environment Record, libraries and other archives and resources. A search will also be made of published and grey literature reports on comparable sites locally and nationally in order to place the site within its landscape and archaeological context. This evidence will be collated and where relevant reproduced in the subsequent publication.

5.4.2 A search of the NHER aerial photography record was previously made and detailed in Clarke 2017b. No further aerial photography evidence is required.

5.4.3 A historical map search was undertaken as part of the desk-based assessment for the Written Scheme of Investigation (Brudenell 2017) for the site by OA East. Relevant historic maps were also consulted for the desk-based assessments produced for the site's development by Norfolk County Council (Norfolk Partnership Laboratory 2016), summarised in section 1.3. A search of further records that will be consulted will include Andrew Bryant's map of 1876 and the Gaywood Tithe map of 1838.

5.4.4 LIDAR data shall be consulted along with historical mapping in the further analysis of the overall saltern complex within the North Marsh.

5.4.5 An online search was made of the catalogues held by the Norfolk Records Office, Norwich (http://www.archives.norfolk.gov.uk/), National Archives, Kew (http://www.nationalarchives.gov.uk/), and the British Library Manuscript Collections (http://www.bl.uk/reshelp/findhelprestype/manuscripts/msscollect/manuscriptscollections.html). Records relating to Gaywood and the 'North Marsh' were noted in Clarke (2017b, 43) and are not repeated here.

5.4.6 An extensive bibliography was also compiled within Clarke (2017b, 47) which lists publications and reports which should be consulted when compiling the publication.

5.5 Publication and dissemination of results

5.5.1 It is proposed that the results of this project and all phases of work for Lynnsport 1-5 and Lynnsport Primary School should be published in the EAA monograph series under the working title 'The Middle to Late Saxon and Medieval salt making industry of Gaywoods North Marsh. Excavations at Lynnsport, King's Lynn, Norfolk.'

5.6 Retention and disposal of finds and environmental evidence

5.6.1 Individual finds specialists have made recommendations at this stage as to which material should be retained or dispersed.

5.7 Ownership and archive

5.7.1 Excavated material and records will be deposited with and curated by Norfolk county Council (NCC) in appropriate country stores under site code XNFARL18EX and HER code ENF145343. A digital archive, including a copy of the report including figures and photographs will be deposited with the OA library and ADS. OA will retain copyright of all reports and the documentary and digital archive produced in this project (unless the client has reserved copyright); OA will maintain the archive to the standards

recommended by the Chartered Institute for Archaeologists (CIfA 2014), the Archaeological Archives Forum (Brown 2011). NCC requires that transfer of ownership prior to deposition.

6 RESOURCES AND PROGRAMMING

6.1 Project team structure

6.1.1 The project team is set out in the table below:

Name	Initials	Organisation	Role
Matthew Brudenell	MB	OAE	Project Manager and prehistoric pottery specialist
Elizabeth Popescu	EP	OAE	Post-Excavation and Publication Manager
Rachel Clarke	RC	OAE	Editor
Rachel Fosberry	RF	OAE	Environmental co-ordinator
Kathryn Blackbourn	KB	OAE	Project Officer & Co-Author
Graeme Clarke	GC	OAE	Project Officer & Author; documentary research
Simon Timberlake	ST	Freelance	Ostracod and foraminifera specialist
Ro Booth	RB	OAE	Flintwork specialist
Sue Anderson	SA	Freelance	Pottery specialist
Ted Levermore	TL	OAE	Fired clay specialist
Hayley Foster	HF	OAE	Faunal remains specialist
Denise Druce	DD	OAN	Archaeobotanist and charcoal specialist
Mary Rutherford	MR	OAN	Pollen specialist
Karen Barker	KB	OAN	Conservator and X-radiography
Patrick Quinn	PQ	UCL	Ceramic petrology
Séverine Bézie	SB	OAE	Illustrator
James Fairbairn	JF	OAE	Finds photography
Nick Holder	NH	Freelance	Historical researcher
Katherine Hamilton	KH	OAE	Archive Supervisor

Table 8: Project team

6.2 Task list and programme

6.2.1 Compilation of a final archive report is normally completed within one year of the approval of the Post-Excavation Assessment and Updated Project Design; thus the final archive report should be completed by September 2020. A publication proposal will be submitted to *East Anglian Archaeology* in September 2019 at the earliest, with the aim of publishing a short monograph on the Anglo-Saxon and medieval saltern remains.

6.2.2 A task list of further work recommended by specialists on the assemblages recovered during this phase of works, and to be incorporated within the overall archive report, is identified in Table 9. These tasks are for the analysis and reporting of this phase of work only. They will form part of the body of work for the completion of the overall archive report and publication for the Lynnsport project.

6.2.3 The archive report will be prepared, incorporating all the phases of fieldwork once complete. Following this, it is proposed that a short monograph will be produced which summarises the results of all the excavations and analysis, including ENF139745 (Lynnsport 1 evaluation) and ENF145343 (Lynnsport 1 excavation), and focus on the key aspects of the site (see below).

6.2.4 A task list is presented below.

Task No.	Task		Staff	No. Days
Project Management				
1	Project management		MB EP	3
2	Team meetings		MB EP GC	2
3	Liaison with relevant staff and specialists, distribution of relevant information and materials		GC, MB, GC	3
Stage 1: Stratigraphic analysis				
4	Integrate ceramic/artefact dating with site matrix		GC	1
5	Update database and digital plans/sections to reflect any changes		GC	1
6	Finalise site phasing		GC	1
7	Add final phasing and groups to database		GC	1
8	Compile group and phase text		GC	1
9	Update overall stratigraphic text and site narrative for incorporation into the full/archive report		GC	1
10	Review, collate and standardise results of all final specialist reports and integrate with stratigraphic text and project results		GC	1
Illustration				
11	Prepare draft phase plans, finds distribution, sections and other report figures		SB/GC	2
12	Select photographs for inclusion in the report		GC	0.5
13	Photography of selected pottery and baked clay examples for archive report & publication		JF	0.5
Documentary research				
14	Research into relevant Anglo-Saxon and medieval saltern sites		GC	2
15	Additional research into the history of King's Lynn		GC	1
16	Visit NHER		GC	1
17	Research into Anglo-Saxon and medieval documents		NH	3
Artefact studies				
18	Late Saxon and medieval pottery: incorporation into archive report and publication synopsis		SA	1
19	Fired clay: incorporation into archive report and publication synopsis		TL	1
Ecofact studies				
20	Ostracod assemblage: archive report and publication synopsis		ST	2
21	Foraminifera assemblage: archive report and publication synopsis		ST	2
22	Charred plant remains and charcoal: incorporation into archive report and publication synopsis		RF/DD	1
23	Animal bone: incorporation into archive report		HF	0.5
24	Pollen: Incorporation into archive report		MR	0.5
25	Radiocarbon dating of 2 x further charred remains samples at *c.*£300 per sample		RF/SUERC	-

Task No.	Task		Staff	No. Days
Stage 2: Report Writing				
26	Integrate documentary research		GC	1
27	Write historical and archaeological background text		GC	1
28	Compile list of illustrations/liaise with illustrators		GC SB	0.5
29	Write discussion and conclusions		GC	1
30	Prepare report figures		SB	0.5
31	Collate/edit captions, bibliography, appendices etc		GC	1
32	Internal edit		RC/EP	1
33	Incorporate internal edits		GC	0.5
34	Final edit/internal approval/QC		RC MB EP	1
35	Send to NCC for approval		MB GC	0.5
36	Approval revisions		GC	0.5
Stage 3: Publication				
37	Produce draft publication		GC	5
38	Compile list of illustrations/liaise with illustrators		GC SB EP RC	1
39	Produce publication figures		SB	3
40	Internal edit		EP/RC	2
41	Incorporate internal edits		GC	0.5
42	Final edit		EP RC MB	1
43	Send to publisher for refereeing		EP/RC	0.5
44	Post-refereeing revisions		EP/RC	2
45	Copy edit queries		EP	1
46	Proof-reading		GC EP MB	1
Stage 4: Archiving				
47	Compile paper archive		GC	1
48	Archive/delete digital photographs		GC	1
49	Compile/check and deposit material archive		GC /KH	2

Table 9: Task list

* See Appendix D for product details and Appendix E for the project risk log.

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APPENDIX A CONTEXT INVENTORY

Evaluation

Context	Cut	Trench	Same as	Category	Feature Type	Function	Period Name	Period Number	Group Number	Width (m)	Depth (m)
355	**0**	7	404	layer	Saltern 10	filtration waste	Late Saxon	2	355		
356	**0**	8	677	layer	saltern 11	filtration waste	Late Saxon	2	356		
361	**0**	7	403	layer	saltern 10	hearth waste	Late Saxon	2	355		
362	**0**	7	404	layer	saltern 10	filtration waste	Late Saxon	2	355		
363	**0**	7	403	layer	Saltern 10	hearth waste	Late Saxon	2	355		
364	**0**	7	404	layer	saltern 10	filtration waste	Late Saxon	2	355		
365	**365**	7		cut	filtration unit	concentrated brine production	Late Saxon	2	355	1.05	0.15
366	**365**	7		fill	filtration unit	clay lining	Late Saxon	2	355		
367	**365**	7		fill	filtration unit	disuse	Late Saxon	2	355		
368	**368**	7		cut	filtration unit	concentrated brine production	Late Saxon	2	355	0.8	
369	**368**	7		fill	filtration unit	clay lining	Late Saxon	2	355		
370	**368**	7		fill	filtration unit	disuse	Late Saxon	2	355		
371	**371**	7		cut	ditch	boundary	Post-medieval/ Modern	4	0	0.77	0.08
374	**374**	7		cut	pit	unknown	Late Saxon	2	355	0.6	0.18
375	**374**	7		fill	pit	backfill	Late Saxon	2	355		
376	**0**	8		layer	saltern 11	hearth waste	Late Saxon	2	356		
377	**0**	8	677	layer	saltern 11	filtration waste	Late Saxon	2	356		
378	**0**	8		layer	saltern 11	hearth waste	Late Saxon	2	356		
379	**379**	8		cut	pit	unknown	Late Saxon	2	356	0.74	0.3
380	**379**	8		fill	pit	backfill	Late Saxon	2	356		
381	**379**	8		fill	pit	backfill	Late Saxon	2	356		
382	**379**	8		fill	pit	backfill	Late Saxon	2	356		
383	**379**	8		fill	pit	backfill	Late Saxon	2	356		
384	**379**	8		fill	pit	backfill	Late Saxon	2	356		
385	**379**	8		fill	pit	backfill	Late Saxon	2	356		

Context	Cut	Trench	Same as	Category	Feature Type	Function	Period Name	Period Number	Group Number	Width (m)	Depth (m)
386	**0**	8		layer	saltern 11	hearth waste	Late Saxon	2	356		

Table 10: Evaluation context inventory

Excavation

Context	Cut	Trench	Same as	Category	Feature Type	Function	Saltern	Group Number	Width (m)	Depth (m)
403	**0**	F, G		layer	saltern hearth waste	salt production	0	403		
404	**0**	F, G		layer	filtration waste	salt production	0	404		
405	**405**	G	506, 507	cut	filtration tank	salt production	10	0	1.58	0.48
406	**405**	G	513, 516	fill	filtration tank	clay lining	10	0	1.55	0.1
407	**405**	G		fill	filtration tank	disuse	10	0		0.22
408	**408**	G	508, 511	cut	filtration tank	salt production	10	0	1.58	0.73
409	**408**	G	509	fill	filtration tank	clay lining	10	0		0.2
410	**408**	G		fill	filtration tank	disuse	10	0		0.26
411	**411**	G		cut	filtration tank	salt production	10	0	0.93	0.11
412	**411**	G		fill	filtration tank	clay lining	10	0	0.93	0.11
413	**411**	G		fill	filtration tank	disuse	10	0	0.93	0.11
414	**414**	G		cut	filtration tank	salt production	10	0	1.5	0.28
415	**414**	G		fill	filtration tank	clay lining	10	0		0.1
416	**414**	G		fill	filtration tank	disuse	10	0		0.23
418	**414**	G		fill	filtration tank	disuse	10	0		0.06
419	**419**	G		cut	turves	salt production	10	0	0.28	0.04
420	**419**	G		fill	turves	disuse	10	0		0.04
423	**423**	G		cut	filtration tank	salt production	10	0	0.78	0.16
424	**423**	G		fill	filtration tank	clay lining	10	0	0.78	0.16
425	**423**	G		fill	filtration tank	disuse	10	0	0.78	0.16
426	**426**	G		cut	filtration tank	salt production	10	0	0.5	0.08
427	**427**	G		fill	filtration tank	clay lining	10	0		0.08
428	**426**	G		fill	filtration tank	disuse	10	0		0.08
429	**0**	G	400	layer	topsoil		0	0		
430	**0**	G	401	layer	subsoil		0	0		
431	**0**	G	440	layer	filtration waste	salt production	10	403		0.28
432	**0**	G		layer	filtration waste	salt production	10	403		0.7
433	**0**	G		layer	filtration waste	salt production	10	403		0.3
434	**0**	G	447	layer	filtration waste	salt production	10	404		0.3
435	**0**	G		layer	saltern hearth waste	salt production	10	403		0.3
436	**436**	F		cut	Trench	Trench	0	0	2	0.6
437	**436**	F		fill	Trench	Trench	0	0		0.6
438	**0**	F	400	layer	topsoil		0	0		0.5
439	**0**	F	401	layer	subsoil		0	0		0.16
440	**0**	F		layer	filtration waste	salt production	10	403		0.46
441	**0**	F		layer	filtration waste	salt production	10	403		0.22
442	**442**	F	453	cut	pit	unknown	10	0	0.9	0.44
443	**442**	F	454/455	fill	pit	disuse	10	0	0.9	0.44
444	**0**	F		layer	saltern hearth waste	salt production	10	403		0.22
445	**0**	F		layer	saltern hearth waste	salt production	10	403		0.2
446	**0**	F		layer	filtration waste	salt production	10	404		0.08
447	**0**	F	434	layer	filtration waste	salt production	10	404		0.16
448	**0**	F		layer	saltern hearth waste	salt production	10	403		0.3
449	**0**	F		layer	filtration waste	salt production	10	403		0.2
450	**0**	F		layer	filtration waste	salt production	10	403		0.3
451	**451**	I		cut	pit/tank	salt prodcution	12	0	1.3	0.47
452	**451**	I		fill	pit/tank	backfill	12	0		0.1
453	**453**	I	442	cut	pit/tank	salt production	12	0	0.9	0.74
454	**453**	I	443	fill	pit/tank	disuse	12	0		0.56
455	**453**	I	443	fill	pit/tank	disuse	12	0		0.74

Context	Cut	Trench	Same as	Category	Feature Type	Function	Saltern	Group Number	Width (m)	Depth (m)
456	**453**	I		fill	pit/tank	clay lining	12	0		0.02
457	**457**	I		cut	filtration tank	salt production	12	0	1.25	0.66
458	**457**	I		fill	filtration tank	clay lining	12	0		0.1
459	**457**	I		fill	filtration tank	disuse	12	0		0.34
460	**457**	I		fill	filtration tank	disuse	12	0		0.29
461	**457**	I		fill	filtration tank	disuse	12	0		0.24
462	**457**	I		fill	filtration tank	disuse	12	0		0.26
463	**463**	H		cut	pit/tank	salt production	11	0	1.1	0.2
464	**463**	H		fill	pit/tank	clay lining	11	0		0.1
465	**463**	H		fill	pit/tank	disuse	11	0	1.12	0.12
466	**451**	I		fill	pit/tank	disuse	12	0		0.15
467	**451**	I		fill	pit/tank	disuse	12	0		0.17
468	**451**	I		fill	pit/tank	disuse	12	0		0.2
469	**451**	I		fill	pit/tank	disuse	12	0		0.25
470	**451**	I		fill	pit/tank	disuse	12	0		0.13
471	**451**	I		fill	pit/tank	disuse	12	0		0.1
472	**472**	I		cut	pit	salt production	12	0	0.4	0.35
473	**472**	I		fill	pit	disuse	12	0	0.4	0.35
474	**474**	I		cut	post hole	structure?	12	0	0.29	0.22
475	**474**	I		fill	post hole	disuse	12	0	0.29	0.22
476	**0**	H		layer	saltern hearth waste	salt production	11	676	1.8	
477	**0**	H		layer	saltern hearth waste	salt production	11	676	0.5	
478	**0**	H		layer	saltern hearth waste	salt production	11	676	0.33	
479	**0**	H		layer	saltern hearth waste	salt production	11	676	0.33	
480	**0**	H	675	layer	tidal silts	natural	11	675	1.55	0.09
481	**0**	H	628	layer	buried soil	layer	11		3.57	0.19
482	**0**	H		layer	saltern hearth waste	salt production	11	676	0.61	0.02
483	**0**	H		layer	saltern hearth waste	salt production	11	676	0.59	0.05
484	**0**	H		layer	saltern hearth waste	salt production	11	676	0.72	0.03
485	**0**	H		layer	saltern hearth waste	salt production	11	676	0.37	0.05
486	**0**	H		layer	saltern hearth waste	salt production	11	676	1.48	0.09
487	**0**	H		layer	saltern hearth waste	salt production	11	676	1.51	0.09
488	**0**	H		layer	saltern hearth waste	salt production	11	676	1.22	0.06
489	**489**	I		cut	pit	salt production	12	0	1.1	0.6
490	**489**	I		fill	pit	clay lining	12	0		0.2
491	**489**	I		fill	pit	disuse	12	0		0.52
492	**492**	I		cut	gully	unknown	12	0	0.24	0.25
493	**492**	I		fill	gully	disuse	12	0	0.24	0.25
494	**457**	I		fill	filtration tank	disuse	12	0	0.2	0.2
495	**457**	I		fill	filtration tank	disuse	12	0		0.14
496	**457**	I		fill	filtration tank	disuse	12	0		0.4
497	**457**	I		fill	filtration tank	disuse	12	0		0.8
498	**457**	I		fill	filtration tank	disuse	12	0	0.59	0.2
499	**499**	I		cut	pit	unknown	12	0	0.47	0.2
500	**499**	I		fill	pit	disuse	12	0	0.47	0.2
501	**501**	I		cut	pit	unknown	12	0	0.52	0.08
502	**501**	I		fill	pit	disuse	12	0	0.52	0.08
503	**503**	I		cut	pit	unknown	12	0	0.38	0.12
504	**503**	I		fill	pit	disuse	12	0	0.38	0.12
505	**451**	I		fill	pit/tank	clay lining	12	0		0.15
506	**506**	G	507, 405	cut	filtration tank	salt production	10	0	1.22	0.18
507	**507**	G	506, 405	cut	filtration tank	salt production	10	0	1.44	0.48
508	**508**	G	511, 408	cut	filtration tank	salt production	10	0	1.14	0.73
509	**508**	G		fill	filtration tank	clay lining	10	0		0.1

