Chapter 9

Rainham and Wennington Marshes

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Rainham and Wennington Marshes (Zones T13–T15)

East of Rainham Creek the rail corridor briefly skirts the terrace edge before continuing across the Rainham and Wennington Marshes, passing beneath the A13 flyover at approximately 26.5km (Fig 23). Prior to construction the land either side of Ferry Lane was occupied by warehouses with concrete areas and patches of waste ground. The marshes, however, comprised relatively open ground with rough grass and scrub, dissected by a network of extant drainage ditches. Ground levels averaged +2.60m OD in the west, dropping to +1.90m OD adjacent to Ferry Lane, and between +0.50m and +1.0m OD on the marshes.

Construction Impacts

The HS1 alignment across the marshes was designed to be as low as possible to minimise environmental impacts and construction whilst still maintaining stability across the soft ground. This involved a concrete slab 12m wide and 450mm thick supported by rows of four or five 600mm driven precast piles at 5m centres. Aside from the extensive piling, direct impact into the underlying alluvium on the marshes generally involved the removal of topsoil, although additional intrusive works included diversion of services and drainage ditches.

The service diversions comprised the excavation of a series of trenches in a combined easement to accommodate the Barking Power and Transco gas mains. Excavation was via open cut techniques with a total combined length of 2935m, 300m of which employed box shoring. The depth of excavation averaged 1.80–2.00m, increasing to 3.80m adjacent to Ferry Lane, and to a maximum of 3.50m where the diversions crossed existing drainage ditches. Two coffer chambers were excavated adjacent to Ferry Lane in order to carry the services beneath the road via a pipe-jacked crossing to a maximum depth of 6.0m. A further 375m of trench was excavated on Rainham Marsh in order to divert the Wennington Sewer. This excavation employed closed box shoring to a depth of 3.0m. The diversion of a series of existing drainage ditches from the HS1 corridor was also carried out between 24.83km and 25.70km. The ditches averaged 1.0m deep and 5.0m wide with the edges sloping at an angle of 40°, reducing the width at the base to 1.50m.

Key Archaeological Issues

The 1999 study designated Zones T13–T15 (Chap 6 *Window 8* and *Window 9*; Fig 23) of low archaeological priority. Between 24.1km (east of Rainham Creek) and 24.9km (Rainham Marsh) the route corridor briefly traverses the edge of the Mucking and West Thurrock Gravel at the margin of the floodplain. Beyond 24.9km (Rainham and Wennington Marshes), however, the route lies to the south or west of the floodplain edge. Two valleys were identified entering the floodplain at *c* 25.5km and 26.5km, the latter corresponding to the former course of Wennington Creek which is known to have been navigable up until the later medieval period.

Examination of the borehole records suggested considerable variation in rockhead surface through Zones T13–T15. The upper surface of the gravels demonstrated similar variation. The Holocene floodplain sediments in the area are dominated by a major peat complex between *c* -2.0m OD and -5.0m OD, with thick clay-silts, silts, sands and organic units below the peat and an upper complex of silts, sands and organic silts. The thickness of modern deposits capping the sequence appeared to be relatively thin throughout these zones. It was predicted initial inundation at the eastern end of this route section at *c* 6000 cal BC (*c* 7200 ^{14}C BP), and the western end by *c* 6000–5500 cal BC (*c* 7000–6500 ^{14}C BP). Key floodplain marginal ecotones may have existed at the boundary between Zones T14 and T15 (*c* 26.0km), and the eastern part of Zone T14 may have acted as an important dry ground zone as wetland inundation occurred in Zone T15. Similarly the western end of Zone T14 (*c* 24.7km) may have formed a dry ground region during early infilling of Zone T13.

Methodologies

Initial fieldwork comprised an archaeological watching brief on the advanced utility diversions. Archaeological remains were identified in the base of a pipe trench

Table 34 Summary of fieldwork events, Rainham and Wennington Marshes

Event name	Event code	Type	Zone	Interventions	Archaeological contractor
West Thames advanced utility diversions	ARC 36100	Watching Brief	13–15		Oxford Archaeology
Rainham, Ferry Lane	ARC RFL02	Evaluation	13	4026TT	Oxford Archaeology
TW sewer diversion	ARC TAM01	Evaluation	14	3972TT	Oxford Archaeology
TW sewer diversion	ARC 31001	Watching Brief	14		Oxford Archaeology
Wennington Marsh	ARC WEN01	Evaluation	15	26501TT, 26502TT	Wessex Archaeology

TT = trench

located at the edge of the floodplain and the gravel terrace immediately east of Ferry Lane at 24.455km (Zone T13). This included a scatter of Early Neolithic worked and fire-cracked flint on a weathered sand horizon sealed beneath peat, and a concentration of Roman pottery and animal bone within the overlying alluvium (see below). Further east, beneath the A13 flyover at 26.54km (Zone T15), evidence of medieval activity comprised an assemblage of potsherds; animal bone and marine shell associated with a drainage ditch and buried soil dated from the 11th–13th centuries AD (see below). The watching brief was followed by a series of evaluation trenches targeted on archaeological remains. Unfortunately no further occupation evidence was identified, perhaps due to the very localised extent of the activity and the fact the trenches could not be placed in the exact locations where remains had originally been identified due to proximity of live services. A summary of the fieldwork events is included in Table 34.

Plate 14 Open trench pipeline excavations on Rainham Marsh

A number of sample profiles were assessed for palaeoenvironmental remains from this route section. Interpretation of the sedimentary sequences was carried out by Elizabeth Stafford. The specialist assessments were carried out by Rob Scaife (pollen), Mark Robinson (charred and waterlogged plant remains and insects) and John Whittaker (ostracods and foraminifera). Subsequently detailed micromorphology (Richard Macphail) was carried out on three sequences containing *in situ* occupation horizons or buried soils (Appendix B, Pls 15A–C and 16A–G). This included deposits associated with the Early Neolithic flint scatter on Rainham Marsh and the medieval marsh soils on Wennington Marsh. A total of 10 radiocarbon dates were obtained during the assessment stage providing a broad chronological framework (Appendix A).

Results of the Investigations

A cross-section of the sequences recorded across the marshes is presented in Figure 49. The relatively shallow depth of excavation of the service diversions dictated that only the upper part of the alluvial sequence and the very top of the main peat unit were regularly observed during the watching brief (Pl 14). Deeper excavations were carried out at the road and drain crossings, although access for sampling purposes was restricted due to safety issues. Evaluation trench 3972TT at 24.755km was excavated to a depth of 4.5m and provided the opportunity to record and sample the main peat complex in greater detail, though the trench did not reach the underlying gravel deposits.

Watching brief and trench excavations on Rainham Marsh

24.455km (East of Ferry Lane)

Basal silty sand (Early Neolithic palaeosol)

In the base of a pipe trench at 24.455km (Figs 50 and 51) the lowermost deposit comprised silty sand (context 192). The upper 0.05m of this deposit appeared to be weathered greyish-brown, grading to light yellowish-brown down-profile. This weathered sand represents the remnants of a former landsurface and contained an *in situ* assemblage of worked and burnt flint of Early Neolithic date (see below, *The archaeological evidence*).

Unfortunately preservation of environmental remains was limited in the palaeosol; with only comminuted *Quercus* sp. (oak) charcoal fragments and waterlogged wood fragments recovered (*Table 35*). Thin-section analysis (Pls 15A–C) revealed context 192 to be a weakly humic palaeosol containing angular fragments of burned (rubefied, cracked and whitened/calcined) coarse and fine flint with coarse angular quartzite and rare 2mm size charcoal. The palaeosol was compact, and had a collapsed structure along with broad burrow or channel infills of coarse silt and fine charcoal and rare coarse roots (Pl 15A). The sharp boundary with the overlying silty peat (context 193b, Pl 15A) suggests rapid inundation and truncation of the palaeosol, causing loss of structure (loss of fines) associated with coarse silt inwash carrying fine detrital charcoal. The coarse quartzite and burnt flint are possibly relict of burnt midden occupations (as at Tank Hill Road, on Aveley Marsh; see Chap 10), and it is likely that these were once also associated with greater concentrations of charcoal than now present. There may be two reasons for this. First, the palaeosol may have been truncated during inundation, and second, gentle inundation and associated soil slaking tends to allow the liberation and lifting of light materials such as charcoal; this produced a widespread charcoal scatter at the Stumble Neolithic site on the Blackwater Estuary, while at the Mesolithic site at Goldcliff on the Severn much of the charcoal was found in the base of the estuarine silty clays that buried the site (Bell *et al* 2000; Macphail 1994; Macphail and Cruise 2000).

Peat

The palaeosol was sealed by a peat unit, *c* 0.3m thick (context 193a/b). The lowermost 0.05m of this deposit (context 193b) was very silty perhaps reflecting episodes of flooding and sedimentation prior to the accumulation of the main peat unit. The base of the main peat unit was radiocarbon dated to the Early Neolithic, 3520–3110 cal BC (NZA-16266, 4601±40 BP). Thin-section analysis revealed that the lower part of the peat contained trace amounts of fine burnt flint and charcoal, possibly picked up during inundation and concomitant localised reworking. It was coarsely layered, peat and minerogenic peat, with patches and fragments of humified peat and plant/woody fragments that had been mixed by both rooting and mesofauna activity. This implies fluctuating water tables and episodic exposure of the peat at this location.

The main peat unit (193a) produced large quantities of comminuted wood, although waterlogged seeds were restricted to *Urtica dioica* (stinging nettle). The pollen assemblage (*Table 36*) was typical of the Neolithic and Bronze Age of the region as a whole and at other sites examined in this study. *Quercus*, *Tilia* (lime) and *Corylus avellana* (hazel) woodland with *Fraxinus* (ash) were dominant, probably growing on drier soils above the floodplain, dense extensive alder carr grew locally. There were few herbs with only a small number of Poaceae (grasses) and Cyperaceae (sedges). Fern spores included monolete *Dryopteris*-type with *Pteridium aquilinum* (bracken) and *Polypodium vulgare* (common polypody).

