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LINDSEY ARCHAEOLOGICAL SERVICES

Springfield Outlet Shopping and Festival Garden
Spalding, Lincs.
Archaeological Excavation

NGR: TF 2650 2400
Site Code: SSFG 03
LCNCC Accession No.: 2003.51

Report for

Thornfield Properties plc

LAS Report No. 801

May 2005

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Springfield Outlet, Shopping and Festival Garden, Spalding, Lincs.
Archaeological Excavation
NGR: TF 2650 2400
Site Code: SSFG 03
LCNCC Accession No.: 2003. 51
South Holland District Council Planning Application Nos. : H16/0361/02, H16/01777/02 and H/16/0360/02

Summary

Excavation at the Springfield Outlet revealed that the former shopping and garden centre had been an intertidal zone in the past. Evidence for this environment was preserved in the flora and fauna found in samples taken from the ancient water courses discovered during the excavations. Areas of high ground were present at the southern (Area 2) and western (Area 4 limits of the site), where the line of a roddon (formerly believed to be a sea bank) was identified. After tidal inundation ceased in the late Saxon period ditches were excavated to drain and reclaim the land. Area 1 was once a water meadow. By the 11th century this reclamation scheme had been successful enough to prompt occupation in Area 2, where ditches and rubbish pits marked the periphery of habitation. The presence of only a few animal bones confirms the interpretation that much of the area investigated was reclaimed land used as pasture for grazing animals and possibly for growing crops, rather than human occupation. The limited evidence for occupation near Area 2 indicated that it ceased in the 13th century, re-locating to Area 4 into the 14th century, where hedged ditches defined parcels of land for animal husbandry. The site apparently continued to be grassland until the Springfield Outlet was built, but there is little evidence for nearby occupation after the 14th century

The results from these excavations highlight the importance of environmental assessment as an integral part of the evaluation process. The lack of environmental input at the evaluation stage led to a misinterpretation of how the area had developed, resulting in the recommendation for excavation to be carried out on a part of the site, which subsequent environmental analysis showed was uninhabitable. The disparate group of natural features, ditches, pits and postholes gave very little indication of the nature and status of occupation in the Spalding area on their own. They might, understandably, have been dismissed as being of only passing interest. However, the results from the environmental analysis have provided significant evidence of land exploitation on the margins and human adaptation as the environment altered over time. Pottery from the site is a small but important group of early material with evidence for local trading, mainly with Bourne, and a few of the other finds hint at international trading contacts. Any links with the development of Spalding itself can only remain conjectural.

Introduction

Lindsey Archaeological Services (LAS) was commissioned by Thornfield Properties plc to undertake an archaeological excavation in accordance with the requirements set out in the *Lincolnshire Archaeological Handbook* published by the Archaeology Section, Lincolnshire County Council (1998) and a brief set by the Heritage Section Lincolnshire County Council on behalf of South Holland District Council. Work commenced 10/02/2003 and was completed 27/03/03, with environmental specialists visits during the period of fieldwork.

Planning Background

In February 2001 outline planning consent for planning application H16/0569/98 was granted by the Secretary of State for the Environment, Transport and the Regions for The Springfield Outlet Shopping and Festival Garden complex to be extensively redeveloped for leisure, horticultural, food and drink, retail and craft workshop related use with landscaping, car-parking and highway improvements included. The consent was subject to conditions which included provision for archaeological investigation of the site which stated:

Before development commences details of a scheme of archaeological investigation shall be submitted to and approved in writing by the local planning authority. The scheme shall provide for

a) the proper identification and evaluation of the extent, character and significance of archaeological remains within the application site.

b) an assessment of the impact of the proposed development on the archaeological remains

c) proposals for the preservation in situ for the investigation, recording and recovery of archaeological remains and the publishing of findings(it being understood that there shall be a presumption in favour of their preservation in situ, wherever possible).

d) sufficient notification and allowance of time to [an] archaeological contractor nominated by the developer to ensure that archaeological fieldwork as proposed in pursuance of a) and c) above is completed prior to the commencement of permitted development in the area of archaeological interest.

e) notification in writing to the County Archaeologist of the commencement of permitted development of archaeological works and the opportunity to monitor such works.

On September 20th 2002 S. Holland District Council granted approval of reserved matters for a new planning application H16/0361/02 for redevelopment of the site as originally applied for in 1998.

On September 23rd Outline Planning permission was granted by S.Holland District Council for the development of a garden centre with associated external facilities, car parking and access

site subject to identical archaeological conditions as described above. Planning permission was also granted for the development of a building for Class A (food and drink) purposes on the site subject to identical archaeological conditions as described above.

Site Location

The town of Spalding straddles the River Welland, which flows north through the fenlands of South Lincolnshire and into the Wash. The Springfield complex site is located on the north eastern edge of Spalding and was formerly occupied by Springfield Gardens. This comprised greenhouses, a managed lawn and landscaped gardens with a grassed area to the west acting as a temporary car park (Fig.1)

Topography and Geology

Spalding is sited on marine alluvium of the Terrington Beds, with Oxford Clay beneath. The site is *c*.3.50m OD above sea level.

Archaeological Background and Previous Work

Spalding is mentioned in the Domesday Survey of 1086 when two manors (estates) are recorded with further land held by the monks of Crowland Abbey. A desk based assessment in 1999, undertaken for Giffords and Partners Ltd (Gifford 1999) concluded that there was a possible presence of archaeological deposits associated with the Romano-British settlement in Spalding. Quantities of Romano-British, Saxo-Norman and medieval pottery sherds had been recovered on, and around, the site. Work undertaken on land at Holbeach Road by 1998 (APS 1998) had established that Roman deposits lay up to 1m below the present ground level. Salt making deposits of Roman or Anglo-Saxon date were also considered a possibility as was early medieval exploitation and drainage of the fenland landscape and tidal control.

In 2000 a watching brief, carried out during the excavation of footings for a hall and office extension at the north-west end of Springfield Garden Centre, noted no archaeological remains (APS 2000). Monitoring of 25 geotechnical test pits during 2001 only three test pits showed signs of past human activity (3E Consulting Engineers 2002). A geophysical survey was undertaken by Archaeological Services University of Durham (ASUD) in 2002 of areas to be affected by redevelopment, to determine the presence or absence of archaeology and its extent (ASUD 2002a). An archaeological evaluation also by ASUD followed later that year. This work established 10th – 13th century occupation at the southern and central west end of the development with ditches at the centre, eastern and western areas of development. A possible medieval flood defence bank was noted west of Camel Gate (ASUD 2002b).

An archaeological written scheme of investigation was prepared, comprising proposals for targeted excavation and sampling of those areas of the site to be affected by the development

which were thought to be particularly rich in archaeological and environmental remains, based upon the results of the evaluation (Gifford 2002).

Aims and Objectives

The principal aim of the excavation was to allow the preservation by record of archaeological deposits, palaeoenvironmental deposits and artefactual and ecofactual assemblages.

The specific aims of the project were to

- Refine the character and date of human ocupation and activity at the site
- Determine and understand the environmental history of the site by examination of the flood deposits
- To investigate the human response to climatic change in the form of drainage and land management
- Investigate the development of medieval Spalding and its hinterland
- Investigate the development of early medieval nucleation
- Provide data which will supplement the current state of knowledge provided by the Fenland Survey

Method

Recording System

L.A.S. operates a standard context recording system, developed by its staff over the past 20 years based on MOLAS and CAS models. A full written (single context) and photographic record was made of the site, including site plans at a scale of 1:20 and 1:50, as appropriate, and section drawings at 1:10. Temporary bench marks were set up on the site and tied in to a fixed bench mark. A full photographic record, in colour print, 35mm format, was made during the progress of the evaluation to cover principal features together with general site views.

A full context list and deposit measurements can be found in Appendix 1.

The Excavation

Five trenches and four open areas of excavation were investigated (Fig. 2). All but one of the areas (4) and one of the trenches (4) were located within the existing shopping and festival garden complex. Many of the trenches had to be repositioned due to a request that all trees should be left undisturbed.

Trench 1, aligned north/south had to be dug in two segments because it straddled a brick wall and an overhanging metal frame which restricted access to the 360° excavator. Segment 2 of Trench 1, attached to Area 1 was *c.*54m long, whilst segment 1, slightly west of Segment 2, was

*c.*21m in length. Continuing the trench southward would have intruded on the parking facilities at the NFU building, blocking access, so the trench was not dug to its full 100m.

Trench 2 was orientated north-west/south-east and was *c.*70m in length. Trench 3 was *c.*60m in length north/south and *c.*22m east/west. Trench 4 was *c.*42m long and, after enlargement, *c.*10m wide. Trench 5 comprised two segments totalling *c.*54m in length.

Area 1 was originally intended to be *c.*40m x 40m in extent but the original proposed location of the trench was over occupied buildings so the trench had to be moved and re-orientated with a reduced size of *c.*35m x *c.*31m. Area 2 measured approximately 56m x 18m. Its size also had to be altered because of active drains and access problems. Area 3, located close to the ornamental pond, was *c.*20m x *c.*20m whilst Area 4 was *c.*29m x *c.*15m.

Results

Trench 1 (Fig. 3, Pls. 1 - 5)

Segment 1

The southernmost part of the trench, cut through a path comprising paving slabs 0.06m deep, **100**, sealing 0.07m of coarse bedding for the slabs of sand and gravel, **101**. Former topsoil, **102**, below **101** was a soft brown grey sand silt whose depth varied from 0.05m to 0.30m. It sealed a north-west/south-east aligned ditch **140**, 4.15m wide and 0.42m deep, filled by dark grey clay silt, **103**, 0.08m deep, light brown fine sand silt **104** and **142**, a soft grey brown sand silt,.

Beneath **140**, at the south end of the trench, was a north-east/south-west aligned creek, **124**, 1m deep, whose full width was not exposed within the trench. It contained a series of silts and sand silts, **118**, **119**, **120**, **121**, **122**, **123**, and **125**.

Below creek **124** was a north-west/south-east orientated palaeochannel **117**, estimated to have a length of over 7.50m and a depth in excess of 0.85m. **117** was filled by a series of brown clay sand silts **105**, **106**, **110 114** and **115**, grey brown sand silts, **107**, **111**, **112** and **113**, and grey light blue sand silts, **108** and **109**.

Cut by **117**, was layer **116**, a grey brown silt clay layer below **124**, whose full depth was not exposed.

A second ditch, **141**, was found *c.*13m from the south end of segment 1, and cut through by ditch **140**. It was aligned east/west and 0.65m wide, 0.40m deep and steep sided with a flat base. It contained **133**, a grey silt with mussel shells and charcoal flecks, from which a sherd of

11th century pottery and a piece of animal bone were recovered, and **134** soft grey brown silt with charcoal flecks.

'V' shaped ditch **132**, immediately to the south of **141**, also had a flat base. It was 1.15m wide and 0.65m deep, filled by **126**, brown grey sand silt containing charcoal flecks and mussel shells, **127**, organic sticky grey clay with charcoal flecks, **128**, light grey brown clay silt mottled with iron panning, **129**, light grey blue fine silt, less than 0.02m deep, **130**, grey brown clay sand silt with panning and **131**, pale orange with rust coloured panning. A similarly shaped ditch, **136**, of similar dimensions, filled by yellow grey brown sand silt, **135**, was noted to the south, cut by **117**.

To the north of the ditches was a 0.25m deep yellow grey brown sand silt layer, **137**, which sealed **138**, 0.28m deep, orange brown clay sand silt, above **139**, firm grey brown silt clay.

Segment 2

Segment 2 was to the north of segment 1 and connected to Area 1. It was placed between two slab paths, within a gardening bed. All archaeological activity was found in the southernmost 14m of the trench. Topsoil, **158**, had a depth of 0.23m whilst the subsoil, **159**, was 0.35m deep. Ditch **143**, 0.91m wide and 0.49m deep, was north-north-east/south-south-west aligned and continued beyond the trench limit. It had three fills, **144**, yellow brown sand silt, **145**, grey blue sand silt with rust coloured flecks and **146**, a 0.19m deep grey blue clay sand silt with frequently occurring panning. This ditch had a 0.30m deep re-cut, **155**, which was filled with yellow brown sand, **154**, laminated dark grey clay silts, **156**, and primary silting, **157**, light grey sand silt.

Ditches **143** and **150** cut firm grey brown silt clay, **147/160**, which was above a pocket, of dirty white sand, **148**, fill of a naturally formed feature, **149**.

Cutting **143** was an east/west orientated, , modern ditch, **153**. It was 1.30m wide and filled with dark grey brown silt sand, **152**, which was not excavated (as agreed in consultation with the Senior Built Environment Officer). To the north of **153**, and cut by it, was an earlier east/west aligned ditch, **150**, 2.75m wide and 0.60m deep. This ditch had one fill, mixed grey and brown sand **151**.

Trench 2 (Fig. 4, Pls. 6 - 7)

The eastern limit of the trench cut through a path which comprised tarmac **221**, 0.02m deep, over limestone brash, **208** above an oily blue grey silt, **222**, which contained a sherd of 12th century pottery.

Topsoil, **201**, 0.30m deep, sealed subsoil **202** which was up to 0.50m deep and contained a late

12th – 13th century piece of pottery. A modern drain with drain pipe, **213**, filled with **214**, **215**, **216**, **218**, **219** and **220**, was *c.*30m west of the eastern trench edge. A drainage ditch, **217**, *c.*8m to the west of **213**, north/south aligned, *c.*3m wide, 0.50m deep, filled by 0.20m thick **228**, brown sand silt, **212**, mid to dark blue grey silt clay of similar depth and **229**, 0.10m deep blue clay. One sherd of pottery was recovered from fill **212**.

Ditch **209/223**, to the west of the path, was the continuation of the modern feature **153** seen in Trench 1. It was 0.55m deep, *c.*7m wide (though this was an oblique cut) and filled by **211**, mid to dark brown clay silt. No finds were present in its fill.

To the west of ditch **209/223** was 0.30m thick topsoil, **201**, above 0.40m deep subsoil, **202**, which produced one piece of animal bone and two sherds of 12th – 13th century pottery. Silts relating to flooding, **203**, a blue silt clay, **225**, **226** and **227**, generally light brown silts, were recorded below the subsoil.

The backfilled evaluation trench from the 2002 investigations, **206** and **207**, was noted *c.*19m from the western trench edge.

At the western end of the trench was a palaeochannel **204**, *c.*12m wide, which had yellow brown sand silt with iron panning as its fill, **205**, and blue clay **224**. **204** cut an earlier palaeochannel, **230**, whose upper fill was laminated light yellow brown silt sands, **210**.

Trench 3 (Fig. 5, Pls. 8 - 15)

This trench had 0.40m deep topsoil, **300**. In the south-east corner, of the east/west aligned segment of this inverted 'L' shaped trench, was a possible pit, **325**, over 2m long and 1m deep, filled by grey brown clay silt **324**, which had a depth of 0.35m, **326**, a 0.30m thick firm mottled grey silt, **327**, olive brown silt and **328** an olive brown clay silt. **325** cut 0.30m deep subsoil, **301**, from which three sherds of 17th – 18th century pottery were retrieved.

8m to the west of **325** were ditches **319** and **321**. Both were on a north-west/south-east alignment. **319** had a 'U' shaped profile, a width of 1.50m, depth of 0.45m, and was filled by **318**, firm orange brown silt and **323**, blue clay, 0.12m thick. **321** was 0.20m to the west of **319**, 0.55m wide and 0.12m deep. It had a flat base and near vertical sides. Its sole fill, **320**, was blue grey clay silt.

6m to the west of **321** was, ditch **317**. It was orientated north/south and 1.30m wide, 0.45m deep with a fill of firm orange brown silt **316**, over **322** a blue grey clay silt.

The north/south arm of this trench contained a field drain which cut the continuation of the

modern ditch, **153/209**, seen in Trenches 1 and 2, *c.*6m from the north end of the trench. This ditch, like pit **325**, cut through the subsoil. Below subsoil **301** was a firm mid to dark grey brown clay silt **307** and blue grey clay **303**. Sealed by **303** and **307** was yellow orange brown silt, **304/ 308**, which was seen for approximately 32m. A sondage placed through this 0.24m thick deposit revealed other similarly coloured silts, **305**, **306** which were above blue grey brown clay silt, **309**, 0.10m deep, covering 0.04m thick bands of light grey clay silt, **310**, **312** and **314**, which sandwiched orange yellow brown silts, **311**, **313** and **315**. The sondage was stopped 1.10m below the topsoil level. At the south end was the continuation of ditch **3307** from Area 3.

Trench 4 (Fig. 6, Pls. 16 - 24)

Modern topsoil **411** was above a possible *c.*3m wide path, **434**, comprising small to medium sized stone chippings, 0.11m deep. Sealed by **434** was a large ditch **425**, over 7m wide and 1m deep. Its upper fill, **425**, was dark orange brown clay silt, **431**, which sealed dark orange brown clay silt, **430**, 0.45m deep. Below **430** were **428** and **429**, dark orange brown deposits, 0.20 - 0.30m deep, comprising varying quantities of clay and silt. They sealed dark brown clay silt, **427**, above dark grey brown clay silt, **426**, which was the earliest fill of the ditch.

Also sealed by **411** was small pit **432**, 0.80m wide, 0.70m deep, which extended 0.31m into the trench. This pit had two fills **433**, fine mottled olive brown silt which had a piece of bone and three 13th – 14th century pottery sherds within it and **435**, a similarly dated darker olive brown silt. Approximately 11m to the west was north/south aligned, 0.90m wide, 0.85m deep, 'V' shaped ditch **440**, filled by mottled brown silt **441**. Cut by **440** was a poorly defined pit, **438**, filled by olive brown silt, **439**. Another pit, with a 'U' shaped profile, **436**, filled by similar material to **439**, was **437**, c.1.50m wide, at least 0.60m deep. Possibly cut by these features, though it was difficult to tell due to later ploughing and the similarity between the deposits, was dark grey brown sand silt, **415**. This 0.25m deep layer produced animal bone, 13th – 14th century pottery sherds and an iron object which could not be identified (SF 35). The poorly defined horizon of these pits and ditch meant that other features, which may have cut into **415**, were not seen unless they penetrated the lower, paler, silts, **414** and **416**, which also produced sherds of 13th – 14th century pottery and a possible quern stone fragment, SF 23 (see Appendix 3).

Three distinct areas of activity were noted below former topsoil **415**, the earliest phase being a roddon, **412**, in the centre of the trench. The roddon comprised deposits **416**, pale brown grey sand silt, 0.46m deep, **417**, orange grey brown sand silt, 0.35m in depth, **418**, 0.08m thick, dark orange brown sand silt, **419** and **421**, bands of blue grey clay silt sandwiching **413** and **412**, dark orange brown sand silts up to 0.70m deep. To the east of the roddon was a build up of laminated sands, **424**, over 1m deep and *c.*5.50m long, which lay on the roddon edge, **423**, whilst to the west was a layer, of light brown orange silt, **414**, up to 0.60m thick, which sealed a

0.22m deep, mottled orange grey brown silt, **420**, above a dark orange brown silt with a slight sand content, **422**, whose full depth was not exposed.

Pit **443** contained modern metal screws in its fill, **444**, whilst pits **445** and **448** had pottery fragments of 13th – 14th century date, six sherds of pottery in **446**, seventeen sherds in **447**and one bone and pottery of 14th century date in **449**.

Trench 5 (Figs. 7 and 8, Pls. 25 - 29)

Segment 1

Tarmac **501**, 0.06m deep, overlay limestone hardcore **502**, 0.28m in depth, which sealed dark grey brown silt, **503**, possibly associated with the paths through which the trench was dug. Ditch, **505**, north-west/south-east aligned, was 2m wide. 32m of its length was exposed within the trench and filled by **507**, an orange brown silt 0.40m deep, which appeared to be within a re-cut of **505**. Lower fill **506** was 0.95m wide, a brown plastic-silt over 0.38m deep. To the north was a 2.50m wide, east/west aligned ditch, **508**, which had a mottled brown clay silt upper fill, **509**, 0.30m in depth, and a dark grey clay silt, **511**, 0.90m thick, as its primary fill. A very small sliver of glass was recovered from a sample of this material and radiocarbon dating dated this feature to the 15th – 16th century. It was cut by land drain **510** and a narrow, steep sided gully **512**, 0.80m wide, 1.50m long, with a concave base, whose single fill, **513**, was dark ginger brown clay silt. These features cut a layer of ginger brown silt, **504**, the natural.

Segment 2

This segment was separated from Segment 1 by a path. It cut through a former flower bed, whose topsoil **514** was 0.36m deep. It sealed a 0.15m deep subsoil, **515**, which was above alternating layers of blue grey silt clay, **516** and **518**, up to 0.08m thick, and firm orange brown silts, **517** and **519**, 0.10m average depth.

Area 1 (Fig. 9, Pl. 30)

In Area 1 the same sequence of modern deposits comprising tarmac **1100**, over limestone hardcore **1107**, covered the area of the entrance/exit within the complex. The tarmac butted a rectangular area of open ground, **1105**, *c.*20m x *c.*16m, which contained **1102**, a dark orange silt sand where plants and trees were planted and a more heavily disturbed area containing many roots, **1103**. A rectangular brick wall **1104**, 4.32m long, 3.57m wide, constructed to retain flowers was within **1103**. A rectangular disturbance, **1110**, over 2m in length, 1.82m wide, ran beyond the southern limit of Area 1. It was filled by green grey silt sand with iron panning, **1109**. Finds from cleaning, **1101**, were modern and, as such, were discarded.

North/south and east/west aligned land drains, *c.*1m wide, crossed Area 1 as did a north-east/south-west orientated water pipe. Deposits **1111** and **1112** may also mark water pipes. These pipes were part of a watering system that extended across the site.

Beneath the modern land drains and water pipes were bands of grey green silts, **1106**, **114**, **1115** and **1116**, which sealed orange silt, **1120**, fill of a former river channel **1122**. The thin bands of silt contained pottery ranging in date from the Saxon period (found during the 2002 evaluation) to the 20th century, (found in the 2003 excavation). This suggests that the area had remained a water meadow until just prior to the construction of the shopping and festival garden complex.

In Area 1 orange silt sand, **1108** and **1113**, the upper fill of another palaeochannel, **1121**, was recorded. **1117**, a grey green and orange silt sand mix, in the south-east corner of Area 1, appears to be the interface between the old palaeochannel deposits and the newly forming land deposit.

Area 2 (Figs. 10 and 11, Pls. 31 - 58)

Phase 1

Topsoil **2201** was 0.30m deep. Unstratified finds, **2200**, included ten sherds of pottery. **2201** sealed ditch terminal **2244** filled by mid to dark grey brown silt sand, **2245**, which yielded three sherds of late 12th – 13th century pottery (Pl. 42). Only 1m of the ditch was within the excavation area. Pit **2298** had a mid to dark green grey laminated silt clay fill, **2297**, which contained two sherds of late 18th – 19th century pottery and animal bone (Pl. 56) .

Beneath **2244** was subsoil **2202/2219/2314** which was between 0.20 - 0.30m deep and contained four sherds of late 13th – 14th century pottery.

Phase 2, 11th – 13th Century

Below the subsoil was north/south aligned ditch **2301**, 1m wide, 0.19m deep, was filled by **2300**, mid to dark grey brown laminated sand silt from which was recovered a dog turd. Similarly orientated ditch **2259** had a single fill, 0.20m deep, 0.63m wide, of light to mid brown grey fine silt sand, **2258**, which produced animal bone. To the west of **2259** was rectangular pit **2265/2310**, 4m x 2.50m x 0.80m, had a brown yellow silt sand upper fill, **2308**, from which 2 fragments of animal bone were retrieved, and a primary fill of grey silt clay, **2309** (Pls. 46 and 57). Its uppermost fill of loose dark grey silt clay with charcoal flecks, **2276**, appeared to be in a separate scoop, **2277**. Fill **2276** contained nine fragments of fire cracked stone, animal bone, ceramic building material and 113 sherds of pottery representing only nineteen vessels (Pl. 50). The group includes three substantially complete vessels (DR1-DR3) which were probably deposited as complete, or near complete vessels directly into the fill. With the exception of five small residual sherds the condition of the other eleven vessels also suggests that they may represent primary deposition. Most of the vessels are Bourne medieval ware jars and jugs, several with external soot deposits. Two decorated jugs are in Grimston-type ware including

part of a unique face jug. The group probably dates to the mid- 13th century. Fills **2263**, light to mid grey brown silt sand and **2264** mid to dark grey brown silt clay, were also within this pit.

*c.*20m from **2301** was a similarly sized rectangular pit, **2217**, filled by **2216**, a loose light grey brown clay silt containing five bone fragments, a copper ferrule or tag (SF 36), slag, ceramic building material and 85 sherds of mid to late 13th century pottery. **2218**, yellow brown sand silt which also had pieces of animal bone, a bone skate (SF 24, Pl. 70), a hone (SF 27, Pl. 71), 42 sherds of mid to late 13th century, pottery, a stone hone and a possible quernstone fragment (SF 37), **2233**, light to mid grey brown clay silt, **2234**, organic yellow olive green silt with iron panning, **2235**, light to mid yellow brown sand, **2238**, mid to dark grey clay silt with 73 sherds of pottery dated to mid to late 13th century, shell, a stone hone imported from Scandinavia (SF 26) and animal bone and **2239**, mid to dark grey silt clay (Pl. 38). **2222**, a grey brown silt clay, filled small pit **2223**, which may also belong to this phase.

Phase 3, 11th – 13th Century

There were 5 earlier ditches within Area 2: **2296**, filled by yellow brown silt sand, **2295**, whose soil sample produced a very small flint and a piece of animal bone (Pl. 55), **2271**, filled by **2270**, light to mid grey sand silt, a very dark almost black organic silt, **2278**, which contained frequent mussel shell inclusions, probably domestic waste, as well as a piece of animal bone and a sherd of pottery of 11th – 12th century date, and **2279**, with a dark brown silt fill. Their spacing was almost exactly the same as the later phase of ditches (Pl. 47). A rectangular pit, **2261**, east/west aligned, was filled by **2260**, a firm mid to dark brown silt clay with animal bone and an 11th century pottery sherd, and light to mid yellow brown laminated silt, **2262**, was between the two ditches (Pl. 45). This deposit had animal bone and two sherds of late 12th – early 13th century pottery within it. An oval pit, **2287** (Pl. 54), filled by a firm mid to dark olive green silt sand, **2286**, was to the west of **2296**.

Possibly associated with this phase of activity was another east/west orientated rectangular pit, **2257** (Pl. 44). It had a 0.30m thick, mixed sand upper fill, **2253**, a 0.70m deep grey brown silt, **2254**, orange sand with areas of grey brown sand, 0.18m in depth, containing 13th – 14th century pottery, **2255**, and **2256**, a waterlogged dark grey brown silt sand 0.20m deep. It was located c.30m to the west of ditch **2296**.

Phase 4 (10th-13th century)

Pit **2212** was filled by **2203**, firm brown grey sand silt with 9 sherds of pottery from the 12th – 13th century, **2204**, green brown friable silt clay, **2205**, dark green grey silt, **2206**, light grey brown sand clay which was a mere 0.03m thick, **2207**, grey black clay silt with grey lenses, 0.10m deep, **2208**, fine light yellow grey sand 0.07m deep, **2209**, dark grey black clay silt, 0.04m thick, **2210**, grey silt, **2211** was a green yellow silt sand with pale grey flecks and primary

fill **2215** a dark grey green clay silt with yellow flecks containing animal bone and late 12th – 13th century pottery. **2212** had a small rectangular depression, **2307**, in its base (Pl. 36). **2307** was filled by dark grey brown silt clay, **2306**, which together with fill **2215** had concretions which suggest **2212** may have initially functioned as a cess pit. The high density of charred cereal and plant remains suggest that it was later used to deposit crop processing waste.

Four circular stake-holes, **2214**, **2225**, **2303**, **2305** formed a *c.*2m x 1m square cutting into the backfilled pit **2212** (Pl. 37). The stake holes were filled by dark orange yellow silt sand, **2213**, **2224**, **2302** and **2304**. They had a diameter of 0.10m and were generally 0.22m deep.

Approximately 22m to the north of **2212**, was north-east/south-west aligned oval pit **2228**, which was filled by dark orange brown silt **2229** and dark grey brown silt, **2230** (Pl. 39).

A possible eastern boundary ditch, **2275**, 0.90m wide, 0.06m deep, filled by **2274**, yellow brown silt clay, which contained 11th century pottery, was also noted, *c.*40m from **2212** (Pl. 49).

Postholes **2251**, **2269**, **2281** (Pl. 51) and **2249** probably belong to this phase. Finds from these postholes varied, **2251** had a sherd of 12th to 13th century pottery in its fill, **2269** produced one small piece of bone, fill **2220** contained one 12th – 13th century sherd of pottery and **2280** contained fragments of animal bone. From **2249** came a sherd of 10th – mid 11th century pot.

Phase 5

A curvilinear ditch **2226/2240/2273** which was generally east/west aligned but turning northwards at both its extremes, had an mixed orange grey clay silt, **2227/2241**, at its west end and **2272**, light yellow brown silt clay, to the east (Pls. 41, 48).

Un-phased

Of the un-phased features there was a small rectangular pit, **2231**, which had orange brown silt fill, **2232** (Pl. 40). Postholes/post pits **2242**, **2221**, **2246** (Pl. 43), **2248**, **2267** (Pl. 46), **2285** (Pl. 53) and oval posthole **2312** (Pl. 58), whose fills varied from yellow brown sand to dark brown or grey brown silt sands, **2243**, **2220**, **2247**, along with **2250**, **2252**, **2266**, **2268**, **2280**, **2284**, **2311**, were also undated. Posthole **2283** produced an animal bone fragment from its fill **2282** (Pl. 52).

Natural

Flood deposits, **2236**, **2288**, **2289**, **2290**, **2291**, **2292**, **2293**, **2294** and **2299**, varying from light to mid yellow brown silt sand to dark grey brown clay silt, were also recorded (Pl. 54).

Area 3 (Figs. 12 and 13, Pls. 59 - 64)

Area 3, to the east of the fish pond, had a topsoil depth of 0.25m, **3301**. A dark orange brown subsoil, **3302**, was 0.20m deep. Natural, **3303** and **3304**, was dark orange brown flood silt

laminations, 0.20m deep.

Phase 1 Ditches

Below **3302** was north-north-west/south-south-east aligned ditch **3305**. This ditch was 0.97m wide and 0.46m deep and over 20m long, running beyond the limit of excavation. It was filled by mottled orange grey brown silt, **3306**. Possible domestic waste, bone and shells as well as a sherd of 12th – 13th century pottery was recovered from this ditch. East-north-east/west-south-west aligned ditch **3311**, may have been the return for **3305**. It was c.15m long, 0.12m deep and 0.52m wide, filled by dark ginger brown clay silt, **3312**.

Phase 2 Ditch

Ditch **3309** was similar to **3305**, but orientated north/south. It was 0.25m deep and hammerscale was recovered from the environmental sample of its fill, **3310**.

Phase 3 Ditches

East/west orientated ditch **3307** was cut by **3305**. At 0.40m it was slightly narrower than **3305**, but otherwise of similar dimensions and fill (**3308**), Ditch **3313**, *c.*4m to the south of **3307** and running parallel, may have also been associated with this particular phase of activity. It had an exposed length of c.9m, was 0.60m wide and 22m deep, had an orange brown silt fill, **3314**, and terminated at its west point.

Phase 4 Ditch

This phase comprised a single north-east/south-west ditch, **3315**, 13m x 0.95m x 0.30m, which had brown silt fill, **3316**.

Area 4 (Fig. 14, Pls. 65 - 69)

Within this excavation area the topsoil, **4402**, was 0.22m deep and contained a single sherd of 13th – 14th century pottery. It sealed a west-north-west/east-south-east orientated ditch, **4410**, at the south end. It was 3m wide, 0.75m deep, and filled by **4414**, a 0.45m deep grey brown silt, which sealed the main yellow grey clay fill, **4413**, and **4411**, an orange grey sand clay, 0.11m deep, containing a piece of 11th century pottery. Primary fill **4412**, a mixed orange and grey sand, was 0.08m deep. This ditch was recorded in Evaluation Trench 6 as ditch ***139***. Similarly aligned ditch **4407**, 7m x 0.95 x 0.19, (recorded in 2002 Evaluation Trench 5 as context ***134***) was *c.*7m to the north. It was filled by **4406**, gritty grey sand silt above dark grey brown silt from which six pieces of tile and two sherds of modern pottery were recovered. **4409**, below, had 13th–14th century finds, ten fragments of bone, one sherd of pottery and three pieces of tile and terminated at its eastern end. **4407** was a re-cut of an earlier ditch, **4405** (evaluation context ***136***), whose upper fill **4404**, yellow light brown silt produced pottery from the 13th century, two nails, six fragments of animal bone and a small piece of lead, possibly a pin head, and a

possible piece of clinker, sealed brown clay silt, **4408**, containing two sherds of 13th – 14th century pottery and a piece of animal bone.

Subsoil **4403**, 0.20m deep, was cut by ditches **4405** and **4410**. Natural was a mottled orange grey sand.

Discussion

Archive information from the evaluation was not available and incomplete drawings of the evaluation trenches made it difficult to incorporate and interpret the evaluation results. It became clear that an understanding of the environmental changes which have taken place over the past 1500 years at the Springfields site is the key to its interpretation. The lack of environmental input at the evaluation stage led to a misunderstanding of ground conditions in the early and later medieval periods. A feature interpreted as a sea bank during the evaluation proved to be a filled in creek (roddon). This resulted in the excavations being focused on land east of the roddon which proved to have been uninhabitable, rather than on the roddon itself. It has been demonstrated elsewhere in the Fens that roddons were favoured locations for human occupation in areas which were mainly too wet, or under threat of inundation, because of their slightly elevated positions. The roddon at Springfields appears to have run through Area B and into Area A but the limited information in the evaluation report only allows a conjectural line to be proposed (Fig. 2).

Despite the lack of buildings the finds retrieved from the ditches and pits, which must have been on the periphery of a settlement, have nevertheless, yielded fascinating information about the human exploitation of land which was on the margins of habitation. The medieval pottery is a small but important early group of material indicating local trading. The two hones and lava quern fragment hint at international trading with Scandinavia and Germany.

Geological/Natural Features

Roddon and Water Channels

The ridge interpreted by ASUD in 2002 as a sea bank proved, upon closer investigation, to be a roddon, a sand-filled ancient tidal channel. Samples taken for optical stimulated luminescence dating (OSL4) from the exposed deposits of the roddon had an 11th century date and indicates that west of creek **423**, had been an area of higher, dry, ground with the eastward retreat of the sea which appears to have occurred during the Saxon period (see below).

Palaeochannels were encountered in all the trenches and Areas 1 and 3. They were present on what would have been low lying land in an intertidal zone. Environmental samples indicate that creek **423** was estuarine in nature and it continued to have estuarine sediments present after creeks to the east, those in Trenches 1 and 2, and the re-opened creek in evaluation trench 1, **124** ceased to be so. Foraminifera analysed from creek **124** show a marine environment

prevailed during the deposition of the earliest deposits but when the low lying land was intertidal it, being on higher ground, was not. Stratigraphic relationships existed between some of the palaeochannels in Trench 1. OSL dating of creek **124** proved to be 4th to 6th century in date, whilst **110** was 6th – 8th century in date. Foraminifera and insect remains in creek **124** indicate that the area was subject to brackish water and tidal inundation. At this time the area as a whole was tidal mudflats and not suitable for human habitation. Evidence from creek, **110**, suggests that the environment later become freshwater based. However this did not last as environmental remains from creek **204** in Trench 2, indicated that by the late 8th century, this part of the site was subject to tidal flooding.

Former Water Meadow

In Area 1, after the river channel **1122**, and other nearby creeks, had silted up, the ground level was raised and a flat plateau intermittently flooded by river channel **204**, in Trench 2, was created. This water meadow, which was probably saltmarsh pasture at its beginning, constituted bands of grey green silts deposited during flooding. Plant remains recovered from the samples of creek **423** in Trench 4, to the west of the water meadow testify that the environment was periodically wet, as do the snail fauna. The presence of 20th century pottery within the laminated flood silts suggests that Area 1 may have stayed a water meadow into the modern era. This suggests that only places suitable for human occupation from the Saxon period onwards were in the vicinity of Area 2 at the south end of the site and Trench 4 and Area 4 to the west, where the land is higher.

Late Saxon Activity

Very few features within the floodplain of the Springfield site contained dating evidence. Only one sherd of pottery was recovered from the north/south aligned ditch in Trench 2. It may have been washed into the ditch during a phase of flooding or have come from activity on higher ground to the south and west (Areas 2 and 4) and, as such, cannot be relied upon to date the ditch or the general alignment of the ditch system for that period. The 11th century pottery recovered from Area 1 came from a modern deposit, whilst Trenches 1, 3 and 5 and Area 3 were devoid of finds altogether.

Given that the evaluation produced Saxon pottery from one of these ditches it seems likely that land reclamation started late into the Saxon period. The ditches divide the newly acquired land into pasture fields, as indicated by the environmental samples. The presence of dung beetles suggests animal husbandry (grazing cattle) was in operation. This may also account for the presence of a few sherds of Saxon pottery in Area 1. The plant assemblage from this period reflects the de-salinisation of the lower marsh land, snail fauna is of wet grassland habitat and the bone assemblage shows the area was populated by vole and other rodent types, such as mice. Frog/toad and possibly fox bones were also present.

Saxo-Norman Activity

In Area 2 two north/south aligned ditches **2271** and **2296** appear to form drainage ditches flanking a 4m wide earthen trackway, as no surface to the track was noted. No activity is recorded in the area to the east or west of the ditches. This suggests that the site was on the periphery of a settlement as these features contained domestic waste. Later evidence suggests that the habitation area could have been very close to the east of Area 2 and south-east of Area 3, although no indication of a settlement was noted during the construction of the Spalding by-pass. The presence of a habitable area testifies to the success of the land reclamation scheme started in the Saxon period. Whether this occupation was permanent or seasonal could not be ascertained. It Is possible that this settlement would have been the hamlet of Fulney.

Domestic waste has revealed cattle sized bones, chicken bones, mussel and oyster shells, beans and eggshells from chicken and goose. Cultivation of cereal crops, barley, wheat, oats and rye, is clearly reflected in the botanical record and taken as a whole the environmental finds suggest a rich and varied diet for those inhabiting the area. The evidence also suggests the settlement would probably have been small, agricultural in nature, with seasonal grazing occurring on the low ground. Fish bones, pike, stickleback, perch, eel and plaice/flounder, from ditches **2271** and **2296**, suggests localised fishing, probably in the Welland or one of its tributaries, supplementing the general diet.

12th Century Activity

Two north/south aligned ditches, **2301** and **2259**, in Area 2 appear to form drainage ditches to a 4m wide trackway slightly to the west of that established in the 11th century. If this trackway represents the western boundary of habitation then ditch **3305** in Area 3 could be a reclamation ditch maintaining the draining of the lower lying (below 2m OD) land to the north of Area 2. As it also contained hammerscale and chicken egg shell fragments it suggests close proximity to human habitation. The slight difference in orientation suggests that they were not open at the same time. Ostracods appear in these ditches as well as in ditch **2259**, which also suggests a contemporary date. The frog, small fish and vole bones recovered from the processing of samples, suggest the absence of a salt water environment indicating that the reclaimed land ceased to be troubled by tidal activity.

Also by the 12th century addition fish types, herring and shad, appear in the bone record, possibly an additional supplement to the daily diet as all previous fish species still occur. The presence of herring suggests possible trade with settlements along the Wash as herring do not occur in the Welland. Evidence of vegetables, beet and orache, been grown was also noted as were edible wild plants. The species present at this period in time continue until the settlement's demise in the late 13th – 14th century.

It should be noted that creek **124** was still subjected to estuarine flooding in this period whilst the low lying lands were clearly becoming less aquatic and more influenced by freshwater flooding. Given the levels of the creek in relation to the reclaimed land it is possible that a bank of some description could have been in operation preventing creek **124** from flooding the fields. As no such bank was recorded during the evaluation and excavation phases it seems likely that any surviving evidence would be west of Area 1, possibly beneath Camel Gate.

Late 12th and 13th Century Activity

On the southern high ground pits, **2217**, **2257**, **2261** and **2310**, of 13th century date, apparently functioned as rubbish pits, which produced additional cat and house mouse bones, probably derived from domestic waste. The presence of these large pits with no apparent associated features also suggests that Area 2 had undergone a change of use. With no ditches present to designate a boundary it is possible that the pits reflect the westward expansion of habitation beyond the earlier boundaries marked by the drainage ditches/track. Pit **2262**, which produced 12th – 13th century pottery, clearly cut earlier ditch **2259**. Rubbish and cess pits would have been on the periphery of occupation and as the settlement expanded would be pushed further from the main hub of settlement. Expansion suggests a degree of economic prosperity which may account for the pottery record and the presence of Scandinavian hones reflecting an increase in trade.

Smaller pits of a different function were also active at this point in time. Pit **2251** indicated that pigs were kept, probably for meat consumption. The bone assemblage was so small that earlier pig keeping cannot be ruled out despite the absence of bone in earlier contexts. Pit **2246**, of a slightly earlier date than **2251**, can be attributed to this period of activity as it contains ostracod remains which do not occur before the 13th century.

The presence of charred grain within pit **2212** and surrounding features shows that crop processing occurred within Area 2. This is another activity which would have been carried out away from the main habitation area. The processed crop would either have been used for human consumption, bread wheat and barley been examples, fodder or fuel. The processed crops are unlikely to have come from the site as barley and wheat require a more calcareous environment. Pit **2212/2307** also showed signs of been used as a cess pit.

Also on the higher southern parcel of land were traces of hazelnut shell fragments and plum, suggesting a wood, possibly managed, may have been close to the settlement.

Ditch **3309** may be indicative of the continued maintenance of the reclaimed lower land.

13th – 14th Century Activity

Most of the activity from this period was centred round Trench 4 and Area 4 west of Camel Gate. This seems to designate a shift of occupation from Area 2 as there is a distinct lack of activity in Area 2 at this date. Why this re-location should occur is not clear. House mouse bones, chicken eggshell, cockle, mussel and oyster, ray, eel, small fish and stickleback bones were all recovered from domestic waste deposits in ditches **4405**, **4410**, **436** and **440** (which had an identical profile to ditch **132** in Trench 1 suggesting a contemporary date) and pits **432**, **445** and **448**. The snail fauna and mole, field vole, common shrew, rodent, indicates that Area 4 and the area west of creek **423**, was grassland with a shaded or wooded element (hazelnut was present), unlike the other areas of the site. This area could have been for grazing as cattle and sheep/goat bones suggest animal husbandry. The ditches defining the fields and preventing livestock from wandering were probably hedged as elder seeds were present in environmental samples. Frog/toad, newt and water vole were also present possibly reflecting the damp environment of the ditches. Wheat, barley and oats were grown close by.

15th – 16th Century Activity

Trench 5 had one east/west ditch dating from this period whose environmental samples indicated the land continued to be used for pasture with cereal crops been grown close by.

Modern

Most of the modern activity recorded can be associated with the building of the shopping centre and Festival Garden. Topsoil was imported to raise the ground level, the site being a field prior to development, and trenches were dug for service pipes and a water system to keep the plants healthy. Posthole **444** might be associated with car park usage.

Evidence of an earlier, though still modern, east/west drainage ditch, presumably part of a larger field system, was observed in Trenches 1 and 2, ditch **153/209**.

Conclusion

The results from these excavations highlight the importance of environmental assessment as an integral part of the evaluation process. The lack of environmental input at the evaluation stage led to a misinterpretation of how the area had developed, resulting in the recommendation for excavation to be carried out on a part of the site which subsequent environmental analysis showed to have been uninhabitable. Despite the paucity of archaeological features over the remainder of the site artefacts retrieved from the ditches and pits, and samples from palaeochannels indicate that site is of major importance in throwing light on the value of land on the margins of occupation and its human exploitation. The pottery is an important group of early

material with evidence for local trading mainly with Bourne. Any links with the development of Spalding itself can only remain conjectural.