Context	Cut	Trench	Same as	Category	Feature Type	Function	Saltern	Group Number	Width (m)	Depth (m)
510	**508**	G		fill	filtration tank	disuse	10	0	0.6	0.42
511	**511**	G	508, 408	cut	filtration tank	salt production	10	0	1.6	0.2
512	**511**	G		fill	filtration tank	disuse	10	0		0.1
513	**506**	G	516, 406	fill	filtration tank	clay lining	10	0		0.1
514	**506**	G		fill	filtration tank	disuse	10	0		0.05
515	**506**	G		fill	filtration tank	disuse	10	0		0.15
516	**507**	G	513, 406	fill	filtration tank	clay lining	10	0		0.1
517	**507**	G		fill	filtration tank	disuse	10	0		0.25
518	**507**	G		fill	filtration tank	disuse	10	0	0.86	0.19
519	**507**	G		fill	filtration tank	disuse	10	0	0.27	0.09
520	**507**	G		fill	filtration tank	disuse	10	0	0.52	0.05
521	**506**	G		fill	filtration tank	salt production	10	0	0.65	0.05
522	**0**	G		layer	saltern hearth waste	salt production	10	403	1.01	0.07
523	**0**	H		layer	filtration waste	salt production	11	677		0.7
532	**0**	H		layer	saltern hearth waste	salt production	11	676		0.12
533	**0**	H		layer	saltern hearth waste	salt production	11	676		0.09
539	**0**	H	609	layer	saltern hearth waste	salt production	11	676		0.18
540	**0**	H		layer	saltern hearth waste	salt production	11	676		0.13
545	**0**	H		layer	saltern hearth waste	salt production	11	676		0.14
548	**0**	H		layer	saltern hearth waste	salt production	11	676		0.1
551	**0**	H		layer	saltern hearth waste	salt production	11	676		0.02
552	**0**	H		layer	saltern hearth waste	salt production	11	676		0.04
553	**0**	H		layer	saltern hearth waste	salt production	11	676		0.11
555	**0**	H		layer	saltern hearth waste	salt production	11	676		0.27
561	**0**	H		layer	saltern hearth waste	salt production	11	676		0.1
576	**0**	H		layer	filtration waste	salt production	11	677		0.15
581	**0**	H		layer	saltern hearth waste	salt production	11	676		0.1
584	**0**	H		layer	saltern hearth waste	salt production	11	676		0.17
591	**0**	H		layer	saltern hearth waste	salt production	11	676		0.07
604	**0**	H		layer	filtration waste	salt production	11	677		0.35
605	**0**	H		layer	saltern hearth waste	salt production	11	676		0.1
609	**0**	H	539	layer	saltern hearth waste	salt production	11	676		0.18
611	**0**	H		layer	saltern hearth waste	salt production	11	676		0.15
619	**0**	H		layer	saltern hearth waste	salt production	11	676		0.16
624	**0**	H		layer	saltern hearth waste	salt production	11	676		0.1
628	**0**	H	481	layer	buried soil	layer	11			0.26
629	**629**	G		cut	filtration tank	salt production	10	0	0.93	
630	**629**	G		fill	filtration tank	clay lining	10	0	0.93	0.1
631	**629**	G		fill	filtration tank	disuse	10	0		
632	**508**	G		fill	filtration tank	disuse	10	0	0.27	0.13
633	**508**	G		fill	filtration tank	clay lining	10	0	0.42	0.1
634	**0**	I		layer	filtration waste	salt production	12	644		0.18
635	**0**	I		layer	filtration waste	salt production	12	644	2.8	0.22
636	**0**	I		layer	saltern hearth waste	salt production	12	644	2.86	0.52
637	**0**	I		layer	filtration waste	salt production	12	644	1.9	0.24

Context	Cut	Trench	Same as	Category	Feature Type	Function	Saltern	Group Number	Width (m)	Depth (m)
638	**0**	I		layer	filtration waste	salt production	12	644	1.42	0.16
639	**0**	I		layer	filtration waste	salt production	12	644	1.22	0.23
640	**0**	I		layer	filtration waste	salt production	12	644	0.8	0.12
641	**0**	I		layer	filtration waste	salt production	12	644	1.16	0.18
642	**0**	I		layer	filtration waste	salt production	12	644	2.8	0.26
643	**0**	I		layer	filtration waste	salt production	12	644	4.1	0.25
644	**0**	I		layer	filtration waste	salt production	12	644	3	0.34
645	**0**	I		layer	filtration waste	salt production	12	644	1.6	0.35
646	**0**	I		layer	filtration waste	salt production	12	644	3.2	0.51
647	**0**	I		layer	filtration waste	salt production	12	644	2	0.54
648	**0**	I		layer	saltern hearth waste	salt production	12	644		0.4
649	**0**	I		layer	filtration waste	salt production	12	644	2.9	0.36
650	**0**	I		layer	filtration waste	salt production	12	644	0.76	0.16
651	**0**	I		layer	filtration waste	salt production	12	644	0.24	0.18
652	**0**	I		layer	filtration waste	salt production	12	644	0.12	0.08
653	**0**	I		layer	clay layer	stabilisation layer	12	0		0.26
654	**0**	I		layer	buried soil	land surface	12			0.02
655	**0**	I		layer	filtration waste	salt production	12	644		0.47
656	**0**	I		layer	filtration waste	salt production	12	644		0.6
657	**0**	I		layer	filtration waste	salt production	12	644		0.3
658	**0**	I		layer	natural	tidal silts	12	675		1
659	**0**	I		layer	natural	tidal silts	12	675		1.06
660	**0**	I		layer	natural	tidal silts	12	675		4.03
661	**0**	I		layer	buried soil	land surface	12			0.08
662	**662**	I		cut	filtration tank	salt production	12	0	1.48	0.7
663	**662**	I		fill	filtration tank	clay lining	12	0		0.1
664	**662**	I		fill	filtration tank	disuse	12	0		0.35
665	**0**	I		layer	filtration waste	salt production	12	644		0.55
666	**0**	I		layer	filtration tank	disuse	12	0		0.1
667	**0**	I		layer	filtration waste	salt production	12	644		0.1
668	**0**	I		layer	filtration waste	salt production	12	644		0.32
669	**0**	I		layer	saltern hearth waste	salt production	12	644		0.04
670	**662**	I		fill	filtration tank	disuse	12	0		0.43
671	**662**	I		fill	filtration tank	disuse	12	0		0.15
672	**0**	I		layer	clay layer	salt production	12	0		0.25
673	**0**	H		layer	saltern hearth waste	salt production	11	644		
674	**0**	H		layer	saltern hearth waste	salt production	11	644		
675	**0**			layer	natural	tidal silts	0	0		
676	**0**	H		layer	saltern hearth waste	salt production	11	644		
677	**0**	H		layer	filtration waste	salt production	11	644		
678	**0**	I		layer	saltern hearth waste	salt production	12			
679	**0**	I		layer	filtration waste	salt production	12			
680	**0**	I		layer	natural	tidal silts	12	675		0.24
681	**0**	I		layer	saltern hearth waste	salt production	12	644		0.01
682	**0**	I		layer	filtration waste	salt production	12	644		0.07
683	**0**	I		layer	saltern Hearth waste	salt production	12	644		0.07
684	**0**	I		layer	saltern hearth waste	salt production	12	644		0.01
685	**0**	I		layer	filtration waste	salt production	12	644		0.17
686	**0**	I		layer	saltern hearth waste	salt production	12	644		0.4
687	**0**	I		layer	saltern hearth waste	salt production	12	644		0.1
688	**0**	I		layer	saltern hearth waste	salt production	12	644		0.03
689	**0**	I		layer	filtration waste	salt production	12	644		0.2

Table 11: Excavation context inventory

APPENDIX B ARTEFACT ASSESSMENTS

B.1 Iron slag, by Simon Timberlake

Introduction

B.1.1 Seven pieces of iron slag (36g) and 54 pieces of mixed (contaminated) salt slag/ iron slag (213g) were recovered from this site (Table 12).

Methodology

B.1.2 The slag was identified visually using an illuminated x10 magnifying lens, and compared where necessary with an archaeological reference collection. The pieces were tested with a magnet to determine the presence of free iron or wustite.

Description

B.1.3 All the pieces of iron slag came from nearby features, being for the most part fresh in appearance, with little obvious sign of breakage and abrasion to suggest transport and re-deposition. At least four of the samples consisted of pieces of iron smithing slag; the largest piece (from context 432) being a fragment of iron-rich vitrified hearth lining (VHL) with the addition of some fused and melted hammer scale plus slag drips alongside the traces of a blow hole of c.22mm diameter covering the tuyere pipe (Bayley et al. 2001). The smaller piece (from fill 462 of tank **457**) is a small fragment of solid slag drip, once again most probably from around the end of a clay or metal tuyere. The unequal magnetisation of the larger (VHL) fragment most likely reflects its heterogenous composition with re-melted inclusions of hammerscale, now largely converted to wustite, within a fayalitic/ iron hydroxide (weathered) but also fused silicate rim.

B.1.4 The vitrified hearth lining (VHL) associated with the iron smithing slag (from context 476 and fill 493, Gully **492**) is variably magnetised, in comparison with the VHL associated with a hearth which seems to have been used both for salt pan boiling and for secondary iron smithing. The vitrified/fused lining includes fragments of both heat-reddened but unfused reddish silt plus traces throughout of peat ash. The latter was confirmed by the presence of a much larger lump of partly-incinerated black peat, with its fibrous structure clearly visible.

Context	Cut	Area	Sample no.	Nos. pieces	Size (mm)	Wt. (g)	Identity	Magnetic (scale 0-4)	Notes
432	-	G		1	92x50x40	91	VHL rim	0-3	tuyere hole and slag drip: projected diameter of hearth = 120-150mm
462	**457**	I		1	30	3	SSL	0	slag drip from tuyere
476	-	H	311	4	15 + 15 + 32 + 35	18	VHL/SSL	3 + 4	small cindery pieces of iron smithing slag
493	**492**	I	310	2	28 + 42	17	VHL/SSL	0 + 2	slightly denser pieces of cindery iron smithing slag
687	-	I	318	54	15-- 95	213	VHL	0	mixture of hackly salt slag and vitrified (bubbly +

Context	Cut	Area	Sample no.	Nos. pieces	Size (mm)	Wt. (g)	Identity	Magnetic (scale 0-4)	Notes
									porous clay/silt) with some inclusions of red burnt clay + smaller flecks of charcoal/ black peat ash. One larger inclusion of incinerated black peat (45mm diam)

Table 12: Catalogue of iron slag and iron/salt slag

Discussion

B.1.5 The assemblage recovered from these saltern sites at King's Lynn (Lynnsport) is interesting by virtue of the evidence, also seen at the nearby saltern sites of Marsh Lane and Greenpark Avenue (Clarke 2016, Knight forthcoming) for the re-use of the salt pan hearths as iron smithing hearths; presumably for the mending or re-forging of iron tools/ horseshoes etc. This suggests that the salt pan hearths may also have used bellows and a tuyere to help raise the temperature for salt production.

B.1.6 Probably the most interesting evidence recovered from this site relates to fuel. It has always been assumed that locally cut peat was used in salt production – as attested by the dark peaty stains and the absence of coal, wood or charcoal from the site. The discovery of a small lump of preserved (yet incinerated) peat as an inclusion within this helps to confirm this.

B.1.7 Documentary reference to the use of peat as a fuel at these sorts of saltern sites during the medieval to post-medieval period comes from Brownrigg (1748): 'the brine being thus prepared they boil it with turf fires in small leaden pans...'.

Further work required

B.1.8 No further work is required on this assemblage, unless the small peat sample from <318> is to be kept for the purpose of future environmental analysis of its macro-botanical inclusions.

Disposal

B.1.9 All of this material can be safely disposed of following the above work.

B.2 Flint, by Ro Booth

B.2.1 A single worked flint was recovered from the excavation. A small slightly plunging narrow flake (measuring 39mm x 14mm) of Late Mesolithic to Early Neolithic date was recovered from the fill (470) of clay-lined tank **451** in Area I and is residual. The flint itself has clearly been utilised as some fine retouch is present along one lateral and both edges exhibit edge damage.

B.2.2 This single flint is considered residual and no further work is needed.

B.3 Pottery, by Sue Anderson

Introduction

B.3.1 Ten sherds of pottery weighing 129g were collected from seven contexts during the excavation. Table 13 shows the quantification by fabric; a summary catalogue by context is included as Table 14.

Description	Fabric	Date range	No	Wt (g)	EVE	MNV
Sandy Ipswich Ware	SIPS	L.8th-9th c.	2	55	0.14	2
Grimston Thetford-type ware	THETG	L.10th–11th c.	4	67		3
Early medieval ware	EMW	11th–12th c.	3	6		3
Unidentified	UNID	-	1	1		1
Totals			**10**	**129**	**0.14**	**9**

Table 13: Pottery quantification by fabric

Methodology

B.3.2 Quantification was carried out using sherd count, weight and estimated vessel equivalent (eve). All fabric codes were assigned from the Norfolk post-Roman fabric series (based on Jennings 1981). Form terminology follows MPRG (1998). The catalogue was input directly into an MS Access database, which forms the archive catalogue.

Pottery by period

Middle Saxon

B.3.3 Buried soil layer 481/628 contained two sherds of Ipswich ware. Both were in the sandy fine fabric and they comprised a rim sherd (West Type A) from a jar with a rim diameter of 120mm, and a base fragment from another small jar.

Late Saxon

B.3.4 Four fragments of Grimston Thetford-type ware were found, representing bases and a body sherd from three vessels. These were in a fairly fine version of the Grimston fabric. They were found in the fills of three tanks.

Medieval

B.3.5 Three small body sherds of fine, thin-walled early medieval ware jars were recovered from two fills of tank **457**.

Unidentified

B.3.6 A small body sherd in a hard black fabric was found in sample <310> from gully fill 493. It appeared to be wheelmade but had traces of soot externally and lime internally, making it difficult to be certain of the method of manufacture. It contained abundant coarse rounded fragments of red grog and may be a later Iron Age/Roman sherd or possibly a Saxo-Norman import.

Pottery by context

B.3.7 Table 14 shows the distribution of fabrics by context.

Area	Context	Cut	Type	Fabrics	Spot date
H	481	-	buried soil	SIPS	L.8-9
	628	-	buried soil	SIPS	L.8-9
I	455	453	pit/tank	THETG	11th c.
	460	457	filtration tank	THETG EMW	11th c.
	462	457	filtration tank	EMW	11th-12th c.
	466	451	pit/tank	THETG	11th c.
	493	492	gully	UNID	?LIA/Rom/LSax?

Table 14: Pottery by context

B.3.8 Middle Saxon activity appears to be concentrated in Area H, with two sherds of Ipswich ware vessels found in a buried soil layer. Most of the activity in Area I appears to date to the 11th or 12th centuries.

Discussion

B.3.9 This small group of pottery, when taken in conjunction with other small assemblages from Lynnsport, suggests earlier activity at the site than previously documented. There is a Middle Saxon presence, represented by two vessels, which has not been identified in other pottery assemblages from the site. The presence of both Thetford-type ware and early medieval ware in one of the filtration tanks appears to suggest continuation of activity across the two pottery periods, although in reality both pottery fabrics were in use in the 11th century in this area. The early medieval sherds were from the thin-walled vessel types also identified at nearby Castle Acre (e.g. Milligan 1982).

Further work

B.3.10 No further work is needed on the current assemblage, however at publication stage this assemblage should be summarised and placed in context along with those assemblages recovered from the other excavated Lynnsport sites.

B.4 Fired Clay, by Ted Levermore

B.4.1 Archaeological work produced a very small assemblage of fired clay (55 fragments, 229g) from saltern related features in Area F. The assemblage contained no diagnostic objects, however some fragments possess structural features; indicators of hand forming and flattened surfaces. Two fragments possess a mineral crust on the surviving surface, probably derived from salt production. The assemblage was collected from saltern waste dumps. This material corresponds with other material from the well recorded multi-period salt production industry at Lynnsport.

Methodology

B.4.2 The assemblage was quantified by context, fabric and form and counted and weighed to the nearest whole gramme. Fabrics were examined using a x20 hand lens and were described by main inclusions present. The quantified data and fabric descriptions are

presented on an Excel spreadsheet held with the site archive. A summary of the catalogue can be found in Table 15.

Analysis

Fabrics

B.4.3 The assemblage comprises two related fabrics; they are composed of the same paste which has been subject to different firing conditions (F1 and F1a). The clay used was a refined very fine micaceous clay with fairly common fine to coarse rounded pores. F1 was composed of this clay, highly fired and with an oxidised colour gradient from mid orange to purple towards grey margins. The other, F1a, had a solid colour of mid orange. The F1a fragments did not possess any structural features as opposed to the F1 fragment which almost always had a margin and an irregular face.

Assemblage

B.4.4 The fired clay assemblage comprised amorphous and structural material – those with flattened surfaces – and divided in fabric along these lines. The amorphous fragments were rounded and formless, fired to an even orange colour, and offered little insight into the original form. The structural material was characterised by a combination of high firing, a gradient of oxidised colours and the presence of a 2-5mm thick grey-green mineral crust, which was vitrified in places. These fragments were between 35 and 40mm thick.

Area	Context	Cut	Feature	Fabric type	Object Form	Notes	Count	Weight (g)
F	436	**436**	Eval Trench	F1	?Lining or ?Pedestal	Fragments of a high fired and oxidised silty clay. Most fragments show colour gradient with a purple to grey margin and some surfaces. Two largest pieces have a grey-green salt crust on this margin (2-5mm thick). This crust is vitrified in places. The pieces are all around 40mm thick, suggests they are from same object, poss lining or a blocky object	27	148
F	444	-	Layer – Saltern Hearth Waste	F1a	?Lining or ?Pedestal	Undiagnostic fragments in an even orange colour. Probably related to material from 436, perhaps body fragments of related obkect	18	61
F	444	-	Layer – Saltern Hearth Waste	F1	?Lining or ?Pedestal	Fragments of a high fired and oxidised silty clay. Fragments show colour gradient with a purple to grey margin and some surfaces. Probably same material as in 436	2	8

F	448	-	Layer – Saltern Hearth Waste	F1a	?Lining or ?Pedestal	Undiagnostic fragments in an even orange colour. Probably related to material from 436, perhaps body fragments of related obkect	8	12

Table 15: Catalogue of fired clay

Discussion

B.4.5 While the fragments were not diagnostic, they are posited to be from the lining of an oven/hearth or part of the equipment used to produce salt. This assemblage corresponds well with the descriptions of the material found in other excavations in the area where salterns have been identified.

Statement of Potential

B.4.6 This assemblage is uninformative without any diagnostic objects. This assemblage indicates light industrial activity, namely salt production, and corresponds with other examples of this kind of material in the vicinity.

Recommendations for Further Work

B.4.7 No further recording is required. This material should be included, alongside the other saltern material excavated by OA East, in any future synthetic publication on the local salt making industry.

Retention, Dispersal and Display

B.4.8 All fragments should be retained.