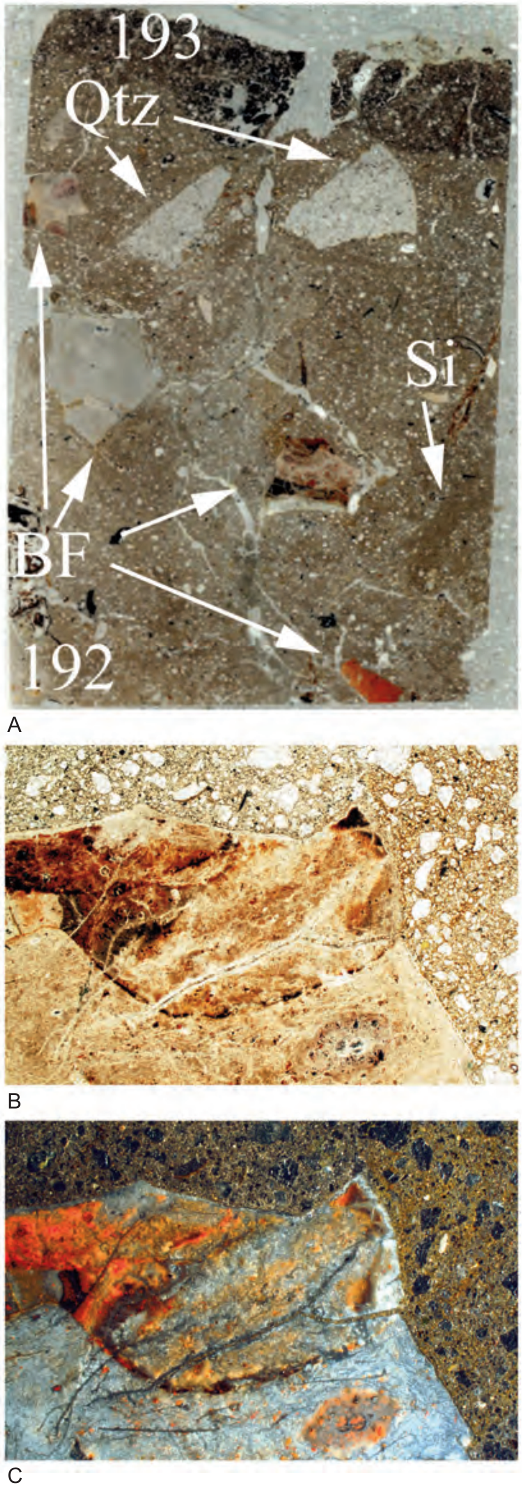


Plate 15 Microphotographs, 24.455km, East of Ferry Lane, Rainham Marsh. A) Monolith 256(B) thin section, contexts 192 and 193b: Palaeosol 192 contains coarse angular quartzite (Qtz) and burnt flint (BF); rubefied iron (~haematite) is poorly preserved because of iron depletion; relict root channels have been infilled with humic silt (Si) from ensuing minerogenic peat deposition (193b). Width is ~50mm. B) Monolith 256(B), context 192: Burnt flint in weakly humic palaeosol (see A.); note red colours and cracking. Plane polarised light (PPL), frame width is ~4.6mm. C) As B: Under oblique incident light (OIL), although in a gleyed environment, small amounts of relict iron staining still retain rubefied (haematite?) induced by heating

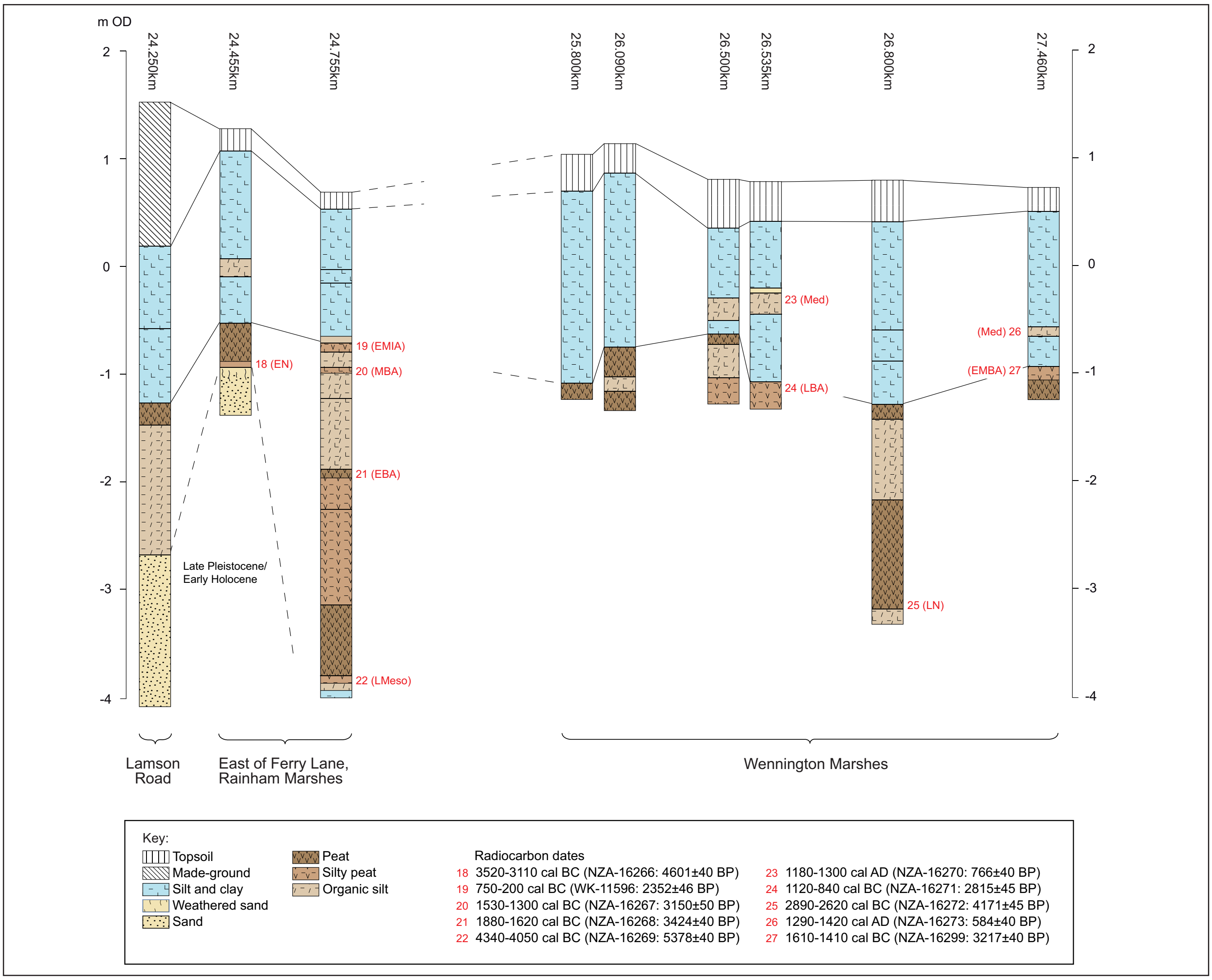


Figure 49 Cross-section, Rainham and Wennington Marshes

Upper silty clays (Roman channel deposits)

The peat was overlain by a bluish-grey silty clay alluvium (context 194), containing clasts of reworked peat, eroded from the underlying deposits, and occasional gravel clasts and lenses of coarse sand. The undulating and abrupt contact with the underlying peat suggests some truncation or erosion had occurred under relatively high-energy conditions, possibly indicating local channel activity. A concentration of Roman pottery and animal bone fragments (cattle, sheep/goat and horse) with butchery marks was recovered from this deposit, possibly inwashed deposits from a nearby settlement area. The condition of the pottery was poor, consistent with the effects of weathering and redeposition (see below; *The archaeological evidence*). Towards the eastern part of the trench bluish-grey silty clay interdigitated with layers of more organic silty clay that dipped northwards suggesting lower energy deposition. This was overlain by a homogeneous dark brownish-grey organic silty clay (context 195) that did not contain artefactual material. The waterlogged seed assemblages from contexts 194 and 195 were more productive. The plant species suggest nutrient rich mud and shallow water, with *Ranunculus sceleratus* (celery-leaved crowfoot), *Ranunculus* subgenus *batrachium* (crowfoot), *Apium nodiflorum* (fool's watercress), *Alisma* sp. (water plantain), *Carex* spp. (sedges) and *Eleocharis palustris* (common spikerush). Some drier, nutrient rich habitats are also suggested with *Stellaria media* agg. (chickweed), *Chenopodium album* (fat hen), *Atriplex* sp. (orache), *Rubus* sp. (bramble) and *Rumex* sp. (docks). The pollen assemblage demonstrates the dominance of herbs indicating more open grass-sedge-reed fen or swamp. Poaceae was dominant but there was also a marked expansion of fen herbs; Cyperaceae and *Typha angustifolia*/*Sparganium*-type (lesser bulrush/bur-reed). Two grains of *Cerealia*-type pollen were also found and may suggest cultivation. However, as previously discussed (Chap 7, Trench 4042TT), the similarity of cereal pollen with some wild grasses such as *Glyceria* (sweet-grass) means that the evidence remains equivocal. Because cereal pollen is not widely dispersed it is likely that any cereal cultivation would have taken place in the vicinity of the site, perhaps on slightly higher and drier ground. However, there is also the possibility of water transport given the depositional environment.

There was some suggestion of marine or brackish water influences, with the halophytes *Plantago maritima*-type (sea plantain) and Chenopodiaceae (goosefoots). However, freshwater reedswamp and aquatic taxa were also present, along with algal *Pediastrum*, suggesting that these sediments were laid down in fresh water conditions with brackish water incursions. Fresh water conditions are also indicated by the