Mick McDaid
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APPENDIX 1

Springfields, Spalding (SSFG 03)
Context Summary

Context	Area	Type	Description	Length	Width	Depth
100	Trench 1	Layer	Paving slabs	18m+	2.15m+	0.06m
101	Trench 1	Layer	Bedding layer	19.20m	2.15m+	0.07m
102	Trench 1	Layer	Topsoil	11.50+	2.15+	0.30m
103	Trench 1	Fill	Fill of 140	2.20m+	2.75m	0.08m
104	Trench 1	Layer	Flood deposit	7.75m	2.15m+	0.08m
105	Trench 1	Fill	Fill of 117	2.15m+	3.30m	0.70m
106	Trench 1	Fill	Fill of 117	2.15m+	3.30m	0.08m
107	Trench 1	Fill	Fill of 117	2.15m+	1.10m	0.15m
108	Trench 1	Fill	Fill of 117	2.15m+	5.55m	0.12m
109	Trench 1	Fill	Fill of 117	2.15m+	3.85m	0.10m
110	Trench 1	Fill	Fill of 117	2.15m+	1.15m	0.10m
111	Trench 1	Fill	Fill of 117	2.15m+	2.55m	0.35m
112	Trench 1	Fill	Fill of 117	2.15m+	5.00m?	0.12m
113	Trench 1	Fill	Fill of 117	2.15m+	2m+	0.10m
114	Trench 1	Fill	Fill of 117	2.15m+	3.20m	0.20m
115	Trench 1	Fill	Fill of 117	2.15m+	n/a	n/a
116	Trench 1	Layer	Grey brown silt clay	2.35m+	1.55m+	0.55m+
117	Trench 1	Cut	Palaeochannel	2.15m+	7.50m+	0.85m+
118	Trench 1	Fill	Fill of 124	2.15m+	3m+	0.20m
119	Trench 1	Fill	Fill of 124	2.15m+	4m+	0.20m
120	Trench 1	Fill	Fill of 124	5.50m+	4.50m+	0.40m
121	Trench 1	Fill	Fill of 124	2m	1.55m+	0.10m
122	Trench 1	Fill	Fill of 124	5.50m+	4.50m+	0.40m
123	Trench 1	Fill	Fill of 124	3m+	2.25m+	0.25m
124	Trench 1	Cut	Creek	5.50m+	4.50m+	1m
125	Trench 1	Fill	Fill of 117	2.15m+	1.70m	0.20m+
126	Trench 1	Fill	Fill of 132	2.30m	0.95m	0.20m
127	Trench 1	Fill	Fill of 132	0.80m	0.85m	0.11m
128	Trench 1	Fill	Fill of 132	0.80m	0.85m	0.10m
129	Trench 1	Fill	Fill of 132	0.80m	0.85m	0.05m
130	Trench 1	Fill	Fill of 132	2.30m	0.55m	0.15m
131	Trench 1	Fill	Fill of 132	0.65m	0.20m	0.13m
132	Trench 1	Cut	Ditch	2.30m	1.15m	0.65m
133	Trench 1	Fill	Fill of 141	2.15m+	0.65m	0.15m
134	Trench 1	Fill	Fill of 141	2.15m+	0.50m	0.20m
135	Trench 1	Fill	Fill of 136	1m+	0.50m	0.43m
136	Trench 1	Cut	Palaeochannel	1m+	0.50m	0.43m
137	Trench 1	Layer	Grey brown sand silt	7.50m+	2.15m+	0.25m
138	Trench 1	Layer	Orange brown sand silt	8.50m+	2.15m+	0.28m
139	Trench 1	Layer	Grey brown silt clay	9.30m	2.15m+	0.22m+
140	Trench 1	Cut	Ditch	2.25m+	4.15m	0.42m
141	Trench 1	Cut	Ditch	2.15m	0.65m	0.40m
142	Trench 1	Fill	Fill of 140	2.25m+	2.70m	0.15m
143	Trench 1	Cut	Ditch	8.75m	0.91m	0.49m
144	Trench 1	Fill	Fill of 143	8.75m	0.91m	0.49m
145	Trench 1	Fill	Fill of 143	0.95m	0.78m	0.10m
146	Trench 1	Fill	Fill of 143	0.95m	0.68m	0.19m
147	Trench 1	Layer	Grey brown silt clay	13m+	2.15m+	0.30m
148	Trench 1	Fill	Fill of 149	1.50m	0.45m	0.45m
149	Trench 1	Cut	Palaeochannel	1.50m	0.45m	0.45m
150	Trench 1	Cut	Ditch	2.25m+	2.75m	0.60m
151	Trench 1	Fill	Fill of 150	2.25m+	2.75m	0.60m
152	Trench 1	Fill	Fill of 153	2.25m+	1.30m	0.45m
153	Trench 1	Cut	Ditch	2.25m+	1.30m	0.45m
154	Trench 1	Fill	Fill of 155	2m+	0.30m+	0.18m

Springfields, Spalding (SSFG 03)
Context Summary

Context	Area	Type	Description	Length	Width	Depth
155	Trench 1	Cut	Ditch	2m+	0.30m+	0.18m
156	Trench 1	Fill	Fill of 155	2m+	0.52m	0.30m
157	Trench 1	Fill	Fill of 155	2m+	0.40m	0.08m
158	Trench 1	Layer	Topsoil	8m+	2.25m+	0.30m
159	Trench 1	Layer	Subsoil	8m+	2.25m+	0.40m
160	Trench 1	Layer	Orange brown silt sand	8m+	2.25m+	0.35m
200	Trench 2	n/a	Unstratified finds	n/a	n/a	n/a
201	Trench 2	Layer	Topsoil	72m+	2.25m+	0.30m
202	Trench 2	Layer	Subsoil	67m+	2.25m+	0.50m
203	Trench 2	Layer	Subsoil	27.85m+	2.25m+	0.05m
204	Trench 2	Cut	Palaeochannel	2.25m+	12m+	0.50m+
205	Trench 2	Fill	Fill of 204	2.25m+	12m+	0.13m
206	Trench 2	Cut	Evaluation trench	2.25m+	2.60m	0.75m+
207	Trench 2	Fill	Fill of 206	2.25m+	2.60m	0.75m+
208	Trench 2	Fill	Fill of 209	2.25m+	3.90m	0.42m
209	Trench 2	Cut	Ditch	2.25m+	10.15m	0.55m
210	Trench 2	Fill	Fill of 230	2.25m+	c.11m	unknown
211	Trench 2	Fill	Fill of 223	2.25m+	7.35m	0.60m
212	Trench 2	Fill	Fill of 217	2.25m+	1.30m	0.30m
213	Trench 2	Cut	Drain	2.25m+	1.77m	1.10m
214	Trench 2	Fill	Fill of 217	2.25m+	1.00m	0.05m
215	Trench 2	Fill	Fill of 217	2.25m+	1.02m	0.45m
216	Trench 2	Fill	Fill of 217	2.25m+	0.85m	0.55m
217	Trench 2	Cut	Ditch	2.25m+	3.75m	0.85m
218	Trench 2	Fill	Fill of 213	unknown	0.60m	0.35m
219	Trench 2	Fill	Fill of 213	2.25m+	0.90m	1.10m
220	Trench 2	Fill	Fill of 213	unknown	1.05m	0.65m
221	Trench 2	Layer	Tarmac	2.25m+	2.65m+	0.08m
222	Trench 2	Fill	Fill of 209	2.25m+	4.05m	0.20m
223	Trench 2	Cut	Ditch	Same	as	209
224	Trench 2	Fill	Fill of 204	unknown	0.50m	0.44m
225	Trench 2	Layer	Light brown silt	2.25m+	7.25m	unknown
226	Trench 2	Layer	Light brown silt	2.25m+	40.10m	0.45m+
227	Trench 2	Layer	Light brown silt	2.25m+	3.80m	unknown
228	Trench 2	Fill	Fill of 217	2.25m+	2.45m	0.37m
229	Trench 2	Fill	Fill of 217	2.25m+	4.30m	0.17m
230	Trench 2	Cut	Palaeochannel	2.25m+	c.11m	unknown
300	Trench 3	Layer	Topsoil	51m+	2.10m+	0.30m
301	Trench 3	Layer	Subsoil	2.10m+	47.20m	0.20m
302	Trench 3	Layer	Grey brown clay silt	unknown	27.75m+	0.07m
303	Trench 3	Layer	Blue grey clay silt	unknown	0.85m	0.03m
304	Trench 3	Layer	Yellow brown silt	unknown	0.85m	0.25m
305	Trench 3	Layer	Yellow brown silt	unknown	0.85m	0.20m
306	Trench 3	Layer	Yellow brown silt	unknown	0.85m	0.20m+
307	Trench 3	Layer	Grey brown clay silt	unknown	3.20m	0.12m
308	Trench 3	Layer	Yellow brown silt	unknown	0.95m+	0.24m
309	Trench 3	Layer	Blue grey clay silt	unknown	0.95m+	0.10m
310	Trench 3	Layer	Blue grey clay silt	unknown	0.95m+	0.04m
311	Trench 3	Layer	Yellow brown silt	unknown	0.50m	0.20m
312	Trench 3	Layer	Blue grey clay silt	unknown	0.50m	0.04m
313	Trench 3	Layer	Yellow brown silt	unknown	0.50m	0.10m
314	Trench 3	Layer	Grey brown clay silt	unknown	0.50m	0.04m
315	Trench 3	Layer	Yellow brown silt	unknown	0.50m	0.06m

Springfields, Spalding (SSFG 03)
Context Summary

Context	Area	Type	Description	Length	Width	Depth
316	Trench 3	Fill	Fill of 317	2.20m+	1.30m	0.25m
317	Trench 3	Cut	Ditch	2.20m+	1.30m	0.45m
318	Trench 3	Fill	Fill of 319	2.20m+	1.30m	0.30m
319	Trench 3	Cut	Ditch	2.20m+	1.50m	0.45m
320	Trench 3	Fill	Fill of 321	2.20m+	0.55m	0.12m
321	Trench 3	Cut	Ditch	2.20m+	0.55m	0.12m
322	Trench 3	Fill	Fill of 317	2.20m+	0.60m	0.25m
323	Trench 3	Fill	Fill of 319	2.20m+	1.50m	0.12m
324	Trench 3	Fill	Fill of 325	0.75m+	2m+	0.35m
325	Trench 3	Cut	Pit	0.75m+	2m+	1m
326	Trench 3	Fill	Fill of 325	0.75m+	2m+	0.30m
327	Trench 3	Fill	Fill of 325	0.75m+	2m+	0.45m
328	Trench 3	Fill	Fill of 325	0.75m+	2m+	0.10m
400-401	Trench 4	n/a	Not used	n/a	n/a	n/a
402	Trench 4	Layer	Topsoil	42m+	10m+	0.28m
403-410	Trench 4	n/a	Not used	n/a	n/a	n/a
412	Trench 4	Cut	Roden	2m+	21m+	1.60m+
413	Trench 4	Fill	Fill of 412	2m+	4.90m	unknown
414	Trench 4	Fill	Fill of 412	2m+	4.90m	0.60m
415	Trench 4	Layer	Former topsoil	42m+	10m+	0.42m
416	Trench 4	Fill	Subsoil	32m+	10m+	0.46m
417	Trench 4	Fill	Fill of 412	2m+	10.85m	0.35m
418	Trench 4	Layer	Orange sand silt	2m+	11m	0.08m
419	Trench 4	Layer	Blue grey clay silt	2m+	12.50m	0.07m
420	Trench 4	Fill	Fill of 412	2m+	20.80m+	0.22m
421	Trench 4	Fill	Fill of 412	2m+	2m	0.07m
422	Trench 4	Fill	Fill of 412	2m+	1.65m	0.25m
423	Trench 4	Cut	Creek	2m+	6.50m+	0.80m+
424	Trench 4	Fill	Fill of 423	2m+	6.50m+	0.80m+
425	Trench 4	Cut	Ditch	2m+	7m	1.10m
426	Trench 4	Fill	Fill of 425	2m+	2m	0.20m
427	Trench 4	Fill	Fill of 425	2m+	5m	0.70m
428	Trench 4	Fill	Fill of 425	2m+	1.90m	0.30m
429	Trench 4	Fill	Fill of 425	2m+	1.70m	0.20m
430	Trench 4	Fill	Fill of 425	2m+	5.30m	0.45m
431	Trench 4	Fill	Fill of 425	2m+	3.75m	0.35m
432	Trench 4	Cut	Pit	0.70m	0.56m	0.70m
433	Trench 4	Fill	Fill of 432	0.70m	0.56m	0.30m
434	Trench 4	Fill	Fill of 425	2m+	3.10m	0.11m
435	Trench 4	Fill	Fill of 432	0.70m	0.56m	0.40m
436	Trench 4	Cut	Pit?	2m+	0.55m	0.28m
437	Trench 4	Fill	Fill of 436	2m+	0.55m	0.28m
438	Trench 4	Cut	Pit?	2m+	0.35m	0.20m
439	Trench 4	Fill	Fill of 438	2m+	0.35m	0.20m
440	Trench 4	Cut	Ditch	2m+	0.90m	0.85m
441	Trench 4	Fill	Fill of 440	2m+	0.90m	0.85m
442	Trench 4	Fill	Fill of 443	0.80m	1.10m	0.25m
443	Trench 4	Cut	Pit	0.80m	1.10m	0.25m
444	Trench 4	Fill	Fill of 445	0.45m	0.50m	0.30m
445	Trench 4	Cut	Pit	0.45m	0.50m	0.30m
446	Trench 4	Layer	Unstratified finds	n/a	n/a	n/a
447	Trench 4	Layer	Unstratified finds	n/a	n/a	n/a
448	Trench 4	Cut	Posthole	0.80m	0.75m	0.50m

Springfields, Spalding (SSFG 03)
Context Summary

Context	Area	Type	Description	Length	Width	Depth
501	Trench 5	Layer	Tarmac	34m+	2m+	0.06m
502	Trench 5	Layer	Hardcore	34m+	2m+	0.28m
503	Trench 5	Layer	Dark grey brown silt	34m+	2m+	0.35m
504	Trench 5	Layer	Orange brown silt	34m+	2m+	n/a
505	Trench 5	Cut	Ditch	24m+	1.41m	0.67m
506	Trench 5	Fill	Fill of 505	24m+	0.93m	0.38m
507	Trench 5	Fill	Fill of 505	24m+	1.41m	0.35m
508	Trench 5	Cut	Ditch	2m+	2.50m	1.20m
509	Trench 5	Fill	Fill of 508	2m+	2.50m	0.30m
510	Trench 5	Feature	Land drain	2m+	0.45m	0.30m
511	Trench 5	Fill	Fill of 508	2m+	2.50m	0.90m
512	Trench 5	Cut	Ditch	1.50m+	0.80m	0.30m
513	Trench 5	Fill	Fill of 512	1.50m+	0.80m	0.30m
514	Trench 5	Layer	Topsoil	20m+	2m+	0.36m
515	Trench 5	Layer	Subsoil	20m+	2m+	0.15m
516	Trench 5	Layer	Blue grey silt clay	20m+	2m+	0.07m
517	Trench 5	Layer	Orange brown silt	20m+	2m+	0.11m
518	Trench 5	Layer	Blue grey clay silt	20m+	2m+	0.05m
519	Trench 5	Layer	Orange brown silt	20m+	2m+	0.09m
1100	Area 1	Layer	Tarmac	35m+	31m+	0.06m
1101	Area 1	Layer	Unstratified finds	n/a	n/a	n/a
1102	Area 1	Fill	Fill of 1105	20m	16m	unknown
1103	Area 1	Fill	Fill of 1105	20m	16m	unknown
1104	Area 1	Wall	Brick wall	4m	4m	unknown
1105	Area 1	Cut	Flower bed	20m	16m	unknown
1106	Area 1	Layer	Grey green sand silt	35m+	31m+	unknown
1107	Area 1	Layer	Hardcore	35m+	31m+	0.28m
1108	Area 1	Fill	Fill of 1121	35m+	31m+	unknown
1109	Area 1	Fill	Fill of 1110	2.10m+	1.82m	unknown
1110	Area 1	Cut	Modern Intrusion	2.10m+	1.82m	unknown
1111	Area 1	Feature	Water pipe	3.50m+	0.63m	unknown
1112	Area 1	Feature	Water pipe	8m+	0.63m	unknown
1113	Area 1	Fill	Fill of 1121	5.81m+	3.50m	unknown
1114	Area 1	Layer	Grey green sand silt	35m+	31m+	unknown
1115	Area 1	Layer	Grey green sand silt	35m+	31m+	unknown
1116	Area 1	Layer	Grey green sand silt	35m+	31m+	unknown
1117	Area 1	Layer	Orange brown silt clay	5.46m+	5.32m+	unknown
1118	Area 1	Layer	Orange brown silt sand	4.90m+	2.10m+	unknown
1119	Area 1	Layer	Grey green sand silt	2.10m+	1.89m+	unknown
1120	Area 1	Layer	Dark orange silt sand	19m+	2.66m+	unknown
1121	Area 1	Cut	Palaeochannel	unknown	unknown	unknown
1122	Area 1	Cut	Palaeochannel	unknown	unknown	unknown
2200	Area 2	Layer	Unstratified finds	n/a	n/a	n/a
2201	Area 2	Layer	Topsoil	56m+	18m+	0.30m
2202	Area 2	Layer	Subsoil	56m+	18m+	0.16m
2203	Area 2	Fill	Fill of 2212	1.30m	0.51m	0.08m
2204	Area 2	Fill	Fill of 2212	1.30m	0.80m	0.07m
2205	Area 2	Fill	Fill of 2212	1.30m	0.71m	0.10m
2206	Area 2	Fill	Fill of 2212	1.30m	0.40m	0.03m
2207	Area 2	Fill	Fill of 2212	1.30m	1.10m	0.10m
2208	Area 2	Fill	Fill of 2212	1.30m	0.90m	0.07m
2209	Area 2	Fill	Fill of 2212	1.30m	0.90m	0.04m
2210	Area 2	Fill	Fill of 2212	1.30m	0.55m	0.03m

Springfields, Spalding (SSFG 03)
Context Summary

Context	Area	Type	Description	Length	Width	Depth
2211	Area 2	Fill	Fill of 2212	1.30m	0.25m	0.06m
2212	Area 2	Cut	Pit	1.30m	1.27m	0.33m
2213	Area 2	Fill	Fill of 2214	01.10m	0.10m	0.22m
2214	Area 2	Cut	Stakehole	01.10m	0.10m	0.22m
2215	Area 2	Fill	Fill of 2212	1.30m	1.18m	0.09m
2216	Area 2	Fill	Fill of 2217	5.80m	4m	0.20m
2217	Area 2	Cut	Rectangular pit	5.80m	4m	0.95m+
2218	Area 2	Fill	Fill of 2217	5.80m	4m	0.60m
2219	Area 2	Layer	Subsoil	Same	as	2202
2220	Area 2	Fill	Fill of 2221	0.50m	0.28m	0.10m
2221	Area 2	Cut	Pit	0.50m	0.28m	0.10m
2222	Area 2	Fill	Fill of 2223	0.70m	0.50m	0.20m
2223	Area 2	Cut	Pit	0.70m	0.50m	0.20m
2224	Area 2	Fill	Fill of 2225	01.10m	0.10m	0.09m
2225	Area 2	Cut	Stakehole	01.10m	0.10m	0.09m
2226	Area 2	Cut	Ditch	11m+	1.02m	0.42m
2227	Area 2	Fill	Fill of 2226	11m+	1.02m	0.42m
2228	Area 2	Cut	Pit	3m	1.26m	0.45m
2229	Area 2	Fill	Fill of 2228	3m	1.26m	0.11m
2230	Area 2	Fill	Fill of 2228	3m	1.26m	0.45m
2231	Area 2	Cut	Rectangular pit	1.04m	0.50m	0.27m
2232	Area 2	Fill	Fill of 2231	1.04m	0.50m	0.27m
2233	Area 2	Fill	Fill of 2217	1.50m+	0.90m	0.12m
2234	Area 2	Fill	Fill of 2217	1.50m+	0.50m	0.10m
2235	Area 2	Fill	Fill of 2217	1.50m+	0.20m	0.10m
2236	Area 2	Fill	Fill of 2217	1.50m+	1.26m	0.20m
2237	Area 2	Fill	Fill of 2217	1.50m+	0.30m	0.06m
2238	Area 2	Fill	Fill of 2217	1.50m+	1.15m+	0.25m
2239	Area 2	Fill	Fill of 2217	1.50m+	0.53m+	0.05m
2240	Area 2	Cut	Ditch	11m+	1.02m	0.38m
2241	Area 2	Fill	Fill of 2240	11m+	1.02m	0.38m
2242	Area 2	Cut	Posthole	0.25m	0.25m	0.11m
2243	Area 2	Fill	Fill of 2242	0.25m	0.25m	0.11m
2244	Area 2	Cut	Ditch	0.60m+	0.80m	0.40m
2245	Area 2	Fill	Fill of 2244	0.60m+	0.80m	0.40m
2246	Area 2	Cut	Rectangular pit	1.05m	0.85m	0.38m
2247	Area 2	Fill	Fill of 2247	1.05m	0.85m	0.38m
2248	Area 2	Cut	Posthole	0.60m+	0.58m	0.36m
2249	Area 2	Fill	Fill of 2248	0.60m+	0.58m	0.22m
2250	Area 2	Fill	Fill of 2248	0.60m+	0.58m	0.14m
2251	Area 2	Cut	Posthole	0.28m	0.28m	0.22m
2252	Area 2	Fill	Fill of 2252	0.28m	0.28m	0.22m
2253	Area 2	Fill	Fill of 2257	2.50m	0.90m	0.30m
2254	Area 2	Fill	Fill of 2257	2.50m	1.80m	0.70m
2255	Area 2	Fill	Fill of 2257	2.50m	1.60m	0.18m
2256	Area 2	Fill	Fill of 2257	2.50m	1.50m	0.20m
2257	Area 2	Cut	Rectangular pit	2.50m	1.70m	1.05m+
2258	Area 2	Fill	Fill of 2259	17m+	0.63m	0.20m
2259	Area 2	Cut	Ditch	17m+	0.63m	0.20m
2260	Area 2	Fill	Fill of 2261	2.40m	1.40m	0.70m
2261	Area 2	Cut	Rectangular pit	2.40m	1.40m	0.70m
2262	Area 2	Fill	Fill of 2261	2.40m	0.65m	0.20m
2263	Area 2	Fill	Fill of 2265	3.98m	0.20m	0.20m
2264	Area 2	Fill	Fill of 2265	3.98m	0.20m+	0.50m+
2265	Area 2	Cut	Rectangular pit	3.98m	2.40m	0.80m+

Springfields, Spalding (SSFG 03)
Context Summary

Context	Area	Type	Description	Length	Width	Depth
2266	Area 2	Fill	Fill of 2269	0.30m	0.30m	0.20m
2267	Area 2	Cut	Posthole	0.09m	0.09m	0.30m
2268	Area 2	Fill	Fill of 2267	0.09m	0.09m	0.30m
2269	Area 2	Cut	Posthole	0.30m	0.30m	0.20m
2270	Area 2	Fill	Fill of 2271	16m+	1m	0.22m
2271	Area 2	Cut	Ditch	16m+	1m	0.22m
2272	Area 2	Fill	Fill of 2273	6.40m+	0.90m	0.18m
2273	Area 2	Cut	Ditch	6.40m+	0.90m	0.18m
2274	Area 2	Fill	Fill of 2275	4.50m	0.90m	0.06m
2275	Area 2	Cut	Ditch	4.50m	0.90m	0.06m
2276	Area 2	Fill	Fill of 2277	1.30m	1.02m	0.27m
2277	Area 2	Cut	Scoop	1.30m	1.02m	0.27m
2278	Area 2	Fill	Fill of 2271	10m+	1.25m	0.12m
2279	Area 2	Fill	Fill of 2271	10m+	1.40m	0.25m
2280	Area 2	Fill	Fill of 2281	0.50m	0.50m	0.12m
2281	Area 2	Cut	Posthole	0.50m	0.50m	0.12m
2282	Area 2	Fill	Fill of 2283	0.30m	0.30m	0.35m
2283	Area 2	Cut	Posthole	0.30m	0.30m	0.35m
2284	Area 2	Fill	Fill of 2285	0.80m	0.80m	0.07m
2285	Area 2	Cut	Posthole	0.80m	0.80m	0.07m
2286	Area 2	Fill	Fill of 2287	0.63m	1.20m	0.19m
2287	Area 2	Cut	Pit	0.63m	1.20m	0.19m
2288	Area 2	Layer	Flood deposit	unknown	unknown	0.02m
2289	Area 2	Layer	Flood deposit	unknown	unknown	0.02m
2290	Area 2	Layer	Flood deposit	unknown	unknown	0.02m
2291	Area 2	Layer	Flood deposit	unknown	unknown	0.02m
2292	Area 2	Layer	Flood deposit	unknown	unknown	0.02m
2293	Area 2	Layer	Flood deposit	unknown	unknown	0.02m
2294	Area 2	Layer	Flood deposit	unknown	unknown	0.02m
2295	Area 2	Fill	Fill of 2296	16.50m+	0.40m	0.08m
2296	Area 2	Cut	Ditch	16.50m+	0.40m	0.08m
2297	Area 2	Fill	Fill of 2298	0.60m+	0.60m	0.15m
2298	Area 2	Cut	Rectangular pit	0.60m+	0.60m	0.15m
2299	Area 2	Layer	Flood deposit	0.60m+	0.80m+	0.59m+
2300	Area 2	Fill	Fill of 2301	16.50m+	1m	0.19m
2301	Area 2	Cut	Ditch	16.50m+	1m	0.19m
2302	Area 2	Fill	Fill of 2303	0.10m	0.10m	0.05m
2303	Area 2	Cut	Stakehole	0.10m	0.10m	0.05m
2304	Area 2	Fill	Fill of 2305	0.10m	0.10m	0.05m
2305	Area 2	Cut	Stakehole	0.10m	0.10m	0.05m
2306	Area 2	Fill	Fill of 2307	0.40m	0.30m	0.20m
2307	Area 2	Cut	Rectangular pit	0.40m	0.30m	0.20m
2308	Area 2	Fill	Fill of 2310	4m	2.50m	0.80m
2309	Area 2	Fill	Fill of 2310	4m	2.50m	0.08m
2310	Area 2	Cut	Rectangular pit	4m	2.50m	0.80m
2311	Area 2	Fill	Fill of 2312	0.40m	0.20m	0.10m
2312	Area 2	Cut	Posthole	0.40m	0.20m	0.10m
3301	Area 3	Layer	Topsoil	20m+	20m+	0.25m
3302	Area 3	Layer	Subsoil	20m+	20m+	0.20m
3303	Area 3	Layer	Natural	20m+	20m+	0.20m
3304	Area 3	Layer	Natural	20m+	20m+	0.20m
3305	Area 3	Cut	Ditch	20m+	0.97m	0.46m
3306	Area 3	Layer	Fill of 3305	20m+	0.97m	0.46m
3307	Area 3	Cut	Ditch	20m+	1.04m	0.46m

Springfields, Spalding (SSFG 03)
Context Summary

Context	Area	Type	Description	Length	Width	Depth
3308	Area 3	Layer	Fill of 3307	20m+	1.04m	0.46m
3309	Area 3	Cut	Ditch	20m+	0.97m	0.25m
3310	Area 3	Layer	Fill of 3309	20m+	0.97m	0.25m
3311	Area 3	Cut	Ditch	15m+	0.52m	0.12m
3312	Area 3	Fill	Fill of 3311	15m+	0.52m	0.12m
3313	Area 3	Cut	Ditch	8.40m+	0.60m	0.22m
3314	Area 3	Fill	Fill of 3313	8.40m+	0.60m	0.22m
3315	Area 3	Cut	Ditch	13m+	0.95m	0.30m
3316	Area 3	Fill	Fill of 3315	13m+	0.95m	0.30m
4401	Area 4		Unstratified finds	n/a	n/a	n/a
4402	Area 4	Layer	Topsoil	29m+	13m+	0.22m
4403	Area 4	Layer	Subsoil	29m+	13m+	0.25m
4404	Area 4	Fill	Fill of 4405	14m+	3.15m	0.45m
4405	Area 4	Cut	Ditch	14m+	3.15m	1.08m
4406	Area 4	Fill	Fill of 4407	0.95m	0.52m	0.10m
4407	Area 4	Cut	Ditch	0.95m	0.52m	0.19m
4408	Area 4	Fill	Fill of 4405	unknown	1.70m	0.65m
4409	Area 4	Fill	Fill of 4407	0.95m	0.52m	0.14m
4410	Area 4	Cut	Ditch	14m+	3.80m	0.90m
4411	Area 4	Fill	Fill of 4410	unknown	0.75m	0.11m
4412	Area 4	Fill	Fill of 4410	unknown	1m	0.75m
4413	Area 4	Fill	Fill of 4410	unknown	3.50m	0.35m
4414	Area 4	Fill	Fill of 4410	14m+	3.80m	0.45m

APPENDIX 2

THE POST-ROMAN POTTERY FROM SPRINGFIELDS GARDEN CENTRE, SPALDING, LINCOLNSHIRE (SSFG03)

JANE YOUNG CERAMIC CONSULTANT

INTRODUCTION

In total, five hundred and thirteen sherds of pottery representing three hundred and seventy-five vessels were recovered from the site. The pottery ranges in date from the Saxo-Norman to the early modern period. The assemblage was quantified by three measures: number of sherds, weight and vessel count within each context. Fabric identification of some of the pottery was undertaken by x20 binocular microscope. The ceramic data was entered on an Access database using fabric codenames agreed locally and nationally.

CONDITION

With the exception of a small number of well-abraded sherds the pottery is in a slightly abraded condition with sherd size mainly falling into the small to medium range (below 50grams). In total only twenty-eight vessels are represented by more than one sherd. A small number of vessels appear to have been mis-fied or burnt post-firing, these sherds either have a bubbled glaze, or have re-oxidised broken edges. One vessel has cracked during firing and may have been sold as a second. About one third of the vessels have exterior soot residues showing that they have been used over an open fire. A small number of vessels have internal soot deposits, possibly the remains of burnt food. White internal 'kettle fur' deposits, caused by the heating of water or containment of urine, were also found on a few vessels. None of the pottery found on this site appears to have been deposited in a waterlogged environment. Only the pottery group from context 2276 appears to represent primary deposition.

THE POTTERY

In total three hundred and seventy-five vessels in thirty-two identifiable post-Roman pottery ware types together with five miscellaneous fragments were recovered from four trenches and two areas on the site (Tables 1 and 2). The range of form types is quite restricted with various types of jug, bowl and jar forming the main body of the assemblage. Examples of cup and dish were also found.

The majority of the pottery was recovered from deposits in Area 2. The Saxo-Norman pottery (mostly of 11th century date) came almost entirely from Trench 1 and Area 2 towards the south of the area under investigation. Large groups of medieval material were only found in Trench 4 and Area 2.The remaining material shows no pattern, possibly a result of the differing trench/area sizes and levels of excavation limit. The pottery is discussed as far as possible by ceramic period, however, the material from this site mainly belongs to pottery productions that spanned several ceramic periods making close dating and estimating residual sherds difficult. For example the Handmade Early Medieval vessels (EMHM) start to be used in the late 11th century and are known to continue in use in some parts of Lincolnshire into the second half of the 13th century.

Table 1 ***Pottery types with total quantities by sherd and vessel count***

codename	full name	earliest date	latest date	sherds	vessels
BEVO2	Beverley Orange ware Fabric 2	1230	1350	1	1
BL	Black-glazed wares	1550	1750	1	1
BOU	Bourne D ware	1450	1650	8	8
BOUA	Bourne-type Fabrics A, B and C	1150	1350	226	147
CREA	Creamware	1770	1830	3	3
DST	Developed Stamford ware	1150	1230	1	1
ELY	Ely-type ware	1175	1350	3	2
EMHM	Early Medieval Handmade ware	1100	1250	77	74
EST	Early Stamford ware	870	1010	1	1
GRIMT	Grimston-type ware	1200	1550	65	18
HEDI	Hedingham ware	1150	1250	1	1
LSW2	13th to 14th century Lincoln Glazed Ware	1200	1320	2	2
MEDLOC	Medieval local fabrics	1150	1450	5	5
MEDX	Non Local Medieval Fabrics	1150	1450	24	20
MISC	Unidentified types	400	1900	5	5
NCBW	19th-century Buff ware	1800	1900	1	1
NOTGL	Nottingham glazed ware Light Bodied	1200	1320	4	4
POTT	Potterhanworth-type Ware	1250	1500	1	1
SAIM	Saintonge mottled glazed ware	1250	1500	1	1
SLQO	South Lincolnshire Quartz & Oolitie	1100	1250	5	5
SLQOF	South Lincolnshire Quartz Oolite & Iron	1100	1250	2	2
SLSHCW	South Lincolnshire Shell-tempered coarseware (generic)	1100	1300	6	6
SLSQ	South Lincs Shell and Quartz (generic)	1100	1250	3	3
SLSQF	South Lincs Shell Quartz and Iron (generic)	1100	1250	3	2
SLST	South Lincolnshire Shell Tempered ware	1150	1250	1	1
SNEOT	St Neots ware	870	1200	3	3
SNLOC	Local Saxo-Norman fabrics	870	1150	2	2
ST	Stamford Ware	970	1200	35	33
STANLY	Stanion/Lyveden ware	1150	1250	2	2
STSL	Staffordshire/Bristol slipware	1680	1800	2	2
THETT	Thetford-type fabrics	1000	1150	8	8
TOY	Toynton Medieval Ware	1250	1450	10	9
TPW	Transfer printed ware	1770	1900	1	1

Saxo-Norman (late 9th to 12th)

At least forty-seven vessels predate the third quarter of the 12th century. Thirty-four of these are Stamford ware products, mainly of 11th to early 12th century date (22vessels). One unglazed Fabric A jar (EST) has diamond roller-stamping on the shoulder and the fabric is at the coarse end of the spectrum, suggesting that this vessel could possibly be of 10th century date, although it is more likely to belong to the first or second quarters of the 11th century. Most of the remaining Stamford vessels (ST) are unglazed coarseware jars and bowls in a finer Fabric A, these vessels are difficult to date closely as they had a long currency from the late 10th through to the beginning of the 12th century. Three Fabric A pitchers were recovered, two of which are glazed and these are likely to be of mid to late 11th century date. The remaining vessels are jars and pitchers in the finer fabrics B and G, dating to the post-conquest period.

Table 2 ***Showing distribution by ceramic date of the post-Roman pottery found on the site***

Ceramic period	Trench 1	Trench 2	Trench 3	Trench 4	Trench 5	Area 1	Area 2	Area 3	Area 4	Total vessels
Saxo-Norman (late 9th to12th)	16	2	1	1		1	22		4	47
Saxo-Norman to early medieval (mid11th to early 13th)	1	1					6			8
Early medieval to medieval (12th to13th)				6	1		70		3	80
Medieval (13th to14th)	2	1	1	51		1	136	1	26	219
Late medieval to early post-medieval (15th to 16th)				3			1		4	8
Late post-medieval to early modern (18th to 20th)			2	3			1		2	8
Not known							2		3	5
Total vessels	19	4	4	64	1	2	238	1	42	375

Eight vessels are in Thetford-type fabrics (THETT); three different fabric types occur (a fine fabric, a smooth fabric and a Grimston type fabric). Thetford-type ware is in use from the late 9th to the 12th centuries and it is difficult to closely date small undiagnostic fragments, the fabrics found on this site however suggest that most of these vessels are of 11th to 12th century date. Certainly the smooth fabric as found at Thetford is considered to be a *** product and Grimston–type Thetford ware is considered to be of mid 11th to mid 12th century date (Rogerson and Dallas 1984) . The two Grimston-type vessels are probably large storage jars whilst the remaining vessels are all likely to be jars.

Three small fragments of shell-tempered St. Neots ware (SNEOT) and two quartz-tempered vessels that are likely to be local (SNLOC) also belong to this period and could date anywhere between the late 9th and mid 12th centuries. All the vessels are likely to be jars.

Saxo-Norman to Early Medieval (mid 11th to early 13th)

Seven vessels belong to productions that span the period between the mid 11th century and the beginning of the medieval period in the early 13th century. They are all coarseware fabrics containing quartz and oolitic inclusions (SLQO and SLQOF) which were probably produced in south Lincolnshire. The vessels are probably all jars. One small Developed Stamford ware vessel (DST) with a copper glaze is of post-mid 12th century date but is unlikely to post-date the early 13th century.

Early Medieval to Medieval (late 11th to mid/late 13th)

Overall, eighty of the pottery vessels submitted for examination are of early medieval to medieval type and can be dated to the period between the late 11th and mid/late 13th centuries. Only two ware types are represented, Early Medieval Handmade (EMHM) and South Lincolnshire Shell-tempered coarseware (SLSHW). Vessels in these unglazed ware types were made at several centres including Bourne in Lincolnshire and Grimston in Norfolk k. No attempt at detailed fabric analysis of these wares has been attempted as part of this project, although obvious attributions have been noted in the archive. With the exception of three possible bowls all of the vessels appear to be jars. No complete jar forms in the shell-tempered fabrics are known but the jars are likely to be a wide-based type similar to those found in other Lincolnshire early medieval productions. The typical Early Medieval Handmade jar however, is around-

based form, often with a wheel-finished rim. Only one vessel, probably a bowl is decorated and this is with an applied thumb-pressed strip.

Medieval (late 12th to 14th)

The overwhelming proportion of the pottery recovered from the site (219 vessels) is of medieval type. Medieval industries have differing start dates, so that some ware types such as Bourne Medieval (BOUA) and Stanion/Lyveden (STANLY) have their origins in the late 12th century whilst others such as Toynton Medieval do not start until the mid to late 13th century. Evidence from this site, suggests, that although Bourne-type products are the major medieval pottery type to be supplied to the area throughout the 13th and 14th centuries, Grimston-type vessels are becoming a more common type from the mid 13th century.

About two thirds of the medieval vessels found on the site are products of kilns producing Bourne-type wares. Production of this type is known at Bourne itself and also at Baston, although there are probably several other production sites still to be found. Three main Bourne-type fabric used in the medieval period have been identified (Healey 1969, 1975), although in practise vessels often appear to be a hybrid of these. Basically the three main fabrics are fine (Fabric A), coarse (Fabric B) and oolitic (Fabric C). The major fabric found on this site is Fabric A, with fifty vessels, followed by A/B hybrids with thirty-two vessels. Vessels in Fabric B were less common with twenty-four examples occurring whilst only one Fabric C jar was recovered; the remaining vessels are in mixed fabrics. There seems to be no correlation between fabric and vessel form with jars being the most common form in all fabrics. The main identifiable form is a squat shouldered jar with an everted or flanged rim. Only twenty-nine vessels were identifiable as jugs, of these thirteen are decorated, either with plain or notched strips applied diagonally or vertically on the body of the vessel. On six of these decorated jugs, iron-rich clay has been used to form the strip, giving a contrasting colour between the body and applied decoration. Three of these iron-rich strips are also notched. Few well-stratified groups of Bourne-type ware have been documented, making it difficult to be precise about the dating of these decorated jugs. Applied notched iron-rich strips however, are an early feature of both the Lincoln and Nottingham glazed ware industries, the technique starting in the very late 12th or early 13th century and dying out by the third quarter of the 13th century. Plain iron-rich strips however continue to be used into the 14th century. It is probable therefore that the Bourne-type jugs decorated with notched iron-rich strips date to the early to mid/late 13th century (1200-12705). The remaining Bourne-type vessels can as yet only be assigned to the general period of production between the late 12th century and the 14th century.

The second most common medieval type represented on the site is visually and typologically similar to material produced at kilns at Grimston, Norfolk. The main difference is in fabric composition and firing technique. The vessels from this site are almost always oxidised on the external unglazed surfaces whereas Grimston ware products are more often reduced. The fabric, under x20 microscopic examination suggests that they may not all be products of a single industry. As it is probable that most of the vessels from this site are not products of the kilns at Grimston, it has been decided to term these vessels Grimston-type until fuller fabric analysis can take place. Only one jar and one bowl form were identifiable amongst the pottery from this site, the remaining diagnostic sherds are all from jugs. These jugs appear to be narrow-based and of a slender type (DR 2). Of note are two jugs from context 2276, both have fresh breaks and may have been deposited as complete or near complete vessels. The most complete vessel is a slender, narrow-based jug with a rod handle and applied vertical iron-stained scales (DR2). This jug has affinities with medieval vesselsfrom the Low Countries. The second jug is most unusual, it had a face applied either side between the handle and a projecting bridge spout (DR4); unfortunately only one face now survives. Whilst face-jugs themselves are an uncommon find this one is exceptional in that the face has a long pointed beard and what must be horns, applied to the top of the head. The eyes are formed by impressed rings and dots, the mouth a slightly impressed line and the beard is edged with short slashed lines. The effect is definitely satanic.

The remaining vessels include a small amount of pottery from known production centres, as well as a slightly larger element from uncertain local (MEDLOC) and non-local sources (MEDX). Nine

vessels, probably all jugs are of Toynton-type; the fabric of all of these vessels can be paralleled at the main production site at Toynton All Saints, Lincolnshire. All of the vessels appear to be of 13th to 14th century types and include two jugs with applied iron-stained decoration. Two vessels are 13th century Lincoln products, one is a small jug, the other, either a jug, or less likely a jar. The only other vessel from a known Lincolnshire source is a large Potterhanworth jar. Four plain jugs are 13th century Nottingham products (NOTGL) and two vessels are of 13th century Stanion/Lyveden type (STANLY) from Northamptonshire, one is a decorated jug with applied light-firing strips and clay pads that have a grid stamp impressed on them. One highly decorated jug sherd is similar to vessels produced in the 13th century at Sible Heddingham, Essex. The sherd has an applied pad in a light firing clay; this pad has been stabbed and appears to represent part of a shield. Another highly decorated jug is a 13th to early 14th century Beverley product, part of a jug with pushed-out bosses possibly further decorated with 'raspberry' and 'wheatear' stamps. Two tentatively identified jars are in an Ely-type ware. A single continental import, a Saintonge mottled ware jug was recovered from the site.

Late Medieval to Early Modern

Little post-14th century pottery was recovered from the site. The eight Bourne Fabric D vessels may not all be of late or post-medieval date, as several vessels with medieval rim types have recently been noted in secure 14th century deposits. The remaining vessels all post-date the late 17th century.

Miscellaneous

Two well-abraded sherds may possibly be of Roman date.

DISCUSSION

Single sherds represent most of the vessels and there are no cross-context joining sherds. This, together with the fragmentary nature of most of the pottery, suggests that much of the pottery recovered from this site arrived in its final deposition place as part of dumping and levelling episodes. Only the pottery from the fill of scoop 2277 can be considered as a primary deposition group. As such, the site assemblage is difficult to interpret. It is possible however, to suggest that there was post-Roman occupation in the area from at least the 11th century if not earlier. Only one Stamford ware Fabric A sherd (EST) is demonstrably of pre-conquest date, the other Fabric A (ST) vessels are undiagnostic and may be placed anywhere within the 11th century or perhaps into the beginning of the 12th century. Occupation possibly continues throughout the 12th century, although no closely dateable vessels occur. The height of activity on the site appears to have been in the 13th century when a range of local, regional and continental imports reached the site. There is little evidence for continuation of occupation beyond the 14th century and it is possible that it ended earlier, in perhaps the late 13th century. The assemblage contains entirely domestic refuse, mainly jars and jugs and although several highly decorated jugs occur, none of the other ceramic forms associated with higher status sites were recovered.

Further work should be done on separating the Early Medieval Handmade ware vessels into sub-fabrics, sourcing some of the shell-tempered sherds and determining the identity of the Grimston-type vessels. The entire collection should be kept for future study.

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Rogerson, A & Dallas, C 1984. The pottery, in Rogerson, A & Dallas, C (eds), *Excavations in Thetford 1948-59 and 1973-80*, E Anglian Archaeol Rep **22**, 117-166, Norfolk Archaeol Unit, Dereham

Springfields Spalding (SSFG 03)
The Ceramic Dating Archive

trench	context	date	comments
1	133	11th	
2	202	late 12th to 13th	
2	211	late 12th to 13th	single sherd
2	222	12th	
3	301	late 17th to 18th	
4	415	13th to 14th & 15th to 16th	
4	416	13th to 14th	
4	433	13th to 14th	
4	435	13th to 14th	
4	444	late 18th to 19th	
4	449	mid 13th & mid 15th to 16th	
5	511	12th to 13th	single sherd
Area 2	2203	12th to 13th	
Area 2	2215	late 12th to 13th	
Area 2	2216	mid/late to late 13th	
Area 2	2218	mid/late to late 13th	
Area 2	2220	12th to 13th	single sherd
Area 2	2234	13th to 14th	single sherd
Area 2	2238	mid/late to late 13th	
Area 2	2245	late 12th to 13th	
Area 2	2247	11th to mid 12th	single sherd
Area 2	2249	10th to mid 11th	single sherd
Area 2	2252	12th to 13th	
Area 2	2255	13th to 14th	single sherd
Area 2	2260	11th	single sherd
Area 2	2262	late 12th to early 13th	
Area 2	2266	12th	
Area 2	2274	11th	single sherd
Area 2	2276	mid 13th	
Area 2	2278	11th to mid 12th	
Area 2	2279	11th to mid 12th	single sherd
Area 2	2295	mid 11th to 12th	single sherd
Area 2	2297	late 18th to 19th	
Area 2	2300	late 12th to 13th	
Area 2	2306	mid/late 11th to 12th	single sherd
Area 2	2314	late 13th to 14th or mid 14th to 15th	
Area 3	3306	12th to 13th	single sherd
Area 4	4402	13th to 14th	single sherd
Area 4	4404	13th	
Area 4	4406	19th to 20th	
Area 4	4408	13th to 14th	
Area 4	4409	13th to 14th	single sherd + handmade brick
Area 4	4411	11th	single sherd

Medieval Pottery Glossary

code name	full name	earliest date	latest date
BEVO2	Beverley Orange ware Fabric 2	1230	1350
BL	Black-glazed wares	1550	1750
BOU	Bourne D ware	1450	1650
BOUA	Bourne-type Fabrics A, B and C	1150	1350
CREA	Creamware	1770	1830
DST	Developed Stamford ware	1150	1230
ELY	Ely-type ware	1175	1350
EMHM	Early Medieval Handmade ware	1100	1250
EST	Early Stamford ware	870	1010
GRIMT	Grimston-type ware	1200	1550
HEDI	Hedingham ware	1150	1250
LSW2	13th to 14th century Lincoln Glazed Ware	1200	1320
MEDLOC	Medieval local fabrics	1150	1450
MEDX	Non Local Medieval Fabrics	1150	1450
MISC	Unidentified types	400	1900
NCBW	19th-century Buff ware	1800	1900
NEOT			
NOTGL	Nottingham glazed ware Light Bodied	1200	1320
POTT	Potterhanworth-type Ware	1250	1500
SAIM	Saintonge mottled glazed ware	1250	1500
SLQO	South Lincolnshire Quartz & Oolitie	1100	1250
SLQOF	South Lincolnshire Quartz Oolite & Iron	1100	1250
SLSHCW	South Lincolnshire Shell-tempered coarseware (generic)	1100	1300
SLSQ	South Lincs Shell and Quartz (generic)	1100	1250
SLSQF	South Lincs Shell Quartz and Iron (generic)	1100	1250
SLST	South Lincolnshire Shell Tempered ware	1150	1250
SNLOC	Local Saxo-Norman fabrics	870	1150
ST	Stamford Ware	970	1200
STANLY	Stanion/Lyveden ware	1150	1250
STSL	Staffordshire/Bristol slipware	1680	1800
THETT	Thetford-type fabrics	1000	1150
TOY	Toynton Medieval Ware	1250	1450
TPW	Transfer printed ware	1770	1900

Springfields Spalding (SSFG 03)
Pottery Archive

trench	context	cname	sub fabric	form type	sherds	vessels	weight	decoration	part	ref no	description	date
1	100	ST	A	jar	1	1	7		BS		soot;unglaze	
1	100	ST	A	jar	1	1	13		BS		soot;abraded int;unglaze	
1	100	ST	A	small jar	1	1	2		BS		soot;unglaze	
1	100	ST	A	?	1	1	2		BS		soot;unglaze	
1	100	ST	A	?	1	1	1		BS		unglaze	
1	100	ST	A	pitcher ?	1	1	2		BS		int & ext glaze	
1	100	ST	A	pitcher	1	1	15		BS		glaze	
1	100	ST	G	bowl	1	1	8		rim		glaze;? ID	
1	100	THETT	smooth fabric	jar	1	1	6		BS		soot	11th to 12th
1	100	THETT	smooth fabric	jar	1	1	4		BS			11th to 12th
1	100	THETT	smooth fabric	?	1	1	24		base			11th to 12th
1	100	THETT	fine fabric	?	1	1	5		base			11th to 12th
1	100	THETT	fine fabric	jar ?	1	1	23		base			11th to 12th
1	100	THETT	G	large vessel	1	1	15		BS		int dep	11th to 12th
1	100	GRIMT		small jug	1	1	2		BS		thin walled	
1	100	THETT	fine fabric	?	1	1	14		BS			11th to 12th
1	133	SLQOF		jar	1	1	4		rim			
1	133	BOUA	A	?	1	1	4		BS		soot int	
1	133	ST	A	jar	1	1	6		base		unglaze	
2	211	SLST		?	1	1	11		base		soot	
2	222	SNLOC	fine quartz & ca	jar ?	1	1	3		BS		soot;very thin walled;fine quartz occ larger occ large ca occ carb veg	
2	222	ST	B	jar/jug	1	1	2		BS		cu spots	
2	222	SLQOF		jar ?	1	1	5		BS		soot	
3	301	STSL		press mould dish	1	1	8	trailed;pressed edges	rim			
3	301	STSL		press mould dish	1	1	11	trailed	BS			
3	301	SNLOC	fine quartz	jar ?	1	1	7		BS		fine quartz sparse larger sparse large fe	
3	345	BOUA	A/B	jar	1	1	9		BS			
4	415	BOU	4	jug	1	1	35		BS	RF10	no glaze;white ext skin;reoxidised over breaks;? ID	

