C263 ARCHAEOLOGY LATE EAST

Fieldwork Report
Evaluation and Watching Brief
Plumstead Portal – XSW11

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Non technical summary

This report presents the results of a field evaluation carried out by the Museum of London Archaeology (MOLA) on the site of Plumstead Portal, White Hart Avenue, London SE28, in the London Borough of Greenwich. This report was commissioned from MOLA by Crossrail Ltd.

This work is being undertaken as part of a wider programme of assessment to quantify and mitigate the archaeological implications of railway development proposals along the Crossrail route.

The sequence within Trenches 1 and 2 and the boreholes on the site shows gravels and sands overlain by peats and sealed by alluvial clays. The elevation of the surface of the Pleistocene/Early Holocene indicates a series of braided river channels within a low lying area of Landscape Zone 2 (LZ2) on the western margins of main channel (LZ3). The extent of the channel was confirmed with the borehole survey, refining the eastern boundary of the channel, which is estimated to be more than 200m wide and up c 3m deep. This feature formed a major part of the floodplain landscape from the Early Holocene, and probably became a major route of drainage when the other early Holocene channels identified in LZ2 became abandoned. It is possible that the channel forms an abandoned arm of a former course of the Great Breach Dyke, which existed from the Early Holocene into the Bronze Age period. A General Watching Brief was held on the site of the Marmadon Sewer, at the east end of the Portal in June 2014. The Sewer had removed all earlier remains.

During the Mesolithic period the area was a terrestrial land surface. This was followed by a rise in sea level by the Early Neolithic leading to waterlogging and widespread peat formation into the Bronze Age. Within the peat deposits worked timbers were recorded which may have formed parts of structures such as trackways, bridges, platforms and jetties constructed to access and traverse the wetlands. The alluvial deposits are likely to be of Iron Age, medieval and historic date representing inundated floodplain soils.

The upper 1.20m thick rubbish dumps represent making up and levelling an area prior to the construction of the rail track and buildings in the vicinity, including the foundations of a former chimney and furnace, and a concrete cooling tower.

The site has the potential to provide a high resolution, site specific palaeoenvironmental reconstruction. Data sets such as this need to be integrated and synthesised into their wider environmental context. This will allow broader models derived from the Late East data set as whole to focus down to the human scale in order to understand how the changing landscape would have influenced human behaviour, exploitation of the landscape and changing settlement patterns. Because of this potential the results from Plumstead Portal are assessed as being of regional significance.

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1 Introduction

This report describes the archaeological evaluation and watching brief work carried out at the Plumstead Portal site by the C263 Museum of London Archaeology (MOLA). The North Woolwich portal is located within the existing railway corridor of the former North London Line (NLL), between Factory Road and Albert Road, in the London Borough of Newham, National Grid Reference 542700 180000.

All levels in this report are quoted in metres Above Tunnel Datum (m ATD). Tunnel Datum is calculated as being 100m above Ordnance Datum eg 1m OD = 101m ATD.

All fieldwork was conducted between 11/04/12 and 09/06/14 and supervised by Portia Askew (MOLA Supervisor), Virgil Yendell (MOLA Senior Geoarchaeologist) and Jason Stewart (MOLA Geoarchaeologist), and included the following:

Fieldwork summary table

Task	Principal Contractor	Date
• **Borehole Survey** (6 boreholes on an east-west transect to the east of the portal)	Hochtief/Murphy Joint Venture (C310)	11/04/12 to 13/04/12
• **Targeted Watching Brief** (located within the footprint of the portal during ground reduction works)	Hochtief/Murphy Joint Venture (C310)	18/06/12 to 01/10/12
• **Trial trench evaluation** (Trench 1 located at the western end of the portal)	Hochtief/Murphy Joint Venture (C310)	01/08/12 to 08/08/12
• **Trial trench evaluation** (Trench 2 located at the eastern end of the portal)	Hochtief/Murphy Joint Venture (C310)	01/10/12 to 10/10/12
• **General Watching Brief** (located during ground reduction works following completion of Trench 2)	Hochtief/Murphy Joint Venture (C310)	15/10/12 to 17th /10/12
• **General Watching Brief on Marmadon Sewer** (Located in the	Hochtief/Murphy Joint Venture	09/06/14

footprint of the portal following the diversion of the sewer)	(C310)	

The Plumstead site lies within the London Borough of Greenwich. The area of the works is comprised of two construction compounds to the north of the existing North Kent Line (NKL). To the west of White Hart Road lies the 'West Worksite', also known as the Plumstead/Old Goods Yard worksite, and to the east lies the 'East Worksite'. The portal site falls within the 'East Worksite', situated between White Hart Road and Church Manor Way. It is within this part of the site that the archaeological evaluation trenches are to be undertaken. The portal site centres approximately on National Grid Reference (NGR) 545546 178885 (Fig 1). The event code (site code) is XSW11.