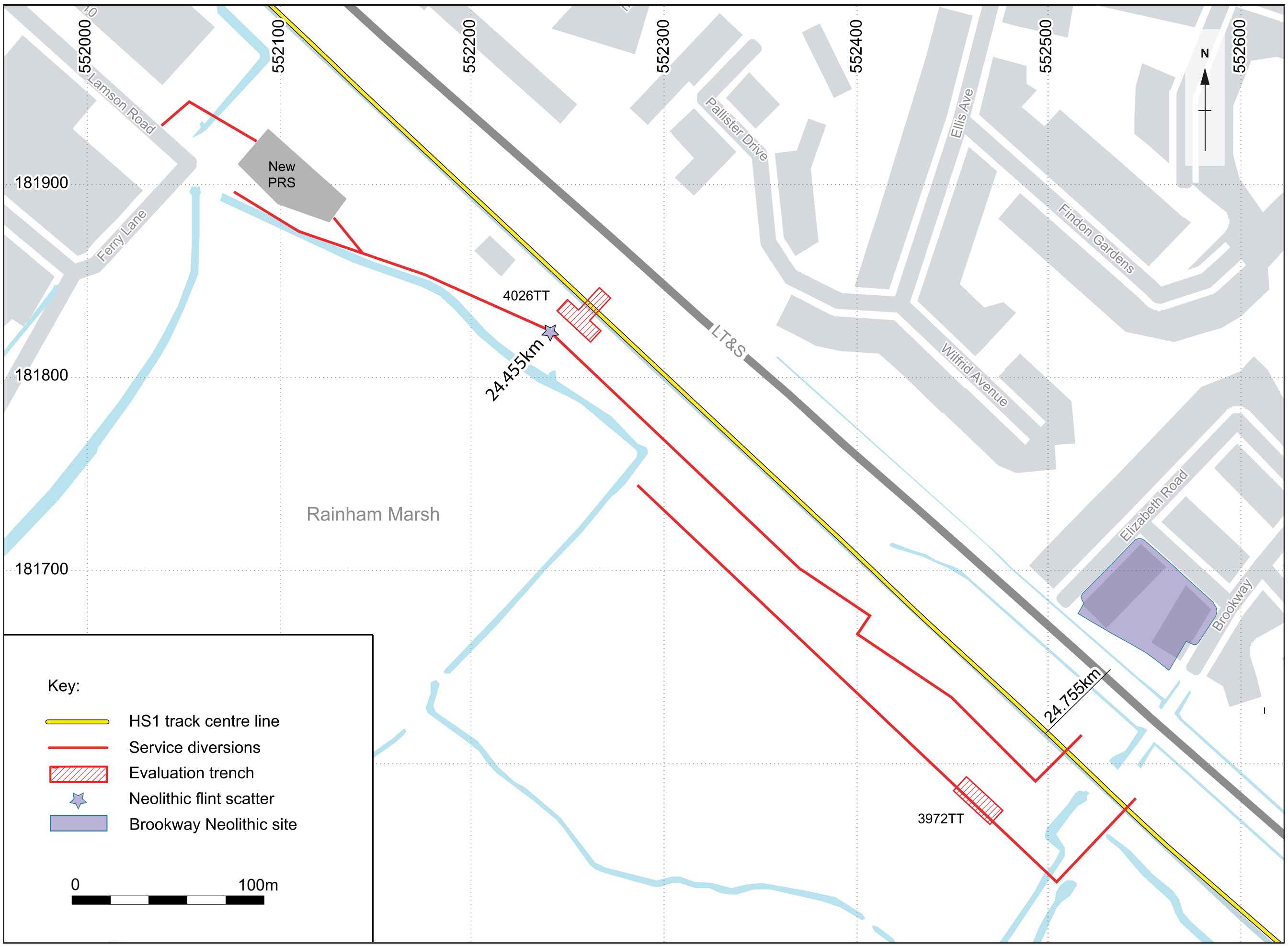


Figure 50 Plan of evaluation trenches and service diversions, East of Ferry Lane, Rainham Marsh

presence of Cladoceran (water fleas) valves and ephippia and partly decalcified freshwater ostracods (cf *Cypria opthalmica*) in context 195.

This sequence of deposits was sealed by further layers of sterile minerogenic alluvium that were not sampled. Context 166 comprised a grey and brown mottled silty clay, and context 392 a greyish-yellow-brown silty clay. The sequence was capped by the modern marsh topsoil (context 393) at *c* +1.20m OD.

Trench 3972TT

Evaluation trench 3972TT (Figs 50 and 51) was sited with the central alignment of the Rainham Sewer diversion, on a north-west to south-east alignment and was to coincide with the projected continuation of the prehistoric trackway previously identified at the Brookway settlement *c* 250m to the north-east. The trench was excavated to achieve a reduced base plan of *c* 15 x 4m to a depth of 4.50m; the maximum impact of the engineering works. The total excavation area on the surface was 25 x 12m. Safe trench support was achieved by stepping the edges of excavation.

Superficially the sediment sequence can be divided into three main units; a lower minerogenic alluvium, a thick organic complex and an upper minerogenic alluvium. Detailed on-site and off-site recording, however, revealed much greater complexity (*Table 37*). Four radiocarbon dates were obtained from trench 3972TT; demonstrating accumulation of the peat and organic deposits spanned a considerable period of time from the Late Mesolithic to Iron Age. No archaeological remains were encountered; however the sampled sediment sequence provides a useful ‘off-site’ record for the artefactual material recovered from the sequence described at 24.455km above.

Lower clay silts

The lower minerogenic alluvial deposit (context 15), exposed in a sondage in the base of the trench, comprised a soft structureless mid-grey clay silt. Unfortunately environmental remains were poorly preserved in this deposit. The overlying more organic clay silt (context 14), at the interface with the overlying peat, was a little more productive with seeds of *Alnus glutinosa* (common alder) and *Corylus avellana* (*Table 38*). The marsh pollen taxa (*Table 39*) was similarly dominated by *A. glutinosa* suggesting locally an alder carr environment. Aquatic taxa were few but *Potamogeton*-type (pondweed) and *Myriophyllum spicatum* (spiked water-milfoil) were present demonstrating that a small proportion of these sediments were laid down in fluviatile/ overbank flow conditions. Of the tree pollen, *Quercus* and *Corylus avellana* were most abundant, with occasional *Tilia* (lime), *Ulmus* (elm) and *Fraxinus* (ash) which

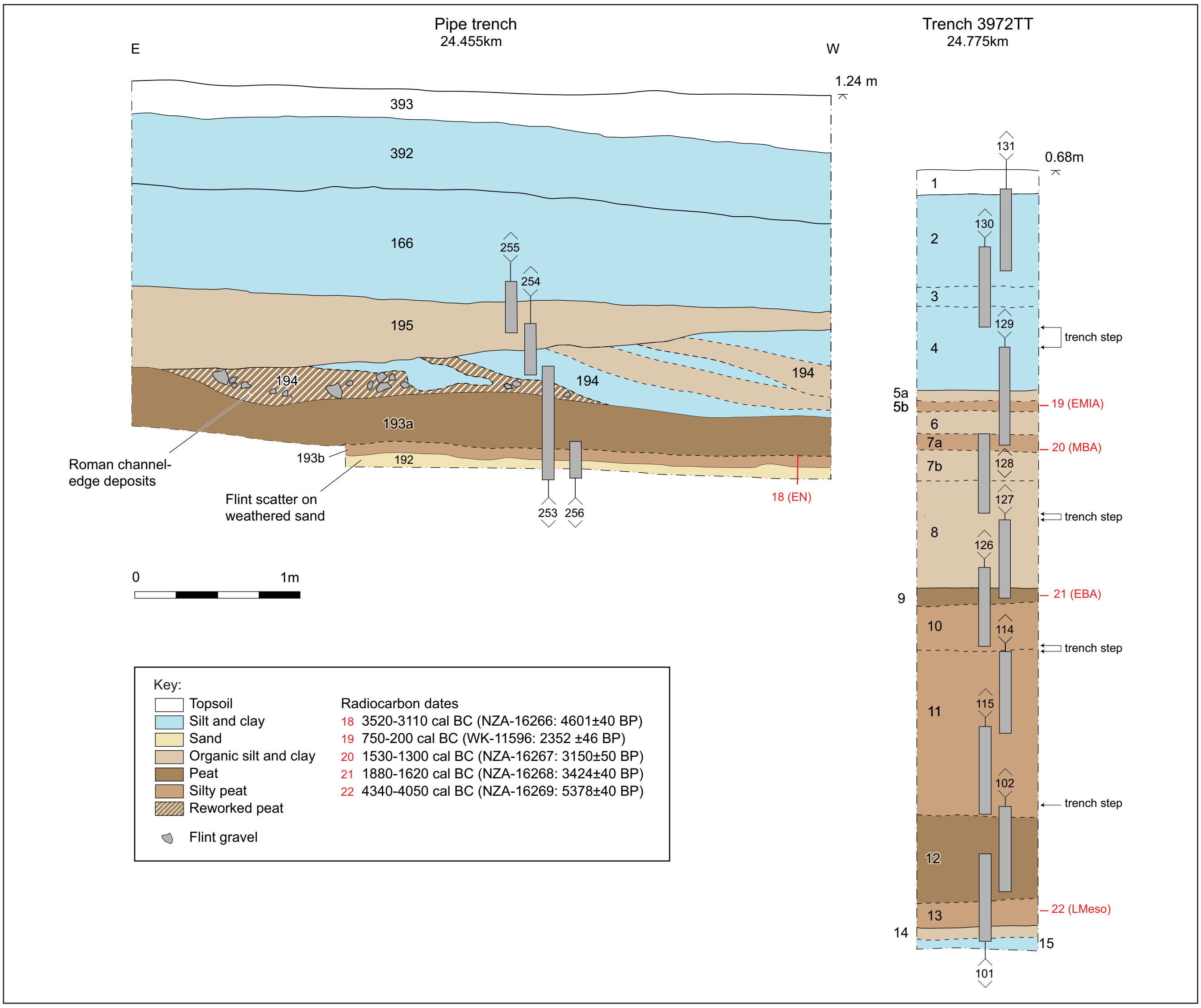


Figure 51 Sample profiles, East of Ferry Lane, Rainham Marsh

were probably growing on higher dry ground. There were few herbs with only occasional Poaceae, Apiaceae and single occurrences of other types.

Organic complex (lower)

The lower part of the organic complex (contexts 13–9) predominantly comprised alder carr wood peats between -3.86m and -1.87m OD. A thick unit of very silty peat (context 11) occurred between -2.55m and -3.12m OD which may indicate a period of localised flooding. Radiocarbon dating suggests these deposits accumulated between the Late Mesolithic and Early Bronze Age periods; context 13 was dated to 4340–4050 cal BC (NZA-16269, 5378±40 BP), and context 9 to 1880–1620 cal BC (NZA-16268, 3424±40 BP). The pollen assemblage from the peats was similar to that described above with locally dense alder carr which became more important and dominant on-site (contexts 12 and 13). Typically, there were traces of other fen carr elements such as *Frangula alnus* (alder buckthorn) and *Rhamnus catharticus* (buckthorn) and associated ground flora comprising *Lythrum salicaria* (purple loosestrife), *Typha angustifolia*-type and Cyperaceae. Spores of ferns were also important with *Dryopteris*-type (monolete), *Polypodium vulgare* and *Osmunda regalis* (royal fern). There was a small peak in Cyperaceae just prior to the change from wood peat (context 12) to silty peat (context 11). The seed assemblage included *Cornus sanguinea* (dogwood), *Oenanthe aquatica* gp. (water dropwort), *U. dioica*, *Ranunculus* cf *repens* (creeping buttercup), *Carex* spp. and Rubus sp., along with *A. glutinosa* and *Quercus*. Occasional beetle remains (*Table 40*) included the small water beetle *Ochthebius* cf *minimus*, the alder leaf beetle *Agelastica alni* and the death watch beetle *Anobium* cf *punctatum*, along with freshwater Cladocerans.