4	415	BOUA	B	jar	1	1	8		BS	RF14	soot;? ID	
4	415	BOUA	B	jug/jar	1	1	5		BS	RF2		
4	415	BOUA	B/C	bowl	1	1	28		BS	RF5	burnt int glaze;? ID	
4	415	BOUA	A/C	jar	1	1	8		BS	RF12	thin walled	
4	415	GRIMT		jug	1	1	53		base	RF15	abraded	
4	415	BOUA	B	jar	1	1	10		BS	RF13	soot	
4	415	BOUA	A	jar	1	1	8		BS	RF6	soot;? ID	
4	415	GRIMT		small jug	1	1	30	pulled thumb at basal angle	base	RF11	reoxidised over breaks;cracked during firing	
4	415	BOUA	A	jar	1	1	18		BS	RF17	soot;? ID	
4	415	GRIMT		jug/jar	1	1	4		BS	RF7	soot;splashed glaze	
4	415	BOUA	C	jar	1	1	6		BS	RF1		
4	415	GRIMT		jug/jar	1	1	5		BS	RF9		
4	415	TOY	A	small jug	1	1	19	thumbed basal edge	base	RF16	soot ext int & over edges;narrow base	
4	415	MEDLOC	OX/R/OX;med sandy;hard	jar ?	1	1	6		BS	RF8	very mixed fabric round quartz ca occ flint	
4	416	NEOT		jar	1	1	10		rim	RF21	soot	
4	416	BOUA	B/C	bowl/jar	1	1	27		base	RF20	int glaze;soot	
4	416	BOUA	B/C	jug	1	1	68	applied diag strip dec	BS	RF18		
4	416	TOY	B	jug/jar	1	1	14		BS	RF19		
4	416	BOUA	A	jar	1	1	9	ridged shoulder	BS	RF22	? ID	
4	433	ELY		jar	2	1	13		BS		abraded;soot;? ID	
4	433	BOUA	B	jar	1	1	4		BS	sample 2		
4	435	BOUA	A/B	?	1	1	1		BS	sample ?		
4	435	BOUA	A	?	1	1	1		BS	sample 3	flake;light firing	
4	435	BOUA	B	jug	1	1	3		BS	sample 3	burnt ?	
4	435	BOUA	A/B	?	1	1	1		BS	sample ?		
4	435	EMHM		jar	2	1	2		BS	sample ?		
4	435	BOUA	A	?	1	1	1		BS	sample ?		
4	435	BOUA	A/B	jar/jug	1	1	3		base	sample 3		

4	444	CREA		closed	1	1	3		BS			
4	444	CREA		dish	1	1	6		rim			
4	446	BOUA	B	jug/jar	2	1	29		BS		int dep;ext slip	
4	446	MEDX	OX/R/OX;coarse shell	large bowl	1	1	55		BS		soot;mod coarse shell comm rounded med-coarse quartz occ limestone	
4	446	EMHM	Bourne ?	jar	1	1	16		BS		soot	
4	446	BOUA	C/B	lipped jar	1	1	82		rim		flanged rim	
4	446	NOTGL		small jug	1	1	3		BS			
4	447	EMHM		bowl ?	1	1	20	applied strip	BS		soot	
4	447	BL	GRE	cup	1	1	2		BS			
4	447	BOU	1	bowl	1	1	21		base			
4	447	BEVO2	B	highly decorated jug	1	1	13	boss moulded	BS		abraded ext	
4	447	POTT		large jar	1	1	69		BS			
4	447	BOUA	A	jar/bowl	1	1	22		BS			
4	447	MEDLOC	OX/R/OX;fine-med sandy;hard	bowl	1	1	22		rim		square rim;decayed int glaze;comm mixed subround to round quartz mod rounded limestone mod fe mod rounded voids sparse flint;? A very poor BOUA	
4	447	BOUA	A	jug	1	1	69	applied vert notched fe strips	BS			
4	447	BOUA	B	jug	1	1	28	applied vert notched strips	BS		misfired/burnt glaze	
4	447	BOUA	B	jug	1	1	14	vert applied notched strips	BS			
4	447	BOUA	A/B	small jug	2	1	11		BS		int dep ?	
4	447	BOUA	B/C	jug	1	1	17		BS			
4	447	BOUA	A/B/C	jug	1	1	66	diag applied strips	BS			
4	447	BOUA	A/C	large bowl/jar	2	1	69		BS		unglaze;soot	

4	449	MEDX	OX/R/OX;med shell	?	1	1	12		BS		soot:mod med shell fine-med subround quartz sparse flint	
4	449	BOU	4	large jug/jar	1	1	0		BS			
4	449	BOUA	B	jug/jar	1	1	14		BS		? ID	
4	449	SAIM		small jug	1	1	11		BS		ext glaze burnt ?	
4	449	GRIMT		small jug	1	1	11		rim		flat topped	
4	449	MEDX	OX/R/OX;mod med-coarse limestone;hard	jar/bowl	1	1	121	thumbed int rim edge	rim		square rim;soot;mod med-coarse rounded limestone mod shell mod fe mod med-coarse subround quartz occ grog	
4	449	EMHM		jar/bowl	1	1	19		BS		soot;occ-mod greensand	
4	449	STANLY		jar/jug	1	1	27		BS		soot;? ID or BOUA fabric C	
4	449	EMHM		jar	1	1	11		BS		int soot	
4	449	BOUA	A	jar ?	1	1	12		base		soot;? ID	
4	449	MEDLOC	OX/R/OX;fine-med sandy;hard	jar	1	1	25		BS		very mixed fabric rounded quartz ca fe occ flint	
4	449	GRIMT		jug	1	1	38	shoulder cordon	BS		light firing	
4	449	EMHM		jar	2	1	32		BS		soot;int dep	
4	449	MEDLOC	oxid;med sandy;hard	jug	1	1	28		BS		no glaze but a trail of slip;a BOUA fabric A ?	
5	511	EMHM		jar	1	1	2		BS	sample ?		
Area 1	1101	ST	B	pitcher/jug	1	1	4		BS		ext burnt glaze	
Area 1	1101	BOUA	A	jug	1	1	20		UHJ			
Area 2	2200	BOUA	A	jug	1	1	29	applied vertical notched strips	BS			
Area 2	2200	MEDX	coarse shell + quartz + fe	jar	1	1	9		rim		purplish ext surfs	
Area 2	2200	BOUA	A	jar/bowl	1	1	19		BS		soot;??ID	
Area 2	2200	BOUA	A/B	jar	1	1	13		BS		soot	
Area 2	2200	GRIMT		jug ?	1	1	24	incised horizontal grooves	BS			
Area 2	2200	ST	A	pitcher	1	1	40		rim & UHJ		soot;folded hollow everted rim;unglaze	
Area 2	2200	BOUA	A/B	jar	1	1	17		rim		everted rim;? ID	

Area 2	2200	BOUA	A/B	jar	1	1	19		rim		flanged rim	
Area 2	2200	BOUA	A/B	jug	1	1	7		rim		triangular rim	
Area 2	2200	BOUA	A/B	jar/bowl	1	1	11		base		int glaze;soot	
Area 2	2203	SLSQF		jar ?	2	1	40		base & BS		knife trimmed base	
Area 2	2203	SLSHCW		jar	1	1	5		rim			
Area 2	2203	EMHM		?	1	1	2		BS			
Area 2	2203	MEDX	coarse shell occ quartz	jar	4	1	23		BS		reduced ext;identifiable ridged shell	
Area 2	2215	STANLY	glazed oolitic	jug	1	1	12	applied white clay strip & grid stamp	BS			
Area 2	2215	SLQO		jar	1	1	11		rim			
Area 2	2215	MEDX	coarse shell	jar ?	2	1	17		BS		purplish surfaces	
Area 2	2215	MEDX	coarse shell	bowl	1	1	54		BS		purplish surfaces	
Area 2	2215	BOUA	B	?	1	1	1		BS	sample 4	soot	
Area 2	2215	SLSHCW	+ occ flint	?	1	1	1		BS	sample 4		
Area 2	2215	BOUA	B/C	jar/bowl	1	1	26		BS		int glaze;soot	
Area 2	2215	MEDX	coarse shell	?	1	1	23		BS		soot;purplish surfaces	
Area 2	2215	EMHM		?	1	1	1		BS	sample 4		
Area 2	2216	BOUA	B	jug/jar	1	1	8		BS		glaze	
Area 2	2216	BOUA	A	jug	1	1	9	incised horizontal grooves	BS		glaze	
Area 2	2216	BOUA	A	jug	1	1	11	fe notched strips	BS			
Area 2	2216	BOUA	B	jug/jar	1	1	19		base		glaze	
Area 2	2216	BOUA	B	jug/jar	1	1	4		BS		glaze	
Area 2	2216	BOUA	B	jar/bowl	1	1	8		base		int glaze	
Area 2	2216	EMHM		jar	1	1	7		rim			
Area 2	2216	BOUA	B/C	jar	1	1	34		BS		soot	
Area 2	2216	EMHM		jar	1	1	6		BS		soot	
Area 2	2216	SLQO		jar ?	1	1	18		BS		abraded	
Area 2	2216	BOUA	B/C	jar	1	1	16		BS		soot	

Area 2	2216	BOUA	B/C	jar	1	1	11		BS		soot	
Area 2	2216	BOUA	A	jar	1	1	32		rim			
Area 2	2216	BOUA	B/C	jug	1	1	15		rim		triangular rim	
Area 2	2216	BOUA	A/B	bowl/jar	1	1	69		base			
Area 2	2216	BOUA	B	?	1	1	8		BS		very abraded;vessel/tile	
Area 2	2216	MEDX	OX/R/OX;fine-med sandy;hard	?	1	1	13		BS		unglaze;abundant fine-med round quartz	
Area 2	2216	BOUA	A/B	jar	1	1	51		base			
Area 2	2216	BOUA	A/B	jar	1	1	18		base		soot	
Area 2	2216	BOUA	B/C	jar	1	1	7		BS			
Area 2	2216	BOUA	A/C	jug	1	1	6		BS		glaze	
Area 2	2216	ST	B	jar/pitcher	1	1	2		BS			
Area 2	2216	EMHM		jar	1	1	4		BS		soot	
Area 2	2216	EMHM		jar/bowl	1	1	5		BS		soot;smooth fabric	
Area 2	2216	EMHM		jar	1	1	1		BS		soot	
Area 2	2216	EMHM		jar	1	1	3		BS		soot	
Area 2	2216	EMHM		?	1	1	1		BS			
Area 2	2216	BOUA	A	?	1	1	3		BS		glaze	
Area 2	2216	EMHM		jar	1	1	2		BS			
Area 2	2216	EMHM		jar	1	1	10		BS		abraded	
Area 2	2216	EMHM		jar	1	1	1		BS		soot;abraded	
Area 2	2216	EMHM		jar	1	1	2		BS			
Area 2	2216	EMHM		jar	1	1	2		BS		abraded	
Area 2	2216	TOY	B	?	1	1	1		BS		flake	
Area 2	2216	BOUA	A/C	jar	1	1	2		BS		soot	
Area 2	2216	EMHM		jar ?	1	1	1		BS			
Area 2	2216	EMHM		jar	1	1	5		BS		abraded	
Area 2	2216	BOUA	A	jug/jar	1	1	4		BS		abraded;glaze	
Area 2	2216	TOY	B	jug	1	1	4	applied fe vert strips	BS			
Area 2	2216	EMHM		jar	1	1	3		BS		soot;abraded	
Area 2	2216	BOUA	A	jug/jar	1	1	2		BS		int deposit;ext glaze	
Area 2	2216	MEDX	coarse shell + fe	jar/bowl	1	1	11		base		black ext surface;mod fe	
Area 2	2216	MEDX	OX/reduced;fine sandy;hard	jug	1	1	20	thubed basal angle	base		fine quartz & oolite	

Area 2	2216	BOUA	A/B	jar ?	1	1	5		BS		very abraded	
Area 2	2216	EMHM		jar	1	1	2		BS		soot	
Area 2	2216	TOY	A	jug ?	1	1	2		BS		glaze	
Area 2	2216	BOUA	A/B	jar	1	1	6		BS		soot	
Area 2	2216	BOUA	B	jar ?	1	1	3		BS		very abraded	
Area 2	2216	BOUA	A/B	jug/jar	1	1	8		BS		glaze	
Area 2	2216	EMHM		jar	1	1	4		BS		soot	
Area 2	2216	EMHM		jar ?	1	1	2		BS		spots of glaze;Bourne ?	
Area 2	2216	MEDLOC	OX/R/OX;med sandy;hard	?	1	1	6		base		comm subround quartz mod fe occ ca comm voids shell/chaff	
Area 2	2216	EMHM		jar	1	1	3		BS		soot	
Area 2	2216	EMHM		small jar	1	1	2		BS			
Area 2	2216	EMHM		jar	1	1	3		BS		soot	
Area 2	2216	GRIMT		jug	1	1	8		BS		soot	
Area 2	2216	GRIMT		bowl	1	1	18		rim		int glaze	
Area 2	2216	EMHM		jar	1	1	5		BS			
Area 2	2216	MEDX	light reduced oxid surfs;smooth;hard	?	1	1	13		BS		white int & ext surfaces	
Area 2	2216	EMHM		jar	1	1	10		BS		int soot	
Area 2	2216	EMHM		jar	1	1	4		BS		soot	
Area 2	2216	EMHM		jar ?	1	1	3		BS		soot;abraded	
Area 2	2216	EMHM		jar ?	1	1	2		BS		soot;abraded	
Area 2	2216	SLQO		jar	1	1	4		BS			
Area 2	2218	BOUA	C/B	jar	1	1	5		BS		soot	
Area 2	2218	BOUA	B	jar	1	1	23		BS		soot	
Area 2	2218	NOTGL		jug	1	1	6		BS			
Area 2	2218	EMHM		jar	1	1	10		BS		soot	
Area 2	2218	BOUA	C/B	jug	1	1	7	fe applied strip	BS			
Area 2	2218	BOUA	A	jar	1	1	10		BS		soot	
Area 2	2218	EMHM		jar	1	1	2		BS			
Area 2	2218	BOUA	A	jug/jar	1	1	9		BS		? ID	
Area 2	2218	EMHM		jar	1	1	3		BS		soot	
Area 2	2218	SLSQ		?	1	1	11		BS		soot	

Area 2	2218	SLQO		?	1	1	2		BS		fabric contains grog	
Area 2	2218	BOUA	A/B	jug	1	1	3		BS		light firing;? ID	
Area 2	2218	BOUA	A/C	jug/jar	1	1	19		BS		? ID;splashed glaze	
Area 2	2218	BOUA	B/C	jar	1	1	4		BS			
Area 2	2218	TOY	B	jug	1	1	0		BS			
Area 2	2218	SLQO		?	1	1	2		BS		soot	
Area 2	2218	ST	B	collared jar/pitcher	1	1	15	incised wavy dec on rim top	rim		glaze	
Area 2	2218	BOUA	A/C	jar	1	1	4		rim			
Area 2	2218	MEDX	coarse shell & fe	bowl/wide mouthed jar	1	1	17	incised wavy dec int & ext rim	rim		soot	
Area 2	2218	BOUA	A/C	jar	1	1	6		rim		? ID	
Area 2	2218	BOUA	B/C	jar/bowl	1	1	10		BS		soot	
Area 2	2218	BOUA	A	jug/jar	1	1	24		BS		very abraded	
Area 2	2218	BOUA	A/C	jar	1	1	2		BS		soot	
Area 2	2218	BOUA	A	jar ?	1	1	3		BS			
Area 2	2218	BOUA	B	jar	1	1	20		BS		light firing;soot	
Area 2	2218	BOUA	A/C	?	1	1	3		BS			
Area 2	2218	EMHM		jar	1	1	3		BS		soot	
Area 2	2218	GRIMT		?	3	1	32		BS		? ID;thick base;possibly EMHM	
Area 2	2218	SLSQ		jar ?	1	1	2		BS			
Area 2	2218	BOUA	A/C	jar	1	1	5		BS		soot	
Area 2	2218	BOUA	A	jar	1	1	4		BS			
Area 2	2218	BOUA	A	jar	1	1	3		BS		soot	
Area 2	2218	BOUA	A	jar	1	1	3		BS		soot	
Area 2	2218	BOUA	A	jar	1	1	4		BS			
Area 2	2218	EMHM		jar	1	1	2		BS		soot	
Area 2	2218	EMHM		jar	1	1	2		BS			
Area 2	2220	SLSQ		jar	1	1	2		BS			
Area 2	2234	BOUA	B/C	jug/jar	1	1	27		base		soot;glaze spot	
Area 2	2238	BOUA	B/C	jar	1	1	8		BS		soot	
Area 2	2238	EMHM		?	1	1	1		BS		soot	
Area 2	2238	BOUA	A	?	1	1	1		BS		soot	

Area 2	2238	EMHM		?	1	1	2		BS			
Area 2	2238	BOUA	A	jug/jar	1	1	24		BS			
Area 2	2238	LSW2		jug/jar	1	1	2		BS		? ID	
Area 2	2238	BOUA	A/B	jug	1	1	8	applied fe strips	BS			
Area 2	2238	BOUA	B/C	jar	1	1	29		base		soot;? A EMHM	
Area 2	2238	BOUA	A/C	jar ?	1	1	7		BS		abraded	
Area 2	2238	BOUA	A	jug	1	1	8	applied notched fe strips	BS			
Area 2	2238	BOUA	A	jar ?	1	1	6	applied dec ?	BS		? ID	
Area 2	2238	EMHM		jar ?	1	1	3		BS		abraded	
Area 2	2238	BOUA	A	jar	1	1	7		BS		soot ext & part int	
Area 2	2238	MEDX	coarse sand	jar ?	1	1	4		BS			
Area 2	2238	MEDX	coarse shell + occ quartz	jar	1	1	7		BS			
Area 2	2238	EMHM		jar	1	1	3		BS		soot	
Area 2	2238	EMHM		jar	1	1	11		BS		soot	
Area 2	2238	EMHM	Bourne ?	jar ?	1	1	8		BS			
Area 2	2238	EMHM		jar ?	1	1	9		BS		? ID;fabric incl rounded limestone	
Area 2	2238	EMHM		jar ?	1	1	5		BS		abraded	
Area 2	2238	EMHM	Bourne ?	jar ?	1	1	6		BS		soot;fabric incl comm ca	
Area 2	2238	EMHM		jar	1	1	3		BS		abraded	
Area 2	2238	EMHM		jar	1	1	3		BS		soot	
Area 2	2238	BOUA	A	jug	1	1	17	fe dec ?	BS		pocked glaze	
Area 2	2238	ST	A	?	1	1	4		BS		very abraded	
Area 2	2238	EMHM		?	1	1	4		BS			
Area 2	2238	EMHM		jar	1	1	9		BS		abraded	
Area 2	2238	EMHM		jar	1	1	9		rim		soot	
Area 2	2238	EMHM		?	1	1	2		BS		soot;? ID as a flake	
Area 2	2238	BOUA	A/B	jug	1	1	15		BS			
Area 2	2238	EMHM		jar ?	1	1	9		BS		very abraded	
Area 2	2238	DST		small jar/bottle	1	1	4		rim		cu glaze	
Area 2	2238	ST	B	jar/pitcher	1	1	2		BS		glaze	

Area 2	2238	BOUA	A	jar	1	1	16		BS		soot	
Area 2	2238	BOUA	C/A	jar	1	1	8	ridged shoulder	BS			
Area 2	2238	ST	B	jar/pitcher	1	1	1		BS		glaze	
Area 2	2238	HEDI		jug	1	1	15	light firing applied stabbed pad poss a shield	BS			13th
Area 2	2238	ST	B	jar/pitcher	1	1	3		BS		unglaze	
Area 2	2238	BOUA	A	jar	1	1	7		rim			
Area 2	2238	NOTGL		jug	1	1	20		BS			
Area 2	2238	BOUA	A	jug	4	1	124		BS		part misfired glaze	
Area 2	2238	SLSHCW	med to coarse shell	jar	1	1	21		rim		hollow upright rim;	
Area 2	2238	BOUA	A	jar	4	1	157	ridged shoulder	rim & BS		soot;folded rim;? ID	
Area 2	2238	BOUA	A	jug	1	1	3		BS			
Area 2	2238	BOUA	A	jar	1	1	21		rim			
Area 2	2238	EMHM		jar	1	1	11		neck			
Area 2	2238	EMHM		jar	1	1	3		BS		soot	
Area 2	2238	TOY	I	jug	1	1	17	complex fe strip dec	BS			
Area 2	2238	BOUA	C/B	jar	1	1	14	ridged shoulder	BS		soot	
Area 2	2238	MEDX	light OX/R/OX;fine sandy;hard	jar	1	1	9		BS		soot;? Light firing fine BOUA;abundant fine subround to round quartz mod fe occ ca	
Area 2	2238	BOUA	B	jar	1	1	6		BS			
Area 2	2238	EMHM	Bourne ?	jar	1	1	5		BS			
Area 2	2238	BOUA	A/B	bowl	1	1	12		BS			
Area 2	2238	BOUA	A/B/C	jar	2	1	43	ridged shoulder	BS		soot	
Area 2	2238	BOUA	A	jar	1	1	13		BS		light firing	
Area 2	2238	BOUA	A/B	jar	1	1	17		rim			
Area 2	2238	MEDX	coarse shell + occ quartz	jar	1	1	12		BS		soot	
Area 2	2238	BOUA	A	jar	1	1	20		rim		everted rim	
Area 2	2238	EMHM		jar	1	1	20		BS			
Area 2	2238	BOUA	A/B/C	jar	1	1	19		BS		soot	

Area 2	2238	BOUA	A/B	jar	1	1	6		BS		light firing;soot	
Area 2	2238	TOY	A	jug	2	1	53	thumbed base	base			
Area 2	2238	BOUA	C/A	jar ?	1	1	30		BS		soot	
Area 2	2238	BOUA	C/B	jar	1	1	7	ridged shoulder	BS		soot	
Area 2	2245	BOUA	B	jar	1	1	25	applied vertical thumbed strip	BS		soot int & part ext;int glaze	
Area 2	2245	SLSHCW		small jar	1	1	3		base			
Area 2	2247	ST	A	jar	1	1	1		BS	sample 6	soot;unglaze	
Area 2	2249	EST	A	small jar	1	1	3	diamond rollerstamping on shoulder	BS			
Area 2	2252	EMHM		?	1	1	5		base			
Area 2	2252	SLSHCW	reduced;medium shell	jar ?	1	1	2		BS	sample 7		
Area 2	2255	ELY		jar ?	1	1	9		BS		?? ID	
Area 2	2260	ST	A	jar	1	1	18		BS		soot;unglaze	
Area 2	2262	EMHM		globular jar	1	1	30		shoulder			
Area 2	2262	SLSHCW	OX/R/OX;med shell	jar ?	1	1	55		BS		fabric incl ech spine;dark brown/purple ex surfs	12th to early 13th
Area 2	2266	ST	B	jar ?	1	1	5		BS		unglaze;soot	
Area 2	2266	EMHM		jar	2	1	8		BS		poss not same vessel	
Area 2	2266	EMHM		jar	1	1	2		BS		soot	
Area 2	2274	ST	A	bowl;type 1	3	1	53	rectangular roller stamp on rim top	rim & BS		unglaze;flanged rim;very abraded	11th
Area 2	2276	EMHM		jar	1	1	2		BS		soot	
Area 2	2276	BOUA	C/B	jar	39	1	1295	ridged shoulder	rim base & BS	DR1	fresh breaks;everted rim;	
Area 2	2276	BOUA	A/B	?	1	1	1		BS	sample 8		
Area 2	2276	BOUA	C/B	jar	25	1	1251		BS	DR3	fresh breaks;upright rim;soot	
Area 2	2276	EMHM		?	2	2	1		BS	sample 8		

Area 2	2276	MISC	shell	?	2	2	1		BS	sample 8		
Area 2	2276	ST	A	jar	1	1	7	square roller stamping on shoulder	BS		soot	
Area 2	2276	THETT	G	large vessel	1	1	16		BS		soot;thick walled;fabric incl moderate greensand	
Area 2	2276	BOUA	A	jar	1	1	4		neck			
Area 2	2276	BOUA	B/C	jug/jar	1	1	6		base			
Area 2	2276	BOUA	A	jar	1	1	18		BS		soot	
Area 2	2276	BOUA	A	jar	1	1	10		BS		soot	
Area 2	2276	BOUA	A/B	jar	2	1	47		BS		soot	
Area 2	2276	BOUA	A/B	jug	1	1	12	fe dec	BS			
Area 2	2276	BOUA	A	jug	7	1	227		rim & UHJ		square rim;UHJ has upper & lower thumbing	
Area 2	2276	GRIMT		face jug	2	1	205	applied vert fe dec;male short beard applied face with horns to rim	rim	DR4	slightly inturned rim	
Area 2	2276	GRIMT		jug	45	1	1437	thumbed basal angle;applied vertical fe scales	rim base & BS	DR2	fresh breaks;upper handle join thumbed;rod handle;square rim;ridged neck & shoulder	
Area 2	2278	NEOT		jar ?	1	1	5		base	sample 13		
Area 2	2278	ST	A	jar	1	1	1		BS	sample 13	soot;unglaze	
Area 2	2278	ST	A	jar/bowl	1	1	14		base		soot ext & over some breaks	
Area 2	2278	NEOT		?	1	1	1		BS	sample 13	flake	
Area 2	2279	ST	A	jar	1	1	1		BS	sample 14	soot;unglaze	
Area 2	2295	ST	A/B	?	1	1	1		BS	sample 9	glaze;tiny flake	
Area 2	2297	CREA		bowl/cup	1	1	1		BS			
Area 2	2297	ST	B	jar ?	1	1	1		BS		unglaze;soot	

Area 2	2300	EMHM		?	1	1	1		BS	sample 10	flake	
Area 2	2300	BOUA	A	?	1	1	1		BS	sample 10	light firing;flake	
Area 2	2306	ST	B	?	1	1	1		BS	sample 5	unglaze	
Area 2	2314	EMHM		jar	1	1	10		BS		soot	
Area 2	2314	BOUA	B	jar/bowl	1	1	18		base		int glaze	
Area 2	2314	BOU	9	jug/jar	1	1	7		BS		hard fired;? ID or is this TOY	
Area 2	2314	EMHM		jar	1	1	11		BS		soot;light firing;? Is this a Bourne type	
Area 2	2314	BOUA	B	jar ?	1	1	17		BS		ext white slip ?	
Area 3	3306	SLSQF		?	1	1	4		BS	sample ?	abraded	
Area 4	4401	EMHM		jar	1	1	4		rim		very abraded;everted rim;? ID	
Area 4	4401	NOTGL		small jug	1	1	19		BS			
Area 4	4401	GRIMT		jar ?	1	1	5		BS		? ID	
Area 4	4401	BOUA	A/B	jug ?	1	1	3		BS			
Area 4	4401	GRIMT		?	1	1	8		BS		light firing;? ID	
Area 4	4401	GRIMT		jar	1	1	7		BS		light firing	
Area 4	4401	BOUA	A	jar	1	1	7		BS		? ID	
Area 4	4401	ST	A	jar	1	1	3		BS		unglaze;soot	
Area 4	4401	GRIMT		jug	1	1	7		BS			
Area 4	4401	BOU	4	jug/jar	1	1	6		BS			
Area 4	4401	BOU	3	jug/jar	1	1	2		BS			
Area 4	4401	MEDX	coarse shell + limes	?	1	1	3		BS		coarse shell mod limestone	
Area 4	4401	BOU	6	jug	1	1	4		BS		cu glaze	
Area 4	4401	BOUA	A/B	jar/bowl	1	1	6		BS		soot;?? ID	
Area 4	4401	LSW2		small jug	1	1	4		BS			
Area 4	4401	TOY	B	jug	1	1	6		BS			
Area 4	4401	ST	A	jar	1	1	4		BS		soot;unglaze	
Area 4	4401	ST	A	pitcher	1	1	8		rim		int & ext glaze;abraded	
Area 4	4401	MISC	pale reduced;smooth;soft	?	1	1	7		base ?		fabric incl large fe grains & sparse flint	Roman ?
Area 4	4401	MEDX	OX/R;fine sandy;hard	?	1	1	4		BS		abundant fine-med quartz sparse shell/limestone	

Area 4	4401	EMHM		jar	1	1	4		rim		very abraded;everted rim;? ID	
Area 4	4401	BOU	2	jug	1	1	4		BS		cu glaze	
Area 4	4402	BOUA	B/C	jar	1	1	4		BS			
Area 4	4404	BOUA	A/B	jug	1	1	6		handle		? ID;strap handle	
Area 4	4404	GRIMT		?	1	1	3		BS		? ID;flake	
Area 4	4404	BOUA	A	?	1	1	1		BS	sample ?		
Area 4	4404	BOUA	A/B	?	2	2	1		BS	sample 1		
Area 4	4404	BOUA	B	jug/jar	1	1	4		BS	sample 1		
Area 4	4404	BOUA	B	jar	1	1	13		rim		abraded;hollow everted rim;? ID	
Area 4	4404	MISC	reduced;fine sandy;hard	jar	1	1	6		BS		slightly oxidised surfs;fine abundant subround quartz mod shell/limestone	Roman or Sxo-Norman
Area 4	4404	BOUA	A/B	jar	1	1	4		BS		soot;? ID	
Area 4	4404	EMHM		jar	1	1	3		rim		? ID or earlier	
Area 4	4404	BOUA	A/B	jar	1	1	4		rim		triangular rim	
Area 4	4404	BOUA	A	jug	1	1	47		LHJ		strap handle;very abraded	
Area 4	4406	NCBW		?	1	1	1		BS			
Area 4	4406	TPW		flat	1	1	2		BS			
Area 4	4406	MISC	bright oxid;fine sandy;hard	?	1	1	1		BS		? Vessel	
Area 4	4408	MEDX	coarse shell comm quartz	large bowl	1	1	74		rim		soot ?;comm mixed subround quartz occ greensand mod fe	
Area 4	4408	BOUA	A	jug	1	1	7		BS			
Area 4	4409	BOUA	A	small jar	1	1	6		BS			
Area 4	4411	ST	A	jar	1	1	2		BS		unglaze;soot	

Springfields Spalding (SSFG 03)
The Fired Clay and Brick

trench	context	cname	frags	weight	ref no	description	date
3	345	FIRED CLAY	1	8		very fine silty fabric	
4	433	FIRED CLAY	2	1	sample 2	fine silty fabric	
4	433	FIRED CLAY	24	7	sample 2	fine silty fabric	
4	435	FIRED CLAY	2	1	sample 3	fine silty fabric	
4	435	FIRED CLAY	2	1	sample ?	very fine silty fabric	
4	435	FIRED CLAY	8	3	sample 3	fine silty fabric	
4	435	FIRED CLAY	20	4	sample ?	fine silty fabric	
4	442	FIRED CLAY	2	1	sample 15	fine silty fabric	
Area 2	2215	FIRED CLAY	14	15	sample 4	fine silty fabric	
Area 2	2216	FIRED CLAY	1	11		fine silty fabric;possible possible handmade brick	
Area 2	2252	FIRED CLAY	3	1	sample 7	pot/tile/clay	
Area 2	2276	BRK	1	124		handmade;hard fine fabric;OX/R/OX;common subround quartz mod fe mod clay pellets; chaff ? Marks on upper surface;25mm thick	possibly Roman
Area 2	2276	FIRED CLAY	2	3		fine silty fabric	
Area 2	2277	FIRED CLAY	21	16	sample 8	fine silty fabric	
Area 2	2278	FIRED CLAY	3	4	sample 13	fine silty fabric	
Area 4	4401	BRK	2	88		fine silty fabric;handmade brick	
Area 4	4404	FIRED CLAY	47	4	sample ?	fine silty fabric	
Area 4	4404	FIRED CLAY	2	1	sample ?	fine silty fabric	
Area 4	4404	FIRED CLAY	74	5	sample ?	fine silty fabric	
Area 4	4404	FIRED CLAY	31	4	sample 1	fine silty fabric;? Brick	
Area 4	4406	BRK	3	7		fine silty fabric;handmade brick	
Area 4	4409	BRK	3	3		fine silty fabric;handmade brick	

APPENDIX 3

The Stone Artefacts

Alan Vince

Introduction

Four stone objects were submitted for identification and assessment. All four stone objects are imported items of medieval date coming from southern Norway (2 items) and the Eifel region in the Rhineland (two fragments of one artefact).

Description

The Hones

Fragments of two small hones were present. Both were made from a light grey phyllite. probably the Norwegian Ragstone, from the Eidsborg district of Telemark, central southern Norway. Roughouts and waste chips of Norwegian Ragstone were found at the city of London, in the early 14th-century backfill of the city ditch at Ludgate Hill, indicating that the hones were exported in a rough state and finished in England. However, both of these examples have original rounded surfaces which suggest that they might have been produced from detrital pebbles. Norwegian Ragstone is not, however, a common erratic in Lincolnshire and it is still likely that the hones are Norwegian imports.

SF26. Context 2238. A fragmentary hone with a sub rectangular cross-section. The hone tapers and at the narrower end is thicker and has what might be a failed attempt to bore a suspension loop. Despite this, the hone has been used and has worn facets on both the broad faces at the wider end.

SF27. Context 2218. A complete hone, pierced for suspension at one end. The hone has an elongated ovoid shape with an elliptical cross-section and worn facets on both faces.

The Querns

Two fragments of lava quern were present. Both are small angular fragments with one flat original surface, coated with black soot. This suggests that both fragments come from the same quern and that this quern might have been reused in an oven or hearth. The lava is a grey vesicular lava with large black phenocrysts and is almost certainly Niedermendig lava, from the Mayen area of southwest Germany. Querns from this source were exported during the Roman period and are also found in mid Saxon and later deposits, continuing into the 12th and 13th centuries. However, these late finds are rare, presumably because of the widespread use of wind- and water-mills and the subsequent decline in domestic grain

milling. The fragments are too small to tell whether they come from the upper or lower stone of the quern.

SF37. Context 2218. Small fragment with blackened face.

SF23. Context 416. Medium-sized fragment with blackened face.

Assessment

The small complete hone, SF27, is unusual and should be drawn and photographed as a record for future reference. The other hone, SF26, should also be drawn and photographed to show the possible failed suspension loop.

All four fragments should be retained for future study.

Table 1 The Stone Objects

REFNO	Context	Subfabric	Form	Part	Description	Weight	Use	Condition
SF26	2238	NORWEGIAN RAG	HONE	BS	POSSIBLE INCOMPLETE HOLE AT NARROW END	9	WORN ON TWO BROAD FACES	BROKEN AT BOTH ENDS
SF27	2218	NORWEGIAN RAG	HONE	BS	SMALL OVAL HONE WITH CIRCULAR SUSPENSION LOOP AT ONE END	3	WORN ON TWO BROAD FACES	COMPLETE
SF37	2218	MAYEN LAVA	QUERN	BS	SMALL FRAGMENT WITH ONE FLAT ORIGINAL SURFACE	8	ORIGINAL SURFACE BLACKENED	FRAGMENT
SF23	416	MAYEN LAVA	QUERN	BS	SMALL FRAGMENT WITH ONE FLAT ORIGINAL SURFACE	116	ORIGINAL SURFACE BLACKENED	FRAGMENT

APPENDIX 4

The Finds from Pit 2217, Area 2

J. Mann

Copper alloy

(2216) <36> is a piece of rolled sheet copper alloy with the edges butted together to form a tube approximately 45mm long. Probably originally of circular section (max diam: 9mm) and slightly tapering, it has suffered some distortion and the patinated surface is pitted in places, either as a result of damage or by corrosion. One of these pits is of more regular shape and may be a deliberate perforation but it is impossible to be certain. One end is decoratively scalloped, the other is probably broken. This is probably part of a ferrule, or perhaps a large lace tag. Such pieces prevented lace ends from fraying and eased threading, and could be used for braids or cord as well as for laces. Similarly large pieces are known from medieval and later contexts elsewhere, as at Norwich (Margeson 1993, fig. 12, 121 & 123) and London (Egan and Pritchard 1991, fig. 188, 1441 & 1443), although other interpretations are possible (*ibid,* 286-90).

The Iron Lump

(2216) <35> The iron lump is possibly a piece of slag, a natural concretion or a very poorly corroded iron object.

Bone Skate

(2218) <24> The bone is the distal end of a (cattle/horse?) metapodial, with both axial and transverse perforations; the shaft is broken (surviving length 148mm). Slight faceting is visible around the surviving edges of the transverse perforation on both faces; the posterior surface of the bone shows areas of abrasion but is otherwise flattened and polished by wear, exposing the medullary cavity. This appears to be a fragment from the heel end of a bone skate. The identification of such pieces as skates has been questioned occasionally but the debate is amply discussed elsewhere by MacGregor (1976; 1985, 141-4); they were used on the Continent from the Bronze Age onwards, but the earliest stratified examples known from Britain date to the Middle Saxon period. They are common finds on Late Saxon and medieval sites in this country and continued in use until the early 20th century, particularly in the Fens. Holes (either axial or transverse) at toe and/or heel would have housed wooden pegs around which were passed a thong or strap, securing the skate to the wearer's foot. This was not absolutely necessary since the technique used resembled skiing rather than skating: the skates were kept flat on the ice and the skater propelled himself by means of an iron-shod pole, and many skates have no holes at all. This piece is unusual in that it has both axial and transverse perforations; this might suggest that the piece had broken and the remaining fragment was reused for another purpose but there is no other evidence to confirm this.

References

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APPENDIX 5

Springfields Spalding
The Environmental Archaeology
Contents

Springfields, Spalding - SSFG03
Environmental Archaeology Report

Introduction

An excavation was undertaken by Lindsey Archaeological Services on the development site at Springfields, Spalding. Previous evaluation had identified archaeology of Late Saxon and medieval date on the site and on the basis of this work a Written Scheme of Works was drawn up by Giffords and Partners for a programme of archaeological excavation at the site. The Written Scheme of Investigation for the project (Giffords and Partners Ltd) included the broad elements of the environmental archaeology of the site and its aims and objectives.

Three basic areas of environmental archaeology were identified as appropriate for investigation during the archaeological excavation of the site.

1. The palaeoeconomy of those areas of the site where occupation activity has been indicated by the results of the archaeological evaluation.

2. The agrarian use of the landscape which the evaluation has shown is divided up into fields separated by ditches, and the general palaeoenvironmental character of the site.

3. The relationship of this late Saxon, medieval and later landscape of fields and settlement to the potential impact of marine and freshwater flood events associated with the changing sea level, coastline and the beginnings of land reclamation and its subsequent maintenance.

These objectives were addressed through a programme of sampling excavated archaeological deposits, natural creeks and sediments and their biological analysis and the dating of the sediments through Optically Stimulated Luminescence (OSL) and radiocarbon dating.

A series of twenty seven bulk samples were taken from archaeological deposits at the site ranging in date from the 11th to 15-16th centuries (Table 1). All these sampled deposits derived from pit and ditch fills. In addition a series of samples from ditches and creek deposits were taken for foraminiferal study, pollen analysis, OSL and radiocarbon dating, and other environmental analyses (Tables 1 and 17).

This report presents the results of this work, and draws on these and those from the evaluation for the interpretation of the sequence and economy at the site.

The report has been divided into three sections, the palaeoeconomic evidence for the late Saxon and medieval settlement on the site; the landscape - primarily changes from marine to terrestrial conditions on site; and the palaeoenvironment of the site.

Methods

The bulk soil samples were processed in the following manner. Sample volume and weight was measured prior to processing. The samples were washed in a 'Siraf' tank (Williams 1973) using a flotation sieve with a 0.5mm mesh and an internal wet sieve of 1mm mesh for the residue. Both residue and flot were dried and the residues subsequently re-floated to ensure the efficient recovery of charred material. A few samples from F127 and ditch 508 proved to be waterlogged and the flots from these samples were kept wet and only the residue dried. These were processed over a 0.5mm mesh residue sieve. The dry volume of the non-waterlogged flots was measured and the volume and weight of the residues recorded.

Table 1: List of samples collected for environmental study

Type	sample no	trench	context no.	sample vol (l)	feature	date
Bulk	1	Area 4	4404	25	Fill of terminal of ditch 4405	13th
Bulk	2	4	433	18	Fill of pit 432	13-14th
Bulk	3	4	435	16	Fill of pit 432	13-14th
Bulk	?	4	435	25	Fill of pit 432	13-14th
Bulk	4	Area 2	2215	16	Fill of pit 2212	Late 12 – 13th
Bulk	5	Area 2	2306	4	Fill of pit 2212	mid-late 11-12th
Bulk	6	Area 2	2247	20	Fill of pit 2246	13th
Bulk	7	Area 2	2252	16	Fill of pit 2251	12-13th
Bulk	8	Area 2	2276	20	Fill of pit 2277	mid 13th ?
Bulk	9	Area 2	2295	20	Fill of ditch 2296	mid 11-12th
Bulk	10	Area 2	2301	16	Fill of ditch 2301 (fill is 2300!)	12-13th
Bulk	11	Area 2	2258	16	Fill of ditch 2259	cf 12-13th
Bulk	12	Area 2			Fill of pit 2277 – no sample delivered	
Bulk	13	Area 2	2278	17	Fill of pit 2277	11- mid 12th
Bulk	14	Area 2	2279	19	Fill of ditch 2271	11- mid 12th
Bulk	15	4	442	16	Fill of pit 443	SCRAPPED
Bulk		4	441	30	Fill ditch 440	Pos. 13-14th
Bulk		4	437	30	Fill ditch 436	Pos. 13-14th
Bulk		Area 3	3306	10	15-25 cm in fill ditch 3305 (section B)	12-13th
Bulk		Area 3	3306	10	25-35 cm in fill ditch 3305 (section B)	12-13th
Bulk		Area 3	3310	10	10-20 cm in fill ditch 3309 (section D)	post-dates 3307
Bulk		Area 3	3310	10	20-30 cm in fill ditch 3309 (section D)	post-dates 3307
Bulk		Area 4	4408	10	F20-30 cm- basal fill of ditch 4405	13-14th
Bulk		Area 4	4408	11	F30-40 cm- basal fill of ditch 4405	13-14th
Bulk		Area 4	4408	11	F40-50 cm- basal fill of ditch 4405	13-14th
Bulk		5	511	11	Rest 20-30 cm fill ditch 508	12-13th
Bulk		5	511	11	Rest 10-20 cm fill ditch 508	12-13th
Bulk		5	511	11	Rest 0-10 cm fill ditch 508`	1450-1650 AD
Bulk		Ev tr 3		6.5	F127 0-10 fill creek (bottom)	Pre late 13th
Bulk		Ev tr 3		7.5	F127 10-20 fill of creek	Pre late 13th
Bulk		Ev tr 3		6.5	F127 20-30 fill of creek	Pre late 13th
Bulk		Ev tr 3		7.5	F127 30-40 fill of creek	Pre late 13th
Bulk		Ev tr 3		7	F127 40-50 fill of creek	650-780AD
Bulk		Ev tr 3		8.5	F127 50-60 fill of creek	Pre late 13th
Bulk		Ev tr 3		3.5	F127 70-80 fill of creek (top)	Pre late 13th
Pollen	1-5	5	511		Pollen samples through lower profile of ditch 508	12-13th
Pollen	A1-A3	Area 3	3308		Pollen samples through ditch section 3307	Pre 12-13th
Pollen	B1-B3	Area 3	3306		Pollen samples through ditch section 3305	post-dates 3307
Pollen	C1-C3	Area 3	3316		Pollen samples through ditch section 3315	Pre dates 3307
Pollen	D1-D4	Area 3	3310		Pollen samples through ditch section 3309	Post-dates 3307
Pollen	E1-E4	Area 4	4414/4412		Pollen samples through basal fill ditch 4410	11th ?
Pollen	F1-F4	Area 4	4408		Pollen samples through basal fill ditch 4405	13th
Pollen	G1-G5	Ev Tr 3			Pollen samples through lower profile creek F127	Saxon
Foram	51-55	1	118-120		10cm intervals through fill creek 124 (OSL5)	449±80 AD
Foram	56-60	1	105-110		10cm intervals through fill creek 117 (OSL6)	666±70 AD
Foram	61-64	2			10cm intervals through creek fill (OSL7)	700±260 AD
Foram	65-67	4			10 cm intervals through deposits at OSL2, creek 423	13th
Foram	68-71	4			10 cm intervals through deposits at OSL1, creek 423	13th
Foram	72-75	4			10 cm intervals through deposits of roddon (OSL3 & 4)	10th
OSL	OSL1	4	424	-	Creek 423 cutting roddon	1260±50 AD
OSL	OSL2	4		-	Creek 423 cutting roddon	
OSL	OSL3	4	416	-	Roddon deposits	Pre 13-14th
OSL	OSL4	4	417	-	Roddon deposits	1020±60 AD
OSL	OSL5	1	120/122		Fills of small creek 124 at 30-40cm	374-534 AD
OSL	OSL6	1	110		Fill of small creek 117	594-734 AD
OSL	OSL7	2			Creek deposits at West end tr 2	444-964 AD
OSL	OSL8	2			Creek deposits at West end tr 2	Pre 10th
OSL	OSL9	Ev Tr 3			Lower buff sands in channel	704-884 AD

The residue of each bulk sample was sorted by eye, and environmental and archaeological finds picked out, noted on the assessment sheet and bagged independently. A magnet was run through each residue in order to recover magnetised material such as hammerscale and

prill and a count was made of the number of flakes or spheroids of hammerscale recovered. The residue was then discarded. The flot of each sample was studied using up to x30 magnification and the presence of environmental finds (i.e. snails, charcoal, carbonised seeds, bones etc) was noted and their abundance and species diversity recorded on the assessment sheet. The flots were then bagged and along with the finds from the sorted residue, constitute the material archive of the samples.

The processing of the samples for more specific specialist study such as pollen and foraminiferal analysis is dealt with in the relevant specialist reports below. The individual components of the bulk samples were identified and the results are summarised below in Tables 2 and 3, and considered in detail in the individual specialist reports.

1. Palaeoeconomy

The results from the analysis of the bulk samples are considered by Area and date (see Tables 2 and 3).

Area 2

The sampled occupation deposits in Area 2 immediately north of the Holbeach Road have been dated to the 11-12th, 12-13th and two to the 13th century. The sampled deposits include pit and ditch fills. All the samples produced animal bone, all but one produced pottery, while most included marine shell, bird eggshell and fish bone. A single fragment of dog turd was present in context 2301. Five of the samples produced between one and three flakes of hammerscale and two produced small fragments of slag. These latter suggest that there may have been some iron smithing somewhere near the site, but the densities are very low. Context 2278 in pit 2277 was a large dump of mussel shells, presumably discarded after processing. Apart from this mussel dump the deposits indicate an input of domestic rubbish into the features, but the densities are fairly low. 2215 in pit 2212 included some concretions that may derive from cess deposits. The other sample from this pit, 2306, includes a few mineralised seeds and this feature may have included some cess, although the evidence does not suggest a cess pit.

Area 3

In Area 3 only two features were sampled and both are thought to be field ditches. These samples were primarily taken for the recovery of snails. However a sherd of pottery in A306, and a little bone, marine shell, eggshell and a single flake of hammerscale in ditch 3309 suggests some occupation activity in the vicinity.

Area 4

The majority of the samples from this area were taken from pits and ditches, but one series was taken from the fills of a natural creek in a re-opened evaluation trench some metres north of the main excavations areas. Most of the features date to the 13-14th century and suggest a later period of activity on the slightly higher ground of this roddon (see below). The sampled pits and ditches have produced pottery, fired earth, animal bone, marine shell, fish bone and eggshell. Densities of finds are however very low. Several of the samples produced one or two flakes of hammerscale and very small quantities of slag. These latter suggest some iron-smithing nearby at this time but the densities are much too low for this activity to have been on the excavated part of the site. Sample 435 from pit 432 produced a bone bead, while a fragment of lead was recovered in the terminal of ditch 4405.