APPENDIX C ENVIRONMENTAL ASSESSMENTS

C.1 Animal bone, by Zoe Ui Choileáin

Introduction and Methodology

C.1.1 A small assemblage of animal bone weighing 49g and totalling eight countable fragments was recovered from the excavation (Table 16). The material, recovered from filtration tank **457** and tank **451**, includes specimens recovered from environmental samples. The fragmentation levels are high and only three specimens can be identified to taxon; cattle, sheep and fish. The remaining fragments were recorded as large or medium mammal.

C.1.2 All bone was identified using Schmid (1972). Preservation condition was evaluated using the 0-5 scale devised by Brickley and McKinley (2004 14-15).

Results

C.1.3 The surface condition of the bone on average represents a three on the scale devised by Brickley and McKinley (ibid). This means that much of the surface of the bone has been affected by erosion to some degree; in this case by root etching. The material is highly fragmented bar a complete sheep metacarpus; this has a length of 127mm giving an estimated shoulder height of 62.1cm (Teichert 1969). A single fish bone from the Gadidae family, which includes haddock and cod, is present. An MNI (minimum number of individuals) of one is recordable for all three taxa.

Summary and Recommendations

C.1.4 This is a very small assemblage, although one of the largest from recently excavated saltern sites in the area. Due to the high fragmentation levels and poor preservation there is little other information that can be gleaned from the material. It is recommended that the material be dispersed.

Cut	Context	Feature	Taxon	Element	Weight (g)	Count
	432	Layer	Cattle (*Bos Taurus*)	PH2	13	1
457	460	Filtration tank	Medium mammal	Mandible	8	1
457	460	Filtration tank	Medium mammal	Rib	3	2
457	462	Filtration tank	Sheep/goat (*Ovis/Capra*)	Metacarpus	24	1
457	462	Filtration tank	Fish; Gadidae Family	Articular	0	1
457	462	Filtration tank	Medium mammal	Long Bone	0	1
451	466	Pit/Tank	Unidentifiable	Unidentifiable	1	1
Totals					**49**	**8**

Table 16: Animal bone: total weight, count and taxa present per feature

C.2 Charred plant remains and charcoal, by Rachel Fosberry and Denise Druce

Introduction

C.2.1 Twenty-one bulk samples were taken from deposits associated with early-medieval salt-making at Lynnsport 1. The samples were taken from deposits within the remains of three saltern mounds (Salterns 10 to 12) and associated clay-lined features within the excavated area. The purpose of this assessment is to determine whether plant remains and environmental indicators such as foraminifera and ostracods are present, their mode of preservation and whether they are of interpretable value for further specialist study.

Methodology

C.2.2 A sub-sample of each of the samples was processed by tank flotation using modified Sīraf-type equipment for the recovery of preserved plant remains, dating evidence and any other artefactual evidence that might be present. The floating component (flot) of the samples was collected in a 0.3mm nylon mesh and the residue was washed through 10mm, 5mm, 2mm and a 0.5mm sieve.

C.2.3 A magnet was dragged through each residue fraction for the recovery of magnetic residues prior to sorting for artefacts. Any artefacts present were noted and reintegrated with the hand-excavated finds.

C.2.4 The dried flots were subsequently sorted using a binocular microscope at magnifications up to x 60 and an abbreviated list of the recorded remains are presented in Table 17.

C.2.5 Identification of plant remains is with reference to the Digital Seed Atlas of the Netherlands (Cappers et al. 2006) and the authors' own reference collection. Nomenclature is according to Stace (2010).

C.2.6 Following standard environmental processing and assessment any charcoal fragments larger than 2mm in size were extracted for charcoal assessment, primarily to determine its suitability for providing radiocarbon dating material, but also to assess its potential for providing information on fuel use.

C.2.7 Charcoal assessment was carried out by Denise Druce using a binocular microscope at up to x40 magnification, whereby fragments were fractured to reveal transverse sections and preliminary species identifications were made. In particular, the presence of any small round wood, sapwood, and short-lived wood species was noted, for the purpose of providing suitable material for radiocarbon dating. The results were recorded on an assessment pro-forma, which will be kept with the site archive. Fragments considered suitable for radiocarbon dating were then fractured to reveal both radial and tangential sections, which were examined under a Meiji incident-light microscope at up to x400 magnification. Identifications were made with reference to Hather (2000), and modern reference material. Characteristics, such as possession of tyloses in hardwoods, any insect damage, or radial splitting were also noted as an aid to assessing wood maturity and condition prior to charring.

Quantification

C.2.8 For the purpose of this assessment, items such as seeds and cereal grains have been scanned and recorded qualitatively according to the following categories:

= 1-5, ## = 6-25, ### = 26-100, #### = 100+ specimens

C.2.9 Items that cannot be easily quantified such as charcoal, foraminifera, ostracods and molluscs have been scored for abundance

+ = rare, ++ = moderate, +++ = frequent, ++++ = abundant, +++++ = super abundant

Results

C.2.10 Plant remains are present in many of the samples with low density and diversity of taxa. Carbonised (charred) plant remains are most frequent in the samples from Saltern 11 but they are also present in several other samples from all types of deposits. They include a single charred barley (*Hordeum vulgare*) grain in Saltern 11 and seeds of wetland plants such as sedges (*Carex* spp.), Great Fen sedge (*Cladium mariscus*), rushes (*Juncus* spp.), cleavers (*Galium aparine*) and a grass (Poaceae) seed. A single charred seed of flax/linseed (*Linum usitatissimum*) is present in Sample 309, fill 461 of clay-lined tank **467**. Several of the charred seeds are too poorly preserved for accurate identification. These include several small seeds that are possibly of heather (*Erica/Calluna* sp.) and charred flowers found in sample 312 (Saltern 11) are also likely to be heather. Charcoal has been identified as mainly oak (*Quercus* sp.) and heather with occasional fragments of holly (*Ilex aquifolium*), alder/hazel (*Alnus*/*Corylus* sp.), elm (*Ulmus* sp.) and apple/pear/cherry-type (Maloideae).

C.2.11 Occasional seeds are present in an untransformed state in that they are not carbonised and must therefore be either waterlogged or resistant to decay. Taxa include elder (*Sambucus nigra*) and bramble (*Rubus* sp.) and sedges, which all produce woody seeds that are more likely to survive, particularly in salty deposits. Waterlogged seeds of rush (*Juncus* sp.) are also present.

C.2.12 There is a clear distinction in the types of remains recovered from the filtration tank deposits and the saltern mound deposits. Foraminifera are frequent in the samples from the filtration tanks but are absent in the saltern deposits. Similarly, snail shells are frequent in the filtration tank deposits but appear to be absent in the saltern deposits. The burrowing snail, *Cecilioides acicula,* is present in many of the samples and may have caused movement between contexts. Ostracods are most common in the filtration deposits but they are not present in all samples. Calcified stonewort (*Charophytes*) *oogonia* are similarly present in some deposits only.

C.2.13 Two charred insect fragments are present in Sample 313 (Saltern 11) and untransformed insect fragments are present in Sample 318 (Saltern 12).

C.2.14 Finds from the samples are scarce with occasional fragments of pottery, small bones and fuel-ash slag.

Sample No.		300	301	302	305	306	303	304	310	320	309	307	311	312	313	314	315	308	316	323	317	318
Context No.		413	416	418	416	418	425	428	493	515	461	465	476	673	674	452	466	454	491	664	678	678
Cut No.		**411**	**414**	**414**	**414**	**414**	**423**	**426**	**492**	**506**	**457**	**463**	**N/A**	**N/A**	**N/A**	**451**	**451**	**453**	**489**	**662**	**N/A**	**N/A**
Trench /area no.		G	G	G	G	G	G	G	I	G	I	H	H	H	H	I	I	I	I	I	I	I
Feature type		Clay-lined tank	Filtration tank	Filtration tank	Filtration tank	Filtration tank	Clay-lined pit	Clay-lined pit	Gully	Filtration tank	Clay-lined tank	Clay-lined pit	Saltern 11	Saltern 11	Saltern 11	Clay-lined tank	Clay-lined tank	Clay-lined tank	Filtration tank	Filtration tank	Saltern 12	Saltern 12
Volume processed (L)		14	18	20	20	18	16	4	18	12	16	16	14	8	10	20	20	20	6	8	8	8
Flot Volume (ml)		2	5	5	1	1	5	<1	60	1	80	5	10	80	25	250	90	1	1	<1	40	30
Charred plant remains																						
***Hordeum vulgare* L. caryopsis**														#								
***Galium aparine* L. nutlet**	Cleavers											#										
***Linum usitatissimum* L. seed**	Flax/Linseed										#											
medium Poaceae indet. [3-4mm]	medium-seeded Grass Family															#						
medium trigonous *Carex* sp. (2-3mm) nut	Common / Slender Spike-rush				#										##	#						#
elongate lenticular *Carex* sp. (>2mm) nut	elongate & flat-seeded Sedges														#							
***Cladium mariscus* (L.) Pohl nut**	Great Fen-sedge														#							
***Juncus* sp. seed**	Rush			#u	##	#u																
***Rubus* subgen. *Rubus* seed**	Brambles		#u															##u				#u
***Sambucus nigra* L. seed**	Elder																					#u
Indet seeds					#						#											
Charcoal Volume (ml)		<1	1	<1		<1	<1		10		15	<1	40	15	80	310	60	1	0	0	3	<1
Charcoal <2mm		+	++	+		+	+		+++		+++	+	+	+++	+++	+++	+++	+			++	+
Charcoal >2mm		+	++			+	+		+++		+++		+	+	+++	+++	+++	+			+	+
Charcoal >10mm											++		++	+	+	+++	+					
Charred stems		+									++			+++	++	++	++					
Charred flowers														++								

Foraminifera		++++	++++	++++	++++	++++	++++	+++	0	+	0	+++++	0	0	0	0	0	0	+	+	+	0
Ostracods		0	0	++	+	+	0	0	0	+	0	+	0	0	0	0	0	0	0	0	0	0
Chara oogonia		0	0	+	+	+	+	0	0	0	+	+	0	0	0	0	0	0	0	0	0	0
arthropod fragments															#							#u
Snails		+/+	+/+	+/+	+/+	+/+	+/+	0	0	0	+/+	0	0	0	0	0	0	0	0	0	0	0
Pottery		0	0	0	0	0	0	0	#	0	0	0		0	0	0	#	0	0	0	0	0

Table 17: Environmental bulk samples

Discussion

C.2.15 The environmental samples from this site have produced environmental indicators in the form of foraminifera and ostracods along with a limited list of plant species that represent vegetation that may have been present when the salterns were in use, or they may represent subsequent growth of vegetation after use. The identification of heather and charred stems/rhizomes may be an indication of their use as fuel, possibly as peat, in addition to oak wood/charcoal being utilised.

C.2.16 These results add to the corpus of results of environmental sampling from salt-making sites at Lynnsport with the samples from this site producing slightly more charcoal that the other sites but being less productive than Lynnsport 4 and 5 and Marsh Lane with regards to preserved seeds. It is interesting to note that duckweed seeds are not present at this site whereas they were present, most commonly in the clay-lined tanks at Lynnsport 4 and 5, possibly as an indicator of seasonality.

Statement of potential

C.2.17 The poor diversity and diversity of the plant taxa produced from these samples precludes the potential for further study. It is considered that the assemblage has little potential to aid the local, regional or national research priorities beyond the record of the taxa presented in this report.

Retention, dispersal and display

C.2.18 The sample flots will be retained in the project archive. Sub-samples have been retained for pollen analysis, if required.

C.3 Pollen, by Mairead Rutherford

Introduction

C.3.1 Three sub-samples were submitted by OA East, for pollen assessment (Table 18). The samples were all taken from silts and silty sands, from layer deposits associated with salterns.

Area	Sample Number	Context Number
I	<322>	644
I	<322>	647
I	<322>	648

Table 18: Sub-samples assessed for pollen

Methodology

C.3.2 The samples were prepared using a standard chemical procedure (method B of Berglund and Ralska-Jasiewiczowa 1986), using HCl, NaOH, sieving, HF, and Erdtman's acetolysis, to remove carbonates, humic acids, particles > 170 microns, silicates, and cellulose, respectively. The sample was then stained with safranin, dehydrated in tertiary butyl alcohol, and the residues mounted in 2000cs silicone oil. Slides were examined at a magnification of 400x by ten equally-spaced traverses across two slides to reduce the possible effects of differential dispersal on the slides (Brooks and Thomas 1967) or until at least 100 total land pollen grains were counted. Pollen identification was made following the keys of Moore et al (1991), Faegri and Iversen (1989), and a small modern reference collection. Plant nomenclature follows Stace (2010). Nomenclature for non-pollen palynomorphs (NPP) follows van Geel (1978) and van Geel and Aptroot (2006). The preservation of the pollen was noted, and an assessment was made of the potential for further analysis.

Results

C.3.3 Two of the three sub-samples from Lynnsport did not contain any pollen, and the third sample contained only a pollen grain each of hazel-type and dandelion-type and a fern spore of a monolete fern type (Table 19).

Sample Number		322	322	322
Context		644	647	648
Preservation		-	-	-
Potential		NO	NO	NO
Depth (m)		0.9-0.40	0.22-0.25	0.06-0.08
Trees/Shrubs				
Corylus avellana-type	Hazel-type	1		
Herbs				

Taraxacum-type	Dandelions	1		
Ferns				
Pteropsida	Monolete fern spores	1		
	Total land pollen	3	0	0
	Number of traverses	10	10	10
Deteriorated grains		5		
Fungal spores/NPP				
Glomus HdV-207		2		

Table 19: Raw pollen counts

Recommendations

C.3.4 No further pollen work is recommended on the samples from this site.

C.4 Ostracods, by Simon Timberlake

Introduction

C.4.1 Three sediment samples taken from the putative filtration tanks (pit) infills: 418 (filtration tank **414**, sample <302>) and 425 (clay-lined pit **423**, sample <303>) from Area G, Saltern 10 and from the fill 465 (clay-lined pit **463**, sample <307>) from Area H, Saltern 11 were processed and examined for ostracods. Ostracods in small numbers were found within all the samples looked at, but most of these just within the smaller size fractions of the flots (0.5-0.25mm and <0.25mm). Slightly greater numbers of these were found within samples <302> (and to a lesser extent <303>), but in general the numbers of these were low as was the diversity of species.

Methodology

C.4.2 Standard processing of the environmental samples by flotation was undertaken by OAE Archaeobotanist Rachel Fosberry using Endecott sieves, the only variation in the technique being that for the purposes of this assessment the fractions examined were limited to: 1-2mm (generally without ostracods), 0.5-1mm, 0.25-0.5 (most ostracods) and <0.25 mm. The smallest fraction(s) were examined to record any juveniles present, hence to establish an idea of population structure and thus determine the degree of autocthoneity of any species recovered. The reporting of juvenile instars to the flot fractions may well be linked to the ability of some of these shells to float, but perhaps also to an entrapment of these within fibrous material such as roots or algae. The recovery of ostracods by this method is never going to be complete, yet it is conceivably representative of the assemblage present. Ostracods were not recorded within any of the other fractions examined by the archaeobotanist.

C.4.3 The examination of the four fractions involved a whole count if this was practically possible within the timescale allowed by the assessment (i.e. when looking at volumes

of residues up to 2g in weight), but if this was not possible then a carefully measured fraction of the sediment was counted and the final numbers calculated (estimated) accordingly.

C.4.4 The ostracods were examined using an illuminated stage Vickers binocular microscope with x10 eyepiece and a x1-x3 objective with individual ostracods being removed using an extra-fine camel hair brush. Standard texts plus a reference collection of published SEM images were used for the purposes of ostracod identification.

C.4.5 The numbers of male and female adult valves and carapaces were counted, and wherever possible those of the sexually dimorphic later instars also.

C.4.6 Notes were made concerning the presence or absence of noded and smooth polymorphs of some of these species, as well as the range of smaller juvenile instars that could be seen within this assemblage. All this data has been presented in Table 20.

Results

C.4.7 An initial assessment of the samples revealed just a few ostracod species with just small numbers of ostracods present in all three of the contexts examined (Graphs 1 and 2). These included mostly brackish water-marine forms, rare truly marine species, and just a few non-marine (freshwater) types. However, small numbers of carophytes suggest the presence of freshwater sources such as ponds or rivers close by. Abundant forams within the sediments most likely indicate the source of the silts being processed at the saltern sites, which would appear to be the nearby saltmarsh and tidal mud flats. A list of the foraminifera genera/species identified has been included in the second half of this report. Spot analyses of the snails and other molluscs encountered during the sorting/picking of the small fraction samples have been included within the ostracod table alongside mention of such other shelly detritus such as broken echinoid spines etc. The diatoms were not looked at.

C.4.8 The ostracods (except for the estuarine-marine and fully marine species) were moderately well preserved in all three of the samples, but were marginally more abundant within sample <303> (context 425) due to the slightly increased numbers of *Leptocythere lacertosa*. Both adults and juveniles (carapaces and valves) were identifiable, therefore it seemed possible to determine the likelihood of autochthoneity. This was calculated by visual determination and a more or less rule of thumb method – simply to provide an indication rather than an absolute determination of what was likely.

C.4.9 Just 27 ostracods were counted in <302> fill 418 (identified from a sample of 1.52g of sieve residue made up of 0.21g (2mm-1mm), 0.38g (1mm-0.5mm), 0.52g (0.5-0.25mm) and 0.41g (<0.25mm) fractions (NB no ostracods were found within the largest-sized fraction 2mm-1mm)). The minimum number of individuals (MNI) based upon the population structure with instar moults valves/carapaces present was estimated in this case as 25, with an ostracod density per sample of 21 individuals per gm sediment. Some 36% (9) of these ostracods consisted of the brackish water species *Loxoconcha elliptica*, another 20% (5) of the marginal brackish water species *Cyprideis torosa* (in fact the polymorph *C.torosa littoralis*), 16% (4) *Cytheromorpha fuscata*, and

just 8% (2) *Leptocythere lacertosa* (another saltmarsh/ estuarine mudflat species). Truly freshwater species (in this case *Candona candida* which was comparatively well-preserved) made up another 8% (2) of the ostracod total. The estuarine/ marine species *Semicytherura angulata* and *Cytherura* sp. (both of which were present as slightly less well-preserved individuals) formed the balance of 8%. Five moderate - indifferently preserved *carophyte oogonia* were also identified, alongside the larvae of *Valvata piscinalis* (freshwater snail), *Hydrobia ventrosa* (a brackish water snail), *Vertigo antivertigo* (marshland terrestrial snail) and *Ceciloides acicula* (a terrestrial sub-ground dwelling snail).

C.4.10 Some 40 ostracods were counted in sample <303> fill 425 (consisting of 3.62g of sieve residue made up of 0.8g (2mm-1mm), 1.02g (1mm-0.5mm), 1.56g (0.5-0.25mm) and 0.24g (<0.25mm) fractions). The MNI was estimated as 34 with an ostracod density of 14 ostracods per gm sediment. Around 62% (40) of these consisted of *Leptocythere lacertosa* adults/juveniles, 18% (7) *Loxoconcha elliptica* (and c.3% (1) *Loxoconcha rhomboidea*), 5% (2) *Semicytherura angulata*, and then just single individuals of *Neocytherideis* sp (a marine form), and the freshwater ostracods *Candona* candida and *Cypridopsis vidua*. *Leptocythere lacertosa* appeared to be the most autocthonous ostracod to the environment associated with this sediment source. Eight *carophyte oogonia* were counted whilst small shells of *Columnella edentula* (a terrestrial marshland snail) and C. acicula (a terrestrial sub-ground dwelling snail) were noted alongside marine shell debris which included broken echinoid spines.