Organic complex (upper)

Overall the upper part of the organic complex (contexts 8–5) between -1.87 and -0.70m OD had a much higher minerogenic component largely comprising organic silt clays suggesting wetter conditions with increased flooding and alluviation in a more open fen environment. Radiocarbon dating suggests these deposits accumulated up until the Early to Middle Iron Age. The change in lithology is mirrored by a significant change in the pollen assemblages. There was a reduction of both terrestrial woodland and the alder carr. The

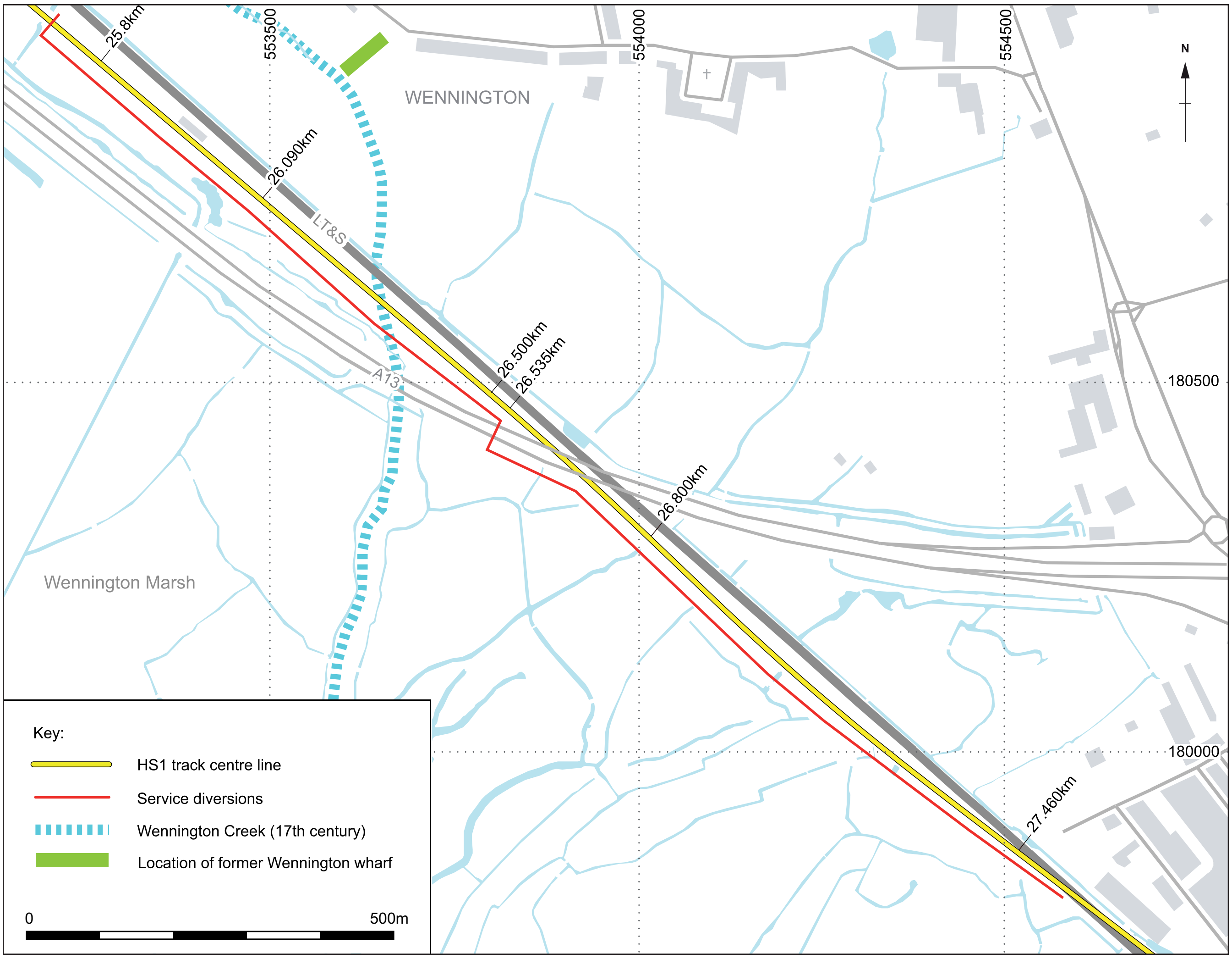


Figure 52 Plan of evaluation trenches and service diversions, Wennington Marsh

alder carr was replaced by grass-sedge-reed fen with alder still growing along its fringes but at further distance from the sample site. There was also an increase in the diversity of herb taxa, including both wetland/marsh taxa (eg, *Iris* (iris), *Typha latifolia* (bulrushes) and Cyperaceae), and dry-land herbaceous taxa. Poaceae attained high values along with Chenopodiaceae and *Plantago lanceolata* (ribwort plantain). Cereal-type pollen was also recorded, perhaps suggesting open land and cultivation in the catchment, although as discussed in the sequence above (24.455km) the identification of cereal-type pollen as opposed to some wild grasses remains problematic. Coleoptera from context 8 included *Helophorus* sp. (*brevipalpis* size), *Ochthebius* cf *minimus*, *Donacia* sp., *Plateumaris sericea*, *Prasocuris phellandrii*, *Apion* sp. and *Ceutorhynchus erysimi*. The seed assemblage was consistent with the development of an open fen environment and included *Ranunculus sceleratus*, *Polygonum hydropiper* (water-pepper) *Alisma* sp., *Sparganium erectum* (branched bur-reed) and *Juncus* spp. (rush). Of note was the presence of the ostracod *Cypria opthalmica* in context 8 (*Table 41*), along with opercula of the mollusc *Bithynia tentaculata* and Cladocerans, suggesting freshwater conditions prevailed at least in the lower part of the sequence. The expanding values of Chenopodiaceae pollen in the upper part however may be indicative of some episodic saline ingress.

Two thin peaty horizons were noted with the upper organic complex (contexts 7a and 5b) which show shifts to a wet terrestrial environment. Context 7a was dated at -0.93m OD to the Middle Bronze Age, 1530–1300 cal BC (NZA-16267, 3150± BP) and context 5b at -0.70m OD to the Early to Middle Iron Age, at 750–200 cal BC (WK-11596, 2352±46 BP). Brackish water incursion is indicated in the overlying organic silty clay layer (context 5a) by the occurrence of ostracods *Cyprideis torosa* and *Loxoconcha elliptica*.

Upper silty clays

Overlying the organic complex was a sequence of silty clay alluvial deposits (contexts 4–2). The principal tree and shrub pollen taxa remain as in the underlying deposits. Herbs were dominated by Poaceae, *Sinapis*-type (eg, mustard), Chenopodiaceae and Lactucoideae (charlocks), the latter peaking in context 2. The presence of *Armeria* (sea lavender and/or thrift) is a good indicator of saltmarsh. *Sinapis*-type, *Aster*-type and *Potamogeton* are also indicators of brackish water/saltmarsh when found in association with definite indicators such as *Armeria*. These deposits also produced a rich ostracod assemblage dominated by species living in sheltered brackish creeks and intertidal mudflats (typified by *Cyprideis torosa*, *Leptocythere porcellanea*, *L. elliptica* and *Cytherura gibba*) and being common to abundant, must be considered *in situ*,

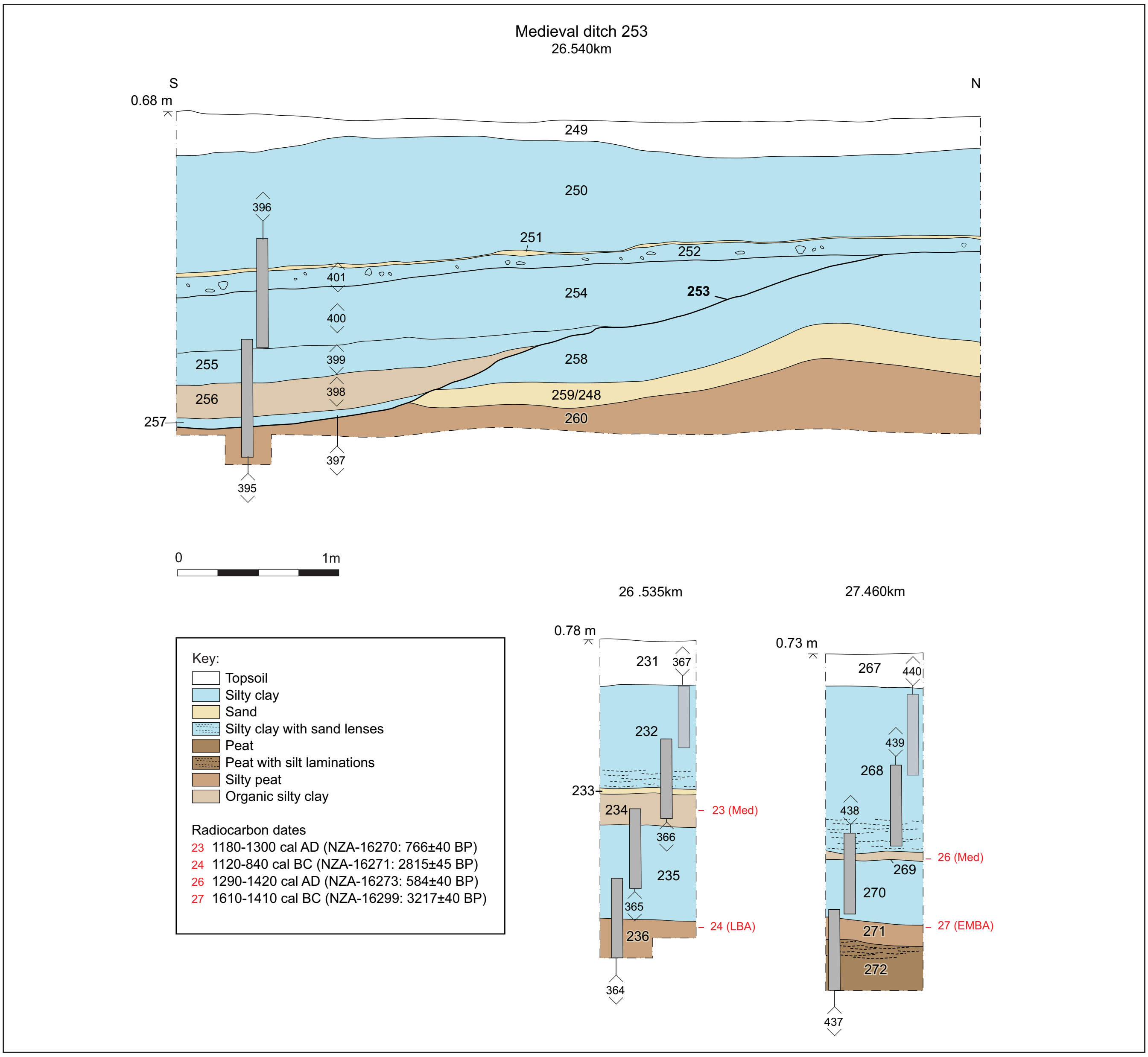


Figure 53 Sample profiles, Wennington Marsh

whereas the freshwater species (*Candona* spp. and *Limnocythere inopinata*) were quite rare. The foraminifera were also supportive of a brackish tidal mudflat environment; they were mostly small in size and consist of euryhaline species of *Ammonia*, *Elphidium* and *Haynesina germanica*.