Table 2: Springfields, Spalding. Archaeological finds from the processed samples

Date	sample no	context no.	samp vol (l)	feature	residue volume (ml)	pot #/g	metal	fired earth/ daub g.	cbm g.	mag. g.	hamm' scale no.	slag	bone g.	marine shell g.	fish bone g.	egg-shell g.	
Area 2																	
11-m 12th	13	2278	17	Fill of pit 2277	4000	4/8		4		<1			1	1922	<1	<1	Mussel shell dump?
11-m 12th	14	2279	19	Fill of ditch 2271	100	1/2		+		<1			1	64	<1	<1	
m-l 11-12th	5	2306	4	Fill of pit 2212	<5	1?/<1		+		<1	1		<1	<1			
m 11-12th	9	2295	20	Fill of ditch 2296	20	1/<1				<1			3	2	<1		Small flint flake
l 12-13th	4	2215	16	Fill of pit 2212	40	3/3		9		1	1		3	4	<1	<1	
12-13th	7	2252	16	Fill of pit 2251	15	2/2		+	<1	<1			1	3	<1	<1	
12-13th	10	2301	16	Fill of ditch 2301 (fill is 2300!)	10	3/1		+		<1	2		1	2	<1	<1	Fragment dog turd
12-13th	11	2258	16	Fill of ditch 2259	15			+		<1		+	6	2	<1	<1	
13th	6	2247	20	Fill of pit 2246	10	1/1		+		<1	1		2	1			
mid 13th	8	2277	20	Fill of pit 2277	35	11/4		12		1	3	+	3	3	1	<1	
Area 3																	
12-13th		3306	10	15-25 cm in fill ditch 3305 (section B)	45											<1	
12-13th		3306	10	25-35 cm in fill ditch 3305 (section B)	45	1/3											
Post 3307		3310	10	10-20 cm in fill ditch 3309 (section D)	20												
Post 3307		3310	10	20-30 cm in fill ditch 3309 (section D)	5					<1	1		<1	<1		<1	
Area 4																	
13th	1	4404	25	Fill of terminal of ditch 4405	40	3/9	Pbx1		3	<1	3	+	5	3	<1	<1	
13-14th	2	433	18	Fill of pit 432	50	1/4		7	<1	<1		+	<1	4		<1	
13-14th	3	435	16	Fill of pit 432	40	2/4		2	<1	<1	2	+	<1	1	<1	<1	
13-14th	?	435	25	Fill of pit 432	120	7/3		7		<1		+	1	4	<1	<1	Bone bead
13-14th ?		441	30	Fill ditch 440	15			+		<1	1	+	<1	1	<1	<1	
13-14th ?		437	30	Fill ditch 436	10					<1	3		<1	1	<1	<1	
13-14th			10	F20-30 cm- basal fill of ditch 4405	30			3		<1							
13-14th			11	F30-40 cm- basal fill of ditch 4405	8			2		<1							
13-14th			11	F40-50 cm- basal fill of ditch 4405	20	3/<1		4		<1	2						Clinker?
e.Saxon			6.5	F127 0-10 fill creek	0												
e.Saxon			7.5	F127 10-20 fill of creek	0												
e.Saxon			6.5	F127 20-30 fill of creek	0												
e.Saxon			7.5	F127 30-40 fill of creek	0												
e.Saxon			7	F127 40-50 fill of creek	0												
e.Saxon			8.5	F127 50-60 fill of creek	25												
m.Saxon			3.5	F127 70-80 fill of creek	3												
Trench 5																	
15-16th			11	Rest 20-30 cm fill ditch 508	2	1/2							<1				Tiny glass flake
15-16th			11	Rest 10-20 cm fill ditch 508	2			<1		<1			1				
15-16th			11	Rest 0-10 cm fill ditch 508	0												

#/g - sherd no/weight in g.
+ = present

Table 3: Springfields, Spalding. Environmental finds from the processed samples

Date	sample no	context no.	samp vol (l)	feature	residue volume (ml)	flot vol. in ml.	char-coal £	charr'd grain £	charr'd chaff £	charr'd seed £	water-logged seed £	snail $	Summary of main identifications
Area 2													
11-m 12th	13	2278	17	Fill of pit 2277	4000	8	4	2		2	1	3/2	Wheat, barley, rye, oats, bean, mussel, oyster, periwinkle, cockle, barnacle, rodent, bird, small fish, chicken and goose eggshell
11-m 12th	14	2279	19	Fill of ditch 2271	100	3	2	1		2	1	2/2	Barley, wheat, oats, mussel, cockle, barnacle, dog/fox, vole, bird, eel, stickleback, small fish, chicken and goose eggshell
m-l 11-12th	5	2306	4	Fill of pit 2212	<5	25	3	3		4		1/2	Barley, wheat, rye, oats, bean, hazelnut, mussel, frog/toad, eel
m 11-12th	9	2295	20	Fill of ditch 2296	20	3	2	1		2	2	3/2	barley, mussel, mouse, frog/toad, eel, small fish
l 12-13th	4	2215	16	Fill of pit 2212	40	75	3	5	3	5	1	2/2	Wheat, barley, rye, oats, plum, bean, hazelnut, mussel, vole, frog/toad, bird, eel, small fish, chicken eggshell, possible cess?
12-13th	7	2252	16	Fill of pit 2251	15	4	2	1		1	1	2/2	Wheat, barley, oats, mussel, pig, rodent, frog/toad, small bird, eel, stickleback, chicken eggshell
12-13th	10	2301	16	Fill of ditch 2301 (fill is 2300!)	10	1	2	2		2	1	2/2	Wheat, oat, cockle, mussel, bird, stickleback, ostacods, chicken eggshell
12-13th	11	2258	16	Fill of ditch 2259	15	3	1	1		1		3/2	Mussel, cockle, frog/toad, chicken, eel, small fish, chicken eggshell, ostacods
13th	6	2247	20	Fill of pit 2246	10	5	2	1		2		2/1	Mussel, field vole, frog/toad, small bird, stickleback, ostracod
mid 13th	8	2277	20	Fill of pit 2277	35	2	2	2		2		3/2	Wheat, barley, oats, cockle, mussel, house mouse, cat, frog/toad, stickleback, herring?, chicken and goose eggshell
Area 3													
12-13th		A306	10	15-25 cm in fill ditch 3305 (section B)	45	4	1				1	5/2	Chicken eggshell, ostracods
12-13th		A306	10	25-35 cm in fill ditch 3305 (section B)	45	13		1			1	5/2	One indet. grain fragment, Ostracods
Post 3307		A310	10	10-20 cm in fill ditch 3309 (section D)	20	4		1		1	1	4/2	One indet grain fragment
Post 3307		A310	10	20-30 cm in fill ditch 3309 (section D)	5	7				1		5/2	Mussel, frog/toad, chicken eggshell
Area 4													
13th	1	404	25	Fill of terminal of ditch 4405	40	7	2	1		1	3	5/3	Sheep/goat, cockle, mussel, small passerine, field vole, mole, common shrew, frog/toad, newt, stickleback, chicken eggshell
13-14th	2	433	18	Fill of pit 432	50	85	5					?	Wheat, barley, oats, cockle, mussel, vole, frog/toad, small bird, stickleback, chicken eggshell
13-14th	3	435	16	Fill of pit 432	40	100	5	2	2	3	1	3/2	Wheat, barley, oats, hazelnut, cockle, mussel, frog/toad, eel, stickleback, ostracods, chicken eggshell
13-14th	?	435	25	Fill of pit 432	120							?	Oyster, cockle, mussel, ray, small fish, chicken eggshell
13-14th ?		441	30	Fill ditch 440	15	6	4	2		2	2	4/2	Wheat, barley, oats, mussel, cockle, rodent, water vole, frog/toad, eel, stickleback, small fish, chicken eggshell, ostracods
13-14th ?		437	30	Fill ditch 436	10	25	5	2	1	2	2	5/2	Wheat, barley, cockle, mussel, rodent, house mouse, frog/toad, eel, small fish, chicken eggshell, ostracods
13-14th			10	F20-30 cm- basal fill of ditch 4405	30	3	1				4	3/2	Field vole, common shrew, frog/toad, stickleback
13-14th			11	F30-40 cm- basal fill of ditch 4405	8	4	1				4	4/3	Mole, field vole, common shrew, frog/toad, stickleback, small fish, chicken eggshell

date	sample no	context no.	samp vol (l)	feature	residue volume (ml)	flot vol. in ml.	char-coal £	charr'd grain £	charr'd chaff £	charr'd seed £	water-logged seed £	Snail $	Preliminary identifications
13-14th			11	F40-50 cm- basal fill of ditch 4405	20	6	1				4	4/3	Cockle, vole, common shrew, mole, frog/toad, small bird, eel, stickleback, chicken eggshell
e.Saxon			6.5	F127 0-10 fill creek	0	2*					2		
e.Saxon			7.5	F127 10-20 fill of creek	0	5*					2		
e.Saxon			6.5	F127 20-30 fill of creek	1	40*					4		Frog/toad
e.Saxon			7.5	F127 30-40 fill of creek	0	75*					4		
e.Saxon			7	F127 40-50 fill of creek	0	150*					5		
e.Saxon			8.5	F127 50-60 fill of creek	25	60*					4	1/1	Caddis, stickleback
m.Saxon			3.5	F127 70-80 fill of creek	3	-	-	1			1	1/1	One indet grain, ostracods
Trench 5													
15-16th			11	Rest 20-30 cm fill ditch 508	2	<1*	1				1	?	*Daphnia*
15-16th			11	Rest 10-20 cm fill ditch 508	2	3*	1				3	?	Water vole, vole, common shrew, *Daphnia*
15-16th			11	Rest 0-10 cm fill ditch 508	0	100*					5	2/1	

* waterlogged flot

£ Frequency: 1=1-10 items; 2=11-50 items; 3=51-150 items; 4=151-250; 5 = >250

$ frequency/diversity: diversity – 1=1-3; 2=4-10; 3=11-25 taxa

The samples from the creek F127 fills have produced no finds, a situation not unexpected for a natural creek.

Trench 5
The only samples collected from Trench 5 were recovered from the fills of ditch 508 which has produced a radiocarbon date of 1450-1650 AD (at 2 sigma - see below). The only pottery from this feature, a single sherd, has been dated to the 12-13th century. Finds are largely absent from this feature and apart from a very little fired earth and 1 gram of bone nothing was recovered. A tiny sliver of glass from sample 20-30cm is probably intrusive.

The environmental finds from the samples have been studied and identified and individual categories are reported below. The bulk of the finds reflect the food remains at the site and suggest a domestic settlement context. Two samples from Area 2, both from pit 2212 do however include a charred plant assemblage of cereal grain, chaff and weed seeds that is suggestive of crop processing waste. This assemblage is considered in detail below. One pit, 432, in Area 4 produced a small charred assemblage with chaff present also perhaps reflecting a crop processing stage.

Otherwise these assemblages consistently reflect the rubbish from food preparation and consumption with fish bones, bird eggshell, edible marine shellfish, charred cereals, pulses, nuts and fruit stones, and a few domestic animal bones. The number of identifiable bones of the latter is small in the samples and even the excavated bone sample (see below) is poor. Only pig, sheep and chicken bones have been positively identified from the samples, but the hand recovered bone includes cattle, horse, pig, sheep/goat and chicken.

The food remains from Areas 2 and 3, and Area 4 are summarised in Table 21.

The Fish Bones
Dr Alison Locker

The following species were identified from samples taken from 11th – 14th century pits and ditches; eel (*Anguilla anguilla*), herring (*Clupea harengus*), c.f. shad (*Alosa* sp.), c.f. smelt (*Osmerus eperlanus*), pike (*Esox lucius*), stickleback (*Gasterosteus aculeatus*), perch (*Perca fluviatilis*), plaice (*Pleuronectes platessa*), plaice/flounder (*Pleuronectes platessa/Platichthys flesus*) and flatfish indet. (Table 4).

There is no difference between the fish found in pits and those from ditches. These are all very small individuals, less than 15 cms and except for herring could have been caught either in the river Welland or its estuary draining into the Wash. Herring could have been caught in the Wash itself. Eel, shad (probably the twaite shad, *Alosa fallax*) and smelt migrate into freshwater. Young plaice and flounder are often found in estuaries, while stickleback can be found in freshwater through to fully marine conditions. The only exclusively freshwater species are pike and perch.

Stickleback may be over represented with its distinctive scutes and dorsal spines, which are very robust and easily recognised. Although it may have been caught with other fishes it is unlikely to have been deliberately targeted for food. Alternatively they could be the stomach contents of a larger predatory species such as pike. However all the pike here are small, and one stickleback dorsal spine shows evidence of burning, so they may have been included in a dish of mixed small fishes.

Table 4. Frequency of bones identified to each fish taxa in each sample.

Date	11-12th	11-12th	11-12th	12-13th	12-13th	12-13th	12-13th	13th	13th	m 13th	13-14th	13-14th	13-14th	13-14th	13-14th	13-14th	13-14th	13-14th	
Sample	9	13	14	4	7	10	11	1	6	8	2	3	?	Tr 4	Tr 4	Tr 4	Tr 4	Tr 4	**Total**
Context	2295	2278	2279	2215	2252	2301	2258	4404	2247	2277	433	435	435	441	437	4408 20-30	4408 30-40	4408 40-50	
Eel	4		2	2	1	1	1	1		1		1		1	1			1	***17***
Herring				7*		4				3				2					***16***
Shad					1														***1***
Smelt													1						***1***
Pike		1					1		1										***3***
Stickleback			1*	5	1	4		5		8	1	3		8		3	1	1	***41***
Perch	4																		***4***
Plaice				1				1											***2***
Pl/Flounder	7									3									***10***
Flatfish				2*										3	1				***6***
Unident	4		2				3	2		4							1		***16***
Indet	12*	1	5*	11*	2	1	2	1	2	19	4	1	3	9	3		1		***77***
Total	***31***	***2***	***10***	***28***	***5***	***10***	***7***	***10***	***3***	***38***	***5***	***5***	***4***	***23***	***5***	***3***	***3***	***2***	***195***

* indicates some burning.
Samples 1, 9, 10, 11, and Trench 4 are ditch fills.
Samples 2, 3, 4, 6, 7, 8, 13, and 15 are pit fills
Unident = potentially identifiable but I was unable to.
Indet = not identifiable as no distinguishing features.

The assemblage from these samples suggest that fish were not very important, the few remains representative of very localised fishing, with no evidence for the consumption of the larger food fishes such as the gadids.

Animal Bone
Dr Jane Richardson

Introduction
The excavations produced only 87 animal bone fragments collected by hand from medieval deposits. Unfortunately the small sample size precludes a meaningful analysis of domestic debris (such as food waste) and/or industrial debris (such as tanning or bone working).

Method
As the total assemblage was small, all bone fragments were identified where possible to species, species group (such as sheep/goat) or a lower order category such as 'cattle-sized' (Table 5). Age data were considered and butchery marks were noted. An assessment of bone condition was also made in terms of erosion, fragmentation and gnawing.

Results
The bone fragments were typically recovered in good condition, although some bones showed signs of eroded and/or porous surfaces Articulated body parts, a cattle forelimb (context 312) and a goose wing (context 409), indicated that rapid disposal was possible, although other bones were left exposed prior to final disposal, as 10% had been gnawed by dogs.

The animal bone assemblage consisted of only 87 bone fragments. Of these, cattle (and cattle-sized fragments) accounted for 52% of the assemblage, sheep/goat (and sheep-sized fragments) 26% and pig 6%. Horse and goose were represented by one and four bones respectively.

All body parts (limb bones, axial skeleton and skull fragments) were present for cattle and sheep/goat, and pig limb bones and skull fragments were identified. Given the full range of body parts, these bones probably represent preliminary carcass processing and dismemberment, while food waste is indicated by butchery marks to meat-rich joints. In total, 13% of the assemblage displayed chop and/or cut marks.

Age data were extremely limited, but the presence of sub-adult cattle and pigs indicate the slaughter of these species for their meat. The identification of adult cattle and sheep suggests that some may have been maintained as breeding stock and for their milk yield (although no neonatal bones were noted), while traction cattle and fleece production may also have been important.

Conclusions
Domestic debris in the form of food waste has been identified. This revealed a diet dominated by beef and mutton, with additional meat coming from sub-adult pigs. Bones from an articulated goose wing may indicate the occasional consumption of poultry, although no butchery marks were noted. The use of secondary products was tentatively identified for cattle (traction and/or milk production) and sheep (fleeces and/or milk production).

Table 5. Animal bone fragments by context

Context	Cattle	Horse	Pig	Sheep/goat	cf. Domestic goose	Cattle-sized	Sheep-sized	Undiagnostic
100	1							
133				1				
200	12		2					
202	1							
222						3		
238								4
312	4		1					
401						1		
404						2	1	3
408						1		
409					4			
433	1							
444			1	1				
449				2				
2215				1				
2216				1		2	2	
2217						1		
2218	1			2		3	2	
2238	1			2			3	1
2247							1	
2258	2							
2260		1					1	
2262				1				
2276	3					2		
2278						1		
2280						1		
2295						1		
2297			1	1				1
2308				1		1		
Total	26	1	5	13	4	19	10	9

The macroscopic plant remains

Lisa Gray

Introduction

The analysis of the charred and waterlogged macroscopic plant remains from the samples has been targeted at the series of questions that form the primary aims of the project. The remains studied derive from deposits that have been dated archaeologically and by OSL and radiocarbon dating to the Saxon to late medieval period. The features sampled were pits, ditches and a creek.

The research questions are listed below:

- Is there any evidence for land reclamation and cultivation?
- What do the charred assemblages tell us about agricultural or domestic activities at the site, the ecology of the fields, crops grown and seasons of sowing?
- What was the contemporary environment like and is there evidence of environmental change?

Sampling and Laboratory Methods

Bulk samples were taken of pit and ditch features and a series of samples were taken from a creek. Samples vary in size from 4 to 30 litres (see Table 1). The sample processing methods are detailed above.

Each selected sample was examined using a binocular microscope with magnifications of between 10 and 40 times. The plant remains were identified as closely as their quality of preservation allowed. Charred remains were counted; waterlogged and mineralised remains were given estimated levels of abundance as follows:- + =1-10, ++ =11-50, +++ = 51-150, ++++ = 150-250 and +++++ = >250.

Modern reference collections and reference manuals (e.g. Beijerinck 1947) were used for identification of the plant macro-remains. Identifications were made to species-level where possible and genus and family where diagnostic features were less clear. For the identification of charred cereal grains and chaff, modern reference material was used together with the criteria taught by Gordon Hillman (pers. comm. MSc 1995/6).

Results

Sample details and contents are given in full in Tables 6 to 14 . In this section the diversity, type and quality of preservation of the botanical remains in the samples will be described. Interpretation of these finds is discussed below.

Preservation quality, type and possible modes of arrival in the samples

Preservation quality was generally good with many identifications being made to species level. Preservation by charring, waterlogging and mineralisation was observed. Charring was the dominant mode of preservation.

Charred remains consisted of wood, grains, chaff, seeds and nutshell fragments. Charring occurs when plant material is burnt under reducing conditions resulting in a carbon skeleton resistant to decay (Jones, D, 2002,12). Interpretation of the charred assemblages needs to allow for the effects of charring on the distortion and differential preservation of cereal remains (Boardman and Jones, 1990). Experimental work on grain, seed and chaff assemblages has shown that in conditions where charring occurs differential preservation occurs with more fragile chaff being destroyed first, then cereal grains and finally more robust weed seeds (Boardman and Jones, 1990).

Preservation by waterlogging occurs when plant remains are in anoxic conditions such as sealed pits or layers or a high water table (Jones, D, 2002, 13).

Mineralised seeds were recovered from three samples, pit fill samples <5>, <6> and <7>. Mineralisation occurs when organic remains are exposed to calcium-rich groundwater, lime, human/mammal faecal material or fish bone and scales (Green, 1979, 281). In these conditions the organic compounds in plant macro-remains are replaced by calcium phosphate. Remains preserved in this way tend to be harder to identify because many of the detailed identification criteria are destroyed by the mineralisation process. Only ten seeds were preserved by mineralisation so the pits being filled with faecal matter such as cess is unlikely. The three samples did contain low quantities of fish bone and marine mollusc shell and these may have created the conditions for mineralisation.

Table 6. Charred remains from samples 1 to 15

				Sample	1	2	3	4	5	6	7	8	9	10	11	13	14	15
				Context	404	433	435	2215	2306	2247	252	277	2295	2301	2258	2278	2279	442
				Feature	Ditch 4405	Pit 432	Pit 432	Pit 2212	Pit 2212	Pit 2246	Pit 2251	Pit 2277	Ditch 2296	Ditch 2301	Ditch 2259	Pit 2277	Ditch 2271	Pit 443
Scientific Name	Common Name	Plant Part	Habitat Code	Date/ Use code	13C	13-14C	13-14C	late 12-13C	m-l 11-12C	13C	12-13C	mid 13C	mid 11-12C	12-13C	c. 12-13C	11-mid 12C	11-mid 12C	-
Triticum aestivum L.	Bread wheat	grains	-	F1	-	8	2	136	7	-	1	5		3	-	2	-	-
Triticum aestivum L.	Bread wheat	tail grains	-	F1	-	-	12	-	-	-	-	-	-	-	-	-	-	-
cf. Triticum aestivum s.L.	Bread wheat	grain	-	FI	-	-	-	-	-	-	-	-	-	-	-	-	1	5
cf. Triticum aestivum type	Bread wheat	rachis	-	FI	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Triticum aestivum L.	Bread wheat	internodes and rachis frags	-	FI	-	-	-	1	-	-	-	-	-	-	-	-	-	-
cf. *Triticum* sp.	Wheat	grain	-	FI	-	-	-	14	-	-	-	-	-	-	-	-	-	-
Triticum sp.	Wheat	grain	-	FI	-	-	-	-	50	-	-	-	-	-	-	-	-	-
Secale cereale	Rye grass	grain	-	FI	-	-	-	137	4	-	-	-	-	-	-	-	-	-
cf. *Secale cereale* L.	Rye grass	grain	-	FI	-	-	-	-	-	-	-	-	-	-	-	2	-	1
Hordeum sativum L.	Barley	grain	-	F1	-	4	12	310	71	-	-	-	3	-	-	7	3	-
Hordeum sativum L.	Barley	internodes and rachis frags	-	FI	-	-	-	26	-	-	-	-	-	-	-	-	-	-
cf. *Hordeum* sp.	Barley	grain	-	FI	-	-	-	90	-	-	3	-	-	-	-	-	-	-
Hordeum sp.	Barley	grain	-	FI	-	3	-	-	-	-	-	3	-	-	-	-	-	-
Hordeum sp.	Barley	sterile grain	-	FI	-	-	-	1	-	-	-	-	-	-	-	-	-	-
Hordeum sp.	Barley	rachis, cf. 2 rowed	-	FI	-	-	-	9	-	-	-	-	-	-	-	-	-	-
Avena sp.	Oat	grain	-	FI	-	1	1	20	8	-	-	4	-	1	-	3	3	-
cf. *Avena* sp.	Oat	grain	A	FI	-	-	-	-	-	-	1	-	-	-	-	-	-	-
Avena sp.	Oat	awn frag	A	FI	-	-	-	1	-	-	-	-	-	-	-	-	-	-
Avena/Hordeum/Secale/ Triticum	Indeterminate cereals	grain frags	-	F1	-	+	++	+++++	-	-	6	+	8	15	-	-	-	-
Avena/Hordeum/Secale/ Triticum	Indeterminate cereals	rachis frag	-	FI	-	-	-	-	-	-	-	1	-	-	-	-	-	-
Avena/Hordeum/Secale/ Triticum	Indeterminate cereals	stem frag	-	FI	-	-	10	120	-	-	-	1	-	-	-	3	-	1
Ranunculus arvensis L.	Corn crowfoot	seed	A	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-
Anthemis cotula L.	Stinking mayweed	seed	AB	GH	-	-	3	2	3	-	-	-	-	-	-	5	-	-
Ranunculus flammula L.	Lesser spearwort	seed	E	G	-	-	-	-	-	-	-		1	-	-	-	-	-
Fumaria sp.	Fumitory	seed	A	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-

Scientific Name	Common Name	Plant Part	Habitat Code	Sample/ Use Code	1	2	3	4	5	6	7	8	9	10	11	13	14	15
Brassica/Sinapis sp.	Wild cabbage/mustard	seed	AB	FGHI	-	-	-	6	-	-	-	-	-	-	-	-	-	-
Bromus spp.	Brome	seed	ABD	-	-	-	-	22	3	-	-	-	-	-	-	-	-	-
Bromus cf. *steralis*	Barren brome	seed	ABD	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
Agrostemmma githago L.	Corncockle	seed	AB	-	-	-	-	15	-	-	-	-	-	-	-	-	-	-
Stellaria media L. (Vill)	Chickweed	seed	AB	-	69	4	4	2	2	-	-	-	-	-	-	-	-	-
Chenopodium album L.	Fat hen	seed	AB	FGH	9	1	-	1	-	-	-	12	-	-	-	1	-	1
Atriplex hastata/patula	Orache	seed	AB	FGH	1	-	-		-	-	-	-	-	-	-	-	-	-
Beta vulgaris L.	Beet	seed	E	FI	-	-	-	-	-	-	-	-	-	3	-	-	-	-
Atriplex sp.	Orache	seed	AB	FGH	-	-	-		-	-	-	-	-	1	2	-	-	-
Chenopodium/Atriplex	Fat hen	seed	AB	H	-	9	-	42	18	1	1	6	2	7	12	7	-	5
Linum sp.	Flax	seed	AD	HI	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Vicia cf. *sativa* type	Common vetch	seed	ABCD	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Vicia faba L.	Celtic bean/ horse bean	seed	-	FI	-	-	-	9	1	-	-	-	-	-	-	-	-	-
cf. *Vicia faba*	Celtic bean/ horse bean	seed	-	FI	-	-	-	-	-	-	-	-	-	-	-	2	-	-
Vicia/Lathyrus spp.	Vetch/tare/ vetchling	seed	ACDE	FI	-	-	6	44	-	-	-	-	-	-	-	-	-	-
Vicia/Lathyrus/Pisum	Vetch/tare/ vetchling/pea	seed	ABCDE	FI	-	-	-	-	4	-	-	-	-	-	-	-	-	-
Prunus domestica L.	Plum/bullace	seed	C	FI	-	-	-	1	-	-	-	-	-	-	-	-	-	-
Polygonum aviculare L.	Knotgrass	seed	AB	G	-	-	-	1	1	-	1	-	-	-	-	-	-	-
Polygonum persicaira L.	Persicaria	seed	ABE	H	-	-	-	-	5	1	-	3	14	6	1	-	-	-
Polygonum cf. *persicaria*	Persicaria	seed	ABE	H	-	-	-	5	-	-	-	-	-	-	-	-	-	-
Polygonum lapathifolium L.	Pale persicaria	seed	ABE	-	-	-	-	7	-	-	-	-	1	-	-	-	-	-
Polygonum spp.	Knotgrass type	seed	ABCDE	FG	-	-	-	5	6	-	-	-	-	-	-	-	-	-
Rumex acetosella L.	Sheep's sorrel	seed	AD	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-
Rumex cf. acetosella L.	Sheep's sorrel	seed	AD	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-
Rumex cf. *palustris*	Marsh dock	seed	BDE	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Rumex crispus L.	Curled dock	seed	BC	-	-	-	3	17	-	-	-	-	-	-	-	-	-	-
Rumex sp.	Dock	seed	ABCDE	FG	-	-	-	1	-	-	-	-	-	-	-	-	1	-
Corylus avellana L.	Hazelnut	shell frag	C	F	-	-	1	1	1	-	-	-	-	-	-	-	-	-
Lithospermum arvense L.	Field gromwell	seed	A	-	-	-	-	230	15	-	-	-	-	-	-	-	-	-
Galium aparine L.	Cleavers	seeds	ABCD	FG	-	1	-	-	2	-	-	-	-	-	-	1	-	-
Galium/Asperula spp.	Bedstraw/ woodruff	seeds	ABCDE	G	-	-	-	9	-	-	-	-	-	-	-	-	-	-
Sambucus nigra L.	Elder	seeds	BC	FGH	-	-	-	2	1	-	-	-	-	-	-	-	-	-
Carduus/Cirsium sp.	Thistles	seeds	ABDE	G	-	1	-	7	3	-	-	-	-	-	-	-	-	-
cf. *Juncus* sp.	Rush	seed	ADE	H	-	-	1	-	-	-	-	-	-	-	-	-	-	-

Scientific Name	Common Name	Plant Part	Habitat Code	Sample/ Use Code	1	2	3	4	5	6	7	8	9	10	11	13	14	15
Eleocharis sp.	Spike-rush	seed	E	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-
cf *Scirpus maritimus* L.	Sea club-rush	seed	E	-	-	-	1	6	-	-	-	-	-	-	-	-	-	-
Scirpus cf. *maritimus* L.	Sea club-rush	seed	E	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-
Scirpus sp.	Club-rush	seed	E	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
cf. *Lolium* spp.	Rye grass	seed	B	I	-	-	-	21	4	-	-	-	-	-	-	-	-	-
cf. *Poa* sp.	Poa	seed	ABD	-	-	-	-	-	7	-	-	-	-	-	-	1	-	-
Avena/Bromus spp.	Oat/brome	seed	ABCDE	FI	-	-	-	20	-	-	-	-	-	-	-	-	-	-
Poaceace	Grass	seed	ABCDE	FHI	-	-	-	-	-	-	-	1	-	-	-	-	-	-
Poaceace	Grass	stem frags	ABCDE	FHI	-	-	-	+	5	-	-	-	-	-	-	-	-	-
indeterminate	-	shell frag	-	-	-	-	-	2	1	-	-	-	-	-	-	-	-	-
indeterminate	-	wood flecks <4mm	-	-	-	+++ ++	-	+++++	++++ +	++	+++ ++	+++	+++	+++	+++	++	++++	-
indeterminate	-	wood frags >4mm	-	-	-	+++ +	+++	+++	-	+	+	-	+	-	-	++	-	+

Table 7. Uncharred remains from bulk samples

scientific name	common name	plant part	preserv-ation	habitat code	sample	4	5	6	7	8	9	10	11	13	14	15
					context	2215	2306	2247	252	277	2295	2301	2258	2278	2279	442
					feature	pit 2212	pit 2212	pit 2246	pit 2251	pit 2277	ditch 2296	ditch 2296	ditch 2259	pit 2277	ditch 2271	pit 443
					Date AD	late 12-13th	m-l 11-12th	13th	12-13th	mid 13th	mid 11-12th	12-13th	cf.12-13th	11-mid 12th	11-mid 12th	-
					use code											
Vicia faba L.	celtic bean/ horse bean	seed	MIN	-	FI	-	-	-	-	-	-	-	-	-	-	-
Vicia/Lathyrus/ Pisum	vetch/tare/ vetchling/ pea	seed	MIN	ABCDE	FI	-	2	1	-	-	-	-	-	-	-	-
cf. *Scirpus* sp.	club-rush	seed	MIN	E	-	-	5	-	-	-	-	-	-	-	-	-
indeterminate	-	seed	MIN	-	-	-	-	-	1	-	-	-	-	-	-	-
Alnus glutinosa (L.) Gaertner	alder	seed	WL	-	-	-	-	-	1	-	-	-	-	-	-	-
Sambucus nigra L.	elder	seed frags.	WL	CE	GH	+	-	-	-	1	-	-	-	-	-	-
indeterminate	-	root frags.	WL	BC	-	+++	-	-	+	-	+	+	-	-	+	-

Table 8. Trench 4 charred remains

Scientific Name	Common Name	Plant Part	Habitat Code	Sample	Tr 4 east	Tr 4 west
				Context	441	437
				Feature	ditch 440	ditch 436
				Date	-	-
				Use Code		
Triticum aestivum L.	Bread wheat	grains	-	F1	12	-
cf. *Triticum aestivum* s.l.	Bread wheat	grain	-	FI	3	-
cf. *Triticum* sp.	Wheat	grain	-	FI	-	1
cf. *Hordeum* sp.	Barley	grain	-	FI	2	4
cf. *Avena* sp.	Oat	grain	A	FI	2	-
Avena/Hordeum/Secale/Triticum	Indeterminate cereals	grain fragments	-	F1	++	11
Avena/Hordeum/Secale/Triticum	Indeterminate cereals	rachis fragments	-	FI	-	1
Avena/Hordeum/Secale/Triticum	Indeterminate cereals	stem fragments	-	FI	-	+
Anthemis cotula L.	Stinking mayweed	seeds	AB	GH	1	-
Chenopodium album L.	Fat hen	seeds	AB	FGH	18	18

Table 9. Trench 4 uncharred remains

Scientific Name	Common Name	Plant Name	Habitat Code	sample		Tr 4 east	Tr 4 west
				context	20-30 (F)	441	437
				feature	ditch 3309	ditch 440	ditch 436
				date	Pre late 13th C	-	-
				Use Code			
Rubus fruticosus/idaeus	Blackberry/raspberry	seeds	C	FGH	-	+	-
Stachys palustris L.	Marsh woundwort	seed	AE	-	-	+	-
Sambucus nigra L.	Elder	seed fragment	BC	FGH	++	-	+
indeterminate	-	root fragments			-	++++	++++

Habitat and Use Codes: A - weeds of cultivated land; B - weeds of arable and disturbed ground; C - woods, scrub, hedgerows; D - grassland; E - damp or marshy ground; F - edible wild; G - medicinal; H - wild with economic uses; I - cultivated

Area 2
Charring was the main mode of preservation for samples in this area. Preservation was generally good. A small number of mineralised seeds were recovered from <5> <6> and <7>. Each sample produced flecks (<4mm) or fragments of wood. All but <5> contained fragments of uncharred roots.

The richest samples were taken from pit 2212. These samples, <4> and <5> were dominated by charred remains, seeds being the most frequent charred taxon followed by grains then chaff.

Evaluation Trench 3
These samples were the series of fills taken from the Saxon creek, F127. Preservation was good and almost all by waterlogging. Each sample contained abundant flecks of charred wood.

Area 4
All of these samples were dominated by charred remains particularly seeds. The most uncharred remains were in sample <15> and these were root fragments.

Table 10. Relative proportions of grain/seed, and chaff in the samples

Date	Sample/ Feature	% Grains	% Seeds	% Chaff	Possible Processing Stage
13C	1 /ditch 4405	0	100 (small seeds)	0	Fine sieving waste
13-14C	2 /pit 432	46	46 (small and large seeds)	8 (internodes)	Coarse sieving waste
13-14C	3 /pit [435]	52	34 (small and large seeds)	14 (rachis and stem fragments)	Coarse sieving waste
12-13C	4 /pit 2212	67	23 (small and large seeds)	7 (stem and rachis fragments)	Coarse sieving waste
11-12C	5 /pit 2212	71	28 (small and large seeds)	1 (internode)	Coarse sieving waste
13C	6 /pit 2246	0	100 (small seeds)	0	Fine sieving waste
12-13C	7 /pit 2251	85	15 (small seeds)	0	Fine sieving waste
13C	8 /pit 2277	25	71 (small and large seeds)	4 (rachis and stem fragments	Coarse sieving waste
11-12C	9 /ditch 2296	38	62 (small seeds)	0	Fine sieving waste
12-13C	10 /ditch 2301	53	47 (small and large seeds)	0	Coarse sieving waste
12-13C	11 /ditch 2259	0	100 (small seeds)	0	Fine sieving waste
11-12C	13 /pit 2277	41	50 (small and large seeds)	9 (stem fragments)	Coarse sieving waste
11-12C	14 /ditch 2271	88	12 (small seeds)	0	Fine sieving waste
	15 / pit 443	40	13	47	Coarse sieving waste
13-14C	Trench 4 - 441	50	50	0	Fine sieving waste
13-14C	Trench 4 - 437	46	52 (small and large seeds)	2 (rachis fragments)	Coarse sieving waste

Interpretation.

Are the charred assemblages evidence of crop-processing or general domestic activities?

Sixteen of the twenty-three samples produced charred assemblages. These consisted of Grains, seeds, cereal chaff, wood and occasional nutshell fragments. The proportions of grains, seeds and chaff are given in Table 10. The possible processing stage is given. This interpretation is based on ethnographic observations of traditional cereal processing (Hillman, 1981, 1984; Jones, G, 1984).

These assemblages are dominated by grains and seeds. Chaff is present but in small quantities. The grains and seeds are a variety of sizes and the chaff consists of rachis fragments, culm fragments and internodes. These assemblages are most likely to be sieving waste or, in the case of the grain rich samples, the final product containing acceptable contaminants. No fully cleaned assemblages were recovered to compare these with.

Van der Veen, in her study of Roman cereal production and consumption notes that charred assemblages containing grain and seeds smaller than or the same size as the grains, such as brome (*Bromus* spp.), oat (*Avena* sp.) and corncockle (*Agrostemma githago* L.) could be an accidentally burnt grain store or semi-cleaned grains brought into the site for final processing (van der Veen, 1992, 91). These samples do seem to be similar to the "cleanings stores", consisting of tail grains, seeds, rachis and culm nodes, noted in Hillman's observations of traditional crop processing (Hillman, 1984, p4-5). These, he notes, could be used for fuel or fodder.

Ethnographic studies of cereal processing and consumption have revealed many ways charred cereal/seed assemblages could have formed (Hillman, 1981, 1984; Bottema, S, 1984; Jones, G, 1984). Charring of these remains could also have occurred during the parching of grain prior to milling or having been used as fuel/tinder and, on a domestic scale, when hundreds of grains are put into a cauldron to cook some will fall out and get burnt (Bottema, S, 1984, p209-10). Another possible source of these seed rich samples was observed during experimental work reconstructing Saxon and Medieval bread ovens (the unpublished work of Cane and Cane cited in Moffett, 1994, 61). These workers noted the use of a layer of uncleaned grain to keep the bread from sticking.

What food crops are present and what is their relative abundance?

Cereals and pulses were the main food crops present. Their relative abundance is given in Fig. 1.

Table 11 below displays the relative abundance of all possible food plants and the samples in which they appeared most frequently.

It is clear, from the chart and table, that wheat and barley are the main food plants recovered and that sample <4> is the source of most of them.

Barley was the most frequent cereal grain recovered at Springfields. Its use would have been for food, fodder or malting. None of the grains had malted so it can be assumed that these grains were originally destined for human or animal food in some form.

An attempt was made to determine the ploidy level of these grains but full analysis of these grains is beyond the scope of this project. The low quantities of chaff in the charred assemblages meant that a clear answer would not be likely. Fifteen clearly twisted and naked

grains were present in sample <4>. Sample <4> also produced one sterile lateral grain and rachis fragments with diploid characteristics. Jones notes the taphonomic problems associated with interpreting a barley assemblage. Straight grains would pass through a sieve resulting in the proportion of straight barley grains being increased by sieving meaning a sieved crop of six-row barley could be mistaken for a mixture of two and six row barley (Jones, 1995, 181). In this case it is sufficient to note that un-malted barley grains were the most abundant crop plant in these samples.

Figure 1. Relative abundance of cereal and pulses in the whole charred plant assemblage. (Key–TRI= wheat;HOR=barley;SEC= rye;AVE=oat;FAB= pulses)

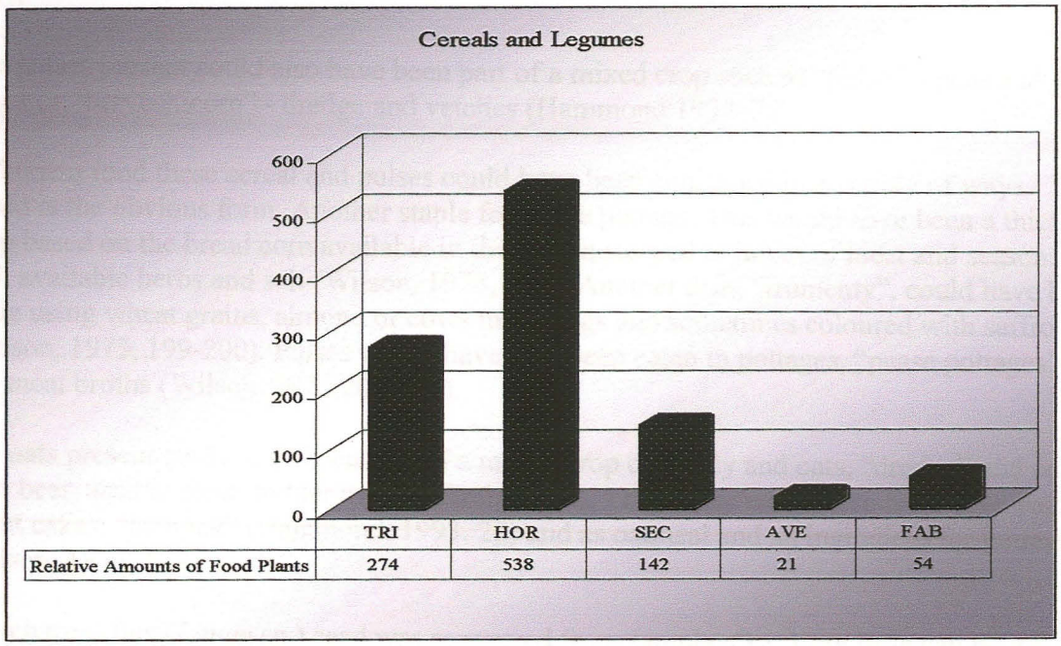


Table 11. Frequency of seeds and grains of possible food plants and the richest sample.

	Quantity (no.) Present (+)	Richest Sample
Wheat (*Triticum aestivum* L.)	274	4
Barley (*Hordeum sativum* L.)	538	4
Rye (*Secale cereale* L.)	142	4
Oats	21	4
Pulses (Fabaceae)	54	4
Plum/Bullace (*Prunus* sp.)	1	4
Cabbage/Mustard (*Brassica/Sinapis* sp.)	+	4
Hazelnut (*Corylus avellana* L.)	3	3
Elderberry (*Sambucus nigra* L.)	+	20-30 ditch 508
Beet (*Beta vulgaris* L.)	3	10
Fat hen (*Chenopodium album* L.)	+	4
Wild Carrot (*Daucus carota* L.)	+	0-10 ditch 508
Blackberry/Raspberry (*Rubus fruticosus/idaeus*)	+	Trench 4 - 441

Bread wheat is the main wheat identified at this site and rye grains, pulses and oat grains were recovered in smaller quantities. It is already noted here that wheat could have been grown as a mixed crop. It could also be the result of a dump of sieving waste from several different crops.

Rye grains were recovered, mainly from the late 12-13th century pit sample <4>. This was also sometimes grown as part of a mixed crop, "maslin", which included rye and wheat (Hammond, 1993, 2). Rye meal was also consumed as a pottage, "brewit" in the Anglo-Saxon to early Medieval period (Hagan, 1992, 54). Rye was also used as fodder for sheep (Vancouver 18113 157-158 in Green 1981, 140) or for straw (Stanes 1969, 3 in Green 1981, 141).

The pulses present could also have been part of a mixed crop such as "pulse" – peas and beans or "bervechicorn" - dredge and vetches (Hammond 1993, 2).

As human food these cereal and pulses could have been consumed in a variety of ways. Bread is the obvious form. Another staple food was pottage. This would have been a thick soup based on the bread corn available in the region steeped in juices of meat and seasoned with available herbs and salt (Wilson, 1973, 199). Another dish, "frumenty", could have been made using wheat grains, almond or cows milk, eggs and sometimes coloured with saffron (Wilson, 1973, 199-200). Pulses would have also been eaten in pottages, "pease pottages" and meat broths (Wilson, 1973,202-203).

The oats present could have been part of a mixed crop of barley and oats, "dredge" and could have been used as food, fodder or fuel (Greig, 1988, 111). They would also have been eaten as oat cakes, "jannock" (Hammond, 1993, 28) and as oatmeal and an ingredient for pottages (Wilson, 1973, 198).

One charred flax (*Linum* sp.) seed was recovered from sample <3>. Very little can be inferred from one seed, however, there is evidence that flax was grown in the region (Campbell, 1994, 67). In this case it could also be present as a crop weed growing in dry, chalky grassland (Clapham *et al*, 1964, 126-7).

The possibility of green vegetables being available is suggested in the find of beet seeds and frequent finds of orache (*Atriplex hastata/patula*) seeds. The leaves of these plants are edible and also eaten in pottages (Wilson, 1973, 204).

Other edible plants that could have been possible wild food plants were elderberries, wild carrot, wild cabbage/mustard, hazelnut, plum/bullace and blackberry/raspberry. These seeds were present in very small quantities across the site.

Spices and herbs would also have been used during this period but none were recovered from this site. Many leafy and ground up food plants tend not to survive archaeologically (Greig, 1996).

As animal food cereal grains and pulses along with the straw would have been used and survive archaeologically after being spilt into the stable floor and mixed with dung and then dumped into a pit (Greig, 1988, 119).

Do the weed seeds present give an indication about the ecology of the fields and season of sowing?

The ecology of the fields

Charred crop weeds identified to species, were present in order of frequency of presence in the samples as follows:-

Fat hen (*Chenopodium album*) -8- in samples <1> , <2>, <4>, <8>, <13>, <15>
Chickweed (*Stellaria media* L. (vill)) -5 in samples <1>, <2>, <3>, <4>, <5>
Stinking mayweed (*Anthemis cotula* L.) – 5 -in samples <3>, <4>, <5>, <13> ,
Cleavers (*Galium aparine* L.) -3 – in samples <2>, <5> , <13>
Knotgrass (*Polygonum aviculare* L.) – 3 – in samples <4>, <5>, <7>
Sea club-rush (*Scirpus maritimus* L.) -3- in samples <3>, <4>, <5>
Field gromwell (*Lithospermum arvense* L.) -2- in samples <4>, <5>
Sheep's sorrel (*Rumex acetosella* L.) -2- in samples <5>, <6>
Curled dock (*Rumex crispus* L.) -2 – in samples <3>, <4>
Corn crowfoot (*Ranunculus arvensis* L.) – 1 – in sample <3>
Lesser spearwort (*Ranunculus flammula* L.) – 1 – in sample <9>
Corncockle (*Agrostema githago*) -1 –in sample <1>, <2>, <3>, <4>, <5>
Beet (*Beta vulgaris*) -1 –in sample <10>

- The presence of fat hen seeds in an assemblage has been interpreted as reflecting large competitive weed species flourishing in nutrient-rich environments (Bogaard *et al* 1998, 21). It is common in loose, damp nitrogenous humus loams and sandy soils and a common weed of spring cereals (Hanf, 1982)
- Chickweed thrives in arable fields and in nutrient rich environments such as manure and sewage waste (Grime *et al*, 1990, 321).
- Stinking mayweed can be found growing in waterlogged soils (Campbell, 1994, 67). It is a common weed of arable and waste ground, particularly heavy soils (Clapham *et al*, 1964, 391).
- Cleavers is common in cultivated fields, hedgerows and scrub (Stace 1997, 649). It is particularly common in cereal fields where it causes lodging and interferes with harvesting (Hanf, 1983, 425). It is a loam indicator (Hanf, 1983, 425). Lodging refers to the habit of this plant to grow over and drag down a crop (website reference 1).
- Knotgrass is a weed common in spring cereals, thriving on nitrogenous humic loams and sandy soils (Hanf, 1983, 397).
- Sea club-rush can indicate seasonally moist fields (Hillman and Charles in prep, 9)
- The most abundant seeds, but only recovered from one feature, were those of field/corn gromwell and formed part of the charred assemblage from pit 2212. This plant is a native plant common in arable fields and wasteground (Clapham, Tutin and Warburg 1964, 301; Stace 1997, 542). It is also recorded as present in chalky soils (Gibbons and Brough, 1992, 204).
- Sheep's sorrel thrives in sandy, dry soils and acidic nutrient deficient loams. It is an indicator of poor soils (Hanf, 1983, 403).
- Curled dock is found in damp, heavy, clay rich loams in arable land (Hanf, 1983, 543).
- Corn crowfoot is a common cornfield weed (Clapham *et al*, 1964, 31).
- Lesser spearwort is common in wet ground (Stace, 1997, 90).

- Corncockle was a common arable weed, toxic to stock and a frequent contaminant in prime grain stores because the seed is similar in size to grains. It is an indicator of nutrient rich, acid to neutral loamy soils (Hanf, 1983, 198).
- Beet is common in nutrient and salt rich soils and occasionally in arable fields (Hanf, 1983).

In summary, the most frequent weed types are those thriving in nutrient rich environments. Pockets of damp, saline ground could be reflected in the presence of beet and sea club rush. The abundance of field gromwell seeds in pit 2122 could indicate that the cereals (mainly barley and wheat) were grown in a drier, more calcareous environment.