C.4.11 Only nine ostracods were counted within sample <307> taken from context 465 within clay-lined feature **463** associated with Saltern 11. These came from 1.66g of sieve residue composed up of 0.11g (2mm-1mm), 1.19g (1mm-0.5mm), 1.2g (0.5-0.25mm) and 0.16g (<0.25mm) size fractions. The MNI was estimated as being eight with a low ostracod density of just 6 ostracods per gm sediment. Approximately 33% (three of these individuals) consisted of *Cyrideis torosa littoralis*, a further 22% (two) probably being an unidentified *Xestoleberis* (brackish water/ marine) species, another 22% (two) of *Loxoconcha elliptica*, with just single individuals of *Cytheromorpha fuscata* and *Semicytherura angulata*. However, four *carophyte oogonia* were identified alongside small shells/ shell fragments of the gastropod *C. acicula*.

Comparison of species count patterns for the 'filtration tanks' and waste silts:

C.4.12 Despite significant differences in ostracod abundance and population structure (such as between adults: juveniles + males: females) between each of the 'filtration tank' samples, a certain commonality in species count patterns links the fauna of the saltern mound with that of the infilled tanks. *Cyprideis torosa*, *Cytheromorpha fuscata*, *Loxoconcha elliptica* and *Semicytherura angulata* are present within all three samples examined, whilst both of the 'tank' sediments contain populations of *Leptocythere lacertosa*. It seems likely that traces of the faunal pattern of the tidal mud flats may be seen within both 'tanks' and the saltern silts.

Discussion

C.4.13 Despite the relative low abundance and diversity of the ostracod counts, the species recorded within these samples provides some useful data on several quite specific marginal marine and brackish – freshwater habitats and environmental preferences, enabling a reasonable picture to be established of the predominant source of the silts dug and then processed ('sleeched') for brine and subsequently therefore for salt production.

C.4.14 The habitat preferences for the various ostracod species recovered reveal a distinct (60%+) positive association with saltmarsh ponds and creeks and the Lower Saltmarsh biotope (c.25%) within Sample <307> (App. C.4 Graph 2), and to species common to the Estuarine Upper Mudflats (45%), the Lower Saltmarsh (20%) and saltmarsh ponds and creeks (10%) biotopes within Samples <302> and <303> (App. C.4 Graph 1). However, if we weight the species according to their probable degrees of autocthoneity with respect to the silts there is a greater likelihood that both sets of data then become more similar, and instead we may be looking at what are predominantly autocthonous species associated with the lower saltmarsh, with tidal creeks as well as with the estuarine mudflats. In all probability it is the tidal mudflats which are key to the source of these silts. Given the small numbers of ostracods recovered from the samples from this phase of the Lynnsport excavations it will be necessary also to look at the foraminifera, as well as comparing this data with the ostracod and foraminiferal populations recorded from the tanks and waste silts of the Greenpark Avenue (i.e. Primary School) Lynnsport site.

C.4.15 As with Lynnsport Sites 4 & 5 we are witnessing the same 'smooth shelled' highly saline tolerant (up to 40 % salinity) polymorph of the ostracod *Cyprideis torosa* referred to as '*C.littoralis*' (Kilyeni & Whittaker 1974). However, in this case these ostracods are clearly not very abundant and not obviously autochthonous to the habitat of this 'filtration tank' (contexts 418 and 425), nor necessarily the main environment (location) for the extraction of silt used in the saltern process. However, there seems little doubt given our current knowledge of this brackish to hypersaline tolerant species (see Brasier 1980; Frenzl et al. 2012; Bloomer et al. 2016), that it was part of the community of ostracods inhabiting the drying-out salt ponds and creeks of the semi-tidal saltmarsh environment.

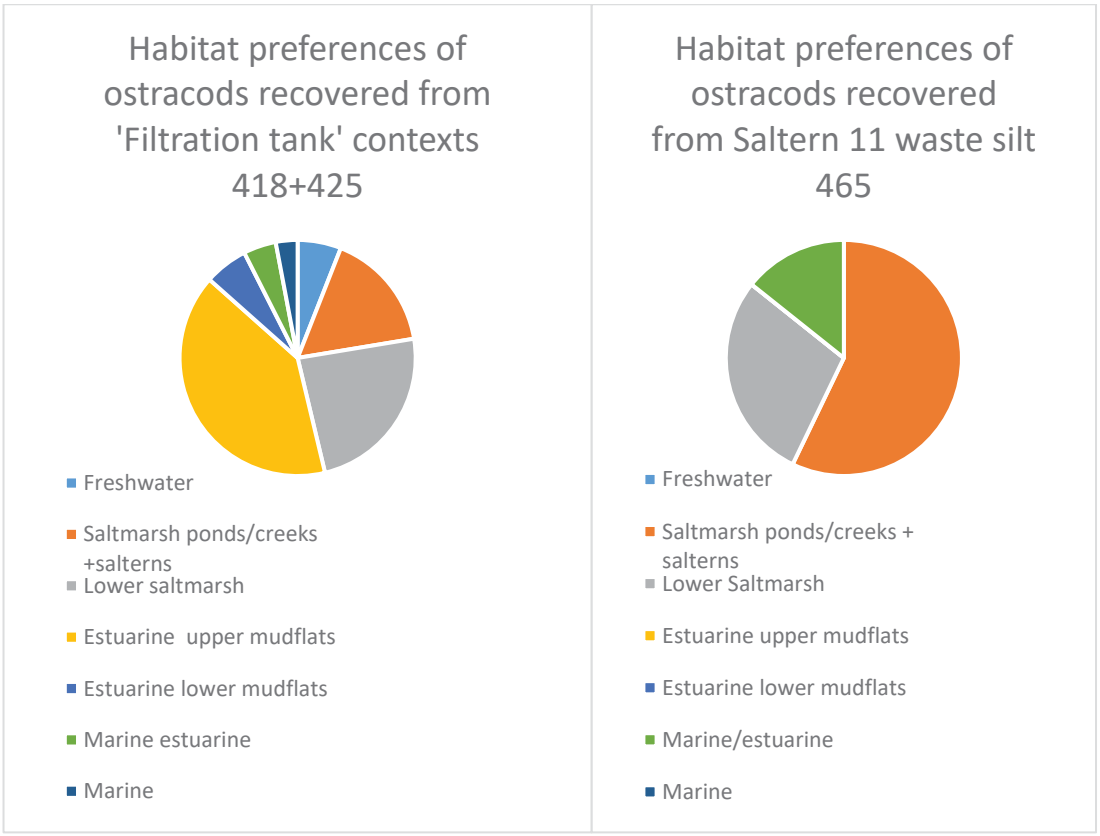
C.4.16 Needless to say it is possible that there may have been a population inhabiting some of the brine tanks associated with the saltern mound(s) here, although we see no evidence of an endemic population within the tank contexts examined. Of course the population of these ostracods could have been periodically depleted as the saline water was tapped off, yet it seems unlikely that these would not have quickly have replenished their numbers, with the species living in some sort of balance below the level of the sediment sieve or filter. Yet another possibility is that these sub-rectangular flat-bottomed pits were not sleeching or filtration tanks, or if they were, they had been totally emptied of any in situ. Sediments, and subsequently infilled with washed-in saltern mound material. Nevertheless, there may have been tanks nearby which could have been the origin, or at least an important source of marginally allocthonous ostracods which included this same smooth-shelled polymorph of *Cyprideis torosa* encountered as juveniles and occasionally as adult ostracods within the dumped waste

filtration silts of the salterns plus the silts backfilled into the tanks and pits. Periodic re-lining the tanks would likewise have resulted in the inclusion of the microscopic dead and moulted shells of these creatures into the clay base.

C.4.17 Perhaps most significant of all within this 'sleeched silt' assemblage is the incidence of *Leptocythere lacertosa*, *Cytheromorpha fuscata* and *Loxoconcha elliptica. Leptocythere lacertosa* is a euryhaline and slightly eurythermal species which prefers a sandy/muddy substrate at water depths of little more than 1m which is common to estuary saltmarsh environments, in particular to the upper mudflats zone (Rosenfeld 1972; Smith et al. 2012, 152-3; Smith 2013,68 Fig.3.12). *Cytheromorpha fuscata* is chloride-dependent species more properly tolerant of marine brackish water which is occasionally also found in inland lakes where brine seepages occur (Neale & Delorme in Thorpe & Couich (eds.) 2001, 821), but which is often found alongside *L. lacertosa* and *C.torosa*. *Loxoconcha elliptica* is an ostracod of the lower saltmarsh biotope, commonly inhabiting salt ponds and sea-grass communities in the muddy substrates of tidal estuary mudflats (Horne & Boomer 2000; Athersuch *et al*. 1989; Smith 2013, Fig.3.12)

C.4.18 Smith (2013 ibid.) notes the common occurrence of *Semicytherura angulata* and other *Semicytherura* species within the brackish water tidal marine environments of the Late Pleistocene - Holocene roddon network which links the Flag Fen basin of Whittlesey (North Cambridgeshire) with the Wash and North Sea coastline closer to King's Lynn. These species she considered typical of the marine/ estuarine environment, therefore marginally allocthonous to the zone of saltmarsh/ mudflats, although their inclusion within the latter sediments is what one might expect to find. Likewise a small percentage of fully allocthonous shallow-water marine shelf species such as *Neocytherideis* sp., *Xestoleberis* and *Cytheropteron* would be typical of this biotope assemblage. This matches to some extent the partially allocthonous composition of the foraminifera population.

C.4.19 The minor presence here of fully-freshwater ostracods as well carophytes serves to confirm the complexity of the saltern mound environment; the presence of permanent/ temporary freshwater waterbodies and the use also perhaps of non-saline water during the 'sleeching' process. Surrounding the salterns may also have been a mixture of both fresh and saltwater marshland, as is suggested by the mollusc evidence.



App. C.4 Graphs 1 and 2: Habitat preferences of ostracods from Samples <302> and <303> and habitats of ostracods from Sample <307>

genus/ species	**<302>** (418) <0.25–1mm (1.31g)	**<303>** (425) <0.25–1mm (2.82g)	**<307>** (465) <0.25 – 1mm (1.55g)	**salinity**	**water temp/ pH**	**water flow / depth**	**substrate**	**degree of autocth (0-4)** 4=high	**habitat environment**
*Cyprideis torosa (*cf *littoralis)* smooth shell	**5** (Adult: 2♀C 1♀RV; Juv: 1♀C + 1♀rv/1♂rv)	**1** (Adult: 1 LV)	**3** (Adult: 1♀LV 1♀RV +1♂RV)	euryhaline (2‰ - 40‰) 'smooth' shell>7‰ sal	eurytherm (4-19ºC)	<30m brackish-tidal	sandy-mud or algae	2	saltmarsh pond/ creeks and brine tanks
Xestoleberis sp.			**2** (Adult 1 ♀RV + 1C)					1	marine/ estuarine
Leptocythere lacertosa	**2** (Adult: 1♂LV; Juv. 1♀LV)	**25** (Adult/Juv: 5C + 13LV + 7RV)		euryhaline	eurytherm	1-30m	mud + fine sand	4	estuary/ saltmarsh: upper mudflats
Cytheromorpha fuscata	**4** (3♂C + 1 LV)	**1** Juv ♂RV	**1** (1 C)	1-35‰ marine-brackish + brine seeps	pH 9.1-9.5	1-30m depth	vegetat + med sand	2	saltmarsh pond/ creeks
Loxoconcha elliptica	**9**(Juv.2♀C/4♂C +2♀RV/ 1♀LV)	**7** (Adult 1♀LV; Juv.1♂C + 3♂LV/ 2♀RV)	**2** (Juv. 2♂C)	brackish mesohaline 7-19‰	4-19ºC	brackish water flow/ tidal	epifaunal + muddy substrate	3	estuarine + lower saltmarsh
Loxoconcha rhomboidea	**3** (Juv.2♀LV/ 1♂RV)	**1** (Juv. 1♂RV)					muddy	3	estuarine + lower mudflats
Candona candida	**2** (Juv. 2♀C)	**1** (Juv 1C)		oligohaline (<5.3‰)	oligotherm (<13ºC)	perm shallow lake	muddy bottoms	1	freshwater
Cypridopsis vidua		**1** (Adult ♂C)		wide tolerance	pH 5-12	lakes <1.5m	epifaunal on *Chara*	1	freshwater
Semicytherura angulata	**1** A LV	**2** A LV	**1** Juv.					2	marine/ estuarine
Cytherura sp.	**1**							0	marine
Neocytherideis sp.		**1**						0	marine
Carophytes (oogonia)	5	8	4					1	freshwater
SNAILS etc	*Valvata piscinalis, Hydrobia ventrosa, Vertigo antivertigo, Ceciloides acicula*	*Columnella edentula, Ceciloides acicula* + echinoid spines	*Ceciloides acicula*					4	terrestrial + freshwater marshland
Total nos. ostracods	**27** (MNI= 25) **21** per g	**40** (MNI= 34) 14 per g	**9** (MNI = 8) 6 per g						

Table 20: Ostracod fauna from samples <302> (<0.25, 0.25 – 0.5, 0.5 – 1mm, 1mm – 2mm) and <303> associated with 'filtration tanks' and <307> associated with Saltern 11 waste silts within the 'filtration tank area' at Lynnsport Site 1, King's Lynn. Total ostracod counts are provided alongside ostracod

C.5 Foraminifera by Simon Timberlake

Introduction and Methodology

C.5.1 Standard processing of the environmental samples by flotation was undertaken by OA East Archaeobotanist Rachel Fosberry using Endecott sieves. The only variation here was in the counting technique, which for the purposes of this assessment was only undertaken for the 0.25-0.5mm size fraction; the size range which contained most of the better-preserved tests. The reason for this was simply the overall abundance of forams within the sample(s) looked at given the limited time available within the costed period of the work. However, it was considered still to be representative of the types and abundance present.

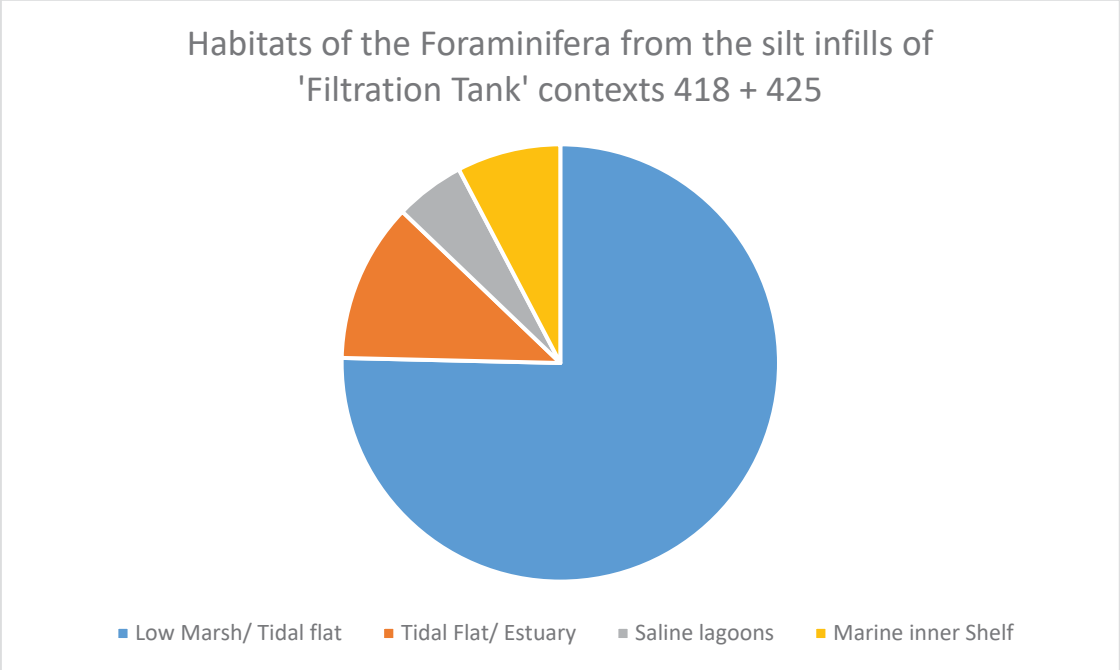
C.5.2 The examination involved a whole count of this fraction if this was practically possible within the timescale allowed, but if this was not possible then a carefully measured fraction of the sediment was counted and the final numbers calculated (estimated) accordingly. The cut-off point in terms of the volume/ weight of sediment which could be looked at in toto. was approximately 2g (as with the ostracods).

C.5.3 The forams were examined using an illuminated stage Vickers binocular microscope with x10 eyepiece and a x1-x3 objective with individual ostracods being removed using an extra-fine camel hair brush. Standard texts plus a reference collection of published SEM images were used for the purposes of identification. These were identified only to generic level except where these could be rapidly and accurately assessed to species level within the timescale (Table 21).