Watching brief on Wennington Marsh

Chainage 26.535km

Peat

The pipe trench at 26.535km (Figs 52 and 53) was excavated to *c* 2.0m depth. The lowermost deposit exposed comprised 0.25m of silty peat (context 236) at -1.05 to -1.3 m OD. The top of the peat was radiocarbon dated to the Late Bronze Age at 1120–840 cal BC (NZA-16271, 2815±45 BP).

Waterlogged remains were very poorly preserved; limited to seeds of *Ranunculus* cf *repens* (*Table 42*). The relatively late date for the top of the peat is reflected in the character of the pollen assemblage (*Table 43*). Trees and shrubs were low in abundance, but *Quercus*, *Corylus avellana*-type and *Alnus glutinosa* were present, with sporadic occurrences of *Betula*, *Tilia* and *Rhamnus catharticus* (buckthorn). Herbs were very abundant, particularly Poaceae along with Cyperaceae. Other taxa were from reedswamp and aquatic habitats with *Potamogeton*-type and *Typha angustifolia*-type. The peat also had high values of monolete *Dryopteris* spores (degraded cf *Thelypteris*) and *Pteridium aquilinum*. A single grain of cereal-type pollen was also present. Overall the pollen assemblage suggests the landscape, at least locally, was largely open. The depositional habitat was grass-sedge fen with some alder present, perhaps fringing wetter areas of the marsh.

Upper silty clays (medieval palaeosol)

The peat was overlain by a series of estuarine silty clay alluvial deposits at -1.05m and +0.43m. Context 235 comprised 0.58m of orangey-brown silty clay alluvium. Overlying this was context 234; a firm dark grey silty clay 0.21m thick (-0.26 to

-0.47m OD) that may represent an ephemeral dry period with increased soil formation. A single sherd of late 13th century pottery was recovered from this layer and charred cereal grain was radiocarbon dated to cal AD 1180–1300 (NZA-16270, 766±40 BP). Stratigraphically equivalent horizons directly south of the sample profile (contexts 239 and 240) in the west-facing section of the pipe trench provided further occupation evidence with pottery sherds of mid-12th century to late 13th century date along with fragments of marine shell; oysters, whelks and mussels (see below; *The archaeological evidence*).

Thin-section analysis of context 234 revealed fine, mostly parallel, laminations of silt, very fine sand and clay, 350–500μm thick (Appendix B, Pls 16A and 16B). The deposit became more massive and clayey upwards and contained much detrital, very fine charred and amorphous organic matter, which often retained a sub-horizontal orientation, along with earthworm granules (biogenic calcite; Pl 16C; Armour-Chelu and Andrews 1994; Bal 1982; Canti 1998). Lower energy deposition is suggested by thin to broad burrows which were characterised by clay clasts with organic matter. Vesicles, intercalations and clayey void coatings in burrows are indicative of general slaking, presumably associated with ensuing flooding. Inundation also probably led to inwash of fine sand down channels from the overlying deposit (context 233). Waterlogging and fluctuating water tables produced much weak iron (Fe) staining in the lower part of context 234 (see χ_{max} in Appendix B), with the more clayey massive upper part being more Fe depleted. Bulk analysis found a low organic content (3.85% LOI, Appendix B). Thus much of the dark colour is due to the presence of highly humified and fine charcoal (Babel 1975). There was, however, no evidence of phosphate enrichment associated with human activity and the magnetic susceptibility provided no evidence for burning. Caution, however, must be stressed with regard to the latter as gleyed deposits are not well suited to magnetic susceptibility analysis because of their generally low Fe content and the potentially unstable nature of Fe mineralogy. Although the exact sequence of events is difficult to fully elucidate, a putative ripened humic clay surface (first stage of weathering and soil formation; Bal 1982; Catt 1979) seems to have formed towards the top of context 234, and earthworms worked this material down profile. Local flooding/stream flow, perhaps associated with the nearby ditch at 26.540km (see below), may have eroded the top of context 234 and produced the overlying fine sandy sediments of context 233.

Thin section analysis revealed context 233 comprised a moderately to poorly sorted clayey sediment with coarse silt, and very fine to coarse sand. It included burnt coarse sand sized chert and much fine charred and amorphous organic matter fragments. It was also burrowed, rooted and both iron depleted and stained as in context 234, with a sharp but burrowed lower boundary (Pls 16D–16G). The sand was overlain by a further deposit of orangey-brown silty clay alluvium 0.64m thick (context 232) which was capped by the modern marsh topsoil to +0.78 m OD.

Unfortunately waterlogged remains were very poorly preserved in the alluvial sequence and were restricted to seeds of *Typha* sp. and *Juncus* sp. in layer 233. The pollen assemblages indicate an open environment similar to that from the top of the peat. Although a marked expansion of Chenopodiaceae which may be an indication of saltmarsh halophytic communities, freshwater marsh taxa also remained important. With the exception of context 234, the alluvium did contain rich faunas of brackish intertidal and creek-dwelling ostracods and foraminifera (*Table 44*), typified by the ostracod species *Cyprideis torosa, Leptocythere porcellanea, Loxoconcha elliptica, Leptocythere castanea* and *Cytherura gibba*, and foraminifera of *Ammonia, Elphidium* and *Haynesina germanica*. Fully marine ostracod species, probably washed in by a tidal surge, are represented by *Pontocythere elongata* in context 232. A minor freshwater/terrestrial component washed in from nearby coastal and floodplain pools and soils are represented by the ostracods *Candona* sp., *Heterocypris salina* and *Pseudocandona* sp.

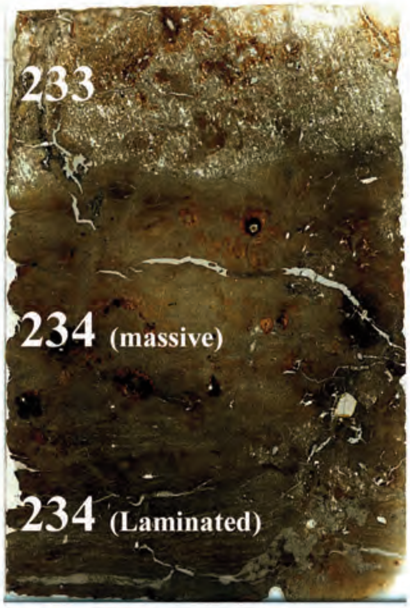
Chainage 26.540km

The basic sequence at 26.540km was similar to that described at 26.535km above, but was located where the pipe trench dog-legged beneath the A13 flyover (Figs 52 and 53). The lowermost deposit exposed comprised a dark reddish-black well humified silty peat (context 260) at -1.05m to -1.3m OD. This was overlain by 0.20m of light greyish-yellow silty sand (context 259/248). The contact between the peat and the sand was very abrupt suggesting an erosional event. The sand contained a rich and diverse assemblage of foraminifera and ostracods (*Table 44*) similar to that described for the alluvium at 26.535km suggesting an estuarine environment with tidal creeks but with some freshwater input. The sand was overlain by a series of silty clay alluvial deposits and modern marsh topsoil to +0.68m OD.

Medieval ditch 253

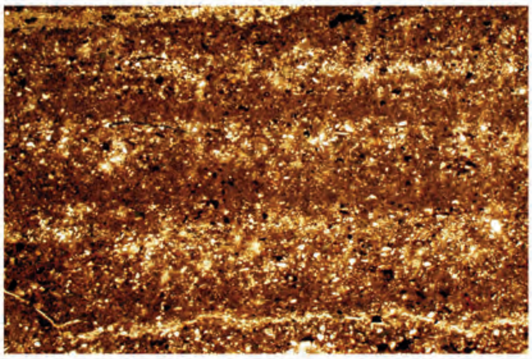
In the east-facing section of the pipe trench, however, part of the profile of a large ditch or channel edge (feature 253) was exposed within the upper alluvium. Pottery recovered from the fills of this feature suggests it was broadly contemporary with the palaeosol (context 234) recorded at 26.535km. Feature 253 measured *c* 1.0m deep and was only partially exposed to a maximum width of *c* 4.3m at the top. The lowermost fill (context 257) comprised a firm mid-yellowish-brown silty clay. This was overlain by a dark grey organic silty clay (context 256) and a light yellowish-grey sandy silty clay (context 255). The upper fill (context 254) comprised a firm greenish-grey silty clay, sealed by a further deposit of bluish-grey silty clay with frequent flint gravel clasts (context 252). In addition to the pottery, a small assemblage of animal bone was recovered from feature 253 including cattle, sheep/goat, pig and a piece of deer antler, along with a quantity of charred cereal grain (see below; *The archaeological evidence*).

Waterlogged plant remains were largely absent apart from seeds of *Lemna* sp. (duckweed), *Alisma* sp. and *Typha* sp. (*Table 42*). The pollen evidence was similar to that described for the sample profile at 26.535km, with an overall low abundance of trees wth a general background presence of *Quercus* and *Corylus* (*Table 43*). The herb assemblages were diverse, coming from a range of habitats that may have included pastoral agriculture and arable cultivation (eg, *Plantago lanceolata* and cereal-type) as well as the autochthonous (on-site) vegetation.