The possible seasons of sowing
Historical studies of medieval agriculture state that wheat and rye were sown in the Autumn, between Michaelmas and Christmas and the rest (barley, oats and pulses) were sown in early Spring, before Easter and all crops would be ready for harvest between August and September (Hammond, 1993, 3).

As the crops present in these samples include all those mentioned above the weed seeds accompanying them should be a mixture of those of spring and autumn cereals. This is the case. Fat hen, knotgrass, chickweed (Campbell, 1994, 69; Hanf, 1983, 397) are found among spring sown crops. Corncockle is found in autumn sown crops (Campbell, 1994, 77) and experimental work at Butser Iron Age Farm revealed the tendency of cleavers to be confined to autumn sown crops as well (Hillman 1981, 146).

Is there any suggestion of halophytic plants?
Several features produced salt tolerant plants. These were distributed as follows:

PLANT	DATE/AREA/FEATURE/ABUNDANCE
Common/spear leaved orache	TR3 all samples, especially 50-60cm./ +++
Beet	12-13C/DITCH2301/3
Cleavers	11-12C/PIT2212/5
	11-12C/PIT2277/1
	13-13C/PIT432/1
Knotgrass	11-12C/PIT2212/1
	12-13C/PIT[2215]/1
	12-13C/PIT2251/1
Curled dock	12-13/PIT[2215]/17
	13-14C/PIT[435]/3
Sea club rush	11-12C/PIT2212/2
	12-13C/PIT[2215]/6
	13-14C/PIT[435]/1
Horned pondweed	TR3 0-10/ ++
	TR3 40-50/++

Table 13. Distribution of halophytic plants

Most of these plants also inhabit waste, disturbed and cultivated ground. Horned pondweed is the only aquatic plant and this grows in fresh or brackish water (Clapham *et al*, 1964, 439). Although it occurs most commonly in freshwater so cannot alone be used as evidence of brackish conditions (De Moulins, 1990, 89).

Beet, here presumed to be a sub-species, *maritima*, which inhabits shores as well as the waste places, of *B.vulgaris* (Stace 1997, 149). In this case preservation was not good enough to identify the beet seeds to species with confidence but the seeds most closely resembled those of *Beta vulgaris* L..

The remaining plants are salt tolerant plants found on shores, shingle or salt marsh.

Spatial and temporal trends will be considered more fully in the next section but it seems that most halophytic plant seeds were recovered from earlier samples. This may reflect the draining and de-salinisation of the salt marsh. No halophytic plant seeds were recovered from Trench 4 and Area 4, but these features are on slightly higher ground.

What can the waterlogged assemblages reveal about the contemporary environment?
The waterlogged remains from bulk samples <1> to <15> consisted of a small number of elder seeds and one alder (*Alnus glutinosa* L.) seed. These reveal little more than a damp, nutrient rich scrub and reflect either survival of the more robust seeds or more recent contamination.

Is there evidence of environmental change in the series of samples taken from Evaluation Trench 3 – the creek, F127?
This section examines a series of six samples taken through the fill of a creek. Waterlogging was the main mode of preservation. Preservation appears to have been good because very fragile seeds such as those of horned pond weed (*Zannichella palustris* L.) survived.

The general trend is an increase in aquatic plant seeds towards the top. It is difficult to make interpretations of seeds based on relative number because some individual plants produce thousands of seeds but if many seeds are recovered from a naturally created deposit it is fair to assume that many seeds mean that that particular plant was thriving in that habitat. If good preservation is clear, as in this case, the problem of differential preservation becomes less important.

At the 30-60 cm depth pondweed seeds are abundant. It was not possible to identify the species but the genus frequents lakes and ponds, some species prefer base-rich soils and some acidic (Stace 1997, 771-773). The aquatic plant crowfoot is also abundant, especially in the 30-60 depth and present in lower quantities below until 0-10 at the base of the sequence where it returns to a moderate abundance. Bulrush (*Schoenoplectus lacustris* (L.) Palla) seeds are only found in the 40-60 cm depth and horned pond-weed is found in the 40-50 depth and in the 0-10 depth. The higher levels also contain seeds of thistles (*Carduus/Cirsium* and *Sonchus asper* (L.) Hill), goosefoots/orache and elder, all could have been growing in the banks of the ditch or have been blown into the deposit.

Table 13. Charred remains from Evaluation Trench 3- Creek F127 fills

			Sample	0-10	10-20	40-50
			Context	TR3	TR3	TR3
			Feature	creek	creek	creek
			Date	Saxon	Saxon	Saxon
Scientific Name	Common Name	Plant Part	Habitat/Use Code			
indeterminate	-	wood flecks	-	-	-	+++++
indeterminate	-	wood fragments >4mm	-	-	+	-

Table 14. Evaluation Trench 3 uncharred remains from creek F127 fills

Scientific Name	Common Name	Plant Part	Habitat Code	Sample	0-10	10-20	20-30	30-40	40-50	50-60
				Context	TR3	TR3	TR3	TR3	TR3	TR3
				Feature	Creek	Creek	Creek	Creek	Creek	Creek
				Date	Saxon	Saxon	Saxon	Saxon	Saxon	Saxon
				Use Code						
Ranunculus subgen. *Batrachium* (DC)A	Crowfoots	seeds	E	-	+++	+	+	+++	+++++	+++
Fumaria cf. officinalis	Fumitory	seed fragment	A	-	+	-	+	-	-	-
Chenopodium album L.	Fat hen	seeds	AB	FH	-	-	+	-	+++	-
Atriplex hastata/patula	Orache	seeds	AB	FGH	+	-	+	-	-	+++++
Atriplex sp.	Orache	seeds	AB	FGH	-	-	-	+	-	-
Chenopodium/Atriplex	Goosefoot/orache	seeds	AB	FGH	-	-	-	-	-	+
Sambucus nigra L.	Elder	seed fragment	BC	FGH	+	+	-	-	-	-
Daucus carota L.	Wild carrot	seed	AB	-	+	-	-	-	-	-
Carduus/Cirsium sp.	Thistles	seeds	ABDE	G	+	-	-	++	++	++
Sonchus asper (L.) Hill	Spiny milk/ sow thistle	seeds	AB	-	-	-	+	++	+	-
Potamogeton sp.	Pondweed	seeds	E	-	-	-	+	+++++	+++	+++
Zanichella palustris L.	Horned pond weed	seeds and frags	E	-	++	-	-	-	++	-
Schoenoplectus lacustris (L.) Palla	Bulrush	seeds	E	-	-	-	-	-	+++	++
Carex spp.	Sedges	seeds	CDE	H	+++	+	-	-	-	-
indeterminate	-	stem/leaf frags	-	-	+++++	+++++	+++++	+++++	-	+++++
indeterminate	-	wood fragments	-	-	-	-	-	-	+++	-
Bryophyta	Moss	leaf fragments	-	-	+	-	-	-	++	+

The 10-30 depth still contains a much smaller number of pondweed and crowfoot seeds. Seeds of plants of arable/wasteground, fat hen, fumitory, orache and thistle are more frequent in this depth than aquatics. This could indicate drier conditions.

The deepest depth 0-10 contains more aquatics and semi-aquatics than the later levels, sedge disappears above 10-20 cm and the highest numbers of sedge seeds are in the basal sediments at 0-10 cm depth. Horned pond-weed and crowfoot are present in numbers in the lowest sample then decrease or disappear, re-appearing in the upper samples between 30-60cm. This could indicate slightly wetter conditions. Horned pondweed, occurs in fresh, slow-moving and brackish water but (Rose, 1981, 449) but as mentioned above other biological evidence will be necessary to determine the changing salinity of the water through time. All these plant remains can do alone is reveal changes in wet and dry conditions

2. Landscape

Spalding lies in an area that has undergone major changes in its landscape as a result of changing sea levels. At times in the past the coastline lay west of Spalding and the estuary of the River Welland covered much of the area now occupied by the town. One of the major interests of the Springfields site is that it lies at the boundary between the land and sea at various times during its history and the Late Saxon occupation identified during the evaluation (ASUD 2002) and reinforced by the excavation marks the first occupation of this area after the movement of the coastline eastwards in the Saxon period. The excavation has allowed us to examine this aspect of the history of the site in more detail.

Field observations of the soils

C.A.I.French

The open trenches generally revealed a sequence of tan coloured, fine to very fine sandy/silt deposits beneath the modern garden topsoil, in turn underlain by pale greyish tan, very fine sandy clay/silt loam material. In many instances there were medieval and later ditches and/or infilled former water courses, generally defining at the base of the topsoil, base of the fine sandy/silt or within the lower, more clayey sand/silts. There were no *in situ* palaeosols or standstill horizons in evidence.

The relict water courses held finely laminated sediments similar to the tan, fine sandy/silts. These were suggestive of natural roddons, or tidal dendritic creeks (French and Pryor 1993,8; French 2003, 139) which ubiquitously drained the salt marsh fens of south Lincolnshire during several phases of marine inundation (Lane 1993; Waller 1994).

In addition, on the west side of the road in Area 4, a large trench had been cut through a suggested former seabank (ASUD 2002) and a meandering water course defining its eastern edge. As the deposits were uniformly fine laminated sediments of the textural range as found elsewhere on the site, exhibiting flat topography and with the proximity of the Coronation Cut some 75m to the west, it is suggested that this high ridge of land may be a large former roddon, perhaps even a former later prehistoric course of the River Welland.

Topography

The roddon is a major landscape feature across the site. A pronounced bank runs broadly north south across the south eastern part of the old car park area (Area 4) and along the boundary behind the houses on Camel Gate up towards the surviving sea bank upon which a modern road runs. Originally interpreted as a flood defence bank in the Evaluation report

(ASUD 2002) the origin of this feature has been re-interpreted (see French above). The area of raised ground extends from the visible eastern bank across the car park area to the edge of the Coronation Channel with very little evidence of a fall in ground level. This clearly cannot

Plate 1. OSL samples OSL 3 and 4 in the roddon, showing the 13-14th century pit cut into the deposits above. The column marks the location of the series of samples taken for foraminifera. The stratigraphically lower sample OSL4 was dated.

Plate 2. OSL samples OSL1 and OSL2 in the deposits of the creek 423 cutting the eastern side of the roddon. The stratigraphically lower sample OSL2 was dated. The column marks the series of samples taken for foraminifera. A thin band of mussel shells is cut by the top half of the left column and the bottom of the right column - not clearly visible in the photograph.

represent a constructed bank and observation of its situation and the deposits of which it is composed indicate that it is probably a roddon, a sand filled ancient tidal channel. The deposits of which it is made show clear banding and fine laminae within the sediments indicating a waterlain inter-tidal context and it is cut by a later creek that itself shows the characteristic laminated deposition typical of tidal sediments. Textural changes in the deposits (Table 16) reflect the changes from a sand flat to mud flat and saltmarsh environments on the site.

Late Saxon features were cut into the upper surface of this 'roddon' and much of the Saxon occupation in Area 4 is likely to have been disturbed by agricultural activity, indicated by the plough furrows recorded by Durham University during the evaluations. The roddon surface was raised above the surrounding land and would have afforded an area of dry ground as the coastline retreated eastwards. The roddon deposits and adjacent creek were sampled for OSL dating (Plates 1 and 2) and foraminiferal analysis, the latter intended to inform on the depositional environment of the sediment.

During the evaluation the Durham University team placed one of their evaluation trenches (Trench 3) across a feature subsequently described as a creek F127. This area was re-opened during the excavation and a section cut through the creek deposits (Plate 3) which were then sampled for palaeoenvironmental analysis and dating. On the lower ground to the east where late Saxon and medieval activity is attested by several features the excavation trenches recorded further creek features. The south end of Trench 1 revealed two adjacent creeks which were sampled for OSL dating and foraminifera. The excavation Trench 2, running east of the car park area in front of the offices, section revealed a large creek feature at its western end upon whose infill the late Saxon pit was recorded in the evaluation. OSL samples and foraminifera samples were collected from this sequence.

OSL and Radiocarbon dating

Jean-Luc Schwennigger and James Rackham

A series of nine OSL dates were collected from the site during the fieldwork. Eight were taken by Dr Eddie Rhodes of the Luminescence Laboratory, Oxford University Archaeological Research Laboratory, and the ninth by the author. The sampling was designed to establish a chronology for the creeks and roddon deposits and in combination with the foraminiferal studies establish when the site was under marine or tidal influences and when it was dry or freshwater. The full report on the OSL dates and the radiocarbon calibration curves are presented in Appendices 1 and 2, while the results are presented in Table 16.

Radiocarbon samples were submitted to Beta Analytic Inc, Florida, from the organic sediments in creek F127 in the Evaluation Trench 3 and the organic rich ditch fill in Trench 5 (Table 15). This deposit was provisionally dated to the 13th century on a single fragment of pot.

The results of both the OSL dating and the radiocarbon dating of these creeks is summarised in Table 17 for each of the features and their position in the sequence and relationship to the foraminifera samples indicated. The complete sequence of foraminifera samples from creek F127 were analysed, while only those deposits from the same level as the dated sediments from the other creeks were studied (see below).

Table 15. Radiocarbon dating results

Sample Data	Measured Radiocarbon Age	13C/12C Ratio	Conventional Radiocarbon Age(*)
Beta - 196801	340 +/- 40 BP	-25.6 o/oo	330 +/- 40 BP
SAMPLE : SSFG03/REST/0-10 CM			
ANALYSIS : AMS			
MATERIAL/PRETREATMENT : (plant material): acid/alkali/acid			
2 SIGMA CALIBRATION : Cal AD 1460 to 1650 (Cal BP 490 to 300)			
Beta - 196802	1270 +/- 40 BP	-21.8 o/oo	1320 +/- 40 BP
SAMPLE : SSFG03/T3/EV 40-50 CM			
ANALYSIS : AMS			
MATERIAL/PRETREATMENT : (plant material): acid/alkali/acid			
2 SIGMA CALIBRATION : Cal AD 650 to 780 (Cal BP 1300 to 1170)			

Table 16. Summary of the Optically Stimulated Luminescence dating results.

Field code	*Lab. code*	*Depth* (m)	D_e (Gy)	*Dose rate* (mGy/a)	*Age* (years AD)
*SS03-01	*X1469*	*0.80*	*1.59 ± 0.05*	*2.13 ± 0.11*	*1260 ± 50 AD*
*SS03-04	*X1472*	*1.20*	*1.94 ± 0.05*	*1.97 ± 0.11*	*1020 ± 60 AD*
SS03-05	*X1473*	*0.80*	*2.56 ± 0.05*	*1.65 ± 0.07*	*450 ± 80 AD*
SS03-06	*X1474*	*0.80*	*2.38 ± 0.05*	*1.78 ± 0.08*	*670 ± 70 AD*
SS03-07	*X1475*	*0.80*	*2.28 ± 0.43*	*1.75 ± 0.12*	*700 ± 260 AD*
SS03-09	*X1784*	*2.00*	*2.15 ± 0.09*	*1.77 ± 0.10*	*790 ± 90 AD*

* Results reported previously by Dr. E.J. Rhodes.

Table 17. Deposits sampled for OSL, C14 and foraminiferal studies.

trench		sample	context	depth	OSL	Date AD
1	Creek 124					
	108-113cm paving stone					
	101-108 sanding bedding for paving					
	75-101 fine sand with patches of silty fine sand,					
	20-75 banded and poorly laminated sands	55	119	60-70		
		54	120/12	30-40	OSL5	450±80
		53	120	20-30		
	10-20 compacted poorly laminated sands	52	120	10-20		
	0-10 fine poorly laminated sands	51	120	0-10		
1	Creek 117					
	120-126 paving stone					
	98-120 dark grey topsoil & sand blinding					
	60-120 brown fine sand & iron mottling	60	105	60-70		
	51-60 slightly silty iron rich mottled fine sand with	59		50-60		
	39-51 grey blue mottled slightly silty sand	58	110	40-50	OSL6	670±70
	22-39 grey brown fine sand	57		20-30		
	0-22 slightly silty grey brown fine sands	56		0-10		
2	103-135 turf and topsoil					
	60-103 mottled yellow brown fine sand	64		70-80		
	25-60 brown fine sand	63		40-50	OSL7	700±260
		62		20-30		
	0-25 brown yellow wet fine sand	61		0-10	OSL8	Not dated
4	Creek 423					
	Bench at 82					
	57-65 mussel layer		424			
	50-57 laminated fine sands		424			
	40-50 laminated very slightly silty fine sands	67	424	45-52		
	0-40 laminated and banded fine sands with iron	66	424	20-30	OSL2	Not dated
		65		0-10		
4	Creek 423					
	135 track surface					
	119-135 gravel of track		402			
	90-119 grey brown sandy topsoil		415			
	33-90 fine yellow brown sands	71	424	60-70		
		70	424	40-50	OSL1	1260±50
	26-33 mussel shell layer	69	424	20-30		
	0-26 laminated fine sands	68	424	0-10		
4	Roddon		402			
	25-80 fine poorly banded sand, mottled	75	415	47-55		
		74	416	25-35	OSL3	Not dated
	10-25 grey brown mottled silty fine sand	73	417	13-20	OSL4	1020±60
	0-10 grey brown & grey mottled fine sandy silt,	72	420	0-8		
Ev Tr 3	Creek F127 depth from ground surface 2.25m					
	190-225 darker brown sands - topsoil					
	102-190 light brown sands					
	98-102 brown clay rich channel lense, sloping					
	56-98 fine mottled light brown sands			70-80	OSL9	790±90
	47-56 grey (+bit blue) sands-with darker organic			50-60		
	40-47 yellow/blue sands			40-50	C14	650-780
	24-40 bluey grey silty sand with numerous shells			30-40		
				20-30		
	0-24 grey silty, very fine sand			10-20		
				0-10		

All measurements were taken from the base of the described and sampled sections

Plate 3. Machine dug section through the creek excavated in Evaluation Trench 3. The grey sediments at the base of the trench form the primary fills of creek F127.

Analysis of sediments for foraminifera
Annette Kreiser

Introduction
Thirteen samples from a number of creek sequences were analysed for foraminifera. The aim of the analysis was to establish whether foraminifera are present and, if so, to assess whether the foraminifera are of sufficient quality and concentration to allow palaeoenvironmental interpretation. In particular, seven samples were examined from the creek F127 sequence with the aim of helping to reconstruct changes in landscape.

Methods
20 cm^3 of wet sediment from each sample was wet sieved through 500μ, 125μ and 63μ mesh sieves. Any foraminifera retained on the 125μ sieve were picked out at 30 - 40 x magnification under transmitted and incident light using a Brunel BMZ zoom stereo microscope. Where possible, a minimum of 100 tests were identified (where the total count exceeded this number) and an assessment of the relative proportions of the species made. The <125μ fraction was also examined for the presence of juveniles although it is generally not

possible to confidently identify juvenile tests to species level. Identification follows Murray, 1973 and Murray, 1979 and interpretation of their ecology follows Murray, 1991 and Haslett *et al.* 1997.

Results

The results from Evaluation Trench 3, Creek F127, are summarised in Table 18 and the results from Trenches 1, 2 and 4 are summarised in Table 19.

Preservation of tests is generally good with some breakage in all samples. The foram concentration varies from >500 tests $20cm^{-3}$ to 3 tests. No foraminifera are present in the 50-60cm sample in Evaluation Trench 3 or in Trench 1, creek 117, sample 58.

Evaluation Trench 3, Creek F127.

Foraminifera are most abundant in the 70-80cm sample where brackish foraminifera form 88% of the assemblage. The dominant species; *Haynesina germanica* and *Ammonia beccarii*, both tolerate large fluctuations in salinity and exposure. *H. germanica* in particular, is associated with intertidal mud flats. The remaining 12% comprises marine species.

Moving down the sequence, 50-60cm is barren and 40-50cm contains just three brackish tests. Sample 30-40cm contains three brackish species; *H. germanica, A. beccarii* and *Jadammina macrescens*. *J. macrescens* forms an agglutinated test from plant detritus so is associated with vegetated saltmarsh surfaces. Below this, sample 20-30cm also contains purely brackish species, dominated again by *H. germanica* and *A. beccarii.* In the 0-10cm sample at the base of the creek deposits *H. germanica* comprises most of the assemblage although *J. macrescens*, the vegetation indicator, is also present.

Trench 1, Creek 124, sample 54

Foraminifera are abundant in this sample and brackish species, principally *H. germanica* and *A. beccarii* form 60% of the assemblage. The remaining foraminifera are species generally found in fully marine, sub-tidal sediments although some (such as *Elphidium earlandi* and *Nonion depressulus*) will tolerate salinity fluctuations and may be found living in estuary mouth sediment.

Trench 1, Creek 117, sample 58

No foraminifera were found in this sample.

Trench 2, sample 63

As in sample 54, foraminifera were abundant in this sample and brackish species comprise 62% of the assemblage. Again, the remainder is made up of marine or outer estuarine species.

Trench 4, Creek 423, sample 65

This assemblage is very similar to those in samples 54, and 63, with brackish species forming 60% of the assemblage and marine/estuary mouth species the remainder.

Trench 4, Creek 423, sample 73

Foraminifera are slightly less abundant in this sample but again, the same combination of brackish species forms 57% of the assemblage with marine/outer estuarine species forming the remainder.

Table 18. Summary of foraminiferal analysis of sediments from Evaluation Trench 3, Creek F127. Samples are arranged in stratigraphic order with the basal sediments at the bottom of the table.

Sample depth in cm.	No. of tests ≥125μ in 20cm^{-3} wet sediment	Species present and total in sample (or % where total ≥100 tests in 20 cm^3).		*Ecology	Forams <125μ present
70-80	209		%		yes
		Haynesina germanica	63	Brackish, mid/low marsh-mudflat	
		Ammonia beccarii	21	Brackish-marine	
		Elphidium williamsoni	4	Brackish, mid/low marsh	
		Elphidium excavatum	8	Estuary mouth/marine	
		Elphidium earlandi	3	Estuary mouth/marine	
		Lagena sp.	1	Estuary mouth/marine	
50-60	0				no
40-50	3	*Jadammina macrescens*	2	Brackish, high-mid marsh	no
		Ammonia beccarii	1	Brackish-marine	
30-40	28	*Haynesina germanica*	15	Brackish, mid/low marsh-mudflat	yes
		Jadammina macrescens	9	Brackish, high-mid marsh	
		Ammonia beccarii	4	Brackish-marine	
20-30	102		%		yes
		Haynesina germanica	78	Brackish, mid/low marsh-mudflat	
		Ammonia beccarii	14	Brackish-marine	
		Elphidium williamsoni	4	Brackish, mid/low marsh	
		Unknown (broken)	4		
10-20	13	*Haynesina germanica*	6	Brackish, mid/low marsh-mudflat	yes
		Jadammina macrescens	3	Brackish, high-mid marsh	
		Ammonia beccarii	2	Brackish-marine	
		Elphidium margaritaceum	1	Estuary mouth/marine	
		Elphidium sp.	1		
0-10	48	*Haynesina germanica*	41	Brackish, mid/low marsh-mudflat	yes
		Jadammina macrescens	3	Brackish, high-mid marsh	
		Ammonia beccarii	2	Brackish-marine	
		A. beccarii v. *batavus*	1	Estuary mouth/marine	
		Lagena sp.	1	Estuary mouth/marine	

- 'Ecology' refers to a literature-derived classification for the individual species and should not be taken as an inferred habitat for a particular sample.

Trench 4, Roddon, sample 73
Foraminifera are very sparse with just three brackish individuals being identified.

Discussion and conclusions
In the Evaluation Trench 3, F127 sequence, the bottom two samples 0-10 and 10-20 suggest a middle saltmarsh or mudflat habitat but the presence of *J. macrescens* indicates vegetated saltmarsh in the vicinity. Above, sample 20-30cm indicates a middle to low marsh habitat.

The absence of marine species suggests there wasn't the degree of marine influence indicated in 70-80cm above, but at the same time the indicators of vegetated saltmarsh are also absent. Moving up the sequence, 30-40cm and 40-50cm suggest the evolution of a higher, vegetated saltmarsh surface. There are no marine species in these sediments. Sample 70-80 at the top of the sequence suggests an intertidal mudflat environment although the presence of some marine species suggests input from sub-tidal, but possibly still brackish, habitats. This indicates a return to a tidal marine environment.

Table 19. Summary of foraminiferal analysis of sediments from Trenches 1, 2 and 4.

Trench and sample number.	No. of tests ≥125μ in 20cm^{-3} wet sediment	Species present and total in sample (or % where total ≥100 tests in 20 cm^3).		*Ecology	Forams <125μ present
1/54	429		%		yes
		Haynesina germanica	29	Brackish, mid/low marsh-mudflat	
		Ammonia beccarii	30	Brackish-marine	
		Elphidium gerthi	3	Estuary mouth/marine	
		Cibicides lobatulus	7	Estuary mouth/marine	
		Elphidium margaritaceum	6	Estuary mouth/marine	
		Nonion depressulus	7	Estuary mouth/marine	
		Gavelinopsis praegeri	3	Estuary mouth/marine	
		Planorbulina mediterranensis	2	Estuary mouth/marine	
		A. beccarii v. *batavus*	2	Estuary mouth/marine	
		Elphidium williamsoni	1	Brackish, mid/low marsh	
		Elphidium earlandi	7	Estuary mouth/marine	
		Elphidium sp.	1		
		Unknown	1		
1/58	0				no
2/63	>500		%		yes
		Haynesina germanica	38	Brackish, mid/low marsh-mudflat	
		Ammonia beccarii	24	Brackish-marine	
		Elphidium gerthi	7	Estuary mouth/marine	
		Nonion depressulus	11	Estuary mouth/marine	
		Elphidium earlandi	8	Estuary mouth/marine	
		Elphidium sp. (broken)	10		
		Brizalina variabilis	1	Estuary mouth/marine	
		Unknown	1		
4/65	>500		%		yes
		Haynesina germanica	31	Brackish, mid/low marsh-mudflat	
		Ammonia beccarii	27	Brackish-marine	
		Elphidium williamsoni	3	Brackish, mid/low marsh	
		Nonion depressulus	11	Estuary mouth/marine	
		Elphidium gerthi	7	Estuary mouth/marine	
		Cibicides lobatulus	<1	Estuary mouth/marine	
		Elphidium margaritaceum	3	Estuary mouth/marine	
		Glabratella millettii	5	Estuary mouth/marine	
		Elphidium earlandi	4	Estuary mouth/marine	
		Elphidium sp.	2		
		Quinqueloculina sp.	2	Estuary mouth/marine	
		Lagena sp.	4	Estuary mouth/marine	
4/70	375		%		yes
		Haynesina germanica	37	Brackish, mid/low marsh-mudflat	
		Ammonia beccarii	20	Brackish-marine	
		Nonion depressulus	17	Estuary mouth/marine	
		Cibicides lobatulus	1	Estuary mouth/marine	
		Elphidium margaritaceum	4	Estuary mouth/marine	
		Glabratella millettii	6	Estuary mouth/marine	
		Elphidium earlandi	7	Estuary mouth/marine	
		Elphidium sp.(broken)	7		
		Lagena sp.	1	Estuary mouth/marine	
4/73	3	*Haynesina germanica*	2	Brackish, mid/low marsh-mudflat	yes
		Ammonia beccarii	1	Brackish-marine	

- 'Ecology' refers to a literature-derived classification for the individual species and should not be taken as an inferred habitat for a particular sample.

The samples from the other trenches (with the exception of samples 58 and 73) all contain very similar assemblages comprising 60% brackish foraminifera and 40% marine or outer estuarine species. It is always difficult to ascertain the allochthonous component in any assemblage, but given the sandy nature of these sediments, it is possible that they contain foraminifera from two sources: intertidal mudflats and sub-tidal brackish-marine sediments, and the sediments in which they are found may not have formed part of the substrate on which either group lived. Several of the marine genera identified (e.g. *Gavelinopsis, Planorbulina, Cibicides* and *Glabratella*) live attached to firm substrates such as rock or seaweed in areas of strong currents so are certainly allochthonous. It seems likely therefore, that these are channel sediments receiving material from both nearby mudflats and sub-tidal estuary mouth sediments.

In conclusion, the abundance and generally good preservation of the foraminifera has allowed reconstruction of the nature of the environment at the time of sediment deposition for most of the samples.

Landscape discussion

The earliest identified feature on the site is the southern creek, 124, at the south end of Trench 1. The OSL date attributes the sediments in this creek to the immediate post-Roman period in the fifth century AD. The foraminifera in the dated deposit suggest a channel feature receiving a biota from nearby mudflat and sub-tidal estuary mouth sediments. We can assume from these results that the area was probably tidal saltmarsh and mudflats at this time.

The adjacent creek, 117, indicates a slightly later period, with an OSL date in the 7th century AD. Interestingly there is a complete absence of foraminifera in the dated deposit. Radiocarbon dated organic sediments from a freshwater organic horizon from a site west of Spalding of AD 530-680 (Rackham *et al* 2000) implies a retreat of the coastline at this time and the absence of foraminifera in creek 117 might reflect this change from a marine/brackish to freshwater environment. A radiocarbon date with an intercept at 680 AD obtained from an organic sediment within the sequence of fills in creek F127 in Area 4 and a relative absence of foraminifera within this dated deposit appears to confirm this freshwater event in the early to middle Saxon period. In the latter feature the sediments underlying the radiocarbon dated horizon all show a marine influence with foraminifera associated with brackish conditions and intertidal mudflats, which clearly shows this creek was functioning as a tidal creek, probably within the inter-tidal mudflat or saltmarsh zone. The occurrence of shells of Scrobiculariidae between 24 and 40cm from the base of this creek also supports the interpretation of the feature as a saltmarsh or estuarine creek.

In Trench 2 sediments from the upper part of a large creek at the west end of the trench were OSL dated to 700 AD (see Appendix 1). It is the infill of this creek that has been cut by the late Saxon pit found during the evaluation and later 12-13th century features. This date has a large error range (see Table 16) but a clear indication that the sediments were deposited in a tidal environment is given by the foraminifera and suggests that the sea has again begun to encroach the eastern side of Spalding by the middle to late Saxon period. This is supported by a very strong brackish water assemblage of foraminifera from the sands 0.2m above the radiocarbon dated horizon in creek, F127, indicating a return to an intertidal mudflat environment which is dated by OSL to 790 AD. The correspondence between the radiocarbon date and that for the OSL analysis on sediments only 0.2m directly above is re-assuring and suggests that the OSL dates can generally be viewed with confidence.

The presence of 11th century pottery in a pit in Area 2 indicates that this area was no longer under the influence of the tide by this time, and that the sea had again retreated or sea banks had been constructed to protect this land south of the River Welland. Two OSL analyses carried out on the deposits of the roddon and the laminated sands laid down within a creek on the edge of this feature post-date all the other OSL dated samples. The roddon deposits have produced a date of 1020 AD (Table 16). These deposits underlie a feature that has produced 13th century pottery and such a recent date has produced an anomalous result that is difficult to interpret. If as has been assumed these deposits represent the upper sediments in a roddon then the creek, F127, to the north which cuts through these sands and has OSL and radiocarbon dates of middle Saxon date would suggest a pre-Saxon date for the roddon deposits, which is at odds with the OSL date for the roddon. The sediments in the adjacent creek to the east, creek 423, have produced an OSL date of 1260 AD (Table 16), which is not inconsistent with the roddon date. This latter deposit produced a brackish water foraminiferal assemblage consistent with a mudflat and salt marsh environment suggesting that this area is still being influenced by tidal waters in the 13th century, further indicated by the fine laminate sediments infilling it. In contrast the roddon deposits were relatively lacking in foraminifera, only three adult tests, perhaps suggesting a diminution of the marine influence.

If the OSL dating of the roddon is to be believed a reinterpretation of this feature is necessary. We cannot have a roddon deposit laid down in the 11th century that was cut by a creek in the 7th. The formation of roddons is not completely understood. A number of possible origins have been proposed. Godwin (1938) suggested that they were the natural levees of tidal rivers and channels, but other hypotheses include the differential compaction of sediments after deposition that results in the coarser sediments in the former river channel standing proud above the surrounding area or peat wastage leading to the channel standing above the drying out organic sediments either side (Shennan in Waller 1994). It is possible that creek F127 is the latest functioning phase of the channel in the roddon, i.e. a narrow creek running down the centre of a now largely filled much larger channel. If this is so then the OSL date is acceptable as some of the latest levee formation or even the upper fills of the same creek recorded in Evaluation Trench 3. The OSL date from creek F127 was obtained from sediments 1.45m below the modern ground surface, while the OSL date in Trench 4 is 0.85m below the ground surface. This would imply that the creek had probably finally ceased to flow by the 11th century and a new creek (423) had cut into the side of the old roddon on the east side and was filling with tidal sediments in the 13th century. This is still difficult to reconcile with the occupation of the lower ground in Areas 1 and 3 in the 11-12th and 13th centuries, although these areas may have been on the east bank of creek 423. The creek appears to run beneath or just west of Camel Gate. Its actual size was not established during excavation but it could have permitted boat access from the Welland to the north.

3. The Palaeoenvironment

The palaeoenvironment on the site has been studied through the analyses above and the pollen, snails, and plant and insect macrofossil remains. While snails have been obtained from most deposits, the pollen evidence, macrofossil insects and plant remains relevant to the environmental reconstruction have only survived in waterlogged deposits. These were primarily restricted to two features. The deposits within the creek, F127, in Area 4 which have been dated to the middle Saxon period, and the deposits in ditch 508 in Trench 5, which have produced a radiocarbon result suggesting a 15-16th century date, although the only pottery from the feature has been dated to the 12-13th century.

Pollen Analysis
Rob Scaife

Pollen analysis, the aims of this study
The study of sub-fossil pollen and spores in peat, mineral soils and lake sediments has a history going back to the beginning of the last century. Pollen analysis has often been regarded as a technique for dating sediments. Whilst this is more true of geological sediments by providing stratigraphical bio-marker horizons, this is not now the case for the present, Holocene period. This dating role of pollen analysis has been largely superceded by radiocarbon measurements. With the advent of radiocarbon dating, there has also been increased awareness of the degree of asynchroneity in vegetation and environmental changes which has taken place in the geographical spread of the principal vegetation types since the final close of the last cold stage (glacial) period some 10,000 years ago. What pollen analysis does achieve, is the study of the plants and plant communities growing during the past. The basic premise is that pollen which becomes incorporated in the peat/sediment/soil reflects, in some way, plants and plant communities which produced the pollen at the time of the sediment deposition. It is from the identification and analysis of the sub-fossil pollen that basic data and interpretations can be made. These data can then be used as proxy for the study of broader environmental aspects such as climatic change, human impact and sea level change.

In order to achieve these data, sediments are sampled sequentially throughout a stratigraphical pollen profile which represents a period of accumulation. Thus, each sample at a specific depth, hopefully containing pollen, represents a particular age/period which may/may not be dated. Any changes in vegetation and thus pollen types and quantity may thus be reflected in the different samples/depths of the profile. To portray these changes, pollen counts which have statistical validity are made for each level, usually some hundreds of pollen grains and spores. Relative percentages of the different types identified are calculated (in various ways) for each level examined. These percentages are plotted as a form of histogram, that is, a standard pollen diagram such as are presented here. Changes in each plant type through time are thus seen through the changing percentages of the 'pollen curve'. Since the stratigraphy of the sediments is important to the interpretation of the pollen, it is usual to show this on the left side of the pollen diagram. Where changes in pollen types occur in phases, it is often desirable to divide the pollen diagram into broad pollen assemblage zones from which environmental interpretations can be made. Such pollen assemblage zones are usually defined without discussion of their cause/effects. This standard approach has been used to describe the pollen sequence of the Polliniferous sediments analysed from the sediment fills of the creek and ditch fills excavated at this site.

Because of the preserved waterlogged sediments in the ditch and palaeo-creek, the Springfield site clearly offered potential for pollen reconstruction of the past vegetation and environments. Consequently, a pollen assessment study was initially undertaken on a range samples obtained from the different contexts observed and with the following aims in question.

a.) To ascertain if sub-fossil pollen, spores and diatoms are present in the deposits, the quality of preservation and whether they are in sufficient numbers to allow a more detailed analysis to be carried out.

b.) If sub-fossil pollen/spores are present, to provide a broad idea of the vegetation types and changes present and the environment during the time-span of sediment deposition.

c.) To ascertain if there was any evidence of human activity in the pollen record such as for example the character of agricultural land use.

d.) Assess the potential for a more complete pollen analysis of the site at a future date.

This preliminary study ascertained that further examination of sediments from the creek (F127, Evaluation Trench 3) and ditch 508 in Trench 5, might provide useful information on the palaeo-environments of the site, while a series of other samples from Areas 3 and 4 were shown to be unsuitable for further study

Sampling and preparation methodology.

Samples of 2ml volume were prepared using standard pollen extraction procedures (Moore and Webb 1978; Moore *et al.* 1991) with the addition of micromesh sieving (10u) for removal of fine/clay deposits in the alluvial sediments. Absolute pollen frequencies were calculated using Stockmarr (1971) *Lycopodium* spore tablets added to known sample volumes (by displacement). Chemical techniques involved KOH deflocculation; sieving at 150u for removal of coarse debris; 10u sieving as noted; hydrofluoric acid for digestion of silica and Erdtman's acetolysis for removal of cellulose. The concentrated pollen was stained with safranin and mounted in glycerol jelly on a microscope slide. This work was carried out in the Palaeoecology Laboratory of the School of Geography, University of Southampton. Pollen was identified and counted using an Olympus biological research microscope fitted with Leitz optics.

For this study, a pollen sum of 300 grains per level plus extant marsh taxa and spores was aimed at for each level. However, in some samples pollen preservation was poor and lesser numbers were attained. The resultant total pollen sums thus range from *c.*100 to >350 grains per level. The results are presented in standard pollen diagram form (Figures 2 and 3). Pollen of marsh taxa have been calculated as a percentage of the pollen sum + the marsh herb taxa. Spores of ferns and miscellaneous taxa (esp. derived geological palynomorphs) have similarly been calculated in the same fashion with these categories as a percentage of the pollen sum + spores at each level. That is, as follows.

Sum =	% total dry land pollen (tdlp)
Marsh/aquatic =	% tdlp + sum of marsh/aquatics incl. *Alnus*
Spores =	% tdlp + sum of spores
Misc. =	% tdlp + sum of misc. taxa.

The pollen diagrams have been prepared using Tilia and Tilia Graph. Because the software used to construct the pollen diagram requires depth measurements to increase down the profile and the samples were collected from zero at the base, the sample levels have been changed for the diagram (i.e. the sample at 10cm in the field is presented on the diagram at 50, while the sample at the top of the sequence in the field, i.e. 50cm is presented as 10). Plant taxonomy in general follows that of Moore and Webb (1978) modified according to Bennett *et al.* (1994) for pollen types and Stace (1991) for plant descriptions.

The Pollen Data

As noted, two pollen sequences have been examined in detail: that is sediments from creek, F127, in Evaluation Trench 3 and ditch 508 in Trench 5b. These are described as follows.

Springfield, Evaluation Trench 3: A total of 5 pollen samples taken at 10cm intervals have been examined (Fig. 2) which span the basal 40cm of sediments filling a creek cut into earlier tidal sediments. The age of this secondary channel fill has been established by radiocarbon dating as 7th century or middle Saxon. Pollen was largely well preserved and abundant in these sediments and pollen counts in excess of 300 grains per sample were made. Absolute pollen frequencies were calculated at between 9,500 grains/ml at 40cm and 80,100 grains/ml at the top of the profile.

This pollen profile can be divided into two local pollen assemblage zones. These are defined and characterised as follows.

Zone 1: 50cm to 25cm. This zone is characterised and delimited by very substantial numbers of bedrock derived geological palynomorphs (to 83% pollen + misc.). Whilst these have no bearing on the historical vegetation of the site, they strongly indicate that these lower sediments were possibly a mud-flat with no vegetation other than possibly *Salicornia* (glassworts). In relation to the latter, likely halophytic Chenopodiaceae (goosefoots, oraches and glassworts) attain their highest values (41%). Other herbs include Poaceae which become increasingly important with percentages expanding from 8% to *c.* 40% subsequently. Cereals (and non-differentiated large Poaceae grains) peak at the top of the zone. Trees and shrubs are also of greater importance in this zone with *Quercus* (oak) and *Corylus avellana* type (most probably hazel but may include sweet-gale) being most important., There are also small numbers of *Betula* (birch), *Pinus* (pine), *Ulmus* (elm) and *Tilia*. *Juglans regia* (walnut) is present and significant in terms of dating these sediments. Marsh and aquatic taxa are represented by small numbers of *Typha latifolia* (lesser reed-mace), *Typha angustifolia* type (greater reed-mace), Cyperaceae (sedges) and cysts of algal *Pediastrum*. Spores of ferns are present and comprise small numbers of *Pteridium aquilinum* (bracken) and monolete, *Dryopteris* forms (typical ferns).

Zone 2: 25cm to 0cm. Values of derived palynomorphs described above decline rapidly to small values. Trees and shrubs also decline in importance while a number of herb taxa become increasingly important. These include Poaceae (grasses; to 42%), *Ranunculus* type (buttercups; peak to 28%), *Plantago lanceolata* (ribwort plantain; to 26% in the top sample) and *Plantago coronopus* (hoary plantain; 5%). Other taxa include *Spergula* and *Spergularia* type (spurrey), *Plantago maritima* type (sea plantain) and cf. *Fumaria* (fumitory). Of note are the small numbers of *Secale cereale* (rye). There are greater numbers of Cyperaceae (sedges) and fewer fern spores.

Springfield, Trench 5b, ditch 508. This series of 5 samples comes from the basal fills of a ditch which has been radiocarbon dated to the 15-16th century AD. Pollen was generally very poorly preserved with strong evidence for differential preservation of more robust pollen taxa (especially Lactucoideae i.e. dandelion type). Absolute pollen values were generally small calculated at lowest to 6,000 grains/ml but with one sample (12cm) with 200,000 grains/ml. Apparent changes in the pollen stratigraphy result from the differential preservation in favour of the Lactucoideae which attain high percentage values (to 48%) at 8cm and above (Fig. 3). Because of this, local pollen assemblage zones have not been designated and the overall characteristics of the profile are described.

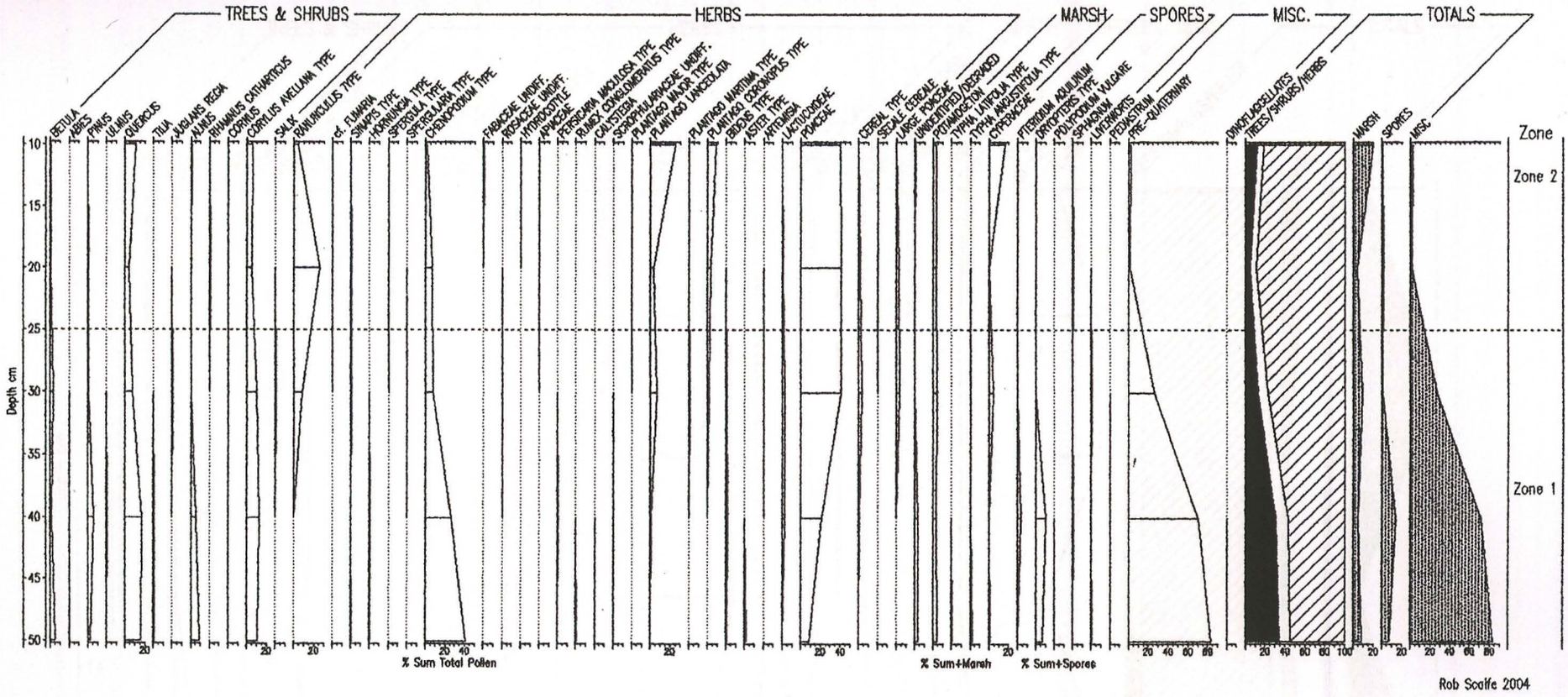
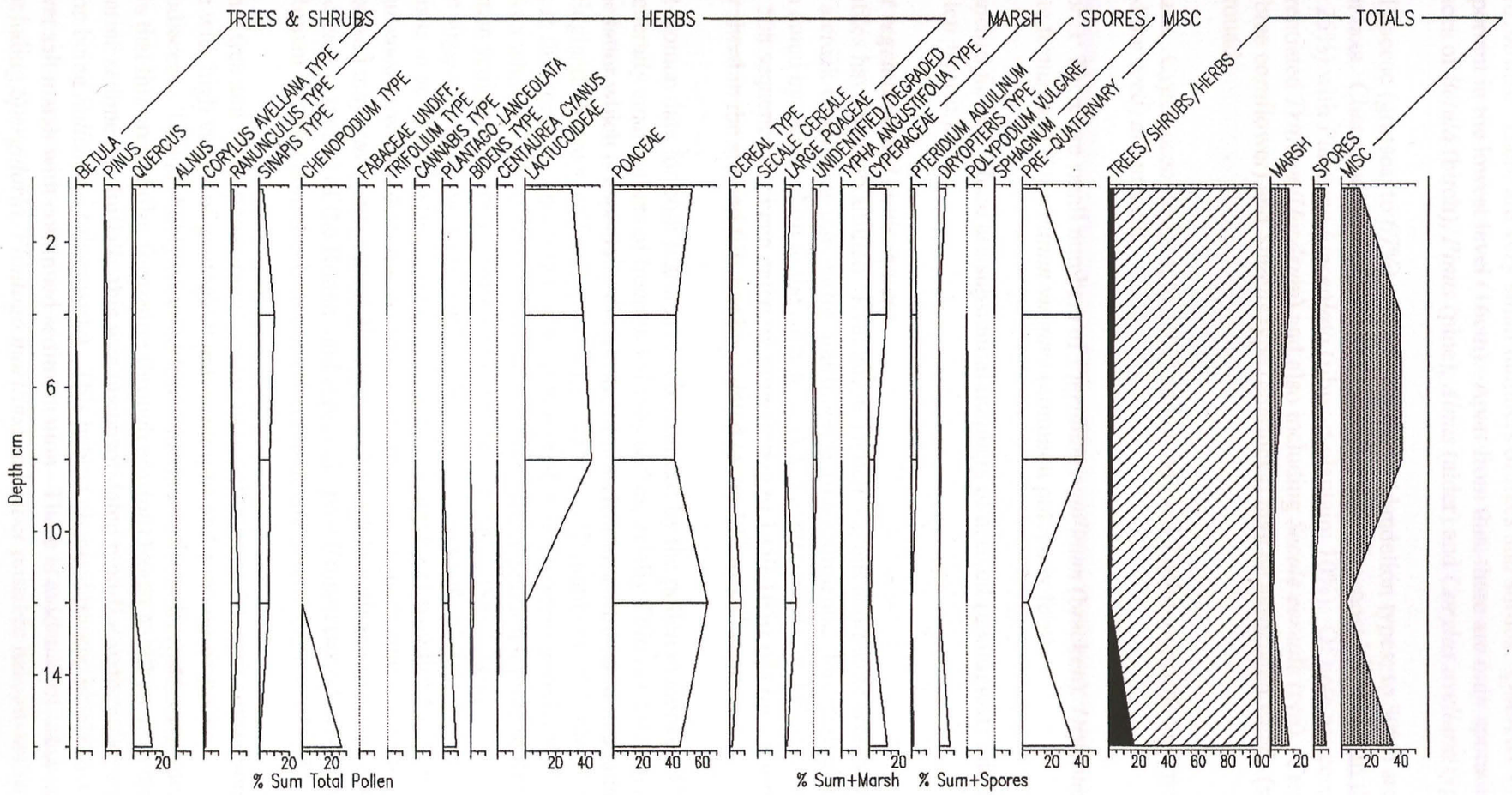


Fig. 2 Pollen diagram for the basal 50 cm of creek F127. The radiocarbon date of AD 650-780 was obtained at 10-20cm on the diagram



Rob Scaife 2004

Fig. 3 Pollen diagram for the samples taken from the basal fills of ditch 508. The radiocarbon date of AD 1460-1650 was obtained at 10-16 on the diagram

Trees and Shrubs: There are very small numbers of trees and shrubs. *Quercus* (14%) is most important in the lowest level (16cm). Apart from this, there are only sporadic occurrences of *Betula* (birch), *Pinus* (pine), *Alnus* (alder) and *Corylus avellana* type.