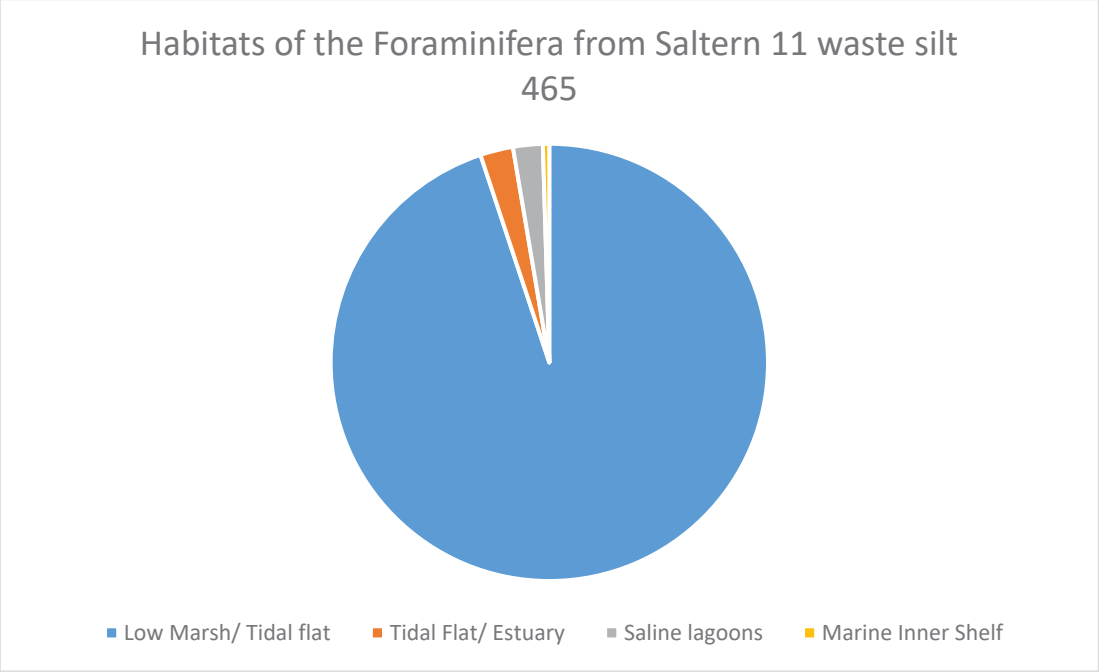
Sample genus/ species	<302> (418) 0.25 – 0.5mm (0.52g)	<303> (425) 0.25 – 0.5mm (1.56g)	<307> (465) 0.25 – 0.5mm (1.2g)	marine/ estuarine environment	autocthonous ?
Elphidium sp. *E. williamsoni* *E. exoticum* *E. incertum*	**281** (78) (12) (1)	**230** (30) (2)	**472** (9) (3)	Low Marsh/ Tidal Flat	Y
Haynesina sp. *H. germanica*	**8**	**162**	**730**	Low Marsh/ Tidal Flat	Y
Ammonia sp. *A. beccara*	11 (8)	4 (2)	8 (8)	Low Marsh/ Tidal Flat	Y
Discorbis sp.	24	24	28	Hypersaline lagoonal	Y?
Cibicides sp.	78	22	27	Tidal Flat/ Estuary	Y
Miliolina subrotunda	5	7	4	Tidal Flat/ Estuary	Y
Lagena spicatula	11	8	1	Marine/Inner Shelf	N
Planorbulina sp.	2	14	3	Marine/Inner Shelf	N
Trochammina sp	20	2		High to Low Marsh	Y
Saccammina sp.			2	Marine	N
Asterigina sp.	5	1		Marine/Inner Shelf	N
Ceratobulimina sp	22	2		Marine	N
Orbulina sp.	1			Marine	N
Ammodiscus sp.	2			Marine	

Sample genus/ species	<302> (418) 0.25 – 0.5mm (0.52g)	<303> (425) 0.25 – 0.5mm (1.56g)	<307> (465) 0.25 – 0.5mm (1.2g)	marine/ estuarine environment	autocthonous ?
Polymorphina sp.	1				
Siphonia sp.	1				
Cassiduolina sp.	1			Marine	N
Milliammina sp.		1		Hypersaline lagoonal	Y?
Spirocyclina sp.		1			
Lenticulina sp.		2		Marine/Inner Shelf	N
Total no. forams	**473** (910 per g)	**480** (308 per g)	**1275** (1062 per g)		

Table 21: Foraminifera from Samples <302>, <303> and <307> with habitat preferences/environment indicated



App. C.5 Graph 1: Foraminifera habitats represented by the silt infill contexts 418 and 425, Samples <302> <303>



App. C.5 Graph 2: Foraminifera habitats represented within the waste silts of Saltern 11, Sample <307>

Results

C.5.4 Large numbers of forams were typical of these particular samples. In all three samples the benthic rotalline foram genera Elphidium and Hayesina were dominant, the only exception to this being Sample <302> with high numbers of Elphidium (x281) but low numbers of Hayesina sp. (x8). Only within Sample <307> (the saltern waste silts) was Hayesina almost 1.5x more abundant than Elphidium (730 individuals compared to 472). The Discorbacean rotallines Cibicides and Discorbis were the next most abundant genera, followed by the Rotaliacean Ammonia (c.f. Ammonia becarra), Trochammina, Planorbulina, the Miliolinid Miliolina subrotunda, Ceratobulimina and the Nodosariacid Lagena spicatula. There was some, but probably little significant variation in the foraminiferal abundances between samples, although the different proportions of these may yet be significant, perhaps suggesting slightly different locations for the extraction of silts which were then dumped within the saltern waste heaps, and/or backfilled or otherwise concentrated within the 'filtration tank'(s).

Discussion

C.5.5 The pie charts shown in Graphs 1 and 2 indicate the proportional habitat preferences of the various foraminifera genera/ species identified within the three different samples. Given that most of these have not been identified to species level this should only be considered as an indication of the sort of habitats suggested and a likely environment based upon the sum total of the evidence known (the probability of this being determined by the numbers of similar known species).

C.5.6 By comparing the proportional habitats represented by the foraminifera of the 'filtration tank' infills with the waste (sleeched) silts a similar picture emerges of a common source dominated by foraminifera typical of a low salt marsh/tidal flat

environment (75% in the case of Samples <302> and <303> associated with the tanks and 90% in the case of Sample <307> associated with the waste silts). However, the reason behind the slightly greater number of fully allocthonous marine (inner shelf) benthic genera such as Lagena, Planorbulina and Ceratobulimina, the estuarine genera such as Miliolina and Cibicides, and the typical saline lagoon genera such as Discorbis present within the 'filtration tank' assemblage(s) is much harder to fathom. The latter may represent different extraction locations for the silts, but possibly it reflects a later infill, or perhaps even a different lining of the tank or pit with a clay dug from another bed. In all events these are just subtle differences which does not alter the general picture that emerges for the sourcing/ extraction of these sleeching silts from the lower salt marsh/ tidal mud flats zone which (presumably) lay closest to the salterns.

C.5.7 Given the well-preserved nature of most of the hyaline foraminifera examined it has proved difficult to distinguish allocthonous from autocthonous forams based just upon the condition of the test, given that some of the autocthonous forms were being re-worked by the tide as much as the allocthonous ones. Nevertheless, a number of the fully marine genera were clearly much more abraded and much rarer than the others.

C.5.8 Smith (2013, 97-103, figs.4.7 and 4.9) illustrates some of the commoner foraminifera species of the Fenland roddon silts of Cambridgeshire which match the sort of species diversity of forams encountered within the tidal creeks and mudflats surrounding the saltern sites at King's Lynn, though not necessarily in the same proportions. For instance Hayesina (H.germanica) was dominant within the Fenland roddons yet the Elphidium spp. were not, the latter being replaced instead by Ammonia beccara (ibid. Fig.3.10). Jadammina, Trochammina and Miliammina have been recorded as typical coastal marsh species (Bloomer et al. 2007), yet these are poorly represented within the Lynnsport 1 saltern silts.

C.5.9 It is difficult to be certain of the age or stratigraphic horizon of the saltmarsh mudflat silts used in the sleeching process. These could have been taken from the Terrington Beds (3000-1900 yrs BP) which outcrop close to King's Lynn or alternatively could have been scraped off from the much more recently deposited tidal mudflats.

Summary conclusions

C.5.10 Ostracods were present in all three samples looked at, but in low abundance and diversity. The assemblage was moderately autocthonous with respect to the saltmarsh/ mudflat origins of the silts used for sleeching and salt production, but not particularly to the environment of the saltern and 'filtration tanks', such as was encountered at Lynnsport Sites 4 & 5.

C.5.11 Brackish water ostracods including Cyprideis torosa (var. littoralis), Cytheromorpha fuscata, Leptocythere lacertosa and Loxoconcha elliptica and L. rhomboidea were identified alongside smaller numbers of estuarine marine ostracods (e.g. Semicytherura angulata) and also non-marine freshwater species such as Candona candida and Cypridopsis vidua. The latter confirm the presence of freshwater waterbodies such as ponds within the vicinity of the salterns.

C.5.12 There are differences in the proportions of ostracod species associated with the 'filtration tanks' and the saltern waste silts, although it seems unlikely that these differences are that significant. However, these may reflect minor changes of source.

C.5.13 The ostracod assemblage suggests that the source of the silts used in the sleeching process came from the area of the Lower Saltmarsh/ Upper Estuarine Mudflats and Saltmarsh creeks close by.

C.5.14 Foraminifera were present in moderately large amounts in all three samples. The assemblage(s) were dominated by the benthic foraminifera Elphidium (various species) and Hayesina which are typical genera/species of the Low Marsh (Saltmarsh) and Tidal Mudflats (between 75 and 90% certainty of association). Much smaller numbers of estuarine, saline lagoonal and marine (inner shelf) forams were present, some of these being allocthanous and washed-in.

C.5.15 In conclusion both the ostracod and foraminiferal evidence confirms the idea that the silts used in sleeching were collected from the Lower Saltmarsh/ Upper Tidal Mudflats zone of the tidal creeks which lay closest to the salterns.

Future work

C.5.16 If time permits a more complete count of all the fractions looked at could be undertaken and a revision of the species identification and their significance be attempted. However, the present assessment is probably sufficient for characterising the basic habitat assemblage and identifying likely sources for the extraction of silts.

C.5.17 Ideally any future work undertaken upon these saltern site(s) should include provision for a more complete sampling strategy of the sediments, including all the putative saltern pits and tanks and the various (dated) phases of the saltern mounds.

C.6 Radiocarbon dating certificates

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

RADIOCARBON DATING CERTIFICATE
13 August 2019

Laboratory Code	SUERC-87794 (GU51884)
Submitter	Zoe Ui Choileain Oxford Archaeology East 15 Trafalgar Way Bar Hill Cambridgeshire CB23 8SQ
Site Reference	XNFARL18EX/ENF145343
Context Reference	476
Sample Reference	311
Material	Charcoal : cf Betula sp
$\delta^{13}C$ relative to VPDB	-28.4 ‰
Radiocarbon Age BP	965 ± 26

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

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

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

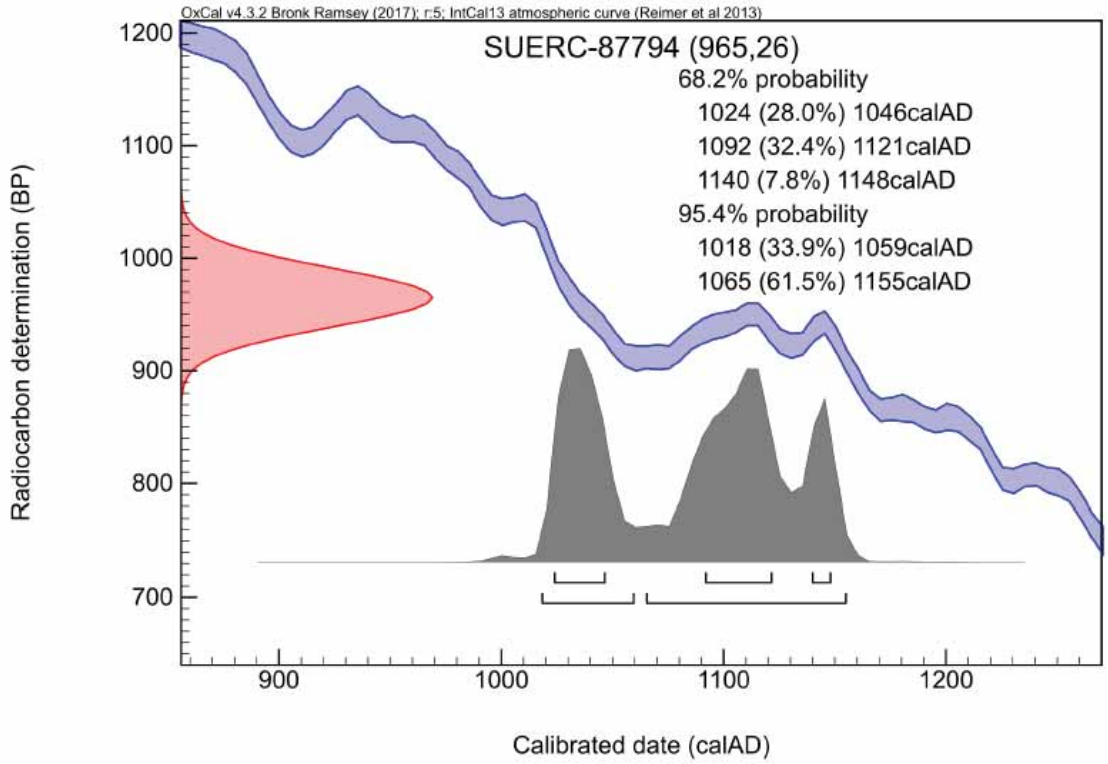
For any queries relating to this certificate, the laboratory can be contacted at suerc-c14lab@glasgow.ac.uk.

Conventional age and calibration age ranges calculated by :

Checked and signed off by :

University of Glasgow
The University of Glasgow, charity number SC004401

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



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

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

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

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

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

RADIOCARBON DATING CERTIFICATE
13 August 2019

Laboratory Code	SUERC-87795 (GU51885)
Submitter	Zoe Ui Choileain Oxford Archaeology East 15 Trafalgar Way Bar Hill Cambridgeshire CB23 8SQ
Site Reference	XNFARL18EX/ENF145343
Context Reference	495
Sample Reference	313
Material	Charcoal : Maloideae
$\delta^{13}C$ relative to VPDB	-28.2 ‰
Radiocarbon Age BP	1045 ± 26

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

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

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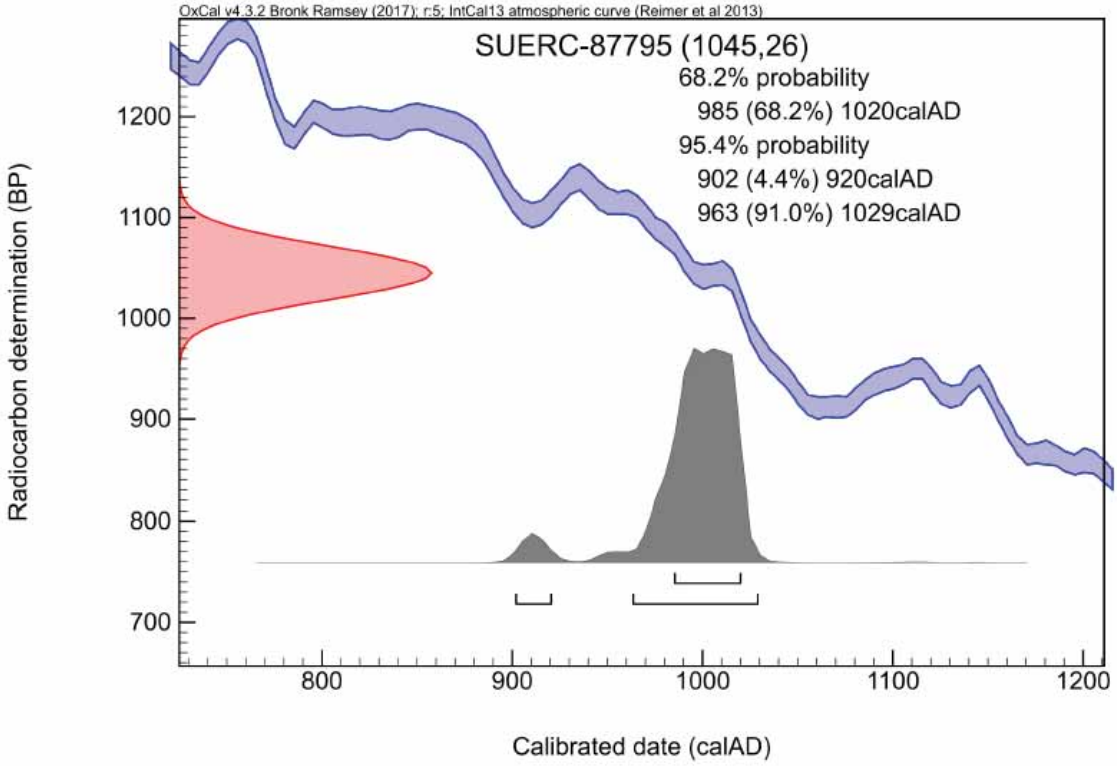
For any queries relating to this certificate, the laboratory can be contacted at suerc-c14lab@glasgow.ac.uk.

Conventional age and calibration age ranges calculated by :

Checked and signed off by :

University of Glasgow
The University of Glasgow, charity number SC004401

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



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RADIOCARBON DATING CERTIFICATE
13 August 2019

Laboratory Code	SUERC-87796 (GU51886)
Submitter	Zoe Ui Choileain Oxford Archaeology East 15 Trafalgar Way Bar Hill Cambridgeshire CB23 8SQ
Site Reference	XNFARL18EX/ENF145343
Context Reference	452
Sample Reference	314
Material	Charcoal-roundwood : cf Quercus sp
$\delta^{13}C$ relative to VPDB	-28.1 ‰
Radiocarbon Age BP	984 ± 26

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

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

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Conventional age and calibration age ranges calculated by :

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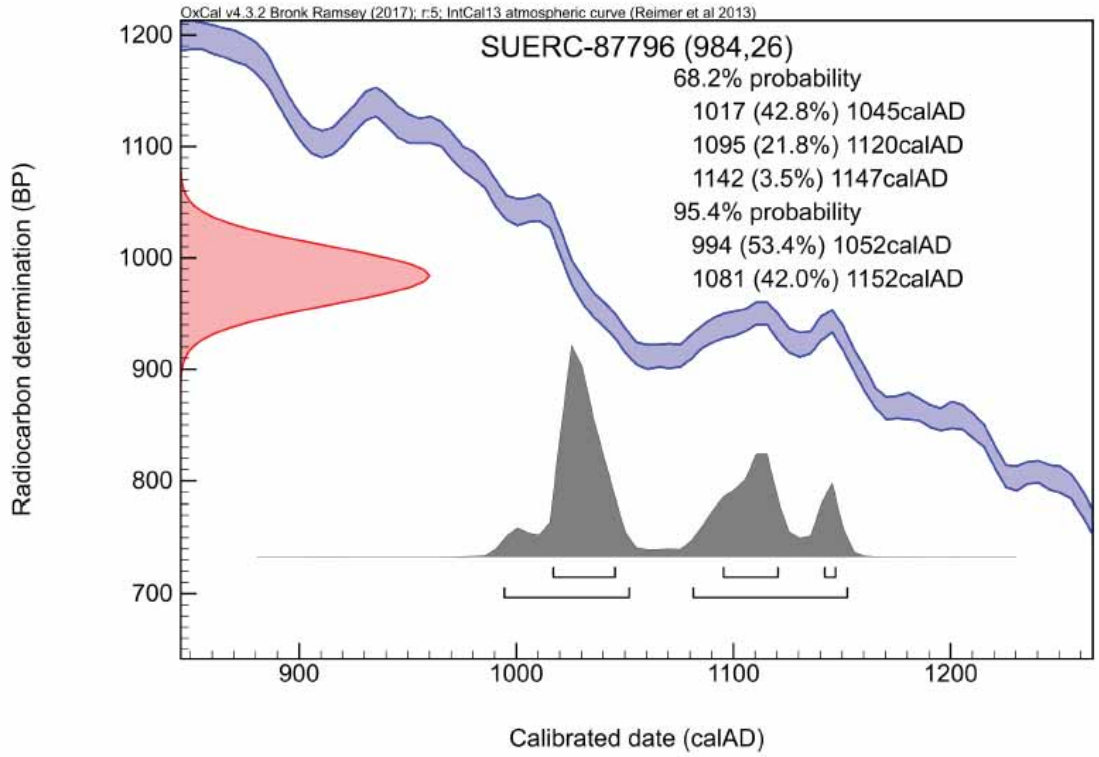

The radiocarbon age given overleaf is calibrated to the calendar timescale using the Oxford Radiocarbon Accelerator Unit calibration program OxCal 4.*

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

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

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

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

RADIOCARBON DATING CERTIFICATE
19 July 2019

Laboratory Code	GU51661
Submitter	Zoe Ui Choileain Oxford Archaeology East 15 Trafalgar Way Bar Hill Cambridgeshire CB23 8SQ
Site Reference	ENF145343/XNFARL18
Context Reference	461
Sample Reference	309
Material	cpr : linium usitatissimum
Result	Failed due to insufficient carbon.