A

A) Monolith 366 thin section, contexts 233 and 234: Very fine sandy context 233 over upper massive clayey context 234 and laminated silt and clay (see B.) in lower context 234. Width is ~50mm.
B) Monolith 366, lower Context 234: Composed of finely laminated silt and humic clay. Plane polarised light (PPL), frame width is ~4.6mm.
C) Monolith 366, upper context 234: Massive, clayey, with partially decalcified earthworm granule (biogenic calcite, arrow) in burrow in humic clay containing sparse silt. Crossed polarised light (XPL), frame width is ~4.6mm.
D) Monolith 366, contexts 234 and 233 interface: Burrowed boundary (arrows). PPL, frame width is ~4.6mm.
E) As D: Under XPL, showing humic clayey context 234 (with very low interference colours) and coarse silt and very fine sand in context 233.
F) Monolith 366, context 233: Partially iron-stained piece of burned chert (BCh) and partially decalcified, probable slug plate (biogenic calcite, BC). PPL, frame width is 2.3mm.
G) As F: Under oblique incident light (OIL), part-calcined and part-rubefied burnt chert (BCh) and biogenic calcite (BC); note other very fine rubefied mineral inclusions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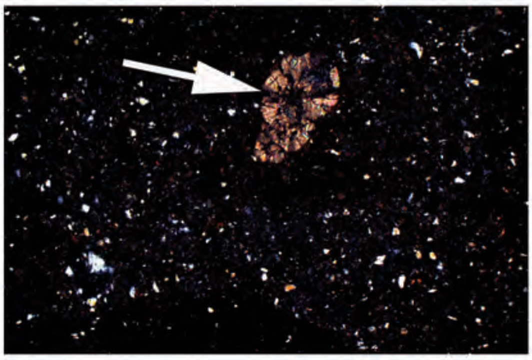
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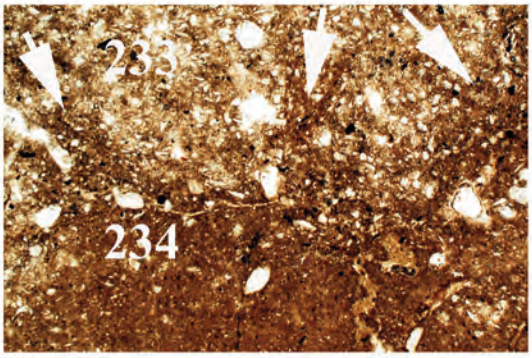

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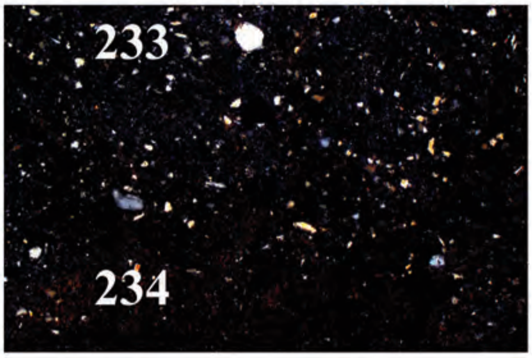

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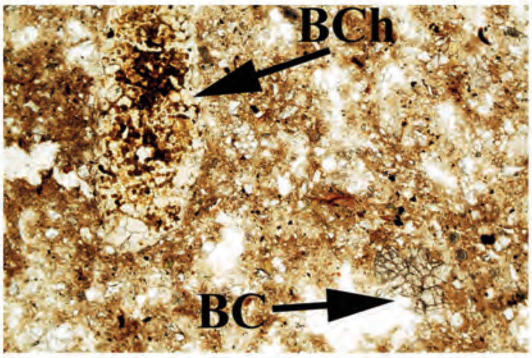

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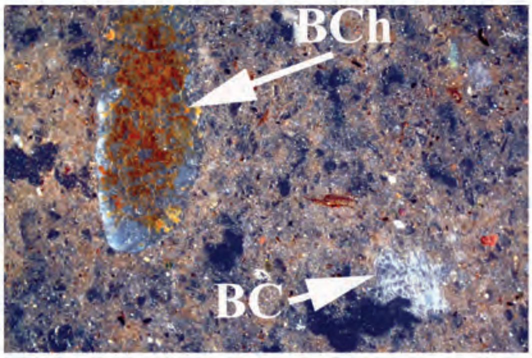

G

Plate 16 Microphotographs from 26.535km, Wennington Marsh

The latter is somewhat enigmatic because there is a strong representation of freshwater types in the on-site vegetation, especially Cyperaceae, but with high values of Chenopodiaceae which, with Hystrichopheres (dinoflaggellates) and *Aster*-type, may indicate saline conditions with development of saltmarsh. A notable peak of *Sinapis*-type may come from coastal/ maritime taxa such as *Raphanus raphanistrum* (radish), *Cakile* (sea kale) or other coastal Brassicaceae. The ostracods and foraminifera provide the sediments with a strong brackish mudflat-and-creek signature throughout, with full tidal access (*Table 44*), although small numbers of cyprinid fish bones, vole teeth and frog/toad bones, suggest the possibility of small freshwater streams inputting here. The freshwater ostracods that were present are able to withstand low salinity.

Chainage 26.800km

At 26.800km (Figs 49 and 52) a deep sequence of deposits was exposed where the pipe trench crossed an extant drainage ditch. The lowermost deposit comprised a mid-grey organic silty clay alluvium between -3.35m and 3.20m OD (context 274). Overlying this was a thick peat bed (context 273) between -3.30m and -2.2m OD, sealed by a series of minerogenic alluvial deposits and modern marsh topsoil to +0.70m OD.

The base of the peat at -3.2m OD was radiocarbon dated to the Late Neolithic, 2890–2620 cal BC (NZA-16272, 4171±45 BP), suggesting the main period of peat formation occurred during the Late Neolithic and Bronze Age. Unfortunately only spot bulk samples were retrieved from the lower alluvium (context 274) and peat (context 273) due to safety issues when accessing the trench. The samples contained seeds and cones of *Alnus glutinosa* as well as *Quercus*, buds and seeds of *Rubus fruticosus* agg. (*Table 45*). The bark beetle *Dryocoetinus alni*, which is often associated with alder, was also present in context 274 along with the alder leaf beetle *Agelastica alni*, the water beetle *Ochthebius* cf *minimus* and *Stenus* sp. (*Table 46*). The pollen assemblage (*Table 47*) from both contexts 274 and 273 contained high numbers of trees and shrubs; *Quercus, Corylus avellana*-type and *Tilia*. *Alnus* was important forming freshwater alder carr woodland.

Chainage 27.460km

The pipe trench at 27.460km (Figs 52 and 53) was excavated to 2.1m. The lowermost deposit exposed comprised 0.30m of firm dark reddish-brown wood peat (context 272) with discontinuous laminations of blue silty clay and shell fragments at -1.36 to -1.06m OD. This was overlain by a further deposit of dark brownish-black fibrous silty peat (context 271) with frequent woody fragments (-1.06 to -0.92m OD). The top of the peat (context 271) was radiocarbon dated to the Early to Middle Bronze Age at 1610–1410 cal BC (NZA-16299, 3217±40 BP).

Peat

Environmental remains from the peat suggest mixed fen woodland and included buds of *Populus* sp. (poplar), nuts of *Corylus avellana* and seeds of *Rubus fruticosus* agg., *Urtica dioica* and *Carex* spp. (*Table 45*), along with the water beetle *Ochthebius* cf *minimus* (*Table 46*). The pollen assemblage contained high values of *Alnus* and, with Cyperaceae and occasional aquatics (eg, cf *Callitriche*), show that an alder carr woodland was responsible for the peat accumulation (*Table 47*). There were numerous monolete spores of *Dryopteris*-type and also present was *Thelypteris palustris*. Herb diversity was smaller than in the overlying mineral sediments, although Poaceae has a basal peak. The importance of *Quercus*, with some *Fraxinus*, may also be attributed to growth in drier areas of this carr woodland. Woodland dominated by *Quercus, Tilia, Corylus* and *Fraxinus* was present in the catchment. *Tilia* was an important constituent of the woodland and, given its poor pollen representation (Andersen 1970; 1973), was possibly dominant or co-dominant with *Quercus* on the better drained soils.

Upper silty clays (medieval palaeosol)

Similar to other profiles on Wennington Marsh the peat was sealed by a series of estuarine alluvial deposits; initially an orangey-brown silty clay alluvium (context 270). The pollen assemblages at this level showed much reduced quantities of tree (especially *Tilia*) and shrub pollen and *Alnus* in the marsh category. Conversely, there were higher quantities of herbaceous-types with Poaceae dominant with greater diversity including peaks of *Sinapis*-type and *Cerealia*-type. Cyperaceae replaced *Alnus* as the dominant marsh taxon. There was some indication of tidal ingress with the brackish water ostracod *Cyprideis torosa* and the foraminifera *Ammonia limnetes* (*Table 48*).

Overlying this was a thin deposit of dark greyish-brown silty clay (context 269). Similar to context 234 at 26.535km (see above), this is interpreted as an ephemeral dry phase which saw increased soil formation. Sediment from the upper part of this context was radiocarbon dated to the medieval period, cal AD 1290–1420 (NZA-16273, 584±40 BP).

Thin-section analysis of context 269 (monolith 438, Fig 53; Appendix B) revealed a lower unit composed of heterogeneous humic clays with silt and a little sand (Pl 17A–D). Blackened, humified and charred organic matter inclusions were unoriented. The deposit was characterised by burrows and channels, an angular blocky structure, iron staining, and trace amounts of pyrite and gypsum. This lower unit may be interpreted as a ripened, once-laminated peaty or humic clay sediment. The uppermost 5mm of context 269 comprised a dark reddish brown layered humified peat with small biochannels containing very thin organic excrements (Pls 17A and 17F). It was not burrowed and the horizontal orientation of the plant fragments was preserved. Overall this probably records a renewed rise in water table which resulted in laminated peat formation. This peat, in turn, was affected by minor ripening (eg, humification and bio-chamber fills of organic excrements; Dinç *et al* 1976; Schoute 1987), again indicating fluctuating water tables. Bulk analysis revealed context 269 to have relatively high organic matter content and organic phosphate values were also higher. There was, however, no evidence of phosphate-enrichment beyond that which might be anticipated as a result of phosphate concentration through nutrient natural cycling and no signs of magnetic susceptibility enhancement.