Herbs: Poaceae (grasses; to 67%) and Lactucoideae (dandelion types; to 50%) are the dominant taxa. Chenopodiaceae (goosefoots and oraches) are most important in the lowest level (to 25%) with *Plantago lanceolata* (ribwort plantain; 10%). Of note are cereal types (undifferentiated *Triticum/Hordeum*) and also including *Secale cereale* (rye). *Centaurea cyanus* (blue cornflower) and *Sinapis* type (charlocks) may be associated weeds (segetals) of arable ground.

Marsh taxa: Cyperaceae (sedges; to 15%) and occasional *Typha angustifolia* type (reed-mace and bur reed) are present.

Fern spores: There are small numbers of *Pteridium aquilinum* (bracken), *Dryopteris* type (monolete forms) and *Polypodium vulgare* (common polypody fern).

Miscellaneous forms: There are substantial numbers of derived (geological) microfossils (to 43% pollen + misc.).

The past vegetation and environment.

Two profiles have been examined. Evaluation Trench 3 spans sediments which were laid down in a creek which cuts into earlier marine/estuarine sediments. The studied sequence has been dated by radiocarbon to the early to middle Saxon period (see below). The Trench 5b ditch 508 sequence has been dated by radiocarbon to 1450-1650 AD (at 2 sigma) although a pottery sherd in the studied fills has been dated to the 12th to 13th centuries.

The post-Roman date for both features is substantiated by the pollen evidence. This is based on the generally small values of trees and shrubs and especially *Tilia cordata* (small leaved lime), the latter which is especially diagnostic of pre-clearance woodland in southern and eastern England. More specifically, there are (albeit small) numbers of *Juglans regia* (walnut) in this section. This tree is generally regarded as a Roman introduction to western Europe as a whole (Godwin 1975) and has been recorded in small numbers in Roman and post Roman sediments from southern England (Scaife 1982; 2000; Greig 1992). This therefore suggests that these sediments at least from *ca.*30cm are of Roman or post Roman age. This is in accord with the remaining largely oak and hazel woodland within the region. The occurrence of walnut does not necessarily imply local growth since its pollen is wind pollinated and may travel substantial distances. Although less diagnostic, the presence of *Secale cereale* is typical of the Roman and especially post Roman period. Once also thought to be a Roman introduction, this is not now held to be the case (Chambers 1985).

The higher tree and shrub percentages observed in pollen zone 1 which subsequently decline, correlate with high values of geological palynomorphs and contemporaneous Chenopodiaceae. This probably resulted from changes in the sedimentary regime. Initially, it appears that this creek (after formation through erosion) began to fill up with brackish water/marine sediments. Initially this was unconsolidated mud-flat with perhaps the only vegetation being *Salicornia* (glassworts). This habitat changed progressively to a more stable, wet salt marsh with continued sedimentation. There is evidence of other salt marsh plants including *Spergularia, Plantago maritima* and other possible halophytes such as *Calystegia* and remaining Chenopodiaceae.

This development may have changed the taphonomy of the pollen with greater fluvially transported material from farther afield in zone 1 (hence the tree and shrub pollen noted) and a more reduced pollen catchment in upper zone 2. However, some indication of local land use can be made. Although distinguishing pastoral activity in pollen spectra is difficult because of the presence of grasses and sedges in fens and marshes, dominance of grasses here with some ribwort plantain suggests that the channel was within a pasture habitat. This would not of course be unexpected given the topographical position. There is, however, also evidence of cereal cultivation and although pollen numbers are small, they include *Secale cereale* (rye). It is likely that arable cultivation was taking place on adjacent areas of better drained soils. One can envisage therefore, mixed arable cropping and rough pasture around the site in the middle Saxon period.

Trench 5b, ditch 508, whilst being securely dated poses some problem in interpretation because of the poor pollen preservation which has resulted in the statistical skewing of those percentages relating to the more robust pollen forms. These are notably, the dandelion types (Lactucoideae) and *Sinapis* type (charlocks). However, it is apparent that there are also some less robust forms (e.g. Cyperaceae and Poaceae) present which suggest that the poorly preserved grain may have been from secondary re-working of older soil/sediment which was progressively filling the ditch. This would also account for the substantial numbers of derived geological palynomorphs. Contemporaneous pollen although sparse is present. If this is considered, there are substantial similarities between the pollen assemblages of the creek sequence (Evaluation Trench 3) and the ditch profile, although it is several centuries later. Although the pollen catchment of such features as ditches and pits is small/local, it is clear that the local environment was devoid of trees and shrubs. The ditch sediments contain sedges (Cyperaceae) and reed-mace which may indicates that the feature was wet. It is also possible, however, that these were air transported from the adjacent wet fen. Of more specific interest are the high values of grasses which along with ribwort plantain and in fact the degraded dandelion types suggests that pasture existed on or near the site. In discussion of Evaluation Trench 3, some arable activity is evidenced. A similar interpretation can be made here including the presence of rye (*Secale cereale*) which is diagnostic of the medieval period. In addition to cereal pollen are taxa typically associated with the disturbed ground of cereal cultivation including especially blue cornflower (*Centaurea cyanus*) and charlocks (Brassicaceae). A single grain of *Cannabis* type may be related to this crop for hemp production (another diagnostic plant of this period) or from hop (*Humulus*). These pollen taxa have strong morphological overlap and it is unfortunately very difficult to separate them. One final point should be made regarding the presence of cereal pollen. Whilst it is most probable that cultivation was taking place nearby, it is also possible for substantial quantities of pollen of cereals and associated weeds to be liberated during crop processing activities and furthermore, may be present in human and animal waste deposited in such ditches, although the bulk samples from this ditch fill show very little evidence for occupation or domestic activity in the immediate vicinity (see Table 2).

Conclusions

Although there have been problems with the generally poor pollen preservation in one of the sequences, useful and relevant information has been obtained. The archaeology revealed at this site is the first evidence of possible reclamation and occupation in this area of Lincolnshire. The pollen data clearly show that the local environment was largely devoid of woodland during the time-span represented by the sediments and that both arable and pastoral agriculture was taking place. The principal points discussed above are summarised below.

* The creek sediments of Evaluation Trench 3 contain strong evidence for mud-flat and salt marsh conditions in their lower levels.

* The pollen evidence, particularly the walnut and rye pollen, in the sediments which implies a Roman or post-Roman date for the assemblages is consistent with the radiocarbon date..

* Tree and shrub pollen percentages are greater in the lower of two local pollen assemblage zones which have been recognised in the Evaluation Trench 3 sequence. This zone shows the greater importance of oak and hazel. These are the typical background woodland (?managed) components from the region as a whole and subsequent to widespread clearance of lime woodland during the late-prehistoric period.

* Dominance of grasses and other herb pollen from taxa of pastoral habitats indicate ?rough pasture local to the site. However, there are also small numbers of cereal pollen, including rye, which suggest that better drained soils away from the floodplain were being cultivated. These data (esp. from pollen zone 2) compare closely with the results from Trench 5b, ditch 508.

* Sediment fills of ditch 508 in Trench 5b show a similar absence of local woodland with a dominance of herbs.

* These ditch fills are dated to the 15th to 16th century and demonstrate that land use immediately adjacent to the site was pastoral. There is, however, cereal pollen present including rye. These probably derive from local arable cropping although the possibility of derived pollen from domestic activities has been mooted.

* *Cannabis sativa* type pollen is present (albeit rare). This is typical of medieval pollen assemblages and may come from hemp cultivation. There is, however, the possibility that this pollen taxon is hop which has a similar pollen morphology.

Snail fauna
James Rackham

The snails from the pits and ditches sampled on the site have been studied and quantified (Table 20). These give a clue to the contemporary environment on the site at the time of deposition in the features. Densities of snails in the earliest samples, 11-12th century pits and ditches, are low except for shells of *Cecilioides acicula*, which is a burrowing snail and is almost certainly intrusive into these deposits. The most abundant shells in these samples are those associated with open country grassland environments, the presence of shells of *Vallonia pulchella* and *Lymnaea truncatula* suggesting a wet grassland habitat.

The 12-13th century samples from pits show a similar composition. The ditches of this date that were sampled in Area 3 have produced an abundant snail fauna. The assemblages from ditches 3305 and 3309 are dominated by shells of *Vallonia* sp., *Hygromia hispida* and *Lymnaea truncatula* and include an element of marsh and ditches that dry up seasonally. Robinson (1988) has noted a high *L. truncatula* fauna, with a high juvenile component - a characteristic of the samples from Springfields also, in alluvial deposits on the floodplain of the Thames. The fauna from these two ditches suggests an open grassland subject to seasonal flooding, permitting the breeding of *L. truncatula* in the pools, but a drying out of the land in

the summer, and a high mortality of juvenile *L. truncatula*. An absence of aquatics, except those characteristic of ditches that dry out seasonally, suggests that these ditches did not hold water in the summer months. The presence of *V. pulchella* in all the samples is also indicative of a wet grassland habitat.

Table 20: Molluscan taxa recorded from the samples

Date	11-12	11-12	11-12	11-12	12-13	12-13	12-13	12-13	12-13	12-13	12-13	12-13
Sample	5	13	9	14	4	7	10	11	15-25	25-35	10-20	20-30
Context	2306	2278	2295	2279	2215	2252	2301	2258	306	306	310	310
Feature type	pit	pit	ditch	ditch	pit	pit	ditch	ditch	ditch	ditch	ditch	ditch
Hydrobia ventrosa							3					
Hydrobia ulvae			3				1			1		
Open country												
Cecilioides acicula	+++	+++	+++	++	+++	+++	++	++		+	+	+
Vertigo pygmaea		1	3	1	1	1	1	1		5	2	3
Vertigo sp.		1							1	9		7
Pupilla muscorum				1				3			1	12
Vallonia costata												
Vallonia excentrica	2	3	7	6	1	9	2	7	23	75	19	39
Vallonia pulchella			2	1	2	1	1	2	11	44	9	52
Vallonia sp.			3						53	221	20	232
Truncatellina cylindica												
Catholic												
Trichia hispida		1	1	4				1	71	296	46	161
Helix sp.												
Cochlicopa lubrica				3			1	1		1	1	1
Cochlicopa sp.				+			+					
Shade loving												
Retinella pura												1
Oxychilus sp.												2
Shade or marsh												
Punctum pygmaeum	1*								1	3		14
Vitrina sp.					1							
Marsh												
Carychium minimum.					1			1				
Vertigo antivertigo											3	27
Vertigo angustior											1	
Succineidae									4	13	4	4
Lymnaea truncatula	1		1						293	945	242	285
Aquatic												
Lymnaea peregra									12			
Bithynia tentaculata	1				1							
Aplexa hypnorum									1	21		
Planorbis leucostoma	1*			1	1*							
Planorbis laevis					2*							
Planorbis crista					1*							
Valvata crista											1	

Table 20: continued

Date	13	13	13	13-14	13-14	13-14	13-14	13-14	13-14	13-14
Sample	6	8	1	2	3			20-30	30-40	40-50
Context	2247	2277	404	433	435	441	437	F	F	F
Feature type	pit	pit	ditch	pit	pit	ditch	ditch	ditch	ditch	ditch
Hydrobia ventrosa		31		+	35					
Hydrobia ulvae				+	1	2				
Open country										
Cecilioides acicula	++	+++	+	++	+++	++	+++		+	+
Vertigo pygmaea		3	44	+		4	1	1	6	9
Vertigo sp.						2	3	1	4	6
Pupilla muscorum		3	24	+	19	69	3	1	3	1
Vallonia costata			52	+	9			2	5	9
Vallonia excentrica	8	7	180	+	23	41	27	4	12	9
Vallonia pulchella	2	4	5			14	2		2	2
Vallonia pulchella/excentrica.		8	86		45	78	38	7	41	20
Truncatellina cylindica			6							
Catholic										
Trichia hispida	2	2	54		3	2		24	44	47
Helix aspersa									1	
Helix sp.			1					1		2
Cochlicopa lubrica		1	36		1	13	2	3	5	6
Cochlicopa sp.		+	8		1			7	18	10
Shade loving										
Retinella pura									2	1
Retinella radiatula									2	
Oxychilus sp.			6						7	1
Oxychilus alliarus			11						1	
Shade or marsh										
Vitrea crystalina			12					1	8	2
Vitrea contracta			1							
Vitrea sp.									17	22
Punctum pygmaeum			16		1	1			3	
Vitrina sp.			3							
Marsh										
Carychium minimum			9					9	4	10
Vertigo angustior										1
Succineidae (cf *Oxyloma pfeifferi*)			2			1	4			
Lymnaea truncatula			15				2	14	1	1
Aquatic										
Aplexa hypnorum										1
Planorbis leucostoma					3					
Planorbis planorbis			1							

* - includes burnt shells; $ percentage *V. pulchella* of identified *Vallonia* species
habitat groupings broadly taken from Evans, 1972; Macan 1977; Ellis 1969; Cameron and Redfern 1976

Interestingly the 13th and 13-14th century ditch faunas have lost this dominance of *L. truncatula* and the open grassland fauna dominates. However all these samples lie on the roddon at a greater elevation than the samples from Area 3, and it may be this elevation, rather than the later date that is responsible for the dryer conditions. Three of these ditches in Area 4 include a shaded or woodland element in the fauna, which was largely absent elsewhere. These and the presence of abundant uncharred elder seeds in the samples suggest that the ditches at this period, on the roddon, were probably hedged. Aquatics are still largely absent from the ditches, and the few shells of *L. truncatula* may just reflect the damper environment within the ditches. The drier environment on the roddon is also reflected in the presence of *V. costata*, a snail more typical of dry grassland, and completely absent from the features on the lower ground to the east in Areas 2 and 3. Two samples only show an

abundance of estuarine or brackish water species, in this case *Hydrobia ventrosa*, and these were both pits (Table 20)

The Insect Remains
David Smith and Emma Tetlow

Introduction
The insect remains discussed come from a 'palaeocreek' (a relict saline channel) and a ditch fill, at Springfields, Spalding, Lincolnshire. Four samples were submitted from two features at this site. A sequence of three samples 50-60cm (sample 1), 40-50cm (sample 2) and 20-30cm (sample 3) was extracted from creek, F127, Evaluation Trench 3. Sample 1 in this sequence is the uppermost sample. The samples recovered come from contexts thought to represent an initial phase dominated by saltmarsh and brackish water. This is subsequently replaced by fresh water and followed by a marine inundation and possible redevelopment of saltmarsh.

A further sample 0-10cm (sample 4) was extracted from the primary fill of ditch 508 in Trench 5. Formation of this deposit postdates the creek deposits by several hundred years. Archaeological evidence also indicates human occupation around this feature for between two and three hundred years.

It was hoped that an analysis of the insects in this material might provide the following information:

1. Are there insects present? And if so, are the faunas of interpretative value?
2. Do the insect remains from both features provide evidence for land use, particularly grazing animals or pasture in the area?
3. Is there any evidence in the samples from Evaluation Trench 3 that indicates increasing or decreasing salinity?

Methods
The samples were received from the Environmental Archaeology Consultancy ready sieved and required paraffin flotation. The samples were subsequently processed using the standard method of paraffin flotation as outlined in Kenward *et al.* (1980). This paraffin flot was then sorted and identified where possible under a binocular microscope.

Results
The sorted material was then identified, where possible to species level. The insect taxa recovered from the flots are listed in Table 21. The taxonomy used for the Coleoptera (beetles) follows that of Lucht (1987).

Discussion
All three research aims were successfully addressed and are discussed in greater detail below.

Interpretative value
A large, diverse and well-preserved insect fauna was recovered from sample 2 (Table 21) in the creek sequence. Considerably smaller, but nonetheless well-preserved, faunal samples were also recovered from samples 1 and 3 in this sequence and from the fill of ditch 508 (sample 4).

Table 21: The Insects from Springfield Outlet Mall, Spalding, Lincolnshire.

			Sample 4	Sample 1	Sample 2	Sample 3
			Ditch 508	F127	F127	F127
			0-10cm	50-60cm	40-50cm	20-30cm
Volume			11	8.5	7	6.5
COLEOPTERA	EG	Syn				
Carabidae	oa					
Notiophilus spp.	oa		-	-	-	1
Dyschirius salinus (Schaum.)	oa		-	-	2	-
Dyschirius globosus (Hbst.)	oa		-	1	5	-
Tachys spp.	oa		-	-	2	-
Bembidion obliquum Strm., 1825	oa		-	1	-	-
Bembidion varium (Ol., 1795)	oa		-	-	1	-
Bembidion semipunctatum (Donov., 1806)	oa		-	-	1	-
Bembidion fumigatum (Duft)	oa		-	1	1	-
Bembidion aeneum Germ.	oa		-	-	2	-
Bembidion iricolor Bedel.	oa		-	-	1	-
Bembidion spp.	oa		-	-	7	1
Pterostichus spp.	oa		-	-	1	-
Agonum thoreyi Dej., 1828	oa		-	-	1	-
Agonum spp.	oa		-	-	1	-
Platynus dorsalis (Pont.)	oa		1	-	1	-
Calathus fuscipes (Goeze.)	oa		1	-	-	-
Dromius longiceps Dej.	oa			-	1	-
Haliplidae						
Haliplus spp.	oa-w		-	-	1	-
Dytiscidae						
Agabus spp.	oa-w		-	-	1	-
Colymbetes fuscus (L.)	oa-w		-	-	1	-
Gyrinidae						
Gyrinus spp.	oa		1	2	-	-
Hydraenidae						
Limnebius spp.	oa-w		-	-	1	-
Octhebius marinus (Payk.)	oa-w		-	1	-	-
Octhebius spp.	oa-w		-	1	26	6
Helophorus spp.	oa-w		-	1	8	4
Hydrophilidae						
Cercyon lugubris (Ol., 1790)	rt	sf	1	-	-	-
Aquatic *Cercyon* spp.	rt		-	-	7	-
Megasternum boletophagum (Marsh., 1802)	rt		-	-	3	1
Hydrobius fuscipes Leach	oa-w		1	1	2	1
Cymbiodyta marginella (F., 1792)	oa-w		-	-	3	-
Histeridae						
Acritus nigricornis (Hoff.)	rt	sf	-	-	1	-
Hister spp.	rt	sf	1	-	-	-
Scydmaenidae						
Scydmaenidae gen. & spp. indet.			-	-	2	-

			Ditch 508	F127	F127	F127
			0-10cm	50-60cm	40-50cm	20-30cm
Orthoperidae						
Coryopholous cassidoides (Marsh.)			-	-	2	-
Staphylinidae						
Trogophloeus spp.	u		-	1	-	-
Oxytelus rugosus (F.)	rt		-	-	3	1
Oxytelus nitidulus Grav.	rt		-	-	2	-
Bledius tricornis (Hbst.)			-	-	1	-
Bledius spp.			-	-	3	-
Stilicus geniculatus Er.			-	-	1	-
Stenus spp.	u		-	-	1	-
Lathrobium spp.			-	-	1	1
Philonthus spp.	u		-	-	2	-
Gryohypnus fracticornis (Mull.)	rt		-	-	-	1
Xantholinus spp.			1	-	3	-
Quedius spp.			-	-	1	-
Staphylinus spp.			-	-	1	-
Tachyporus spp.			-	1	2	-
Aleocharinae gen. & spp. Indet.			-	-	1	-
Elateridae						
Adelocera murina (L.)	oa-p		1	-	1	-
Dryopidae						
Dryops spp.	oa-w		-	-	1	-
Phalacridae						
Phalacrus spp.	rt		-	-	4	-
Lathridiidae						
Encimus spp.	rd-h	st	-	1	-	-
Anobiidae						
Anobium punctatum (Geer, 1774)			-	-	-	1
Scarabaeidae						
Aphodius sphacelatus (Panz.)/ *prodromus* (Brahm.)	oa-rf		-	1	-	-
Aphodus granarius (L.)	oa-rf		1	1	-	-
Aphodius spp.	oa-rf		2	1	2	-
Phyllopertha horticola (L.)			1	-	-	-
Chrysomelidae						
Chrysomela spp.	oa		-	-	1	-
Hydrothassa spp.	oa		1	-	-	-
Phyllotraeta spp.	oa		-	-	1	2
Haltica ericeti (Allard)	oa		-	-	-	1
Chaetocnema concinna (Marsh.)	oa		-	-	-	1
Chaetocnema spp.	oa		-	-	-	-
Curculionidae						
Apion hydrolapathi (Marsh.)	oa-p		-	-	1	-
Apion spp.	oa		-	1	4	-
Phyllobius spp.	oa		-	-	-	1
Polydrusus spp.	oa		1	-	-	-
Barypeithes spp.	oa		2	-	2	-

			Ditch 508	F127	F127	F127
			0-10cm	50-60cm	40-50cm	20-30cm
Sitona suturalis Steph.	oa		-	-	1	-
Sitona spp.	oa		2	-	2	-
Cleonis piger (Scop.)	oa		-	-	1	-
Bagous spp.	oa-w		-	-	1	-
Hypera spp.	oa		1	-	1	-
Ceutorhynchus contractus Marsh.	oa-p		-	-	-	1
Ceutorhynchus spp.	oa		-	-	1	-
Trichoptera			-	-	1	-
Diptera			1		-	-

Ecological Codings (Kenward and Hall 1995)
oa (& b) – species which will not breed in human housing
w – aquatic species
d – species associated with damp watersides and river banks
rd – species primarily associated with drier organic matter
rf – species primarily associated with foul organic matter, often dung
g – species associated with grain
l – species associated with timber
p – phytophagous species often associated with waste areas, grassland or pasture.
h – members of the 'house fauna'. This is a very arbitrary group based on archaeological associations (Hall and Kenward 1990).

Synanthropic codings (Kenward 1997, pers.comm.)
sf – faculative synanthropes – common in natural habitats but clearly favour artificial conditions
st – typical synanthropes – particularly favour artificial habitats but believed to be able to survive in nature in the long term.
ss – strong synanthropes – essentially dependant on human activity for survival.

Do the insect remains from both features suggest grazing animals or pasture?
Evidence of grazing and pasture was recovered from both features and from all but one sample (sample 3, Creek F127).

The Scarabaeidae or 'dung beetles' found in sample 4 from ditch 508, and samples 1 and 2 from F127 indicate the presence of large, ruminant animals in the vicinity. *Aphodius granarius* is commonly found with cow dung (Jessop 1986). Other species such as the Staphylinidae *Oxytelus rugosus* and *Oxytelus nitidulus* found in F127 sample 2 also suggest foul rotting material such as manure and well decayed, damp organic detritus (Koch 1989, Tottenham 1954).

A number of species suggest disturbed grassland. The curculionid *Hypera* spp. is a genus closely associated with open grassland, as is the Histeridae *Acritus nigricornis* (Koch 1989, 1992). Whilst the garden chafer *Phylopertha horticola* is a common pest of grass and turf and is often found in poor quality pasture (Jessop 1986). A number of other Curculionidae suggest the presence of a variety of weeds found in meadows and pastures: *Sitona suturalis* is found on vetches (*Vicia* spp./*Lathyrus* spp.), *Cleonis piger* is found on thistles (*Cirsium* spp./*Carduus* spp), *Ceutoryhncus contractus* is found on wild cabbages and rocket (*Brassica* spp./*Sisymbrium* spp.) (Bullock 1993). Finally *Apion hydrolapathi* is found on docks (*Rumex* spp.) (Bullock 1993).

Species that indicate pasture are absent from the lower-most sample in creek F127 (sample 3).

Is there any evidence in the samples from the creek F127 which may indicate increasing or decreasing salinity?
Evidence from samples 1 and 2 strongly suggest the presence of saline or brackish conditions, many of the insects recovered from these samples are closely associated with saltmarshes and coastal locations.

A single hydreanid *Octhebius marinus*, a halophilous beetle (a species with an affinity for saline conditions), was recovered from sample 1. This species is frequently found at the edges of shallow pools and saltpans on salt marshes (Hansen 1987).

In the sample directly below this (sample 2), numbers of halophilous and halbiontic (salt demanding) species increase dramatically. Four species of Carabidae recovered from this sample are all commonly found on saltmarshes:

- *Dyschirius salinus* and *Bembidion varium* are both found on clay and silty soils at the seashore (Lindroth 1974).
- *Bembidion iricolor* is also a halobiot found on salt marshes in inner estuaries (Lindroth 1974, 1985).
- *Bembidion aeneum* is found on sedges (*Carex* spp.) on salt marshes and estuaries (Lindroth 1974, 1985).

Two further species *Bembidion semipunctatum* and *Bembidion punctatum* are both found on rushes (*Juncus* spp.) and horsetails *(Equisetum* spp.) in saltmarshes and other freshwater habitats.

Finally, several individuals of the halbionitic Staphylinidae *Bledius tricornis* were recovered, this species is exclusive to saltmarshes (Tottenham 1954).

In the lowest sample from this sequence (sample 3) evidence of salt marsh, saline or brackish conditions are absent. The assemblage recovered from this sample was relatively small but might suggest a damp, fresh water environment.

Conclusions
The assemblages from creek F127 samples 1 and 2 strongly suggest an area of saltmarsh, which was being utilised as saltmarsh pasture. This practice is still common today and may be observed around Mont St.-Michel in Normandy and in the British Isles in the Solway Firth and many estuaries around the British Isles. The insect assemblages also suggest that this was high salt marsh. This is the saltmarsh zone above mean high water spring tide (MHWST) and will experience inundation perhaps for only 2 to 3 hours during the highest equinoctial tides (Long and Mason 1983; Packham and Willis 1997). It is an environment characterised by damp silty clay substrates with a cover of relatively short grasses and sedges and is vegetated by a mix of both halophilous and terrestrial species interspersed by temporary saltpans and an infilling creek network.

The saltmarsh assemblages are strongly reminiscent of those recovered from the Mesolithic, basal peats at Redwick and Goldcliff East on the Gwent Levels by Tetlow (2005). Many of the species of *Bembidion* spp. that have been used as salt marsh indicators were recovered from both sites, none however, in the abundance and diversity with which they have been recovered from Spalding.

The 'freshwater hiatus' seen in the foraminfera between 40 and 60cms (i.e. samples 1 and 2 above - see above) in this sequence is not represented in the insect record. Freshwater conditions do appear to occur near the base of the profile (sample 3- 20-30cm)) but obviously at an earlier stage in the infilling of the creek.

4. General discussion and conclusions

The results of the sampling and these analyses have succeeded in addressing some of the aims first set out for the project. Not all the evidence is complementary but a picture of a changing landscape over some 900 to a thousand years has emerged.

The site clearly lay within the intertidal zone of the River Welland estuary in the immediate post-Roman period, although since this evidence is forthcoming from the OSL date and foraminiferal evidence from creek 124 on the lower ground approximately 1.5m lower than the roddon surface of Area 4 it may be that the roddon formed a ridge of ground that may have remained beyond the reach of all but the more exceptional tides. This roddon may itself be a former course of the Welland and the contemporary river or a later creek may still have been flowing in it. It is not possible to estimate the size of the roddon but in Area 4 it is at least 75m wide before it is cut by the channel and banks of the Coronation Cut which runs around Spalding on its southern side. It widens to the north where it merges with the sea bank that runs parallel with the south bank of the modern river. This sea bank is attributed to the 13th century (Healey 1993) and must have been protecting the lower eastern and southern parts of the site in the medieval period.

At this time when the lower areas of the site were in the intertidal zone a tidal creek, F127, was still running in the roddon, although whether the residue of the main channel or an independent creek we do not know. The foraminiferal evidence in the lower fills of this creek (F127) clearly show a tidal regime and saltmarsh and mudflat. The pollen data also suggests mudflat and saltmarsh conditions at the time these sediments were deposited and shells of Scrobiculariidae between 24 and 40cm from the base of the creek is also suggestive of a saltmarsh channel, although these molluscs can burrow to several feet and occur below their contemporary levels. The insect evidence is somewhat at odds with this picture. The lowest sample studied (20-30cm) suggests a freshwater environment, while those above suggest an area of high saltmarsh being used as saltmarsh pasture. The drop in foram numbers between 40 and 60cms has been taken to indicate a freshwater phase in the creek, a conclusion supported by the volume of well preserved organic debris surviving in the 40-50cm sample (see Table 3) compared to the deposits below. However it is just these levels in which the insects show their greatest evidence for a saltmarsh environment, although not one regularly flooded by tides. The plant macrofossil assemblages show an increase in aquatics up the profile, particularly between 30 and 60cm where pondweed is abundant supporting the inference from the foraminifera that these sediments were deposited in fresh water. Perhaps the insect fauna reflects the unimproved pasture lands surrounding the creek that were developed on the reclaimed saltmarsh, a picture consistent with the pollen evidence. The incidence of dung beetles in the creek is clearly testimony to the grazing of these pastures at this time. The radiocarbon date on the deposit at 40-50cm shows that these were the conditions in the 7th -8th century. At the top of this creek sequence in sands at 70-80cm the foraminifera again show a clear marine influence with an assemblage associated with brackish mudflat conditions. This level has been dated by OSL to the 8th-9th century and indicates a return to a tidal environment. The freshwater phase has been recognised in a creek on the west side of Spalding which produced a radiocarbon date of cal. AD 530- 680 (at 2

sigma -Beta 143278) for a peat deposit and showed a similar sequence in the foraminifera assemblages from marine into freshwater and back into marine (Rackham *et al* 2000).

These results suggest a short period in the early to middle Saxon period when the landscape around the site was a grazed saltmarsh pasture, probably very rarely flooded by high tides or storm events. It was predated and post-dated by a landscape of intertidal mudflat and saltmarsh. During this period the site may never have been sufficiently protected from the sea to be settled, although the roddon would have formed a ridge above the floodplain and reclaimed saltmarshes.

A landward invasion by the sea perhaps sometime in the 8th century is evident from the deposition of the upper sediments in the creek (F127) and also the deposition of sands on the roddon in Trench 4. Creek 423 at the east end of Trench 4 cut into the side of the roddon and is filled with finely laminated tidal sediments of fine sands that have produced a brackish water and mudflat foram assemblage with some estuary mouth taxa. These samples bracket a sandy sediment that has been dated by OSL to the 13th century and would imply the continued influence of tidal waters at this time. It is at this stage that it becomes more difficult to reconcile the archaeological evidence with the sequence of marine incursion and retreat. There is 11-12th century activity including pit and ditch digging in Area 2 to the south of Trench 4 and the evaluation records a 10th-11th century pit in evaluation trench 15 some 70m east of Trench 4. At approximately 3.4m OD these areas may just have remained above the influence of most tides at this time and the creek, 423, which ran just west of and parallel with Camel Gate was clearly functioning and may even have given access by boat to the site at high tide. The layer of mussel shells (see Plate 3) that tips into the creek stratigraphically beneath the OSL dated horizon of 1260 ±50 AD clearly illustrates human activity on the west side (the roddon side) of this creek in the 13th century and is probably contemporary with the 13th and 13-14th century activity indicated by pits and ditches on the top of the roddon.

The ditches in Area 3 perhaps show the character of this area in the 12-13th century. The snail assemblages are dominated by the shells of *Lymnaea truncatula*, a 'semi-aquatic' species that is noticeably abundant in areas of floodplain grassland subject to seasonal flooding (Robinson 1988), and carrying pockets of water into the summer months. Evidently this area now largely beyond the influence of marine floods was subject to freshwater flooding. A limited number of other marsh taxa, but an abundance of grassland and wet grassland snails reflects what must have been a seasonally wet pasture. In contrast the snail assemblages in the features excavated on the roddon of 13th and 13-14th century date largely lack shells of *Lymnaea truncatula*, and are dominated by open grassland taxa including *Vallonia costata* a snail typical of drier grasslands. A few snails that favour shaded or wooded habitats in the ditches in this area (Area 4) suggest that these may have been accompanied by hedges. At some point in the 13th century, or thereabouts, the sea bank was constructed and these areas of the site would have had protection from all but the most violent sea storms.

The final piece in this jigsaw is the waterlogged deposits in ditch 508 in Trench 5. These are dated by radiocarbon to the 16th century and show a terrestrial and freshwater environment. The insects include a number of dung beetles indicating the presence of grazing animals and a few species associated with pasture and meadowland plants are present including the cockchafer *Phylopertha horticola* a species often found on poor quality pasture. The pollen evidence supports a pastoral land use around the site. Archaeological occupation associated with this period was absent from the excavations, although the evaluation picked up ceramics

dated to the 16th and 17th centuries and the landscape of the site is likely to have been grazing pasture.

Interestingly the pollen evidence from creek F127 and ditch 508 does suggest some cereal cultivation in the area. The early and middle Saxon sequence in creek F127 shows the presence of rye and cereal (wheat/barley) pollen in the middle part of the sequence. This is from the same deposits as the radiocarbon date, and a single charred grain from the base of the sequence is the only 'archaeological' find other than charcoal in this series of samples. Cereal and rye pollen both appear in the base of the sequence of ditch 508 (the same horizon that was radiocarbon dated) suggesting cereal cultivation near by at this time also. This pollen evidence implies some cultivation of cereals on or around the site in the Saxon period and 16th century. The consistent occurrence of rye grains among the charred plant assemblages from the occupation deposits, as well as wheat, barley and oats, suggests that these assemblages may be deriving from locally grown crops.

A diminution in the numbers of tree pollen from the base upwards in creek F127 and an increase in Poaceae and other grassland taxa may indicate a local vegetational change, perhaps partly consequent upon the changing influence of the sea and tides, and pollen Zone 2 compliments the insect evidence for pasture and animal grazing at this time. Only the basal part of the 16th century ditch sequence (508) can be relied upon since the upper levels are likely to be biased by preservational problems. Herbaceous taxa dominate the assemblage in the bottom two samples suggesting the continuation of the open pastureland right through the medieval period. Unfortunately the absence of waterlogged deposits between the 7th and 16th centuries leaves a rather big gap in this part of the story that will have to be filled by other sites if this lack of local change is to be confirmed.

The archaeological features on the site have yielded assemblages that reflect 11-12th century, and 13th and 13-14th century activities. These appear to be focused in Area 2, with perhaps a lesser density of activity in Area 1 and Area 4. Elsewhere the archaeological remains probably relate to field systems contemporary with these activities.

Most of the evidence appears to reflect domestic occupation with debris from food preparation and consumption entering the features. A few flakes of hammerscale in both the 11-12th century and 13-14th century deposits in Areas 2 and 4 suggest contemporary iron smithing but not on the excavated parts of the site. A broadly contemporary site on Holbeach Road a couple of hundred metres west produced large quantities of hammerscale suggesting a local smithing at this site (Rackham 2004). Only two of the samples, both from pit 2212, produced any substantial quantity of charred cereal grain, chaff and weed seeds. This has been interpreted as coarse sieving waste (Hillman 1981) and suggests, given that the site has free threshing cereals (bread wheat, rye and barley) and not glume wheats, that the site is producing its own cereals. The pollen records for both cereal and rye also suggest the local growing of these crops. Barley dominates these assemblages, followed by wheat and then rye. Oats and pulses comprise a smaller element of the assemblages, although oats occurs in more samples than rye grain (Table 22), but the charring of peas and beans is a much less likely event than that of cereal grain. Other food plants identified include plum/bullace and hazelnut, while plants such as beet, elderberry, raspberry/bramble, fathen and wild carrot may also have contributed to the diet.

Bones of domestic animals are surprisingly uncommon in the samples with only pig, sheep and chicken represented, although cattle and horse were recovered by hand excavation and

the evaluation include dogs as well and a goose sized bird. Unidentifiable fragments of large and small ungulate (presumably cattle and sheep) do occur but as can be seen from the weight of animal bone most samples produced no more than two or three grams from a 20 litre sample. Interestingly more samples produced eggshell than any other food item, and on the basis of criteria given by Sidell (1993) these are mostly chicken with a few fragments of goose egg. The other abundant food item is mussel shell. Not only does this occur in more samples than any other item except eggshell, it occurs as a large dump in pit 2277 and as a spread on the surface of the western edge of the 13th century creek (423) in Trench 4.

Table 22. Summary of food remains identified in the samples from Areas 2, 3 and 4 (excluding F127). Number of samples producing each taxa

	Area 2 and 3	Area 4
	11-12th & 12-13th	13-14th
No. samples	**14**	**9**
Pig	1	
Sheep		1
Chicken	1	2
Chicken eggshell	11	6
Goose eggshell	3	
Wild bird	5	3
Eel	7	5
Herring	3	1
Shad	1	
Smelt		1
Pike	3	
Perch	1	
Plaice	1	1
Plaice/flounder	2	
Flatfish	1	2
Stickleback	5	7
Mussel	11	6
Oyster	2	1
Cockle	3	7
Periwinkle	1	
Wheat	7	4
Barley	7	4
Oats	6	3
Rye	3	
Bean	3	
Plum/bullace	1	
Hazelnut	2	1

Other marine resources although occurring consistently are not abundant. Locker has noted that most of the fish are small, many less than 15cm long, and all could have been taken in the river or tidal estuary near the site. Considering the proximity of the site to Spalding and presumably access to the sea at a time when cod and ling are readily available in Kings Lynn this focus on diminutive fishes available locally, and local mussels, cockles, oysters and periwinkles does not indicate any great wealth. It seems probable that the grain and pulse crops of an agricultural settlement, with the pastoral products from the grazing of the marshes are being supplemented by food sources that could be obtained over the sea or river bank in the Welland estuary, and in the ditches, dykes and creeks on and nearby the site. The low density of many of these food items in the deposits and a general lack of features in all but Area 2 perhaps suggests a very low level of activity on the margins of the saltmarsh, in an

area subject to intermittent flooding and unsuitable for long term settlement. It is even possible that the occupation at this site may have been seasonal but we have no positive evidence for this.

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2nd December 2004

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Optically Stimulated Luminescence Report

Jean-Luc Schwenniger

Section 1: Project summary P152 – Springfield Spalding

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Nature of samples	Holocene sediments
Number of samples submitted	6 (one sample dated free of charge for research purposes)
Location of site	Springfields, Spalding
Period of interest	Holocene

Field code	*Lab. code*	*Depth* (m)	D_e (Gy)	*Dose rate* (mGy/a)	*Age* (years AD)
*SS03-01	*X1469*	*0.80*	*1.59 ± 0.05*	*2.13 ± 0.11*	*1260 ± 50 AD*
*SS03-04	*X1472*	*1.20*	*1.94 ± 0.05*	*1.97 ± 0.11*	*1020 ± 60 AD*
SS03-05	*X1473*	*0.80*	*2.56 ± 0.05*	*1.65 ± 0.07*	*450 ± 80 AD*
SS03-06	*X1474*	*0.80*	*2.38 ± 0.05*	*1.78 ± 0.08*	*670 ± 70 AD*
SS03-07	*X1475*	*0.80*	*2.28 ± 0.43*	*1.75 ± 0.12*	*700 ± 260 AD*
SS03-09	*X1784*	*2.00*	*2.15 ± 0.09*	*1.77 ± 0.10*	*790 ± 90 AD*

OSL dating results. Sand-sized quartz samples were measured using a modified SAR measuremnent procedure (Murray and Wintle, 2000). Gamma dose rates were measured in-situ. In the case of samples X1469, X1472 and X1784 beta dose rate values were calculated using concentrations of U, Th and K determined by INAA. For samples X1469 and X1472 (reported previously) a value of 15 ± 5 % water content was assumed. For the remaining

* Results reported previously by Dr. E.J. Rhodes.

samples a water content of 25-30% was used in the age calculations based on direct measurements of the current water content of sub-samples.

Section 2:Comments on the interpretation of the results

The samples were collected by Dr Ed Rhodes assisted by T. Gurling, on the 20th of February 2003. James Rackham submitted an additional sample (X1784) on the 21st of August 2003. Age estimates are based on sand-sized quartz grains extracted from each sample. Dose rates were calculated by *in-situ* NaI gamma spectrometer measurements. Supplementary instrumental neutron activation analysis (INAA) was carried out on samples X1469, X1472 and X1784 in order to assess the beta dose rates and to provide an independent check of radioisotope concentration in the sediments.

The well-preserved laminations within the sediments sampled suggests that they had not been adversely affected by bioturbation or other post-depositional effects. Extremely low IRSL values were observed in all of the samples, suggesting good quartz separation had been achieved. The samples are characterized by a low degree of variability between aliquots. No signs of incomplete zeroing were observed although the degree of scatter among the palaeodose estimates for X1475 was noticeably higher than for the other samples. This is the reason why the error on the final age estimate of this sample is considerably higher.

Samples X1473, X1474 and X1784 displayed high OSL sensitivity whereas X1469 and X1472 were characterized by low sensitivity. However, the other observed luminescence characteristics of the samples, namely recycling values (means ranging from 0.99 to 1.04) and low thermal transfer (mean values below 5% of the natural OSL signal) strongly suggest that the age estimates are likely to be reliable.

The OSL results suggest that the Late Holocene sediments from this site appear to be particularly well suited for optical dating. The high sensitivity of some samples combined with the elevated environmental dose rate offer very favourable conditions for achieving high precision on the luminescence measurements and good accuracy on the final age estimates.

A potential issue relates to the correct assessment of the average water content of the samples during the burial period. Increasing amounts of water within the sediment will tend to attenuate the true dose received by the samples. The underestimation of the sample water content may cause a systematic underestimation of their true age. Drainage conditions are likely to have improved considerably over the last few decades and thus, there is a risk that the modern day water content values may not be representative of the long term conditions. However, because the samples were collected during the winter and the measured values are close to saturation it seems reasonable to assume that most samples would have been close to saturation for most of the time.

Section 3:The physical basis of luminescence dating

When ionising radiation (predominantly alpha, beta or gamma radiation) interacts with an insulating crystal lattice (such as quartz or feldspar), a net redistribution of electronic charge takes place. Electrons are stripped from the outer shells of atoms and though most return immediately, a proportion escape and become trapped at meta-stable sites within the lattice. This charge redistribution continues for the duration of the radiation exposure and the amount of trapped charge is therefore related to both the duration and intensity of radiation exposure.

Even though trapped at meta-stable sites, electrons become 'free' once again under certain conditions (e.g. if the crystal is heated and/or illuminated). Once liberated a free electron may become trapped once again or may return to a vacant position caused by the absence of a previously displaced electron (a 'hole'). This latter occurrence is termed 'recombination' and the location of the hole is described as the 'recombination centre'. As recombination occurs, a proportion of the energy of the electron is dissipated. Depending upon the nature of the centre where recombination occurs, this energy is expelled as heat and/or light. When the crystal grain is either heated or illuminated following irradiation (the 'dose') the total amount of light emitted (luminescence) is therefore directly related to the number of liberated electrons and available recombination sites. This is the fundamental principle upon which luminescence dating is based.

In cases where the duration of dosing is not known (as is the case for dating), estimates can be made from laboratory measurements. The response (the sensitivity) of the sample to radiation dose (i.e. the amount of light observed for a given amount of laboratory radiation, usually β-radiation) must be established. From this relationship the equivalent radiation exposure required to produce the same amount of light as that observed following the environmental dose can be determined, and is termed the 'equivalent dose' (D_e). The D_e (measured in Gy) is therefore an estimate of the total dose absorbed during the irradiation period. When the dose rate (the amount of radiation per unit time, measured in μGy/a) is measured (or calculated from measured concentrations of radionuclides), the duration of the dosing period can be calculated using the equation:

$$\text{Duration of dosing period} = D_e / \text{dose rate.}$$

The technique of optical dating was first applied to quartz by Huntley *et al.* (1985), and methodological details were further developed by Smith *et al.* (1986) and Rhodes (1988). The technique was demonstrated to work well for aeolian samples by Smith et al. (1990), and has further proved to provide useful age estimates for a range of sedimentary contexts ranging from aeolian (e.g. Stokes *et al.* 1997) to glacial contexts (Owen *et al.* 1997). Further developmental research has introduced D_e measurement protocols that use a 'single aliquot regenerative-dose' (SAR) protocol. These protocols have the potential to provide increased precision in the luminescence measurements, and may in some cases provide an indication of incomplete zeroing of the luminescence signal at the time of deposition.

Section 4: The Single Aliquot Regenerative-Dose (SAR) protocol

The SAR method is a regeneration procedure where the light level of the natural signal is converted into Gy via an interpolation between regenerated (i.e. known dose) points. The natural and regenerated signals are measured using the same aliquot. Sensitivity change commonly observed in quartz TL/OSL has previously precluded meaningful results being obtained this way. A key development reported by Murray and Wintle (2000) is that sample (aliquot) sensitivity is monitored following each OSL measurement (L_i) using the OSL response to a common test dose (S_i). Plots of $OSL1_i/OSL2_i$ provide the necessary (sensitivity change corrected) data for interpolation. The procedure is further outlined below, in Figure 1.