N.B. Any questions directed to the laboratory should quote the GU coding given above.

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

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

Checked and signed off by : P. Naysmith

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APPENDIX D PRODUCT DESCRIPTION

Product number: 1
Product title: Full archive report
Purpose of the Product: To analyse the site and address the research aims and objectives stated in this report and to disseminate to the local community
Composition: Grey literature archive report deposited at Norfolk HER and ADS/OA online library
Derived from: Analysis of site records, specialist reports and data and background research
Format and Presentation: Grey literature client report
Allocated to: GC, MB
Quality criteria and method: Checked and edited by RC MB
Person responsible for quality assurance: MB
Person responsible for approval: MB
Planned completion date: September 2020

Product number: 2
Product title: Publication report
Purpose of the Product: To disseminate the findings of the archaeological investigations to the local community
Composition: Published report, in accordance with the relevant journal and EH guidelines
Derived from: Analysis of site records, specialist reports and data and background research
Format and Presentation: Article in serial journal on later prehistoric remains
Allocated to: GC, MB, EP
Quality criteria and method: Checked and edited by EP
Person responsible for quality assurance: EP
Person responsible for approval: EP
Planned completion date: (at earliest) 2020

APPENDIX E RISK LOG

E.1.1 The table below lists potential risks for the PX analysis work.

No.	Description	Probability	Impact	Countermeasures	Estimated time/costs	Owner	Date updated
1	Specialists unable to deliver analysis report due to over running work programmes/ ill health/other problems	Medium	Variable	OA has access to a large pool of specialist knowledge (internal and external) which can be used if necessary	Variable	GC MB LP	Sept. 2019
2	Non-delivery of full report due to field work pressures/ management pressure on co-authors	Medium	Medium-high	Liaise with OA management team	Variable	GC MB LP	Sept. 2019

Table 42: Risk log

APPENDIX F HEALTH AND SAFETY POLICY

F.1.1 All OA post-excavation work will be carried out under relevant Health and Safety legislation, including the Health and Safety at Work Act (1974). A copy of the Health and Safety Policy can be supplied. The nature of the work means that the requirements of the following legislation are particularly relevant:

- Workplace (Health, Safety and Welfare) Regulations 1992 – offices and finds processing areas
- Manual Handling Operations Regulations (1992) – transport: bulk finds and samples
- Health and Safety (Display Screen Equipment) Regulations (1992) – use of computers for word-processing and database work
- COSSH (1988) – finds conservation and environmental processing/analysis

APPENDIX G OASIS REPORT FORM

Project Details

OASIS Number	Oxfordar3-363781
Project Name	Late Saxon to Early Medieval Salterns at Lynnsport 1: Land South of Aconite Road, King's Lynn, Norfolk. Post Excavation Assessment and Updated Project Design

Start of Fieldwork	14/1/19	End of Fieldwork	1/2/19
Previous Work	Yes	Future Work	No

Project Reference Codes

Site Code	ENF145343	Planning App. Number	16/00227/FM
HER Number	ENF145343	Related Numbers	

Prompt	National Planning Policy Framework (NPPF)
Development Type	Urban Residential

Techniques used (tick all that apply)

☐ Aerial Photography – interpretation	☒ Open-area excavation	☐ Salvage Record
☐ Aerial Photography - new	☐ Part Excavation	☐ Systematic Field Walking
☐ Field Observation	☐ Part Survey	☐ Systematic Metal Detector Survey
☐ Full Excavation	☐ Recorded Observation	☐ Test-pit Survey
☐ Full Survey	☐ Remote Operated Vehicle Survey	☐ Watching Brief
☐ Geophysical Survey	☐ Salvage Excavation	

Monument	Period
Saltern mound	Early Medieval (410 to 1066)
Filtration tank	Early Medieval (410 to 1066)
pit	Early Medieval (410 to 1066)

Object	Period
pottery	Early Medieval (410 to 1066)
bone	Early Medieval (410 to 1066)
Fired clay	Early Medieval (410 to 1066)

Insert more lines as appropriate.

Project Location

County	Norfolk
District	King's Lynn and West Norfolk
Parish	King's Lynn
HER office	Norfolk
Size of Study Area	717m²

Address (including Postcode)

Land south of Aconite Road
King's Lynn
Norfolk
PE30 3PN

National Grid Ref	TF 63371 21278	

Project Originators

Organisation	Oxford Archaeology East
Project Brief Originator	James Albone
Project Design Originator	Matt Brudenell
Project Manager	Matt Brudenell
Project Supervisor	Kathryn Blackbourn

Project Archives

	Location	ID
Physical Archive (Finds)	Norwich Castle Museum	ENF145343
Digital Archive	Norwich Castle Museum	ENF145343
Paper Archive	Norwich Castle Museum	ENF145343

Physical Contents	Present?	Digital files associated with Finds	Paperwork associated with Finds
Animal Bones	☒	☒	☒
Ceramics	☒	☒	☒
Environmental	☒	☒	☒
Glass	☐	☐	☐
Human Remains	☐	☐	☐
Industrial	☒	☒	☒
Leather	☐	☐	☐
Metal	☐	☐	☐
Stratigraphic		☐	☐
Survey		☐	☐
Textiles	☐	☐	☐
Wood	☐	☐	☐
Worked Bone	☐	☐	☐
Worked Stone/Lithic	☒	☒	☒
None	☐	☐	☐
Other	☐	☐	☐

Digital Media		Paper Media	
Database	☒	Aerial Photos	☐
GIS	☐	Context Sheets	☒
Geophysics	☐	Correspondence	☐
Images (Digital photos)	☒	Diary	☐
Illustrations (Figures/Plates)	☒	Drawing	☒
Moving Image	☐	Manuscript	☐

Spreadsheets	☒	Map	☐
Survey	☒	Matrices	☐
Text	☒	Microfiche	☐
Virtual Reality	☐	Miscellaneous	☐
		Research/Notes	☐
		Photos (negatives/prints/slides)	☐
		Plans	☒
		Report	☒
		Sections	☒
		Survey	☐

Further Comments

Museum accession number to be acquired for the combined Lynnsport 1-5 project.

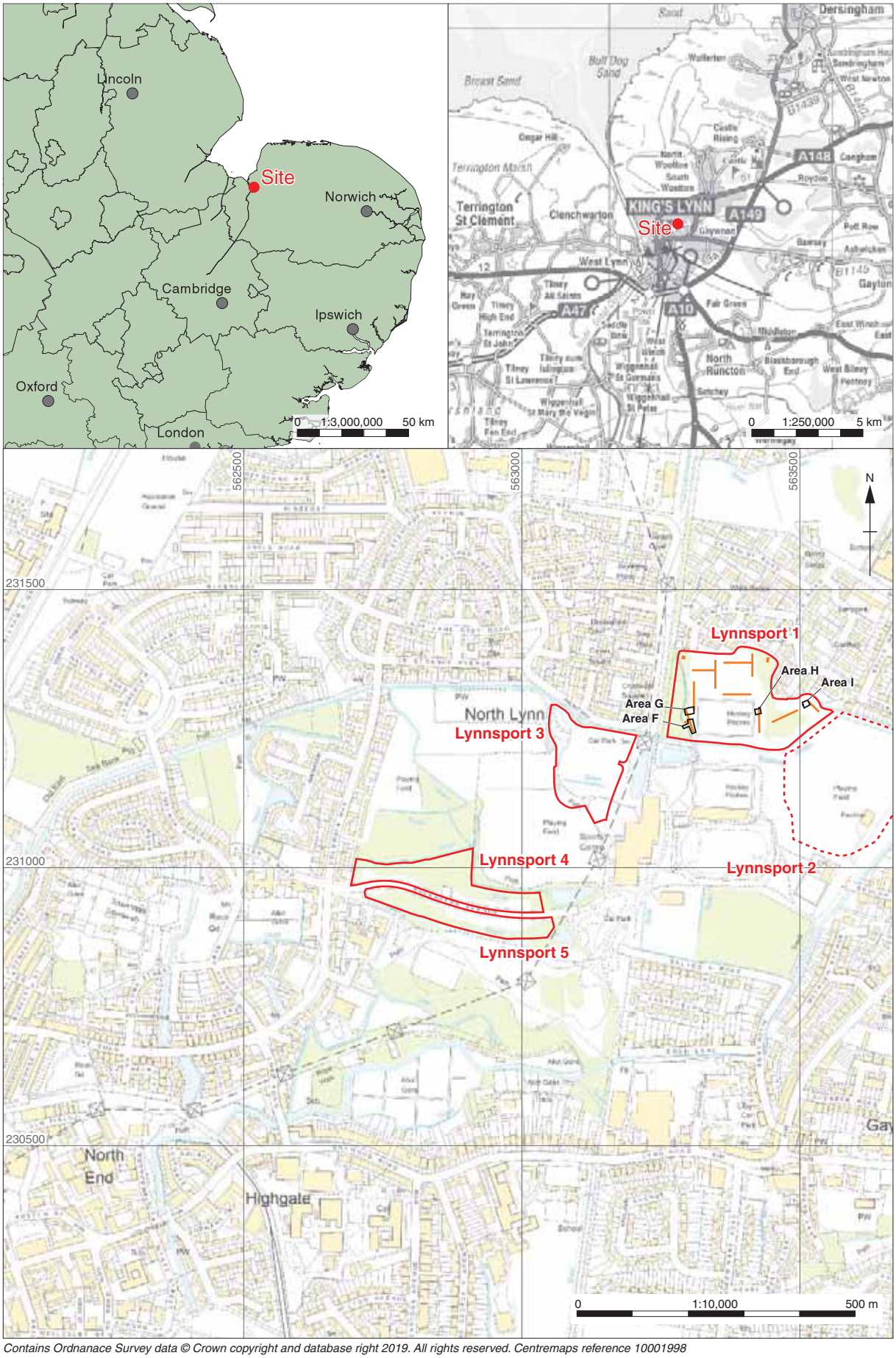


Figure 1: Site location showing excavation areas outlined (black), evaluation trenches and test pits (orange) in development area and adjacent Lynnsport sites outlined (red)

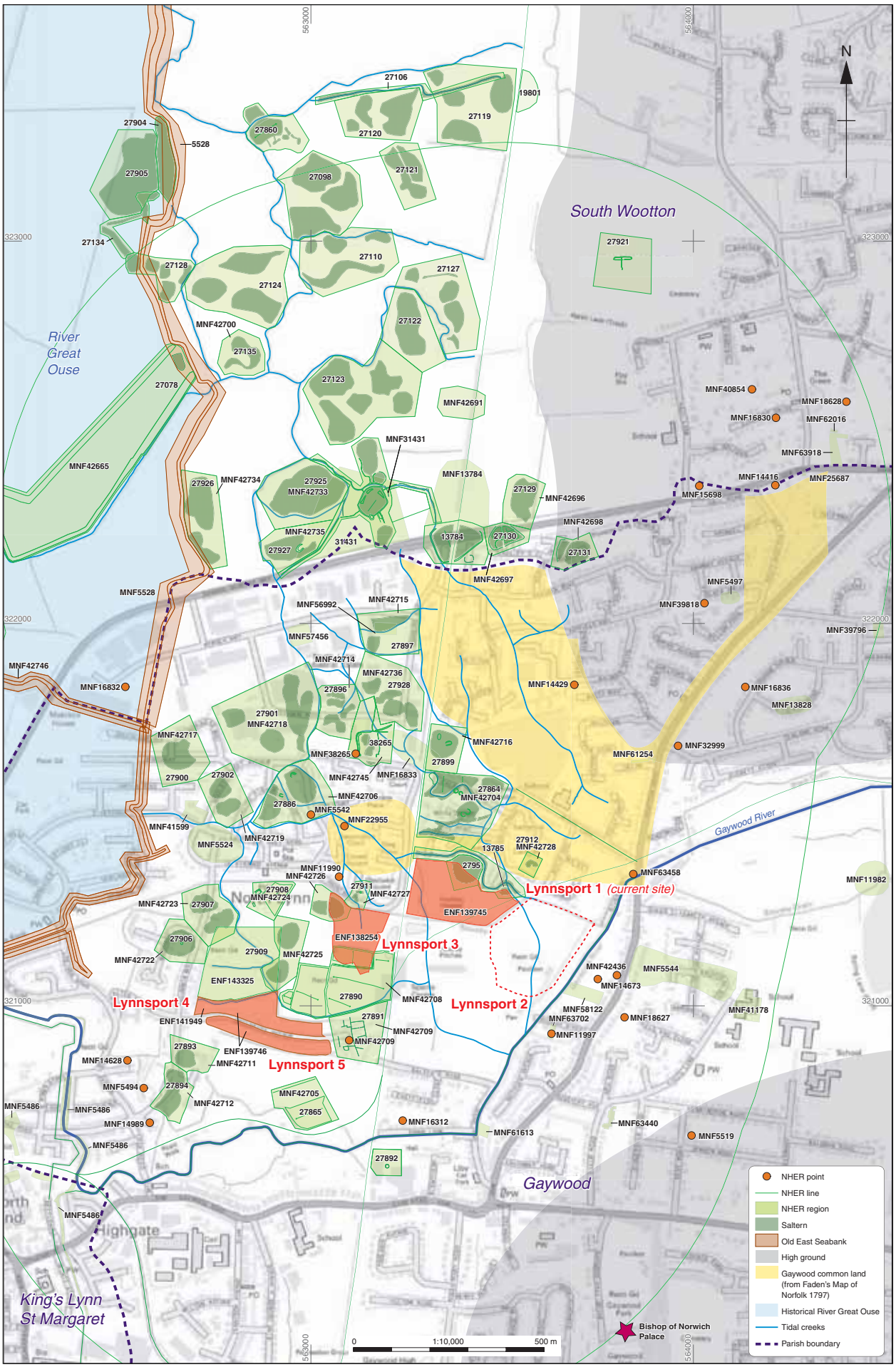


Figure 2: Map showing location of NHER records with NMP data (Copyright Historic England National Mapping Programme, licensed to Norfolk County Council). Sea banks & pre-existing tidal creeks mapped from historic photograph (NHER reference: TF62_TF6321_A_RAF_16Apr1946.tif). Site development areas shown in red.