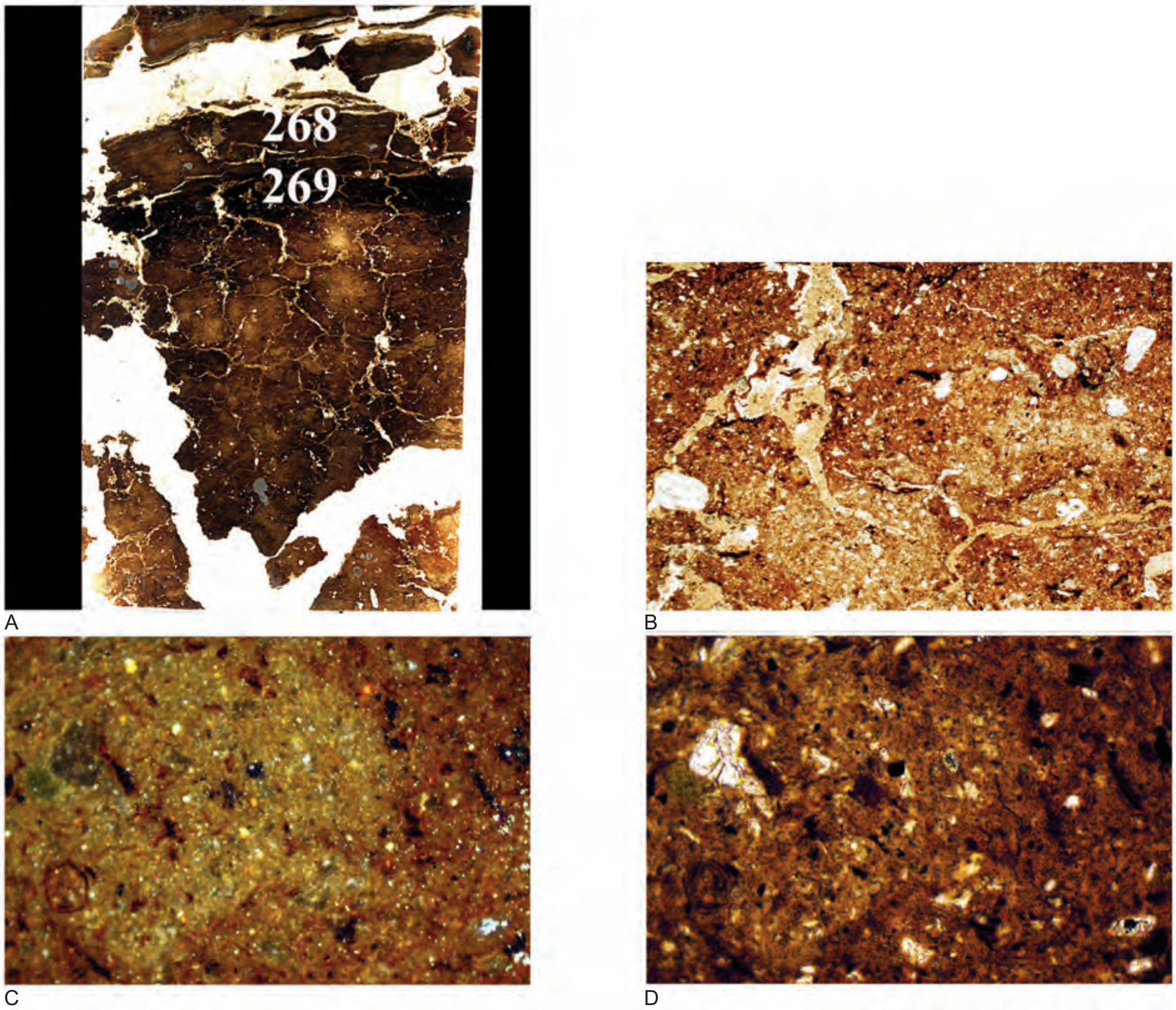

Plate 17 Microphotographs from 27.460km, Wennington Marsh. A) Monolith 438 thin section, contexts 268 and 269: Very fine sandy laminated context 268, over very dark reddish uppermost context 269 (partially humified peat). Peat formed over humic clays (lower context 269) that have undergone sediment ripening and angular blocky structure formation; minor post-depositional cracking has also affected the peat. Width is ~50mm. B) Monolith 438, lower context 269: Burrowed and homogenised humic silty clay, with curved planar void development (angular blocky structures). Plane polarised light (PPL), frame width is ~4.6mm. C) Detail of B: Under oblique incident light (OIL), showing biomixing of dark brown humic and pale poorly humic, clayey silts. Frame width is ~2.3 mm. D) As C: Showing presence of humic clay, coarse silt and very fine sand. PP

The environmental remains suggest grassland, possibly pasture, was dominant on-site during this period. Waterlogged seeds included *Potentilla anserina* (silverweed) and some seeds of *Juncus* sp. Tree pollen values were low in samples from layer 269. Pollen in the upper horizon had better preservation than the lower and had high values of Poaceae along with some Lactucoideae and Cyperaceae. The lower horizon had typical differential preservation of pollen in favour of the more robust pollen taxon, Lactucoideae. No ostracods or foraminifera were preserved in this deposit but fragments of Cladocerans may tentatively suggest freshwater conditions.

Thin section analysis of the overlying deposit (context 268) revealed it to be composed of multiple thin (2–4mm) laminations of very fine sand and humic clay; the latter was also characterised by high concentrations of blackened and charred fine organic matter (Pls 17E, 17G and 17H). The evidence indicates renewed alluviation/flooding events. Arboreal pollen recovered in this layer compared to below with increases in *Ulmus, Quercus, Corylus avellana*-type and *Alnus*. Herbs showed an expansion of Chenopodiaceae, which along with Aster-type and large (non-cereal) Poaceae may suggest marine/brackish water influence. The sequence was capped by the modern marsh topsoil to 0.73m OD. The ostracod and foraminifera assemblages were similar to others from the upper alluvium on Wennington Marsh suggesting a strong tidal influence.

The Archaeological Evidence

Early Neolithic

During the watching brief at 24.455km (Fig 50), on Rainham Marsh, an Early Neolithic *in situ* flint knapping scatter was identified in the base of the pipe trench within the sandy palaeosol (context 192) sealed by peat (see 24.455km above for detailed description of the

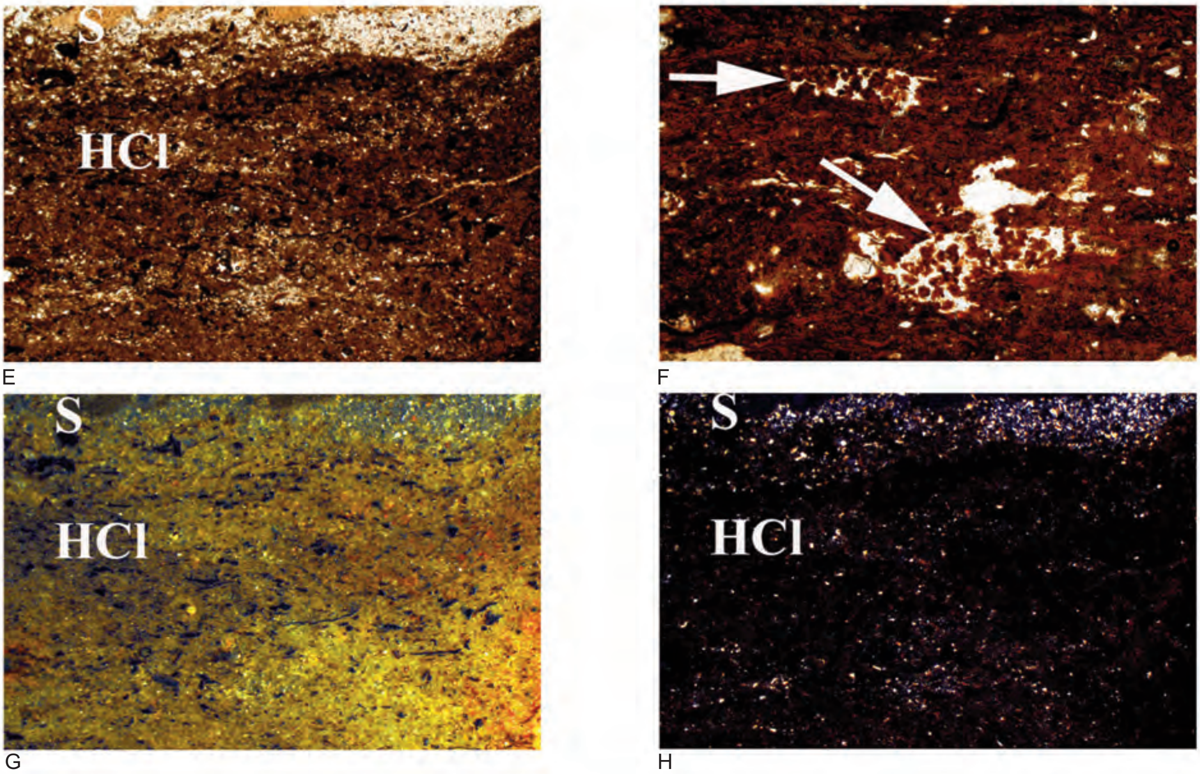

Plate 17 continued: E) Monolith 438, context 268: Junction between humic clay (HCl) and very fine sand (S) laminae. PPL, frame width is ~4.6 mm. F) Monolith 438, upper 5mm of context 269: Dark reddish brown humified peat colours and bio-channels containing very thin organic excrements of mesofauna (arrows); no coarse burrows were observed. PPL, frame width is 2.3mm. G) As E: under OIL; note very abundant sub-horizontally oriented detrital, blackened and charred organic matter in the humic clay (HCl) layer. Reddish staining on right hand side is due to iron impregnation. H) As E: Under cross polarised light (XPL); note occurrence of very fine sand- (S) size quartz

sedimentary sequence). The majority of the assemblage was recovered from the upper 0.10m of context 192, exposed over a $2m^2$ area. A total of 65 worked flints were examined by Hugo Anderson-Whymark, which included 31 chips from sieving of bulk samples (*Table 49*). The 30 flakes were generally of narrow proportions (10 blade-like pieces) and many exhibited platform-edge abrasion. The flakes were struck using both hard and soft hammer percussors. Side and distal trimming flakes were present within the assemblage, indicating that cores were prepared on site. A fragment of a face rejuvenation flake was also present. A refitting exercise located a knapping refit between two blade-like flakes. Both flakes possessed a distinctive olive green cortex. Several flakes, although not refitting, appeared to be of the same flint. The presence of a refit and several possibly related flints indicates the material recovered may have formed part of an *in situ* knapping scatter. A single, platform flake core and two small, crude multi-platform flake cores were also present. Platform edge abrasion was apparent on two of the cores. Scars present on the side of a blade-like flake indicate that it was struck from a well-prepared blade core, although none were present in the assemblage. The reduction strategies employed on the majority of the assemblage, despite being relatively careful, exhibiting platform edge abrasion and face rejuvenation, appear to be aimed at the production of flakes and blade-like flakes rather than blades and bladelets. A Neolithic date for the scatter would seem most appropriate and the radiocarbon date on the base of the peat sealing the flint scatter would seem to support this. The only diagnostic artefact recovered is a very fresh microlith of Late Mesolithic geometric form (Type 7a1, Jacobi 1978, 17).