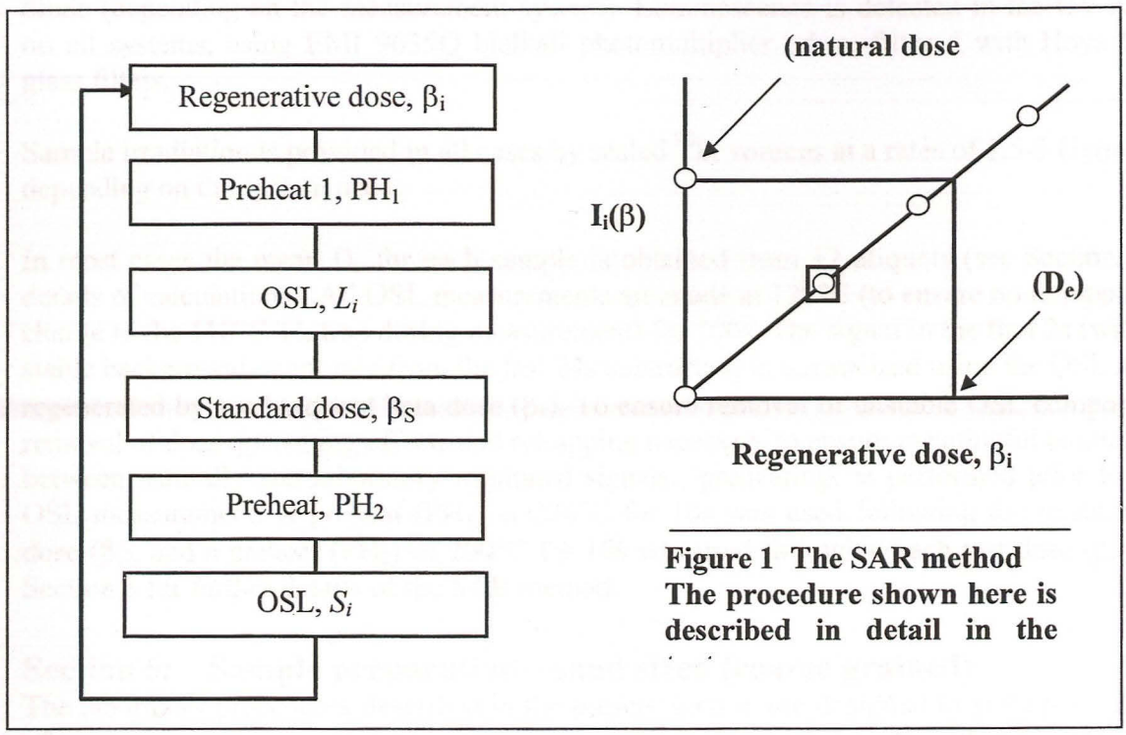


Figure 1 The SAR method The procedure shown here is described in detail in the

Figure 1.

Steps 1-6 are repeated n times in order to produce the data points required for interpolation (the first dose β_1 being zero, to give a measure of the natural signal). Typically n=7 (i.e. the natural plus 6 regeneration points, including one zero dose point and one repeat point). PH_1 and PH_2 are usually different although Wintle and Murray (2000) report no dependence of D_e on either (over the range of 200-280°C). The OSL signal is integrated over the initial part of the decay (to ~10% of initial intensity) and the background is taken as the light level measured at the end of the OSL measurement.

Wintle and Murray (2000) have introduced two further steps in to the measurement procedure. The first is the re-measurement of the first regenerated data point (indicated by the box in the explanatory Figure 1 above). The ratio of the two points (the "recycling ratio") provides an assessment of the efficacy of the sensitivity correction and the accuracy of the technique (large differences being suggestive of an ineffective technique). The second additional step is a measurement of the regenerated OSL due to zero dose. This value gives a measure of the degree of thermal transfer (to the trap(s) responsible for OSL) during preheating. The ratio of this value to the natural OSL value (both corrected for sensitivity change) gives the "thermal transfer ratio" and this is typically in the range of 0.005-0.020. The "recycling ratio" (ideally unity) is typically in the range 0.95-1.05.

Section 5: Measurement procedures / conditions

Luminescence measurements are made using automated Risø luminescence measurement equipment. There are currently three different systems that can be used for routine dating. The major difference between them being the optical stimulation sources. In the first two systems, optical excitation is provided by filtered blue diodes (emitting ~410-510nm), and in the third a filtered Halogen lamp (emitting ~420-560nm) is used. In all three systems,

infrared stimulation is also possible using either an array of IR diodes or a single IR laser diode (depending on the measurement system). Luminescence is detected in the UV region on all systems, using EMI 9635Q bialkali photomultiplier tubes, filtered with Hoya U340 glass filters.

Sample irradiation is provided in all cases by sealed ^{90}Sr sources at a rates of 1.5-3 Gy/minute depending on the system used.

In most cases the mean D_e for each sample is obtained from 12 aliquots (see Section 4 for details of calculations). All OSL measurements are made at 125°C (to ensure no retrapping of charge to the 110°C TL trap during measurement) for 100s. The signal in the first 2s (with the stable background count rate from the last 24s subtracted) is normalized using the OSL signal regenerated by a subsequent beta dose (β_s). To ensure removal of unstable OSL components, removal of dose quenching effects and retrapping necessary to ensure meaningful comparison between naturally and laboratory irradiated signals, 'preheating' is performed prior to each OSL measurement. A preheat (PH_1) at 220°C for 10s was used following the regenerative dose (β_i), and a preheat (PH_2) of 200°C for 10s was used following each test dose (β_s). See Section 3 for further details of the SAR method.

Section 6: Sample preparation – sand sized (coarse grained)

The laboratory procedures described in the present section are designed to yield pure quartz, of a particular grain size range, from natural sediment samples. In order to obtain this material, samples are taken through a standard preparation procedure, as outlined below. All laboratory treatments are performed under low intensity laboratory safe-lighting, from purpose-built filtered sodium lamps (emitting at 588 nm).

Each sample is treated with hydrochloric acid (HCl) to remove carbonate. The sample is then wet-sieved to a resolution of ~50μm, and the modal grain size is retained for further processing. Typically the grain sizes used for dating are 90-125μm or 180-250μm. The chosen fraction (see Appendix A for details of each specific sample) is treated in concentrated HF (48%) for 100 minutes. This treatment serves two purposes: (i) to dissolve feldspar grains, and (ii) to remove (etch) the outer surface of quartz grains (the only part of each quartz grain exposed during burial to natural alpha radiation). Any heavy minerals present are subsequently removed by centrifuging the sample in a sodium polytungstate solution at 2.68 $g.cm^{-3}$. Finally, each sample is re-sieved to remove heavily etched grains. The prepared quartz samples were mounted on 1cm diameter aluminium discs for luminescence measurement using viscous silicone oil.

Various tests for sample purity are made. Sub-samples of the prepared material are examined using optical microscopy. Further, the sample is exposed (within the Risø measurement system) to infrared light. Quartz does not produce measurable luminescence at room temperature. Feldspar, the primary source of contamination, does produce luminescence when stimulated with IR at room temperature. The presence of IRSL (infra-red stimulated luminescence) is therefore used as a criterion for rejection. In the rare cases where samples are rejected due to presence of IRSL, the prepared sediment is stored for ~ 1 week in 20% H_2SiF_6 (silica-saturated HF) that effectively dissolves non-quartz material. If following this treatment, IRSL persists then the sample proceeds to the dating (luminescence measurement) phase and the results are interpreted with caution and the possible contamination of the sample is discussed in the final report.

Section 7: Dose rate determination

Radiation dose is described in units of Gray (Gy), the standard SI units of absorbed dose (1 Gy = 1 Joule/kg). The measurement of annual dose rate can be made using a variety of different methods. For most samples, the majority of the environmental dose rate is due to the radioactive decay of unstable isotopes of uranium (U), thorium (Th) and potassium (K). It is therefore necessary to measure the concentrations of each of these elements in each dating sample. An estimation of U, Th and K content can be made using a variety of different methods. These methods are described briefly below.

7.1 Field-based gamma-spectrometry

A portable spectrometer is taken to the sampling site. The probe (housing an NaI scintillator crystal) is inserted in to the cavity left behind following extraction of the sample. Measurements typically take up to one hour and result in direct estimation of the total in-situ gamma radiation field. The spectra are also used to estimate contributions from U, Th and K individually. Through comparison to known concentration standards, quantitative estimates of U, Th and K concentrations are made.

7.2 Neutron Activation Analysis (NAA)

A representative sample (typically 10-20g) of the sediment is sent for commercial analysis. The analysis involves an initial (neutron) irradiation of each sample. This leaves the samples in a highly unstable (i.e. radioactive) state. The radioactive decay of the sample (the gamma emission) is then measured using high resolution gamma-spectrometry. These measurements yield estimates of U, Th and K concentration.

7.3 Alpha-counting and flame photometry

A sub-sample of sediment (typically 3g) is dried and crushed to a fine powder (<34μm). The powder is then placed in a shallow container that holds a zinc-sulphide α-scintillator screen directly beneath the sample. The α emissions of U and Th (during radioactive decay) are then counted, giving a measure of total uranium/thorium concentration. The potassium concentration is estimated using standard flame-photometry methods.

The estimates of U, Th and K concentration are converted to estimates of radiation dose rate (mGy/a) using the standard conversion factors of Adamiec and Aitken (1998) (see Appendix A).

Other factors that influence the annual dose rate, and hence require calculation/measurement, are described below.

7.4 Moisture content of the sample

Moisture within the pore spaces of sediments absorbs α, β and γ-radiation. As a result, less is absorbed by the mineral grains. It is therefore important to assess the present day water content of the sediment and to make some assessment of the variability of moisture throughout the burial period of the sample. The moisture correction factors of Aitken (1985) are used in the age calculation (Appendix A).

7.5 Cosmic dose rate

The contribution of cosmic radiation to the total dose rate is calculated as a function of (geomagnetic) latitude, altitude, burial depth and average over-burden density, according to the formulae of Prescott and Hutton (1994).

7.6 Radiation attenuation factors

For coarse grains, the portion of the sample that receives an α-dose is removed by HF etching. Therefore, no consideration of the α-dose is made during the age calculation. β-particles (electrons) are significantly attenuated (i.e. a large fraction of the energy is absorbed) as the β-particle passes through a grain. Account of this effect is needed in order to correctly estimate to dose received by the 'average' grain. The so-called 'attenuation factors' are taken from the empirical work of Mejdahl (1979).

The γ-dose is assumed to be unaffected by attenuation as the penetration of gamma-rays through sediments is several orders of magnitude greater than (~10^5 times) the size of individual grains. Consequently, no attenuation factors are applied to the γ-dose.

Results for the U, Th (ppm) and K (%) concentration of each sample, together with the other parameters used in the age calculation, are given in Appendix A.

Section 8: Statistics and error calculation

The calculated age depends on the estimate of total absorbed dose (D_e) and the annual dose rate (D_R). Both of these estimates have uncertainties associated with them. This section gives general details of how the 'error' (the statistical uncertainty) is calculated for each term and combined with the errors on other terms to give an overall estimate of uncertainty on the estimate of age.

8.1 D_e estimation

As described in a previous section (Figure 1), individual estimates of D_e are obtained from each of the aliquot (sub-samples) measured, using the SAR technique. The value (D_e) is obtained by interpolating between the points of the dose response curve. Statistical uncertainties are calculated for each of the individual points and also on the interpolated value of De. Typically, 12 aliquots are measured for each sample.

Each of the points on the growth curve is defined as

$$I(\beta)_i = \frac{L_i - f \cdot l_i}{S_i - f \cdot s_i \cdot} \qquad \text{Eq.1}$$

where L_i is the integrated (initial) OSL from the regeneration dose and l_i is the measured background signal, S_i is the integrated (initial) OSL from the test dose (see Section 3) and si is the background; f is a scaling factor included to take account of the difference in duration of the L_i, S_i and l_i, s_i measurements.

The error on each dose-response data point (see Figure 1) is calculated by propagating 'counting statistics' errors (assuming Poisson statistics) from the integration of raw OSL data. The error on each term in Equation 1 is given by the square-root of the value. For example, the range for L_i is given by $L_i \pm \sqrt{L_i}$. The errors on each value are propagated in the standard way (see below) to give the uncertainty of $I(\beta)_i$.

In cases where the dose response can be (locally) approximated by a straight line, a weighted least squares linear fit is used. The errors in this case are calculated analytically using standard formulae.

In cases where the dose response is significantly non-linear, a single saturating exponential function is used to describe the dose response (a Simplex algorithm is used for fitting in this case). Occasionally an extra linear term is added to the exponential term in order to better describe the form of the dose response, although this is not commonly necessary. The uncertainty for non-linear fitting is calculated using a Monte-Carlo method in which 'random samples' of the dose response data are taken (assuming normally distributed probabilities) and used to obtain a D_e value. The spread in these values is then used to calculate the error on the mean D_e for each aliquot, giving a range for each De of $D_{ei} \pm \sigma D_{ei}$

Once the individual D_e values have been obtained from each aliquot (and the associated uncertainties calculated) the values are grouped to give a final overall estimate of D_e. The final estimate (D_e) is calculated using a weighted average. The weight of each D_e is referred to as w_i and defined as

$$w_i = \frac{1}{\sigma D_{ei}^{\,2}} \Bigg/ \sum_i \frac{1}{\sigma D_{ei}^{\,2}} \qquad \text{Eq.2}$$

The weighted mean is defined

$$\overline{D}_e = \sum_i D_{ei} \cdot w_i \qquad \text{Eq.3}$$

The weighted standard error, $\hat{\sigma}_{\bar{x}w}$, is calculated from

$$\hat{\sigma}_{\bar{x}w} = \sqrt{\frac{\sum_i w_i \left(D_{ei} - \overline{D}_e\right)}{1 - \frac{1}{n}}} \Bigg/ \sqrt{n} \qquad \text{Eq.4}$$

where n is the number of aliquots. The range of the weighted mean D_e is then defined as

$$\overline{D}_e \pm \hat{\sigma}_{\bar{x}w} \qquad \text{Eq.5}$$

Slight modifications to the approach outlined above are made in special circumstances, though in most cases this description is sufficient.

8.2 Dose rate

The errors on the dose rate are due to errors in a range of values, for example, the concentration of U, Th and K, the water content of the sample. The individual components of the dose rate calculation are shown in Appendix A. The uncertainty on the overall dose rate is calculated by combing the uncertainties according to the standard propagation formula given below.

8.3 Age calculation

The calculated age is obtained from dividing the mean D_e (Eq.3) by the total dose rate (Appendix A). The uncertainty on the final age estimate is calculated using the error propagation formula given below. All calculations were performed using software developed within the laboratory.

8.4 Standard error propagation

If a calculated value (y) is calculated using a function (f) which contains terms $x_1, x_2, x_3 .... x_n$, then

$$y = f(x_1, x_2, x_3 ... x_n) \qquad \text{Eq.6}$$

Each term (x_i) has an associated uncertainty with a range expressed as $x_i \pm \sigma_{xi}$. The overall error of y can be calculated through the addition of the partial derivatives of y with respect to each term. Formally, this is written as

$$\sigma_y = \sqrt{\sum_i \left(\frac{\partial y}{\partial x_i} \cdot \sigma_{xi} \right)^2} \qquad \text{Eq.7}$$

giving a range for y as $y \pm \sigma_Y$.

APPENDIX A

Sample number Laboratory code	SS03-01 X1469	SS03- 04 X1472	SS03- 05 X1473	SS03-06 X1474	SS03-07 X1475	SS03-09 X1784
De (Gy)	1.59	1.94	2.56	2.38	2.28	2.15
uncertainty	0.05	0.05	0.07	0.07	0.43	0.10
measured	0.04	0.04	0.05	0.05	0.43	0.09
Laboratory calibration error 0.020	0.032	0.039	0.051	0.048	0.046	0.043
Grain size						
Min. grain size (μm)	90	90	90	90	90	90
Max grain size (μm)	125	125	125	125	125	125
External gamma-dose (Gy/ka)	0.733	0.637	0.695	0.740	0.754	*0.718*
error	0.02	0.02	0.02	0.02	0.02	*0.050*
Measured concentrations						
standard fractional error	0.050	0.050	0.050	0.050	0.050	0.050
% K	1.500	1.460	*1.054*	*1.199*	*1.177*	1.350
error (%K)	0.075	0.073	0.053	0.060	0.059	0.068
Th (ppm)	6.470	6.020	*5.056*	*5.148*	*5.474*	6.590
error (ppm)	0.324	0.301	0.253	0.257	0.274	0.330
U (ppm)	1.510	1.340	*1.557*	*1.535*	*1.558*	1.540
error (ppm)	0.076	0.067	0.078	0.077	0.078	0.077
Cosmic dose calculations						
Depth (m)	0.800	1.200	0.800	0.800	0.800	2.000
error (m)	0.100	0.100	0.100	0.100	0.400	0.500
Average overburden density (g.cm^3)	1.900	1.900	1.900	1.900	1.900	1.900
error (g.cm^3)	0.100	0.100	0.100	0.100	0.100	0.100
Latitude (deg.), north positive	52	52	52	52	52	52
Longitude (deg.), east positive	0	0	0	0	0	0
Altitude (m above sea-level))	1	1	1	1	1	1
Cosmic dose rate (μGy/ka)	0.189	0.179	0.189	0.189	0.189	0.162
error	0.027	0.020	0.027	0.027	0.095	0.042
Moisture content						
Moisture (water / wet sediment)	0.150	0.150	0.270	0.260	0.290	0.300
error	0.050	0.050	0.050	0.050	0.050	0.050
Total dose rate, Gy/ka	2.13	1.97	1.65	1.78	1.75	1.77
error	0.11	0.11	0.07	0.08	0.12	0.10
% error	5.30	5.45	4.34	4.48	6.78	5.76
AGE (ka)	0.746	0.983	1.555	1.338	1.304	1.213
error	0.045	0.060	0.080	0.071	0.263	0.090
% error	6.097	6.109	5.165	5.338	20.140	7.397
Date AD/BC	**1256**	**1019**	**449**	**666**	**700**	**791**

Sample number Laboratory code	SS03-01 X1469	SS03- 04 X1472	SS03-05 X1473	SS03-06 X1474	SS03-07 X1475	SS03-09 X1784
Average beta-attenuation						
standard fractional error	0.050	0.050	0.050	0.050	0.050	0.050
Natural U	0.900	0.900	0.900	0.900	0.900	0.900
error	0.045	0.045	0.045	0.045	0.045	0.045
Th-232	0.852	0.852	0.852	0.852	0.852	0.852
error	0.043	0.043	0.043	0.043	0.043	0.043
K-40	0.962	0.962	0.962	0.962	0.962	0.962
error	0.048	0.048	0.048	0.048	0.048	0.048
Dose rate conversion (Gy/ka)						
standard fractional error	0.050	0.050	0.050	0.050	0.050	0.050
U (ppm)						
Beta	0.146	0.146	0.146	0.146	0.146	0.146
error	0.007	0.007	0.007	0.007	0.007	0.007
Gamma	0.000	0.000	0.000	0.000	0.000	0.000
error	0.000	0.000	0.000	0.000	0.000	0.000
Th (ppm)						
Beta	0.027	0.027	0.027	0.027	0.027	0.027
error	0.001	0.001	0.001	0.001	0.001	0.001
Gamma	0.000	0.000	0.000	0.000	0.000	0.000
error	0.000	0.000	0.000	0.000	0.000	0.000
K (%)						
Beta	0.782	0.782	0.782	0.782	0.782	0.782
error	0.039	0.039	0.039	0.039	0.039	0.039
Gamma	0.000	0.000	0.000	0.000	0.000	0.000
error	0.000	0.000	0.000	0.000	0.000	0.000
Cosmic dose						
Geomagnetic latitude	54.7	54.7	54.7	54.7	54.7	54.7
Dc (Gy/ka), 55N G.lat, 0 km Alt.	0.189	0.179	0.189	0.189	0.189	0.161
error	0.027	0.020	0.027	0.027	0.095	0.042
Moisture						
F	0.420	0.420	0.608	0.593	0.639	0.655
error	0.099	0.099	0.080	0.081	0.078	0.077
W	0.420	0.420	0.608	0.593	0.639	0.655
error	0.099	0.099	0.080	0.081	0.078	0.077
WF	0.176	0.176	0.370	0.351	0.408	0.429
error	0.059	0.059	0.068	0.068	0.070	0.071
Age uncertainties	1.000	1.000	1.000	1.000	1.000	1.000
dDR/K	0.616	0.616	0.514	0.523	0.498	0.490
dDR/dC(B, K)	1.182	1.151	0.693	0.801	0.750	0.846
dDR/dA(K)	0.961	0.935	0.564	0.651	0.609	0.687
dDR/dTh	0.019	0.019	0.016	0.016	0.015	0.015
dDR/dC(B, Th)	4.514	4.200	2.945	3.046	3.086	3.655
dDR/dA(Th)	0.145	0.135	0.094	0.098	0.099	0.117
dDR/dU	0.108	0.108	0.090	0.091	0.087	0.086
dDR/dC(B, U)	0.738	0.738	0.616	0.626	0.596	0.586
dDR/dA(U)	0.181	0.160	0.155	0.156	0.151	0.146
dDR/dW	-0.521	-0.499	-0.396	-0.438	-0.426	-0.476
dDR/dF	-0.521	-0.499	-0.396	-0.438	-0.426	-0.476
dDR/C(G, K)	1.249	1.215	0.741	0.856	0.803	0.907
dDR/C(G, Th)	5.386	5.012	3.556	3.676	3.735	4.427
dDR/dC(G, U)	1.257	1.116	1.095	1.096	1.063	1.035
dDR/dCosmic	1.000	1.000	1.000	1.000	1.000	1.000
Dage/dDe	0.469	0.506	0.607	0.562	0.572	0.564
Dage/dDR	-0.350	-0.498	-0.944	-0.752	-0.745	-0.685

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-25.6:lab. mult=1)

Laboratory number: **Beta-196801**

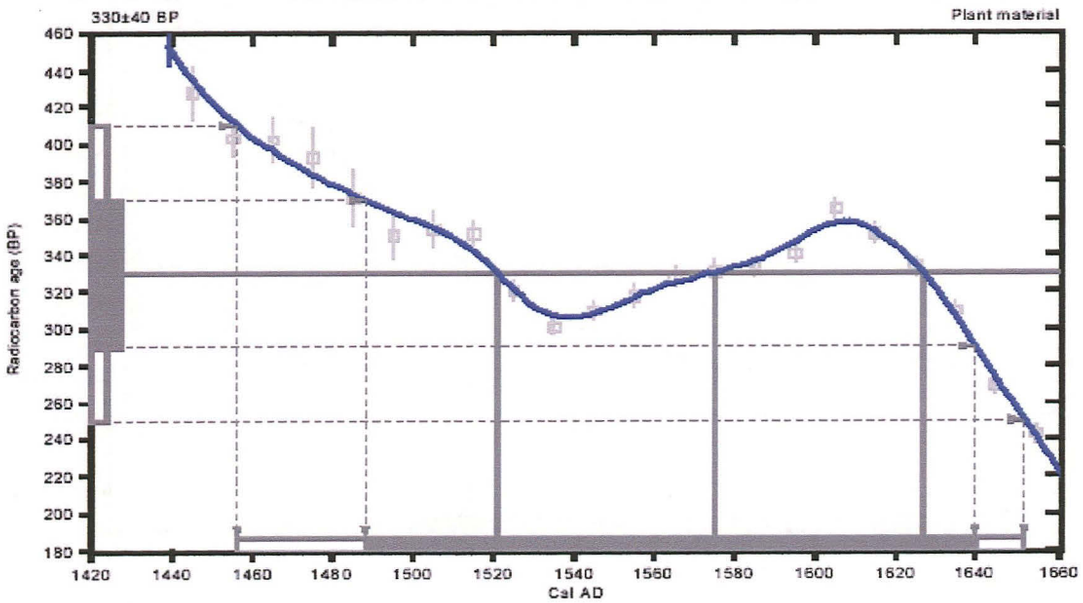
Conventional radiocarbon age: **330±40 BP**

2 Sigma calibrated result: (95% probability) **Cal AD 1460 to 1650 (Cal BP 490 to 300)**

Intercept data

Intercepts of radiocarbon age with calibration curve: Cal AD 1520 (Cal BP 430) and
Cal AD 1580 (Cal BP 380) and
Cal AD 1630 (Cal BP 320)

1 Sigma calibrated result: (68% probability) Cal AD 1490 to 1640 (Cal BP 460 to 310)



References:

Database used
Intcal98
Calibration Database
Editorial Comment
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INTCAL98 Radiocarbon Age Calibration
Stuiver, M., et al., 1998, Radiocarbon 40(3), p1041-1083
Mathematics
A Simplified Approach to Calibrating C14 Dates
Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2), p317-322

Beta Analytic Radiocarbon Dating Laboratory
4985 S.W. 74th Court, Miami, Florida 33155 • Tel: (305)667-5167 • Fax: (305)663-0964 • E-Mail: beta@ radiocarbon.com

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-21.8:lab. mult=1)

Laboratory number: **Beta-196802**

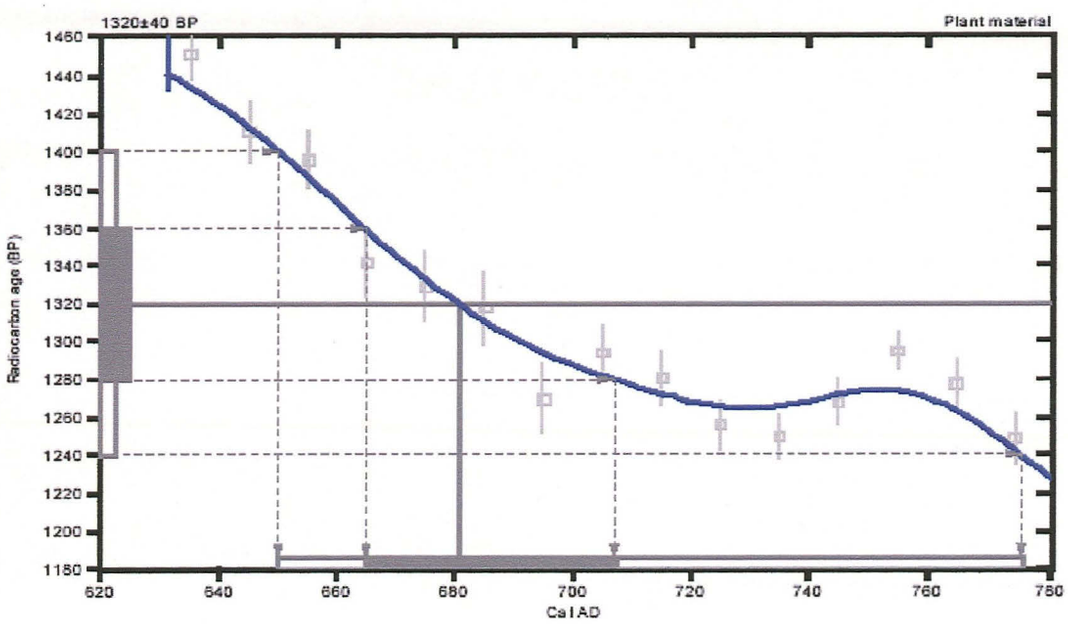
Conventional radiocarbon age: **1320±40 BP**

2 Sigma calibrated result: (95% probability) **Cal AD 650 to 780 (Cal BP 1300 to 1170)**

Intercept data

Intercept of radiocarbon age with calibration curve: Cal AD 680 (Cal BP 1270)

1 Sigma calibrated result: (68% probability) Cal AD 660 to 710 (Cal BP 1280 to 1240)



References:

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Intcal98

Calibration Database

Editorial Comment

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INTCAL98 Radiocarbon Age Calibration

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THE FIGURES

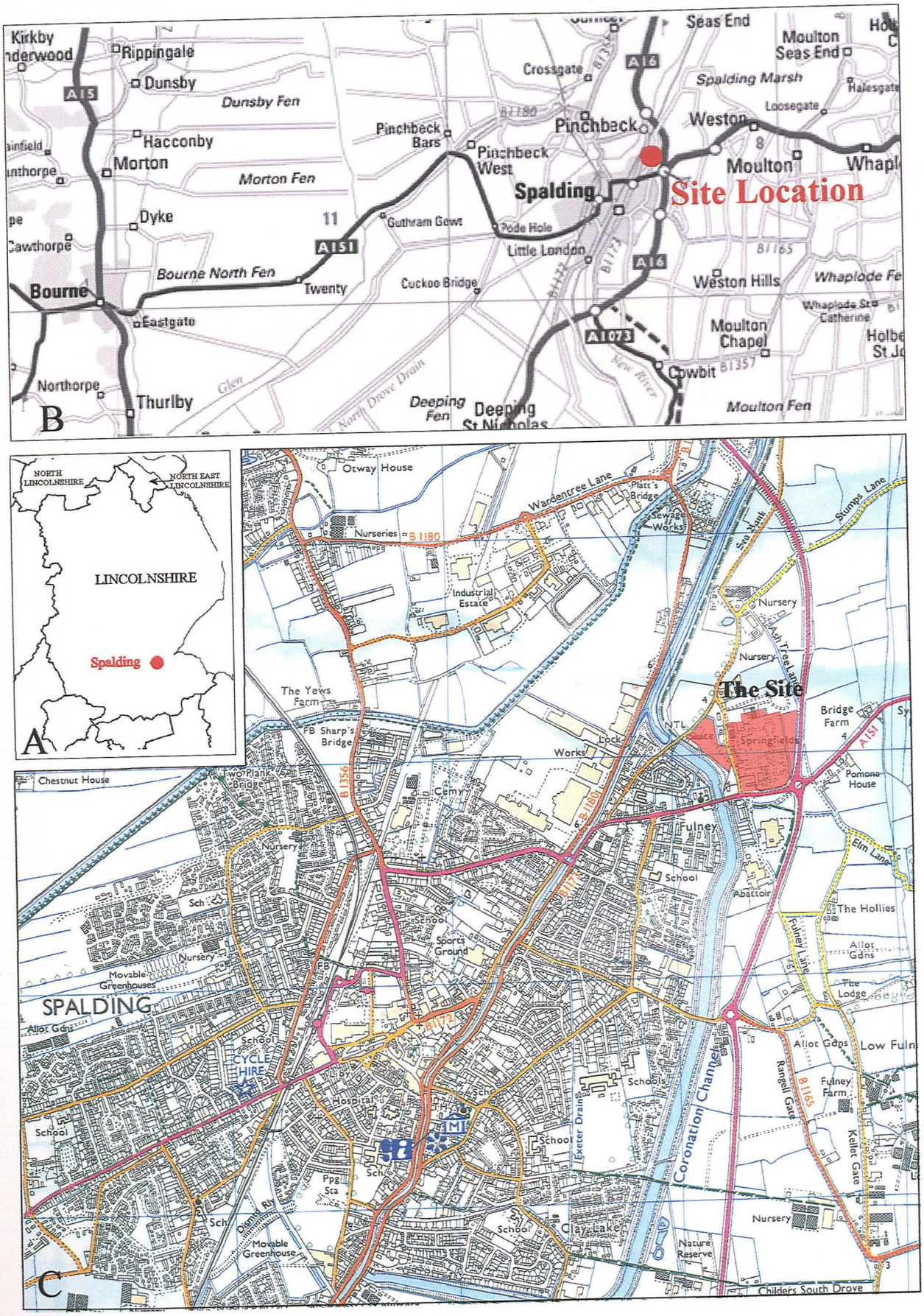


Fig. 1 Location of Spalding (C based on the 1999 Ordnance Survey 1:25,000 Explorer map 249. © Crown copyright, reproduced at reduced scale with the permission of the Controller of HMSO. LAS Licence No. AL 100002165).

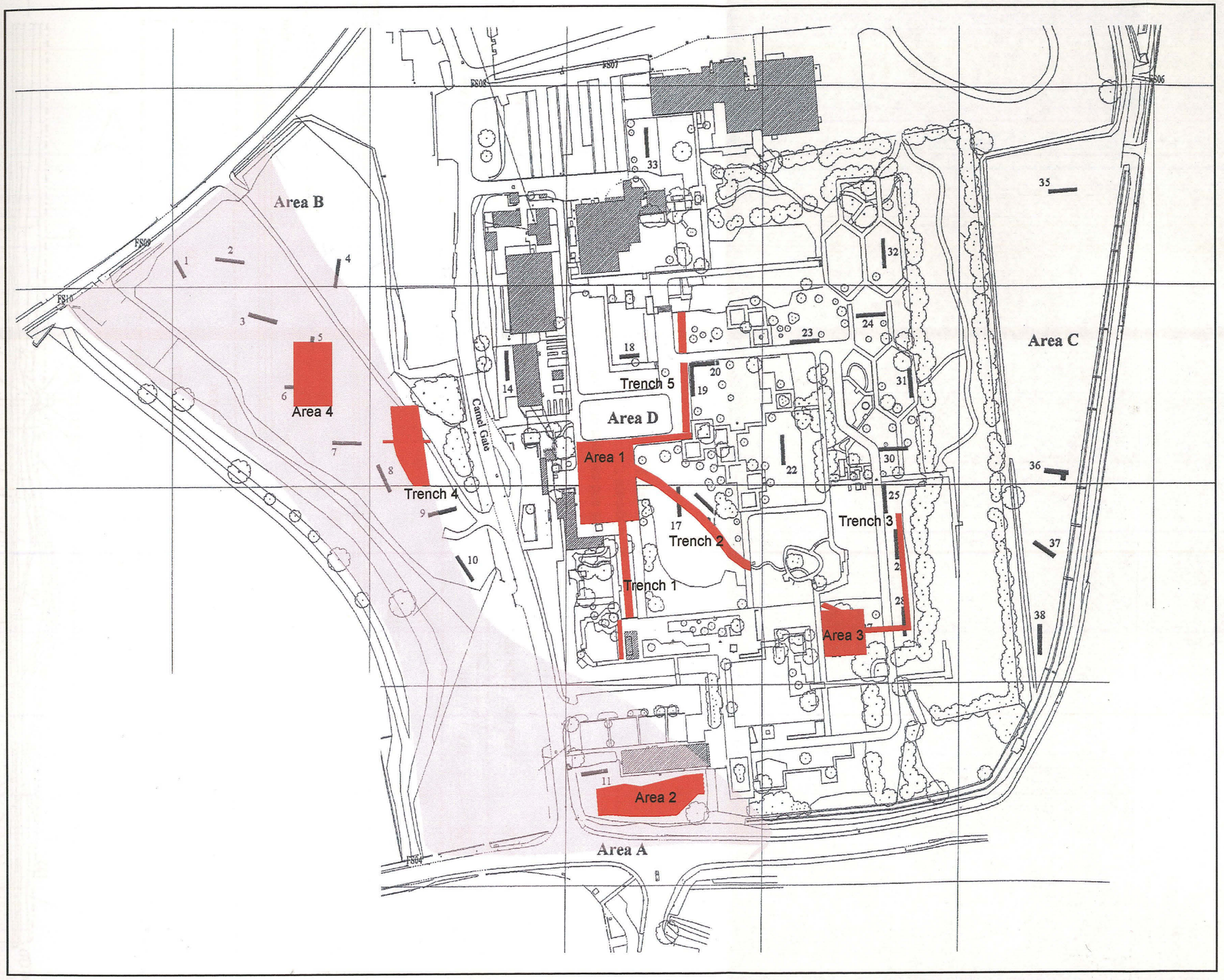


Fig. 2: Position of the evaluation and excavation areas within the development site.

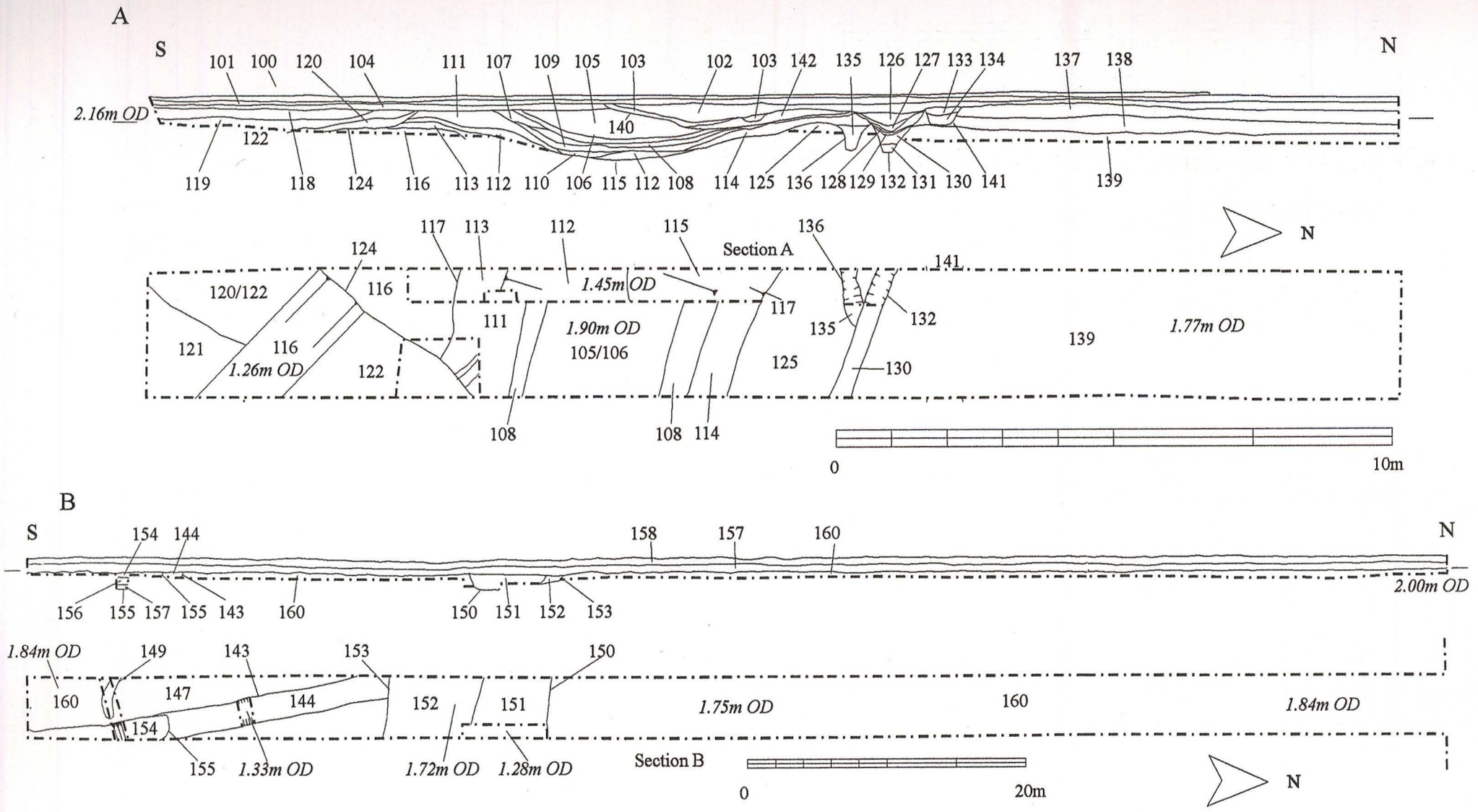


Fig. 3 Plans and sections of Trench 1.

A) Segment 1.

B) Segment 2.

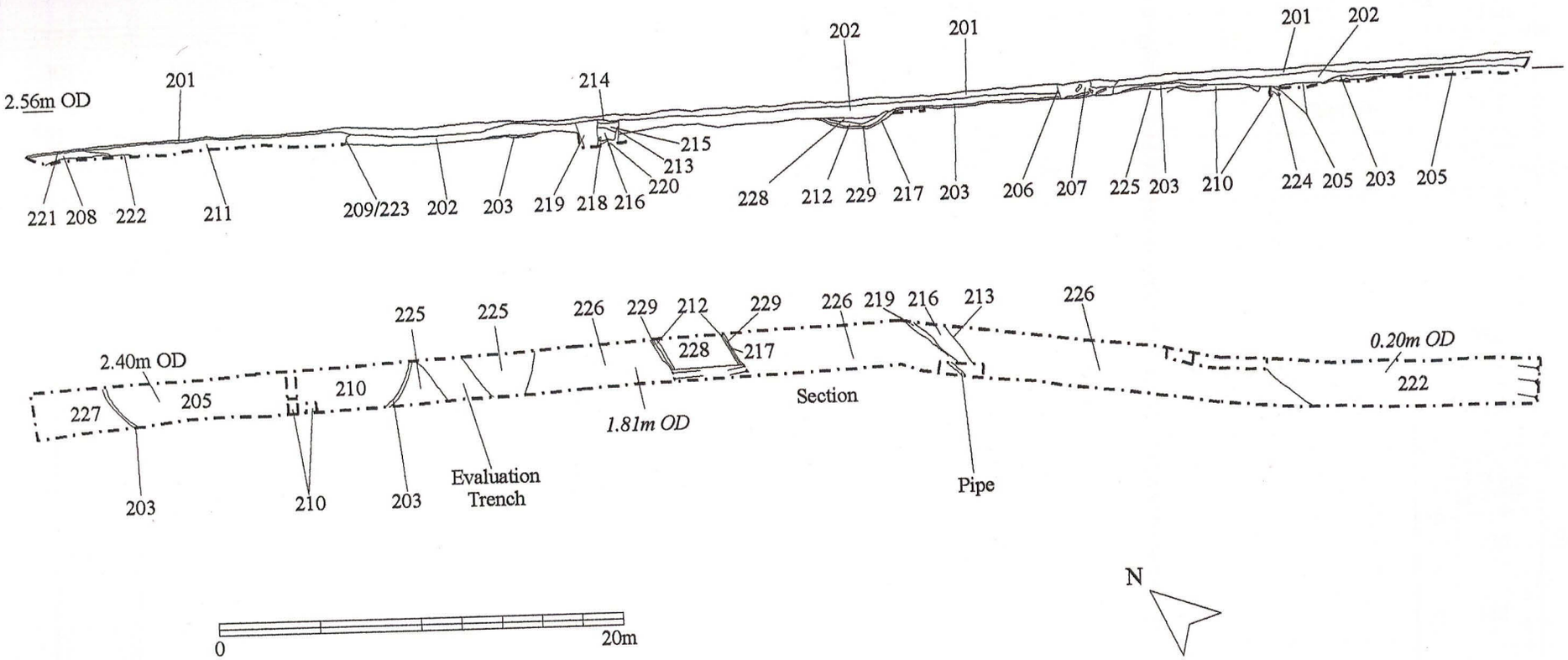


Fig. 4 Plans and section of Trench 2.

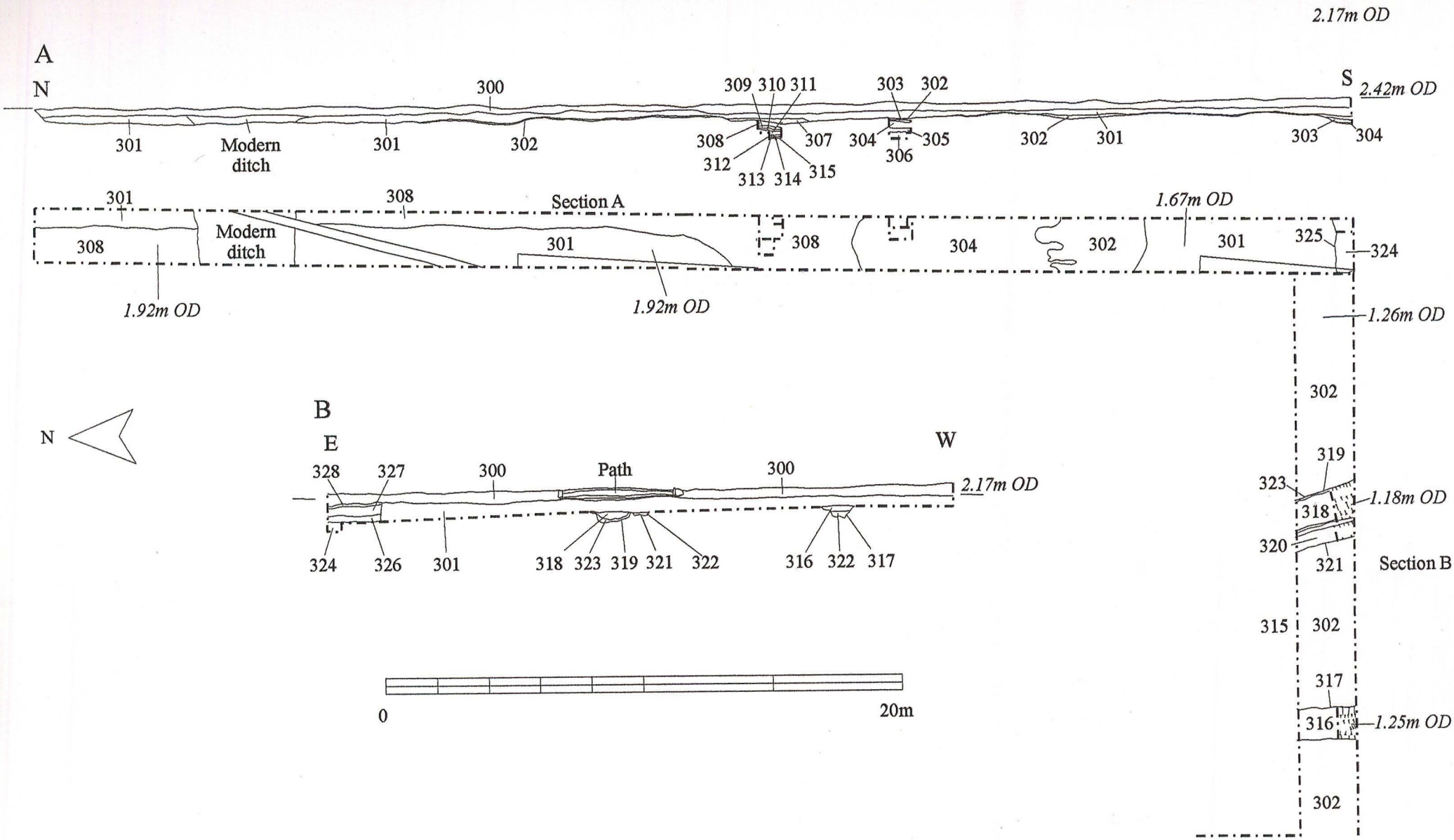


Fig. 5 Plan and sections of Trench 3.

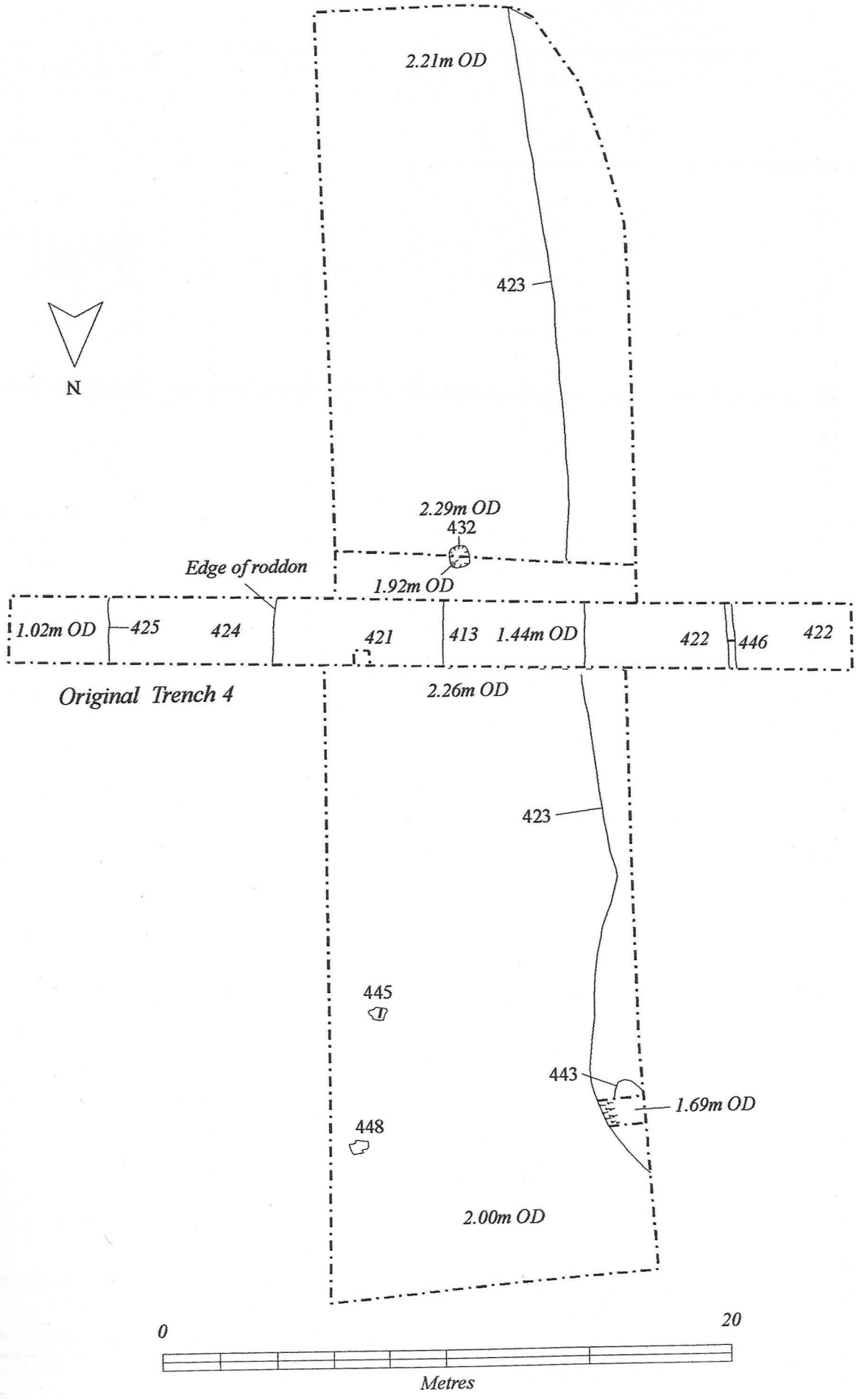


Fig. 6 Plan of Trench 4.