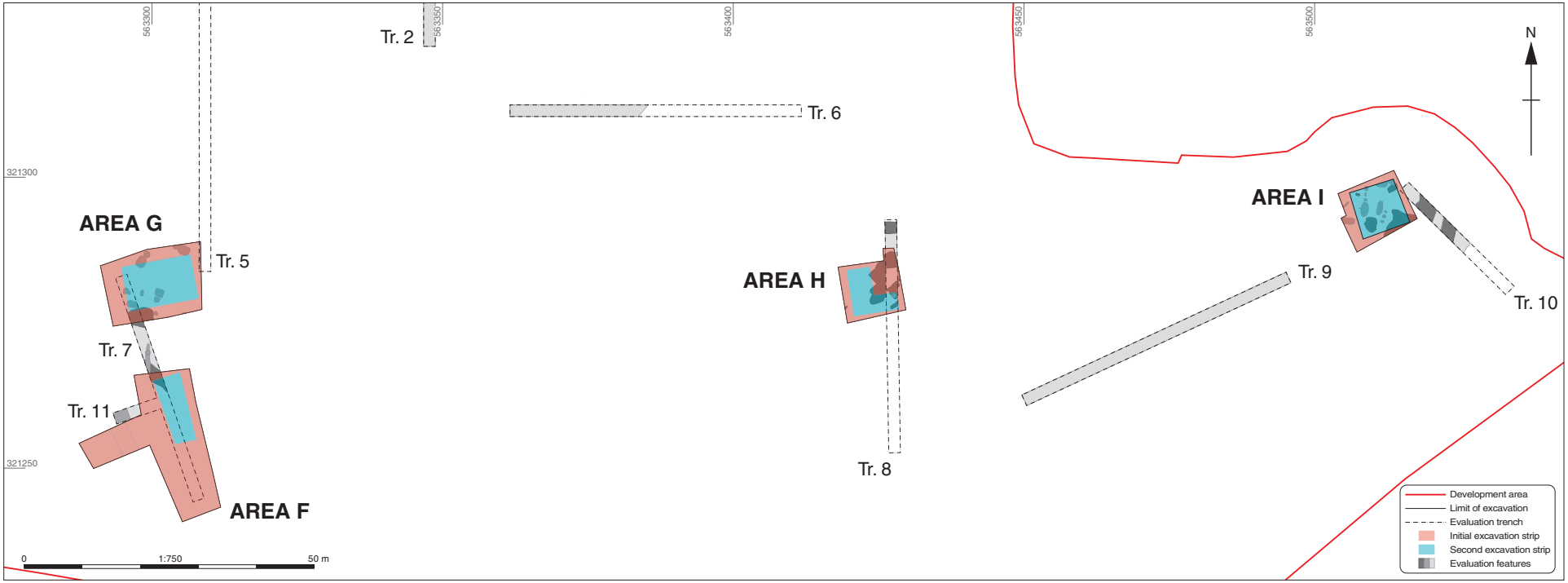


Figure 3: All areas showing phases of excavation

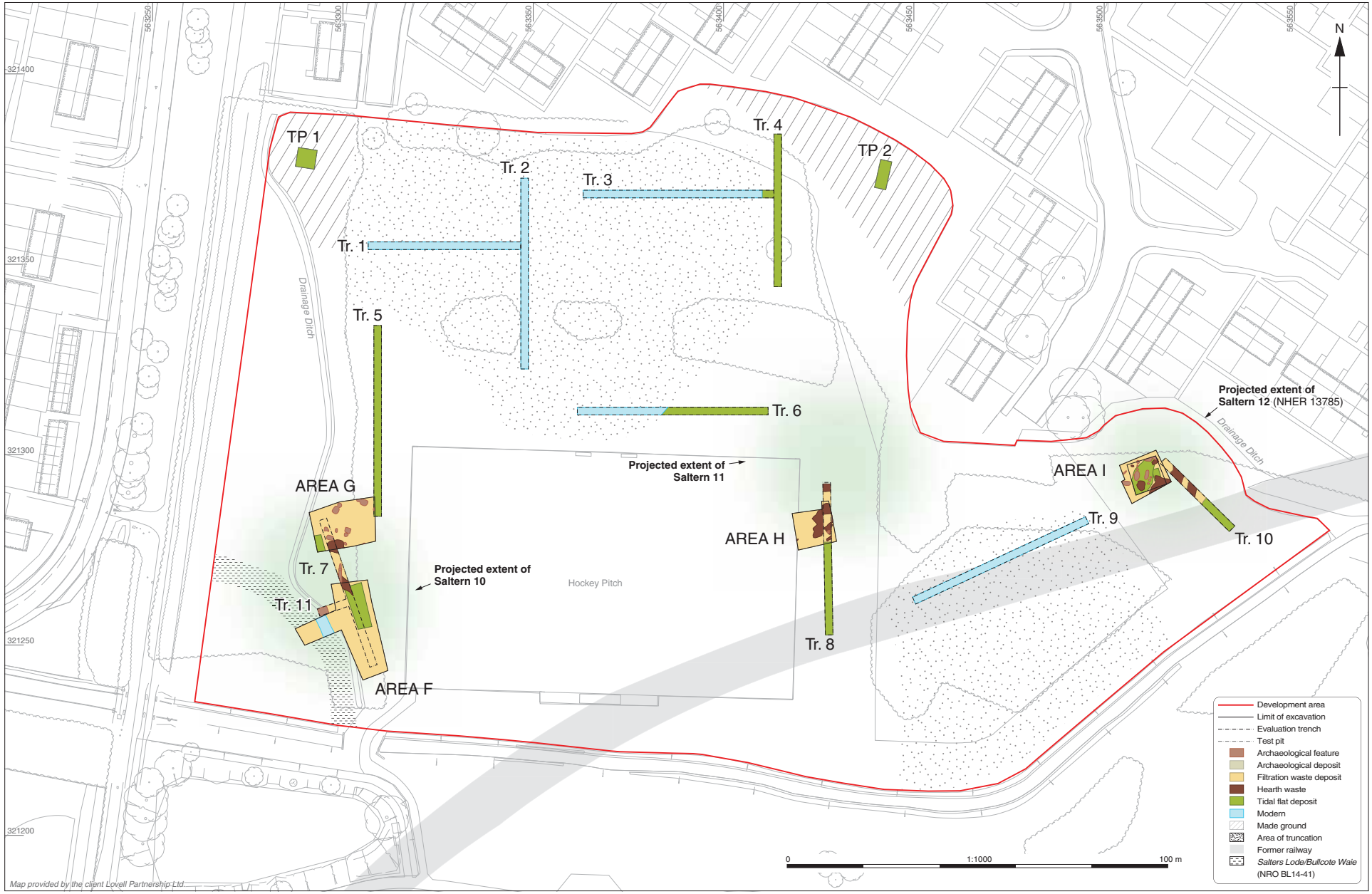


Figure 4: All excavation areas plan with evaluation trenches

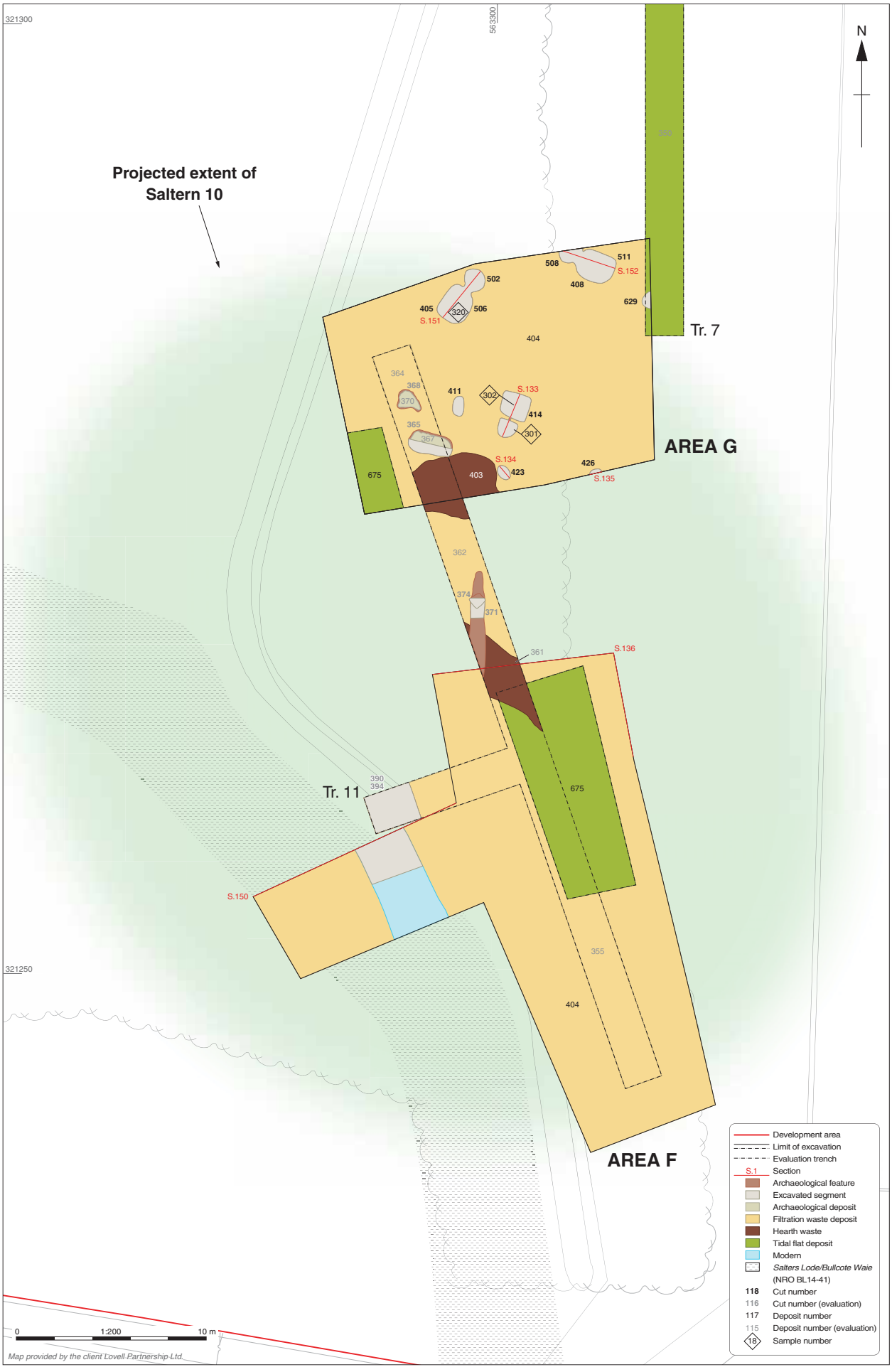


Figure 5: Plan of Areas F and G

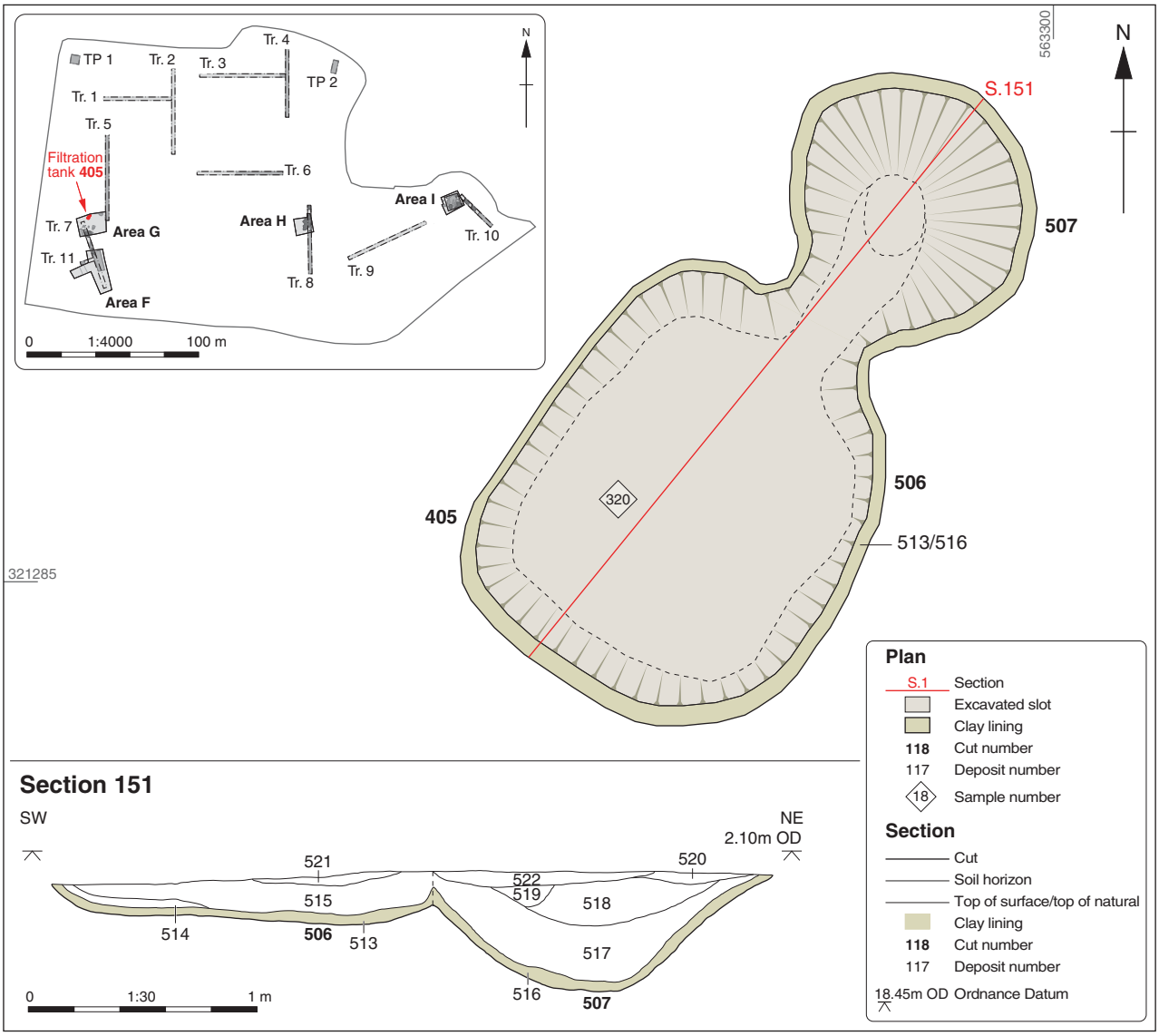


Figure 6: Plan and section of filtration tank **405**

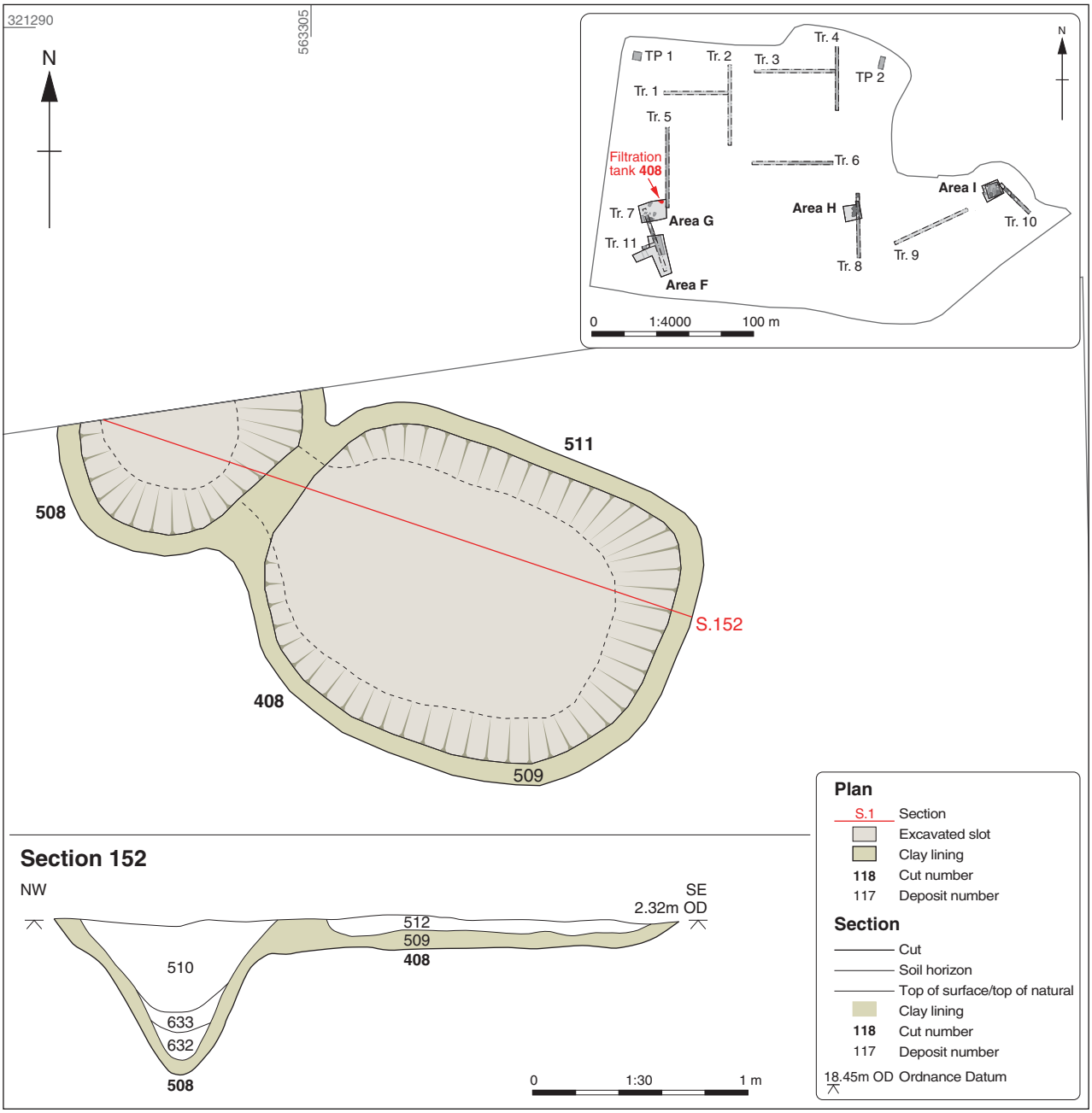


Figure 7: Plan and section of filtration tank **408**

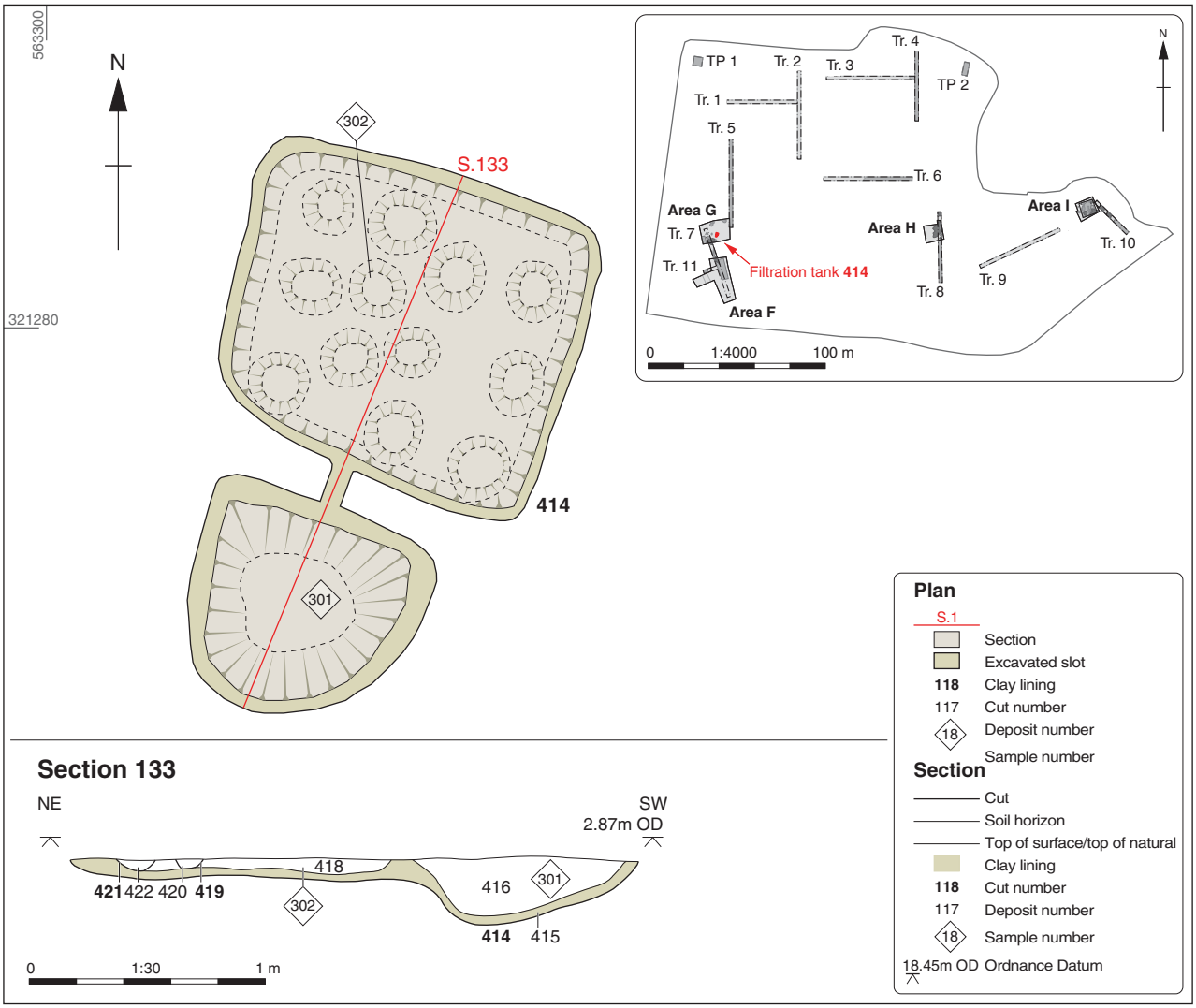


Figure 8: Plan and section of filtration tank **414**

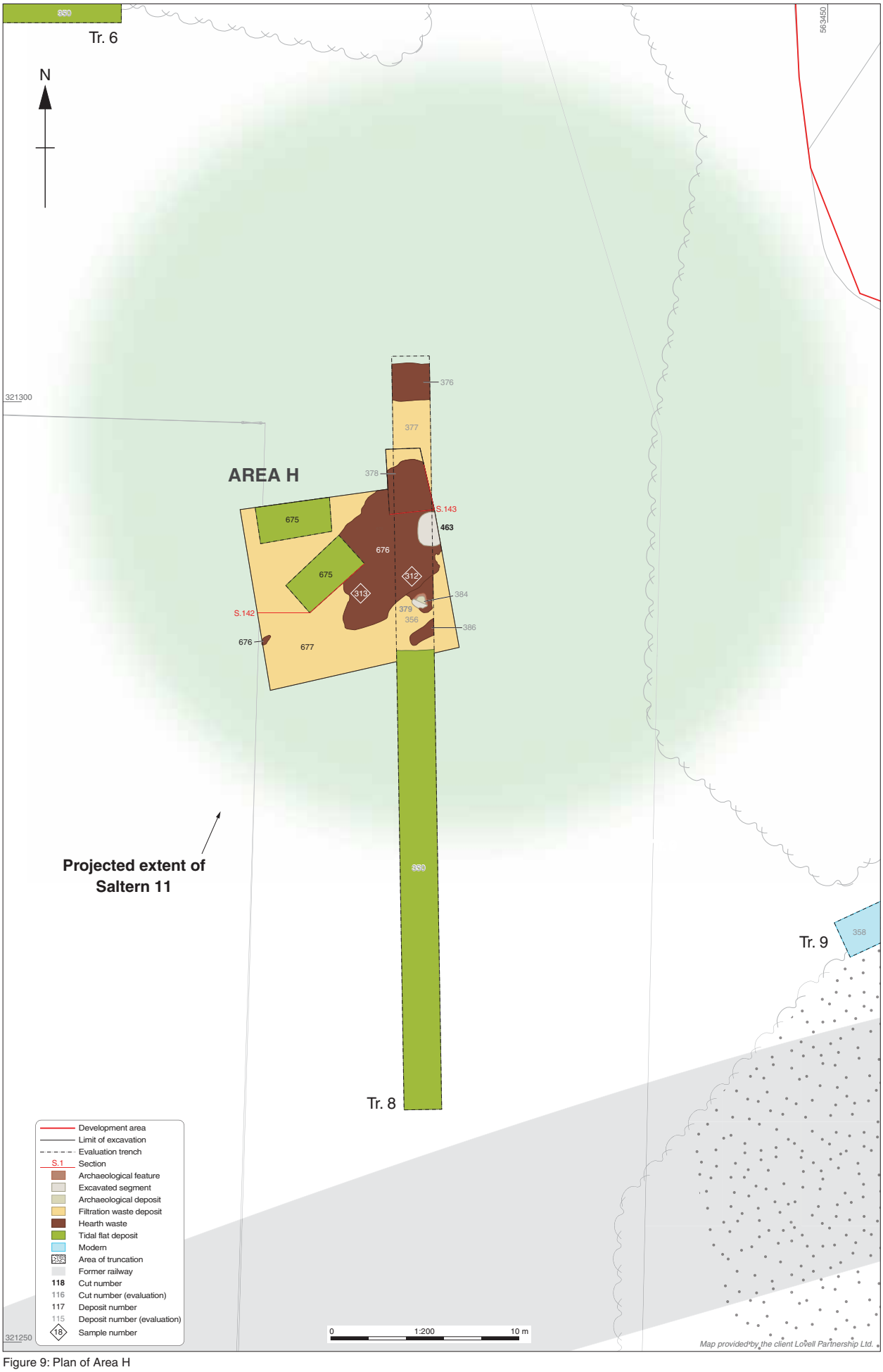


Figure 9: Plan of Area H

Figure 10: Plan of Area I after secondary strip

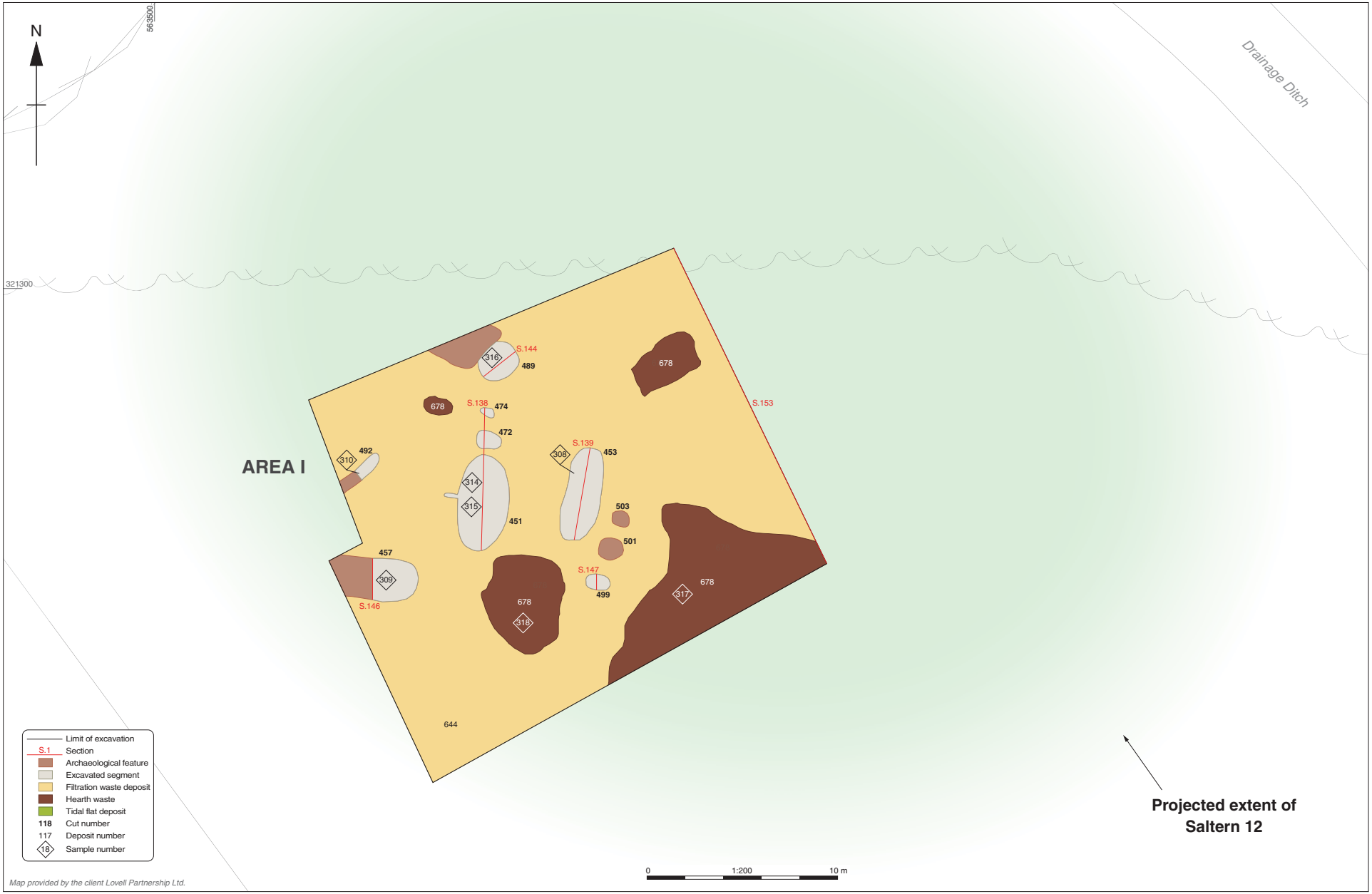


Figure 11: Plan of Area I after initial strip

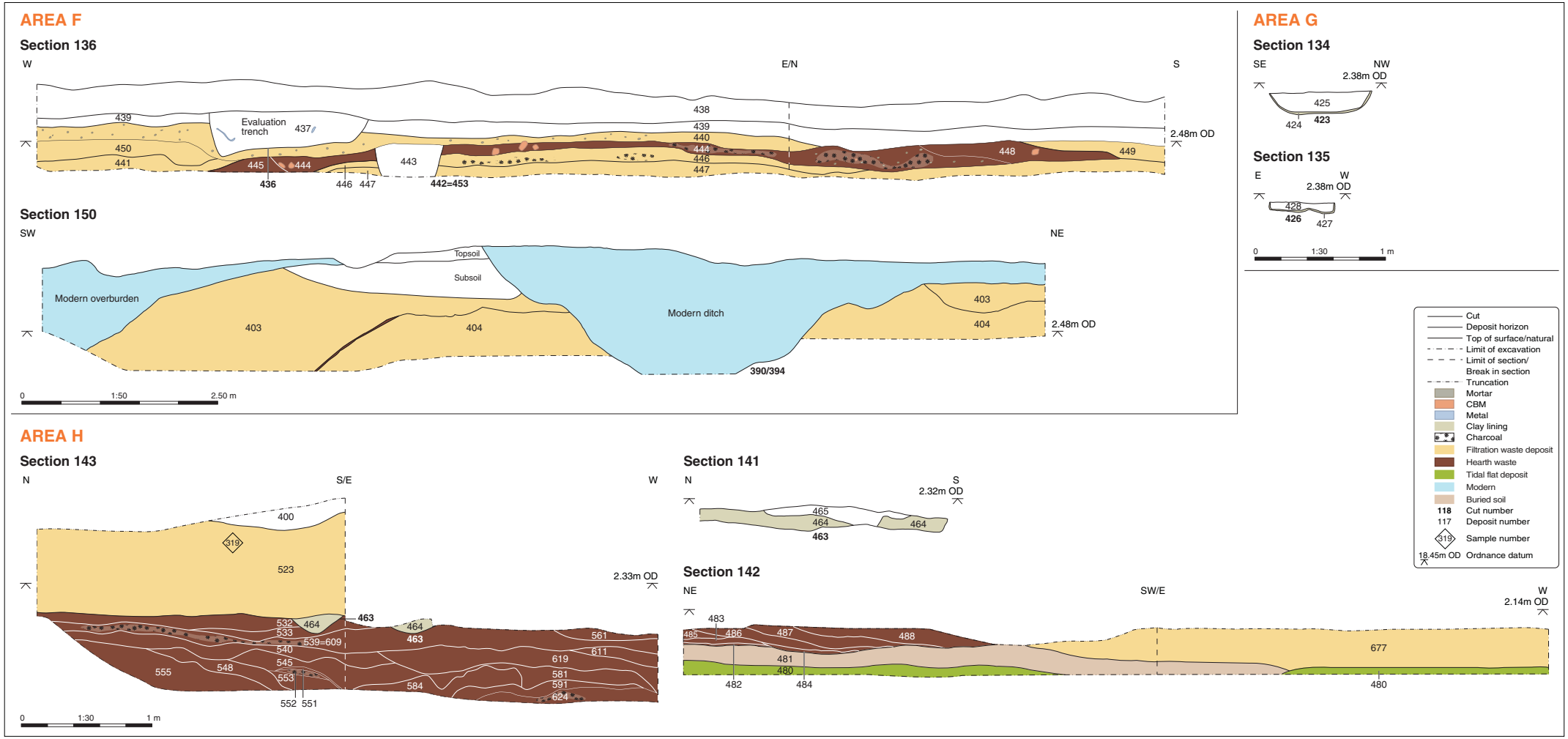
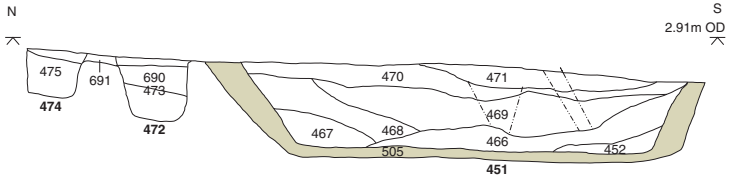


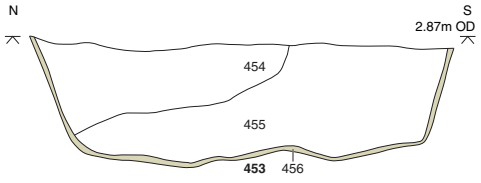
Figure 12: Selected sections (Areas F and H)

AREA I

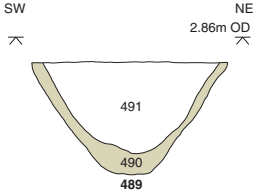
Section 138



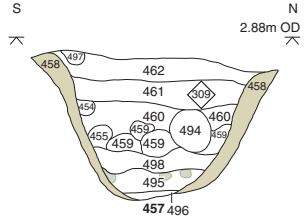
Section 139



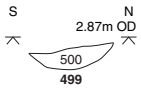
Section 144



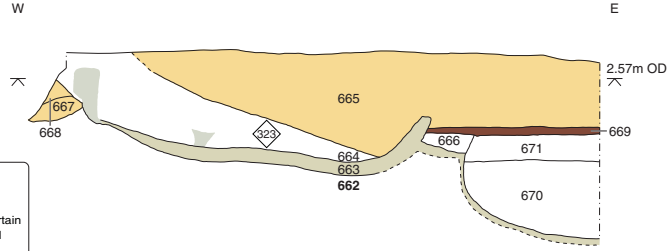
Section 146



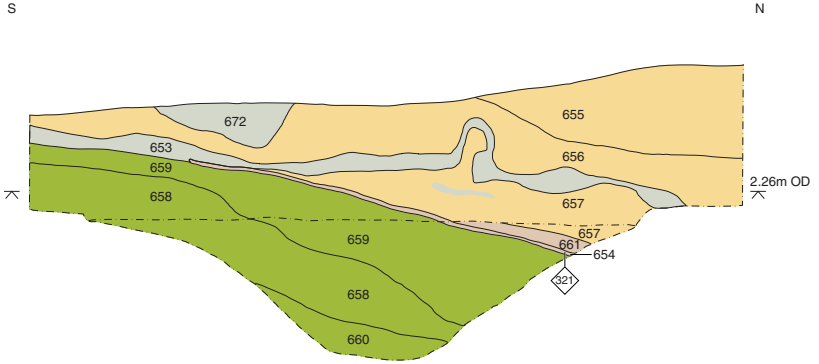
Section 147

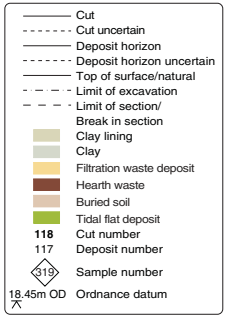


Section 156



Section 155





Section 153

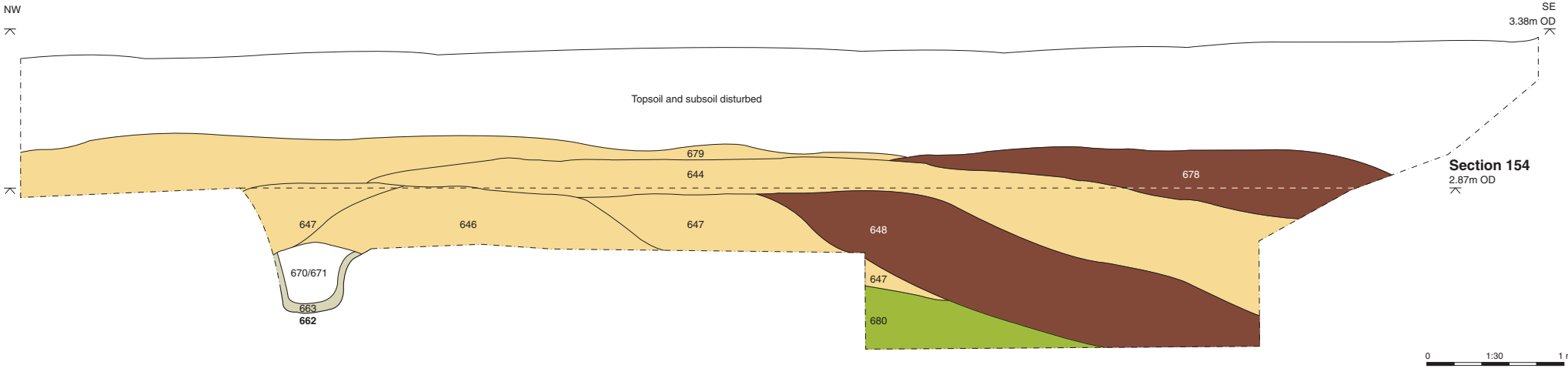


Figure 13: Selected sections