The sedimentary and environmental evidence indicates that this activity is likely to have occurred on a slightly raised area of higher drier ground at the edge of the gravel terrace and an area of wetland alder carr that extended onto the floodplain. Oak, hazel and lime woodland, with some ash and elm, probably grew on the terrace. No other archaeological features were identified and the scatter probably represents a short-lived activity area, perhaps associated with more permanent settlement on the higher ground of the gravel terrace. At the Brookway site to the north-east evidence of Neolithic occupation was identified crossing from a dry gravel outcrop into the marsh. The artefact assemblage included pottery of the Plain Bowl tradition and some Mildenhall style wares, along with a large amount of flint knapping debris (MoLAS 2000). Neolithic features also included pits, post-holes, a gravel surface and a hearth. Some post-holes appeared to from part of a structure. At Launders Lane, further to the north, a ritual monument in the form of a ring ditch 15m in diameter was found associated with a central pit, Mildenhall pottery and worked flint (Meddens 1996, 325; MoLAS 2000, 68–9).

Later prehistoric

No archaeological remains were identified from the Bronze Age or Iron Age. The sedimentary and environmental evidence indicates fresh water alder carr continued to dominate the low-lying floodplain during the later Neolithic and Early Bronze Age with mixed oak woodland on the drier ground. The upper part of the peat/organic profiles examined on Rainham and Wennington Marsh frequently demonstrated a general trend to more open environments from the Middle Bronze Age with the development of freshwater grass-sedge-reed fen or swamp. The high minerogenic content of much of these deposits suggests increased episodes of flooding and alluviation were occurring. This was probably a result of rising water tables as a consequence of an increase in the rate of sea-level rise; a prelude to more widespread estuarine inundation.

The area around Rainham is rich in archaeology of this period. Major occupation appears to have been largely confined to the dry ground of the gravel terraces, as evidenced by the distribution of cropmarks, findspots and potential settlement sites. However, there is increasing evidence to suggest that activity extended onto the floodplain, in the form of seasonal activity. Increased wetness during the later periods may have instigated the widespread building of timber trackways to maintain access to the marsh. At Bridge Road, Rainham, wooden structures were located on the bank of Rainham Creek along the northern edge of a gravel rise, forming an insubstantial brushwood trackway constructed using coppiced alder. A small rectangular enclosure was identified adjacent to the trackway. Two radiocarbon dates from the trackway – 1430–1010 cal BC (Beta-58377, 3000±80 BP) and 1730–1270 cal BC (Beta-58378, 3210±90 BP) – place it in the Middle to Late Bronze Age (Meddens and Beasley 1990, 244).

Roman

Archaeological remains dating to the Roman period were recorded within the upper alluvium at 24.455km on Rainham Marsh (Fig 50). This comprised an assemblage of pottery and animal bone associated with a channel edge within an open environment of grass-sedge-reed fen or swamp. It is likely that the artefact assemblage represents in-washed deposits from a nearby area of activity at the floodplain edge. During the excavations at Brookway activity dating to this period was identified on the gravel terrace, including a field boundary and drainage ditch (MoLAS 2000). Ditches identified in a watching brief for the Horndon-Barking pipeline on Rainham Marsh were also thought to be of Roman date (Birbeck and Barnes 1995).

The pottery, assessed by Edward Biddulph, comprised 47 sherds, weighing 123g, and was recovered from channel deposit 194 (*Table 50*). The condition of the pottery was poor, with sherds being small and abraded, probably as a result of weathering and redeposition. Shell-tempered ware formed the largest proportion with smaller quantities of sand-tempered grey ware and grog-tempered ware. A single sherd of fine 'Upchurch'-type oxidised ware was also present and a rim sherd, possibly from a beaker, was present in grog-tempered ware. The oxidised and shell-tempered wares are characteristic of North Kent products, although local manufacture cannot be ruled out for the grey ware and grog-tempered ware. The pottery can be assigned to the late 1st century AD although, given the condition of the material and the possibility of it being entirely residual, final deposition may have occurred in the early 2nd century AD. The context also yielded two sherds of handmade, flint-tempered ware. This tends to date to the Iron Age, but is not necessarily out of place within a later 1st century assemblage.

The small animal bone assemblage, examined by Emma-Jayne Evans, comprised six bones of cattle, sheep/goat and horse. Butchery marks were noted on a cattle mandible and a sheep/goat 1st phalanx, which was also charred black, indicating that animals were processed, probably for consumption and/or marrow extraction. Fusion data suggests that at least one sheep/goat died before reaching 1½ years old.

Medieval

Medieval activity was recorded on Wennington Marsh, directly beneath the A13 flyover at 25.540–26.535km. This comprised an artefact-rich occupation soil and drainage ditch identified within the upper minerogenic alluvial deposits.

The pottery assemblage, examined by Paul Blinkhorn, consisted of 78 sherds with a total weight of 678g. The range of ware types present indicate that there was medieval activity at the site from around the time of the Norman Conquest until the mid-late 13th century, with perhaps another phase during the 16th century. The small size of the assemblage does however mean that it is possible that the medieval activity continued up until that time. Some of the pottery types are common in London, and where appropriate, the Museum of London fabric codes have been used (Vince 1985, 38). These include Shelly Limestone ware (SHEL), early medieval Sand and Shell ware (EMSS), London ware (LOND), Kingston-type ware (KING) and Mill Green ware (MG). Three other wares were also noted, and appear likely to be the products of kilns in Essex or south Suffolk. These include Sandy Coarseware (SANDY), a Micaceous Coarseware (MICA) and Red Earthenwares (RE). The pottery occurrence by number and weight of sherds per context by fabric type is shown in *Table 51*. Each date should be regarded as *terminus post quem*.

The small animal bone assemblage, assessed by Emma-Jayne Evans, comprised three bones, one each of cattle, sheep/goat and pig, along with a piece of red deer antler. With the exception of the antler, all exhibited butchery marks and fusion data suggests that the pig remains belonged to an individual that died before reaching two years of age. Fusion data, along with the presence of butchery marks, may suggest that pigs were kept for meat. As pigs can produce large litters outside the usual seasonal cycles followed by cattle and sheep, a plentiful supply of pork is always available; therefore pigs are usually killed prior to full maturation (Dobney *et al* 1996). However, the age at death of one individual may not be representative of the population as a whole. Carnivore gnawing was noted on a sheep/goat tibia, indicating that the bone was exposed on the surface before its final deposition.

The charred grain from feature 253, examined by Mark Robinson, included free-threshing *Triticum* sp. (rivet or bread wheat), hulled *Hordeum* sp. (hulled barley) and *Avena* sp. (oats) (*Table 52*). Arable weed seeds, such as *Galium aparine* (goosegrass) and *Anthemis cotula* (stinking mayweed) were also present. This assemblage is typical of Saxon or medieval crop-processing activity.

The concentrations of artefactual material at this location indicates there may have been a settlement nearby that was either seasonal or on higher ground. The site is approximately 500m to the south-east of the village of Wennington and originally lay within the ancient parish. The parishes probably formed out of early medieval Manors recorded in *Domesday Book*. The exact location of the Manors is uncertain but it is likely that historic centres of settlement grew up around them. Several early pre-Conquest charters mention land at Wennington given to Westminster Abbey, including a burh (fortified settlement/house) mentioned in a charter dated to *c* AD 1042–4 (*VCH Essex* vii, 182). At the time of the *Domesday* Survey the manor comprised 2½ hides and was in the possession of St Peter's, Westminster. The location of the village on the very edge of the marsh, close to a navigable creek inland, suggests that it may have originated as an early sea-borne settlement (*ibid*, 180). The size of the later parish of Wennington is far larger than the 2½ hides recorded in *Domesday Book*, suggesting that most of the marshland at that time of the *Domesday* recording was marsh and probably used to graze the sheep that are recorded for the manor (*ibid*, 185). During the medieval period it is probable that each of the Manors at Rainham, Wennington and Aveley owned a part of the coastal marsh, or at least had access to it for grazing or other seasonal activities (Oxford Archaeological Unit 2001).

The deposits at 26.535km and 26.540km are in the vicinity of the former Wennington Creek, which is thought to have run roughly north-east to the village of Wennington (Fig 52). Documentary sources suggest that this watercourse was navigable up until the late medieval period, after which it silted up (Oxford Archaeological Unit 2001, 11). The occupation soil may represent a phase of intentional land reclamation. By the end of the 12th century there are documentary references to 'inning' (ie, reclamation) of Wennington Marsh: in 1198 nineteen acres of 'New Land' is mentioned, in the early 13th century 'New marsh' and 'Old marsh' are distinguished and in 1563 the parish had 331 acres of 'inned' marsh (*VCH Essex* vii, 185). Reclamation took the form of the construction of channels around parcels of land. Marsh embankment at Wennington Creek, for which the earthworks are still extant to the south and east of the route corridor, began to be constructed in the 12th century. The purpose of reclamation of 'waste' (marginal land) would have been primarily economic, providing good-quality grazing for livestock and fertile land for crops. Investigations on Canvey Island *c* 20km to the east revealed remains of a series of medieval midden (rubbish) deposits and hearths dated from the 12th to 15th centuries which probably represent temporary settlement by shepherds (Wymer and Brown 1995 quoted in Green 1999, 18). It has been suggested, taking into account the position of Wennington Creek and cartographic sources, that the oldest (medieval) part of the reclaimed marsh occupied the north-eastern area shown on an estate map of 1619 (*VCH Essex* vii 185 in Oxford Archaeological Unit 2001), coinciding with the location of occupation deposits identified during the watching brief.

The occupation horizon at Wennington Marsh is overlain by additional minerogenic silt-clays, in some cases laminated with sand. If land reclamation was being carried out at this location it appears to have been initially unsuccessful and may have been temporarily abandoned. In the 13th century commissions were granted for the review and repair of the marsh defences in the region and serious flooding on Rainham marsh led to that community's taxpayers, together with those of neighbouring Wennington and Aveley, to petition for relief from a subsidy in 1452 on the grounds of their losses to the Thames (*VCH Essex* 7, 134–8 in Galloway and Potts 2007, 10).