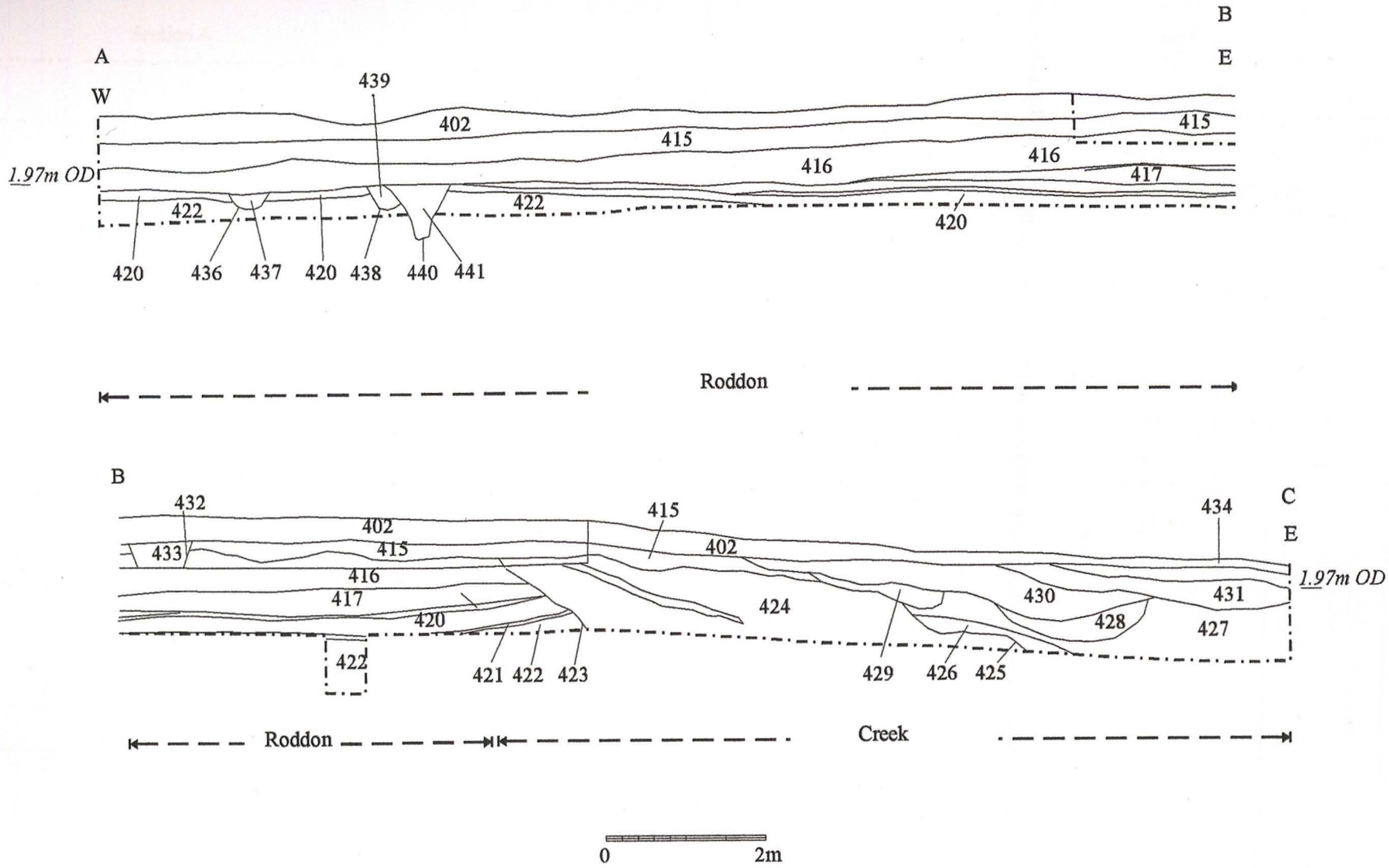


Fig. 7 South facing section of Trench 4.

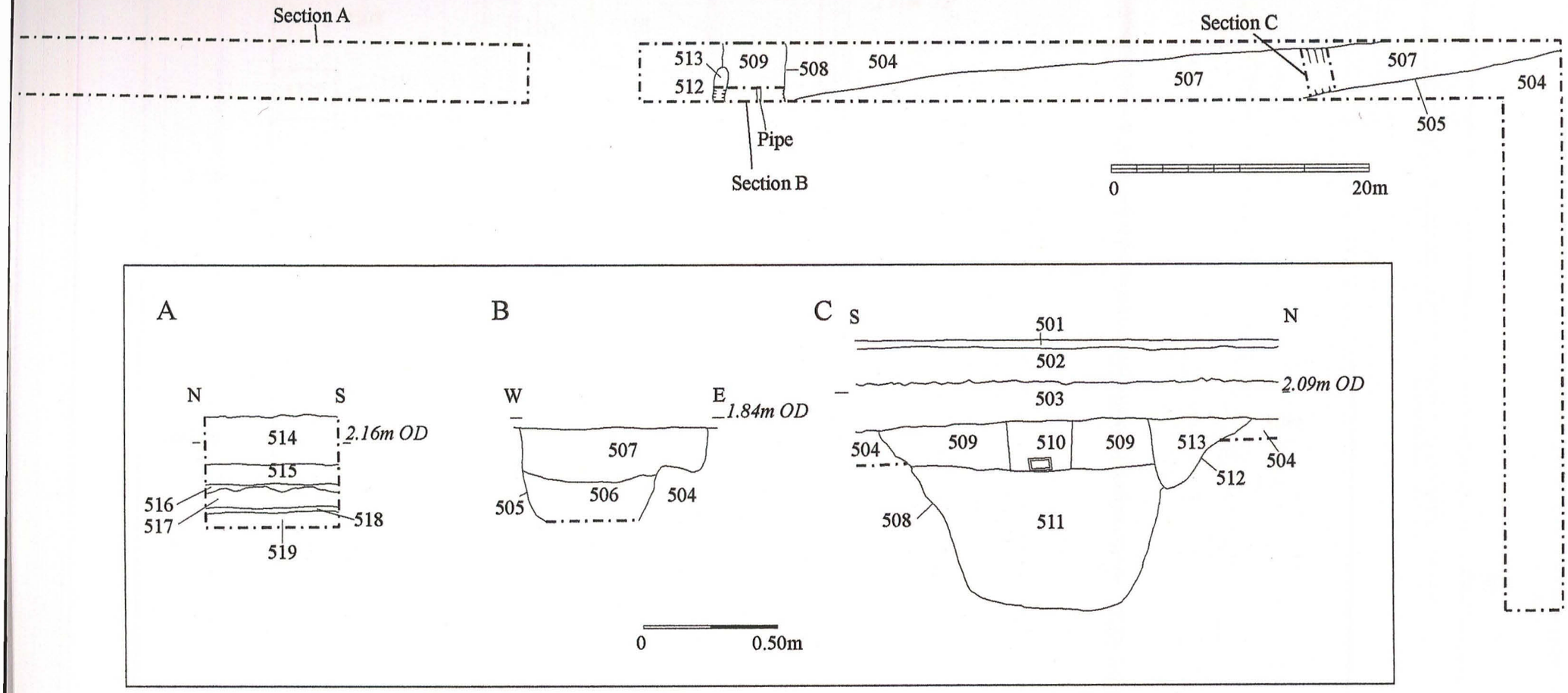


Fig. 8 Plans and sections of Trench 5.

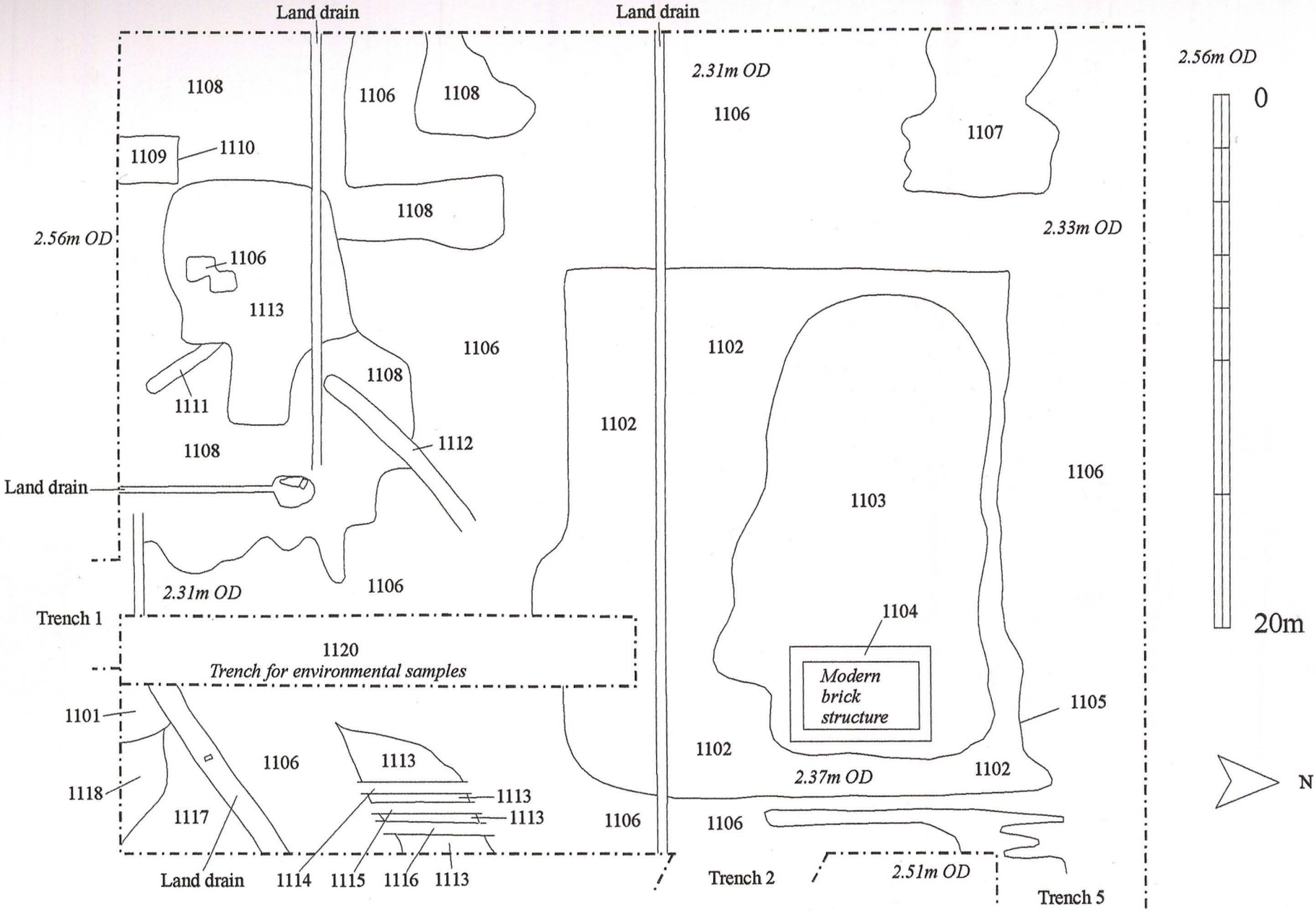


Fig. 9 Plan of Area 1.

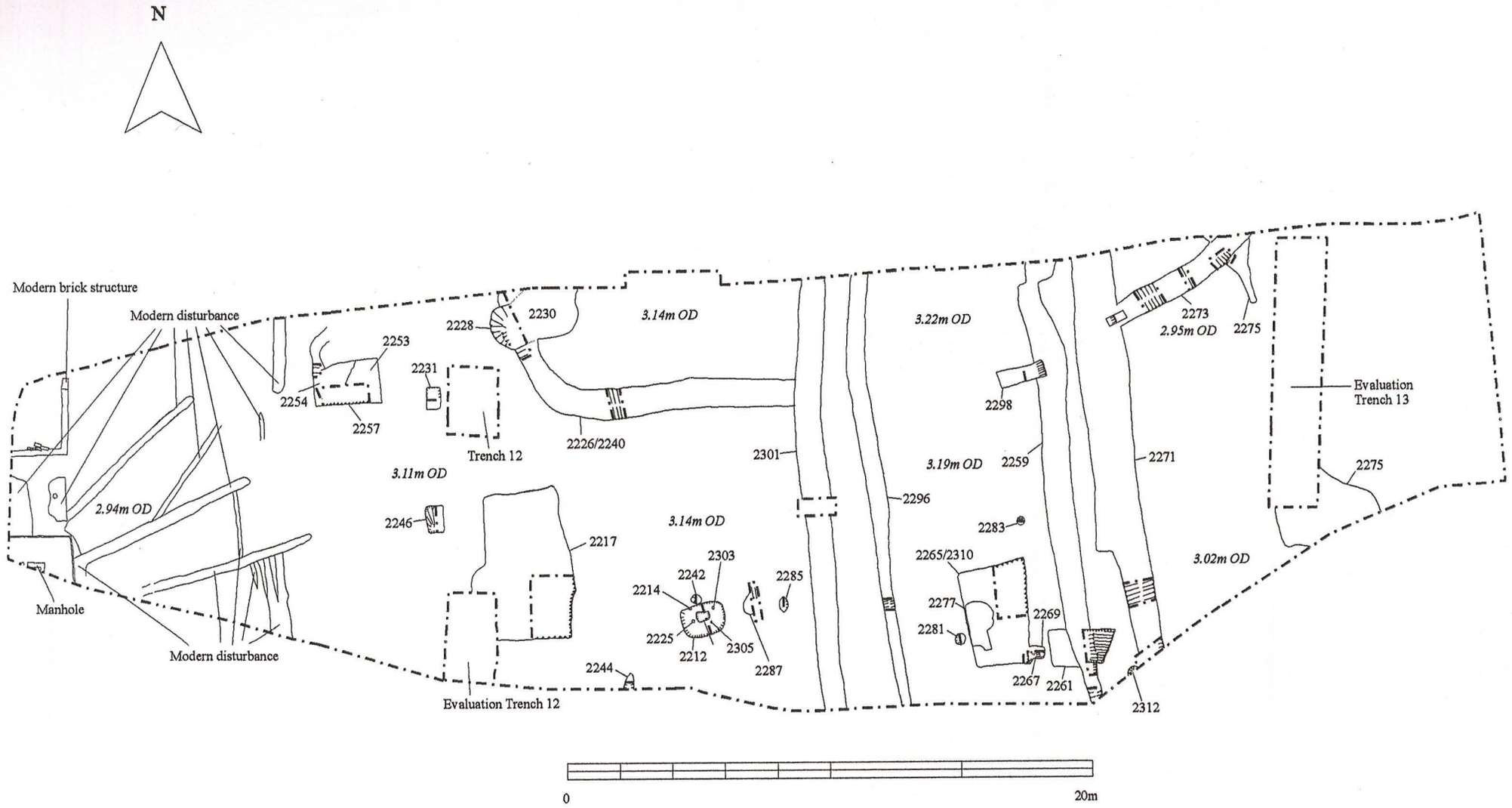


Fig. 10 Plan of Area 2.

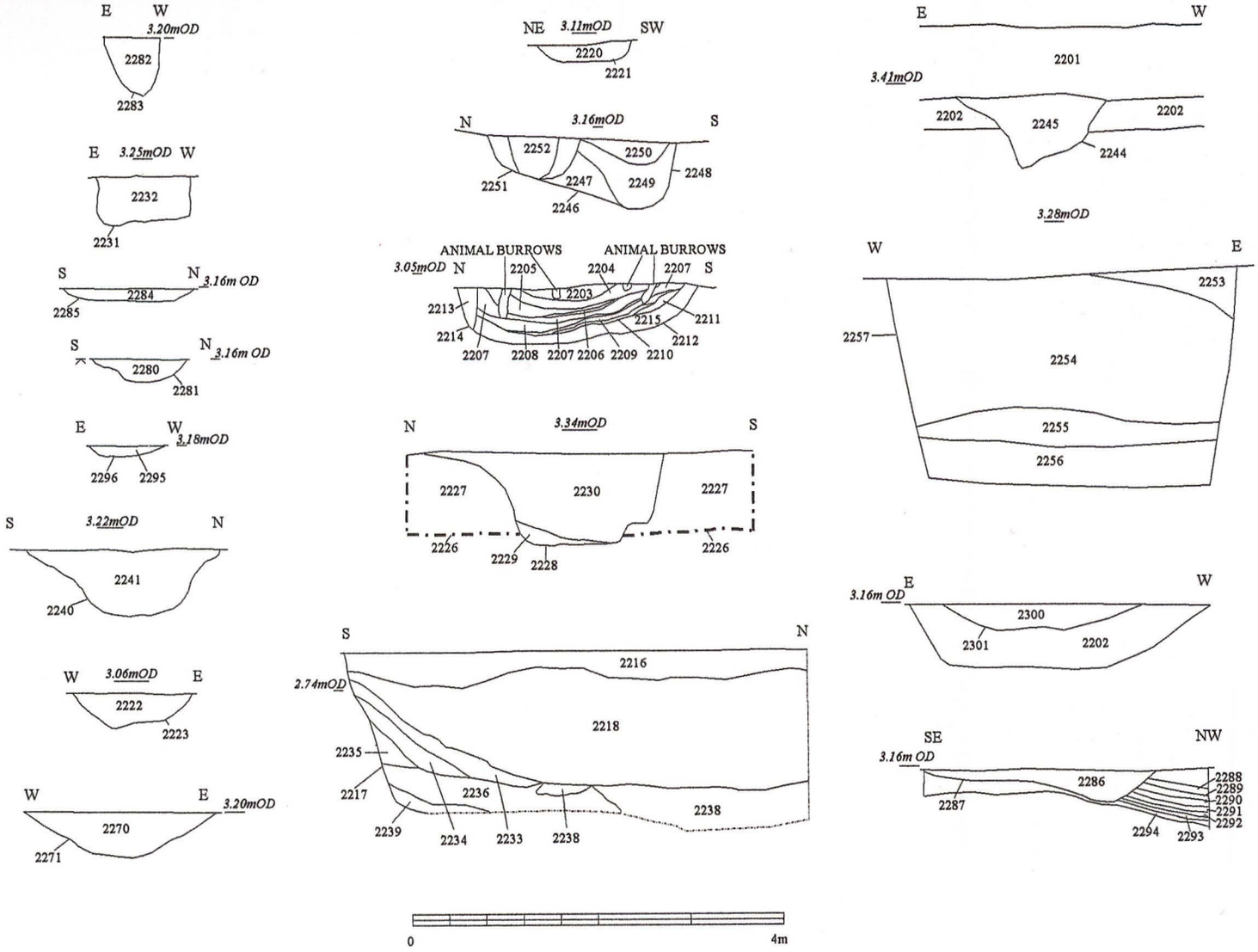


Fig. 11 Sections of Area 2 features.

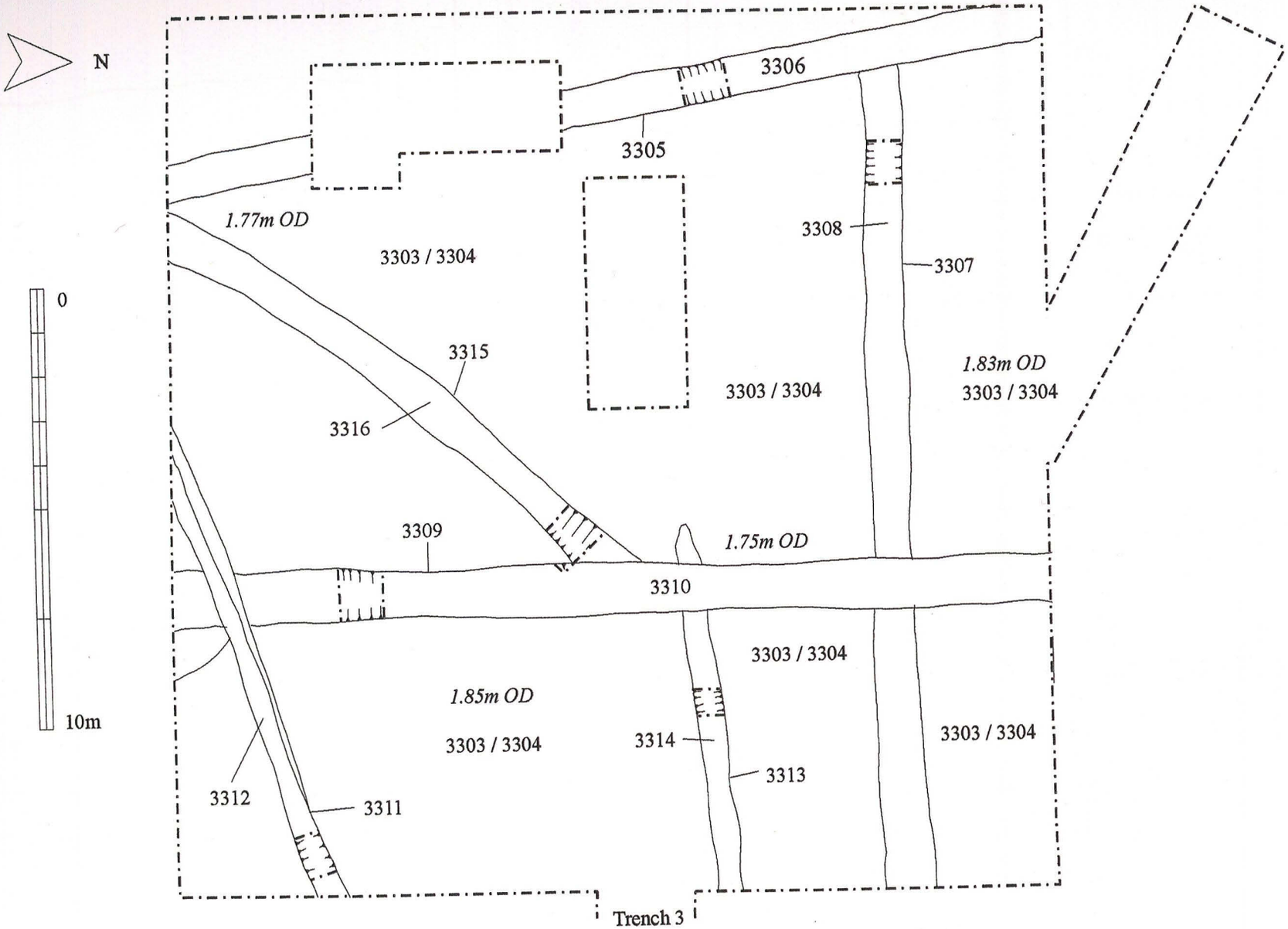


Fig. 12 Plan of Area 3.

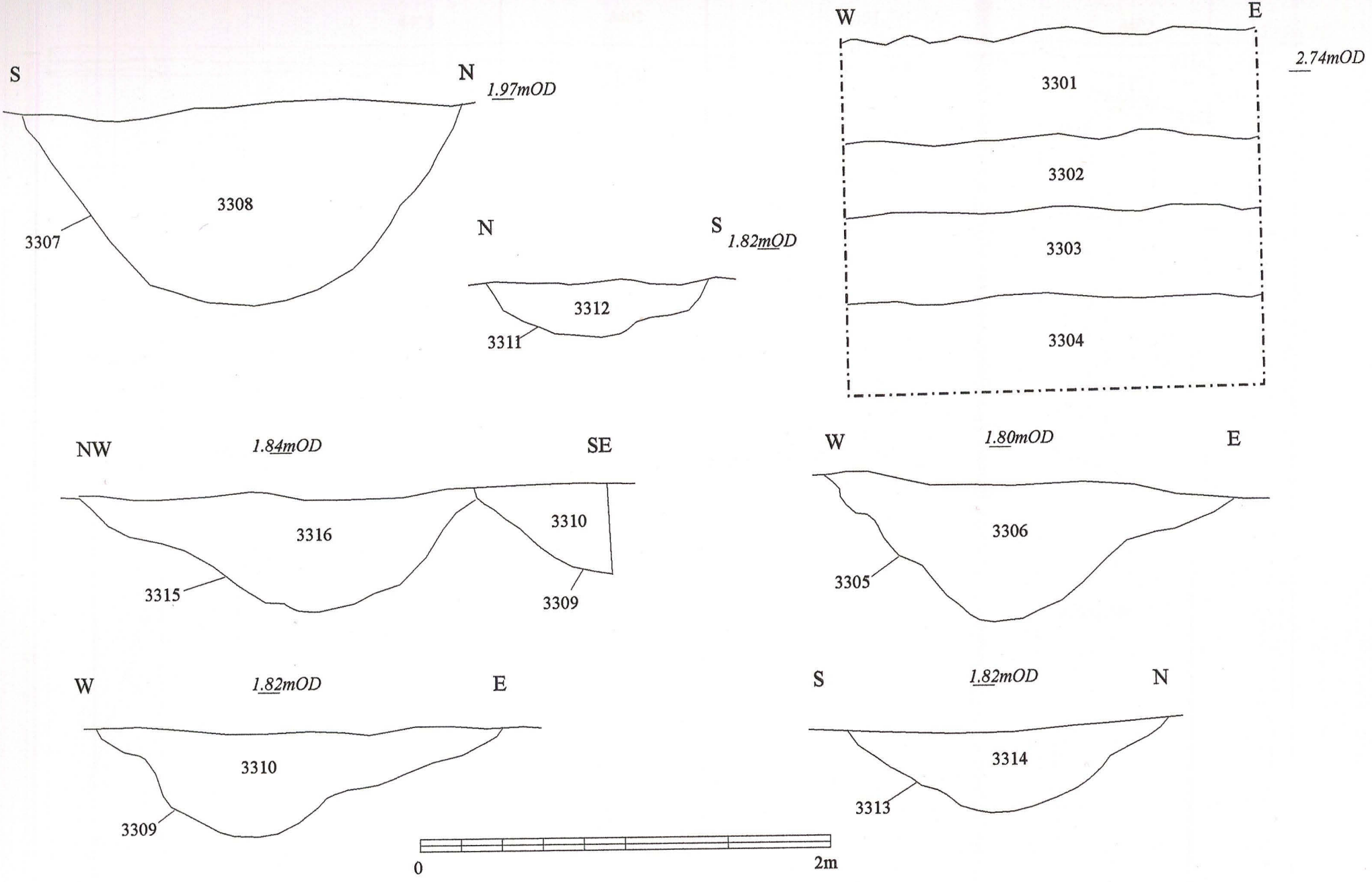


Fig. 13 Sections of Area 3 features.

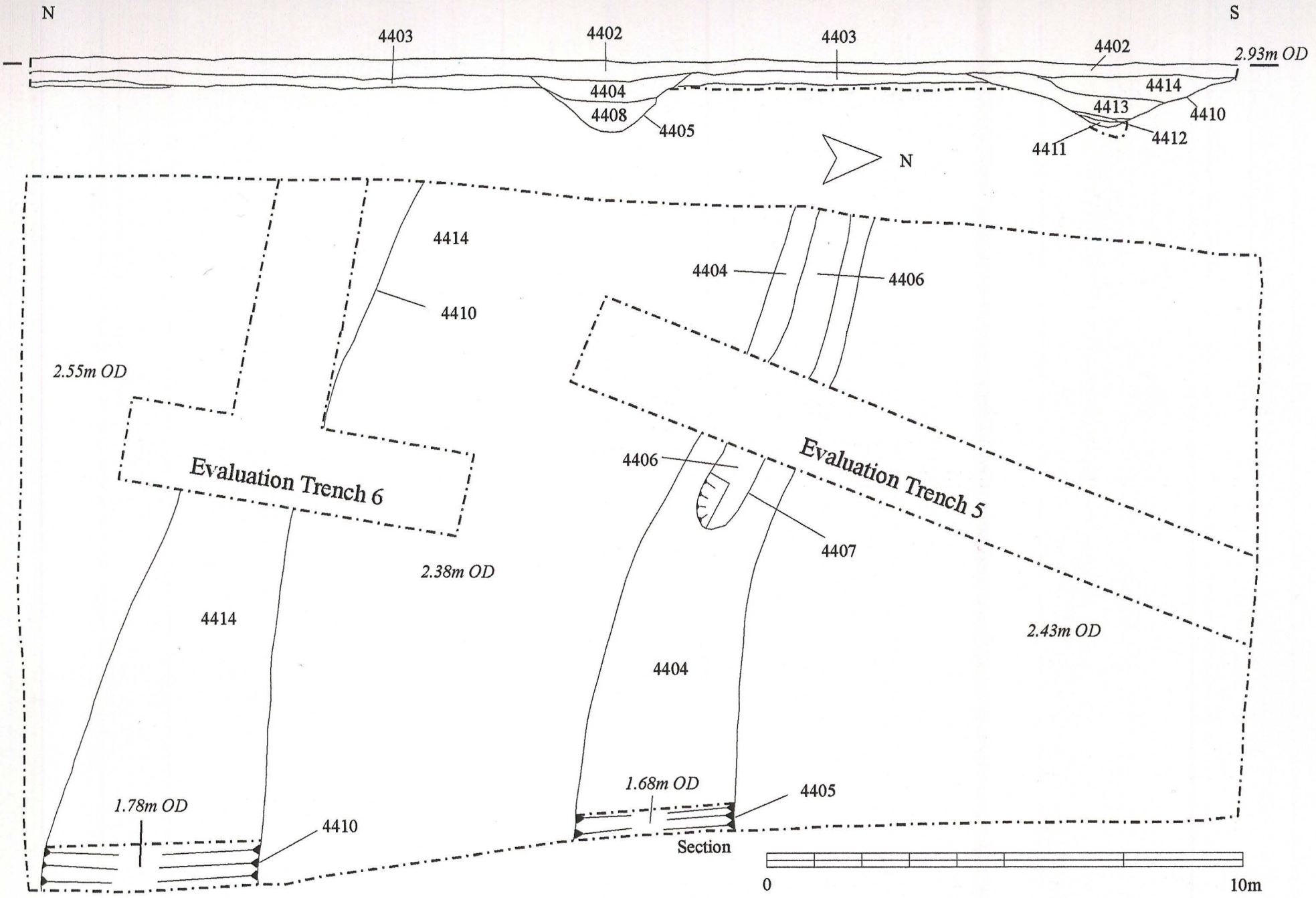
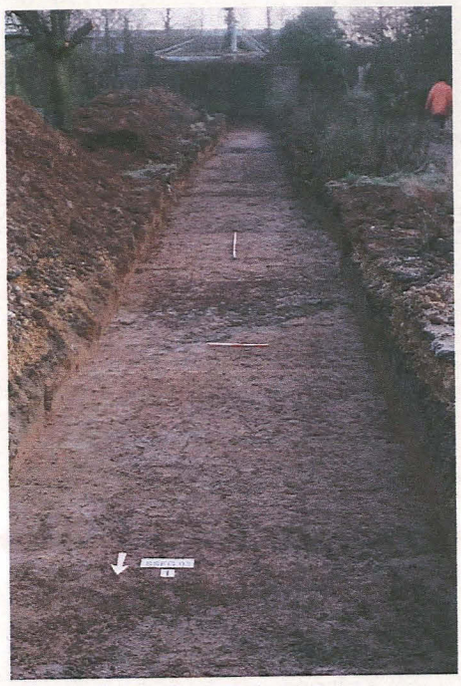


Fig. 14 Plan and section of Area 4.

THE PLATES



Pl. 1 Trench 1, cleaned, looking south. Scales 1m and 2m.

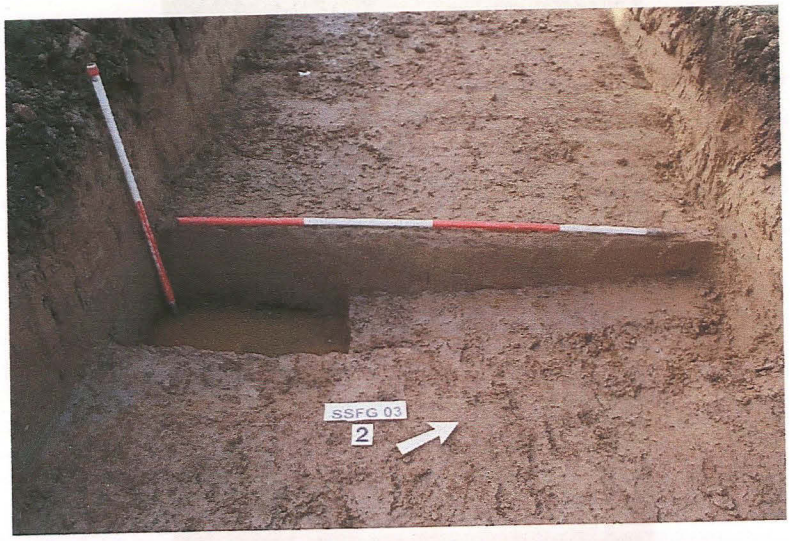
Pl. 2 Trench 1. Channel 117, west facing section. Horizontal scale 2m, vertical scale 1m.

Pl. 3 Trench 1. Channel 124, west facing section. Horizontal scale 1m, vertical scale 0.50m.

Pl. 4 Trench 1. Ditches 132 and 136, west facing section. Horizontal scale 1m, vertical scale 0.50m.

Pl. 5 Trench 1. Ditch 150, west facing section. Horizontal scale 2m, vertical scale 1m.

Pl. 6 Trench 2, cleaned, looking south-east. Scales 1m and 2m



Pl. 7 Trench 2. Slot through palaeochannel 230, east facing section. Horizontal scale 2m, vertical scale 1m.

Pl. 8 Trench 3, cleaned, looking west. Scales 1m and 2m.

Pl. 9 Trench 3, cleaned, looking north. Scales 1m and 2m.

Pl. 10 Trench 3, cleaned, looking south. Scales 1m and 2m.

Pl. 11 Trench 3, Sondage through flood deposits. Horizontal scale 2m, vertical scale 1m. Arrow points north-west.

Pl. 12 Trench 3, Sondage through flood deposits. Vertical scale 1m. Arrow points north-west.

Pl. 13 Trench 3, Ditch 317, north facing section. Scale 1m

Pl. 14 Trench 3, Ditch 319 and 321 (right), north-east facing section. Scale 1m

Pl. 15 Trench 3, Pit 325, north facing section. Horizontal scale 2m, vertical scale 1m.

Pl. 16 Trench 4, cleaned, looking north-west.

Pl. 17 Trench 4 southern extension, cleaned, looking south-west. Scales 1m and 2m.

Pl. 18 Trench 4 northern extension, cleaned, looking north-west. Scales 1m and 2m.

Pl. 19 Trench 4. Western end showing excavated ditch 440, looking north. Scales 2m.

Pl. 20 Trench 4, western half, south facing section. Scales 1m and 2m.

Pl. 21 Trench 4, eastern half, south facing section. Scale 2m.

Pl. 22 Trench 4, eastern half, south facing section of ditch 425. Scale 2m.

Pl. 23 Trench 4. Ditch 443, south facing section. Horizontal scale 2m.

Pl. 24 Trench 4. Posthole 445, east facing section. Scales 0.50m.

Pl. 25 Trench 5, segment one, cleaned, looking north.
Scales 1m and 2m.

Pl. 26 Trench 5, segment one, cleaned, looking south.
Scales 1m and 2m.

Pl. 27 Trench 5, segment two, cleaned, looking north.
Scales 1m and 2m.

Pl. 28 Trench 5. Ditch 505, south facing section. Scale 1m.

Pl. 29 Trench 5. Ditch 508, east facing section. Scale 2m.

Pl. 30 Area 1, cleaned, looking north-east.

Pl. 31 Area 2, eastern end, cleaned, looking south. Scales 2m.

Pl. 32 Area 2, central area, eastern end, cleaned, looking south. Scales 2m.

Pl. 33 Area 2, central area, western end, cleaned, looking north. Scales 2m.

Pl. 34 Area 2, western end, cleaned, looking north. Scales 2m.

Pl. 35 Area 2, west end, cleaned, looking north. Scales 2m.

Pl. 36 Area 2. Pit 2212 and postholes 2221, 2223 and 2242, south -west facing section. Horizontal scale 1m.

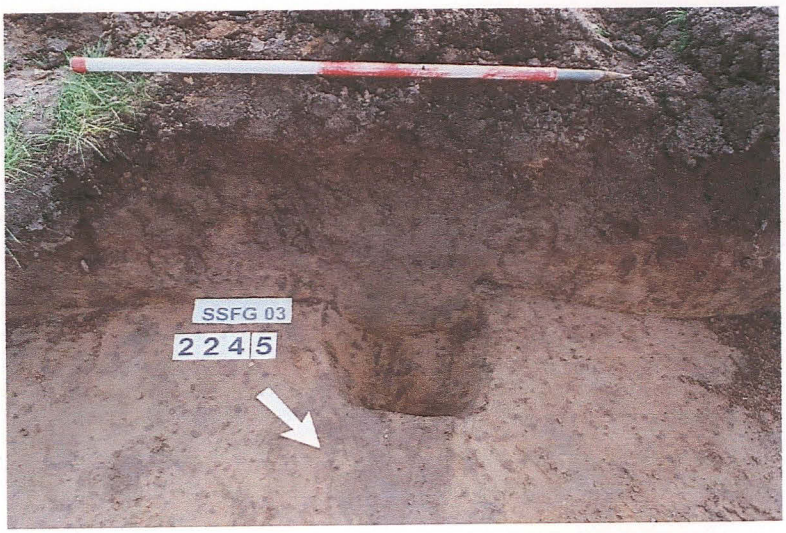
Pl. 37 Area 2. Pit 2212 post excavation with stakeholes 2214, 2225, 2303 and 2305 in its base. Scales 1m and 2m.

Pl. 38 Area 2. Pit 2217, south facing section. Scales 2m.

Pl. 39 Area 2. Pit 2228, south-west facing section. Scale 2m.

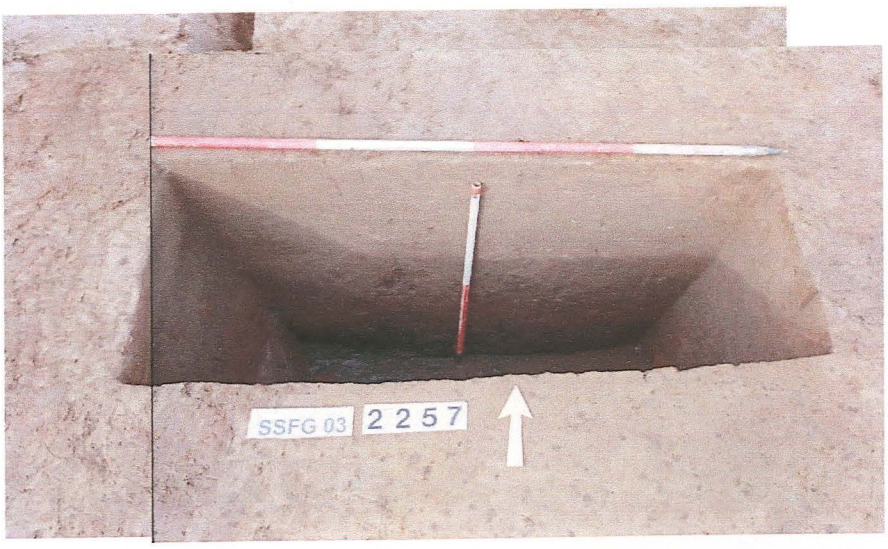
Pl. 40 Area 2. Posthole 2231, north-east facing section. Scale 0.50m.

Pl. 41 Area 2. Ditch 2240, east facing section. Scale 1m.

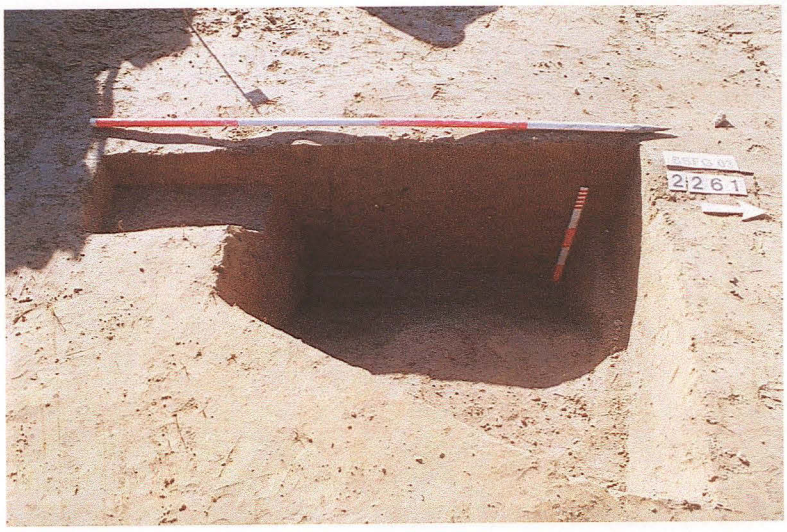


Pl. 42 Area 2. Ditch terminus 2245, north facing section. Scale 1m.

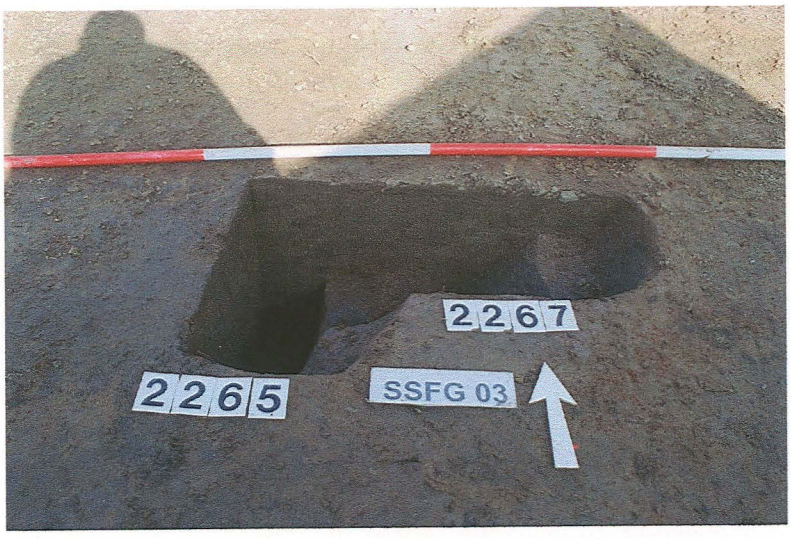
Pl. 43 Area 2. Pit 2246, west facing section. Scale 1m.



Pl. 44 Area 2. Pit 2257, wsouth facing section. Horizontal scale 2m, vertical scale 1m.



Pl. 45 Area 2. Pit 2261, east facing section. Horizontal scale 2m, vertical scale 0.50m.



Pl. 46 Area 2. Pit 2265 and posthole 2267, south facing section. Scale 2m.

Pl. 47 Area 2. Ditch 2271, north facing section. Horizontal scale 2m, vertical scale 0.20m.

Pl. 48 Area 2. Ditch 2273, west facing section. Scale 1m.

Pl. 49 Area 2. Slot through ditch 2275, looking north-west. Scale 1m.

Pl. 50 Area 2. Scoop 2277, east facing section. Scale division 0.50m.

Pl. 51 Area 2. Posthole 2281, west facing section. Scale 0.50m.

Pl. 52 Area 2. Posthole 2283, north facing section. Scale 0.50m.

Pl. 53 Area 2. Posthole 2285, east facing section. Scale 0.50m.

Pl. 54 Area 2. Posthole 2287, east facing section. Scale division 0.50m.

Pl. 55 Area 2. Ditch 2296, south facing section. Scale 0.50m.

Pl. 56 Area 2. Pit 2298, filled by 2297, east facing section.
Horizontal scale 1m, vertical scale 0.50m.

Pl. 57 Area 2. Pit 2310, north facing section. Scale division 0.50m.

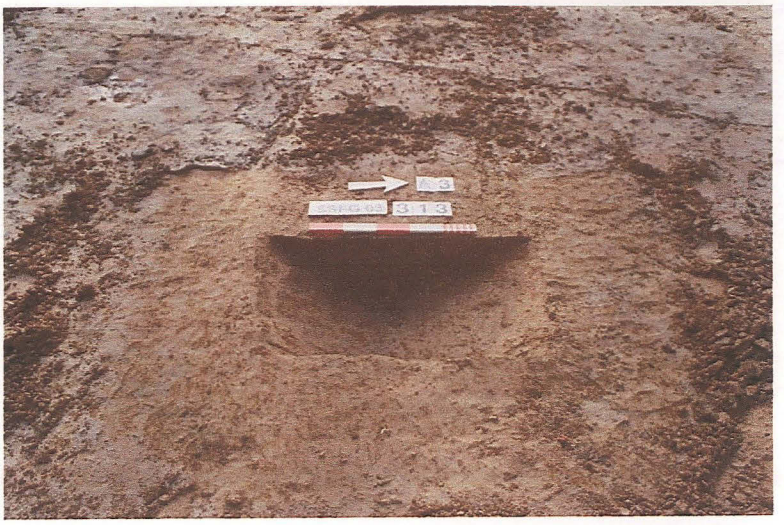
Pl. 58 Area 2. Posthole 2312, north facing section. Scale 0.50m.

Pl. 59 Area 3, cleaned, looking north-east.

Pl. 60 Area 3. Ditch 3305, south facing section. Scale 1m.

Pl. 61 Area 3. Ditch 3307, east facing section. Scale 1m.

Pl. 62 Area 3. Ditch 3311, south-west facing section. Scale 1m.



Pl. 63 Area 3. Ditch 3313, east facing section. Scale 0.50m.

Pl. 64 Area 3. Ditch 3315, south-west facing section. Scale 1m.

Pl. 65 Area 4, cleaned, looking north. Scales 2m.

Pl. 66 Area 4, north end cleaned, looking north-east. Scales 2m.

Pl. 67 Area 4. Ditch 4405, west facing section. Horizontal scale 2m, vertical scale 0.50m.

Pl. 68 Area 4. Ditch terminus 4407, looking north.

Pl. 69 Area 4. Ditch 4410, west facing section. Scales 2m.

Pl. 70 The bone skate.

Pl. 71 The Hone from 2218.

Pl. 72 The pottery face from 2276.