Plate 1: Area G, looking north-west

Plate 2: Filtration tank **414**, Area G, looking south-east

Plate 3: Filtration tank **405**, Area G, looking north-west

Plate 4: Clay lined pit **411**, Area G, looking north-west

Plate 5: Photogrammetry of Area H

Plate 6: Saltern 11, Area H, looking east

Plate 7: Clay lined pit **463**, Area H, looking east

Plate 8: Photogrammetry of Area I fully excavated

Plate 9: Photogrammetry of Area I excavation (initial strip)

Plate 10: Tidal silts 675 and buried soil 654 and 661, Area I, looking south-west

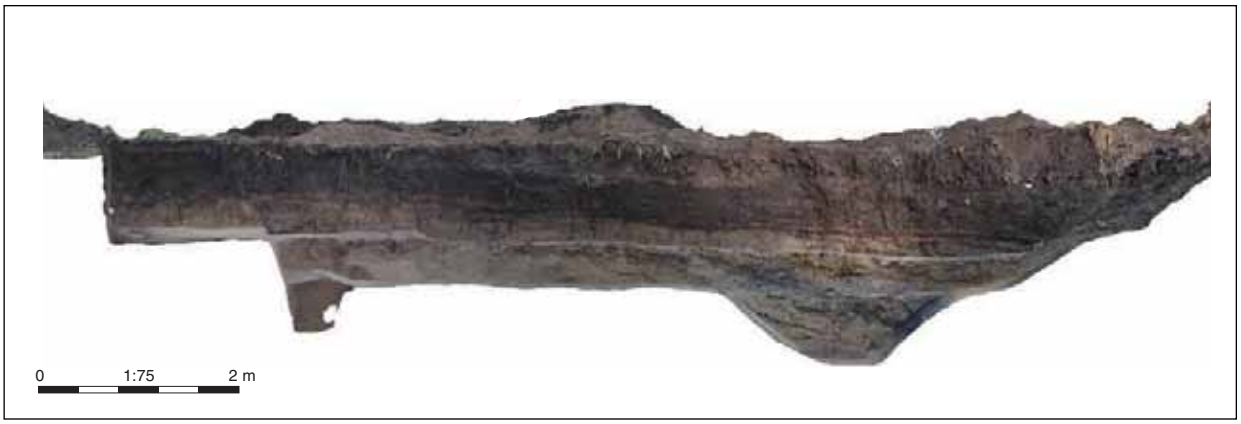


Plate 11: Saltern 12, Area I, looking north-east

Plate 12: Clay lined tank **451**, Area I, looking east

Plate 13: Clay lined tank **457**, Area I, looking west

Plate 14: Modern ditch cutting through filtration deposits of Saltern 10, Area F, looking north-west

oxfordarchaeology

Head Office/Registered Office/ OA South

Janus House
Osney Mead
Oxford OX2 0ES

t: +44 (0) 1865 263 800
f: +44 (0) 1865 793 496
e: info@oxfordarchaeology.com
w: http://oxfordarchaeology.com

OA North

Mill 3
Moor Lane
Lancaster LA1 1QD

t: +44 (0) 1524 541 000
f: +44 (0) 1524 848 606
e: oanorth@oxfordarchaeology.com
w: http://oxfordarchaeology.com

OA East

15 Trafalgar Way
Bar Hill
Cambridgeshire
CB23 8SQ

t: +44 (0) 1223 850500
e: oaeast@oxfordarchaeology.com
w: http://oxfordarchaeology.com