The investigation was intended to assess the archaeological potential across the area of the proposed Crossrail line and mitigate its impact on any archaeological remains encountered.

The fieldwork was carried out in accordance with:

- A **Site-specific Archaeological Written Scheme of Investigation** (SS-WSI - C156 *Plumstead Portal, Crossrail, Doc. No. C156-CSY-T-RGN-CR148_PT005-00028 Version 4, Dec 2010* and the *WSI Addendum C122-OVE-T1-RGN-CR148_PT005-50001*
- C263 Archaeology Late East, ***Method Statement**, Archaeological Evaluation, Non Listed Building Recording Assessment and General Watching Brief, Plumstead Portal, Doc. No. C263-MLA-X-RGN-CRG07-50042 Version 4, 10-07-12*

2 Planning background

The legislative and planning framework in which all archaeological work took place is summarised here:

The overall framework within which archaeological work will be undertaken is set out in the Environmental Minimum Requirements (EMR) for Crossrail (http://www.crossrail.co.uk/therailway/ getting-approval/parliamentary-bill/environmental-minimum-requirements-includingcrossrail- construction-code). The requirements being progressed follow the principles of Planning Policy Guidance Note 16 on archaeology and planning (1990). Accordingly the nominated undertaker or any contractors will be required to implement certain control measures in relation to archaeology before construction work begins.

Schedules 9, 10 and 15 of the Crossrail Act (2008) concern matters relating to archaeology and the built heritage and allows the dis-application by Crossrail of various planning and legislative provisions including those related to listed building status, conservation areas and scheduled ancient monuments (Schedule 9). Schedule 10 allows certain rights of entry to English Heritage given that Schedule 9 effectively dis-applied their existing rights to the Crossrail project, and Schedule 15 allows Crossrail to bypass any ecclesiastical or other existing legislation relating to burial grounds.

Notwithstanding these disapplications, it is intended that agreements setting out the detail of the works and requiring relevant consultations and approvals of detail and of mitigation arrangements will be entered into by the nominated undertaker with the relevant local planning authorities and English Heritage in relation to listed buildings and with the Department of Culture, Media and Sport (DCMS) and English Heritage in relation to Scheduled Ancient Monuments (SAMs).

3 Scope of the report

This report has been commissioned from Museum of London Archaeology (MOLA) by Crossrail Ltd. The report has been prepared in accordance with the following guidance and standards:

- English Heritage Centre for Archaeology Guidelines, Environmental archaeology: a guide to the theory and practice of methods, from sampling and recovery to post-excavation (2002)
- English Heritage, 2004, Geoarchaeology: using earth sciences to understand the archaeological record
- Institute for Archaeologists (IFA) Standards and guidance for watching briefs and field evaluation (IFA 2009)
- Museum of London Archaeological Site Manual (1994)
- Museum of London General Standards for the preparation of archaeological archives deposited with the Museum of London (1998)
- United Kingdom Institute for Conservation's Conservation Guidelines No. 2

It considers the significance of the fieldwork results (in local, regional or national terms) and makes appropriate recommendations for any further action, commensurate with the results.

4 Previous work relevant to archaeology of site

Previous Crossrail studies are as follows:

- *Assessment of Archaeology Impacts, Technical Report, Part 4 of 6, South-East Route Section: Isle of Dogs to Abbey Wood.* Crossrail 2005 (Doc No. 1e0318-E2e00-00001)

- *MDC4 Archaeology Planning And Environment, Package Specific WSI Deliverable, Detailed Desk Based Assessment (DDBA) Plumstead Portal*, Crossrail 2008 (Doc. No. CR-SD-PRW-X-IS-00003)

Previous site investigations

- *Archaeological Monitoring of Ground Investigations, Borehole Package 10, Plumstead Portal,* (Crossrail 2006 Doc. No. 1E0418-E2E00-00002).

- *Archaeology Monitoring Of Ground Investigations, Borehole Package 20, Plumstead Portal* (Crossrail, February 2009).

- *Enabling Works, Plumstead Portal, Geoarchaeological Monitoring of Utilities Trial Trenches at White Hart Depot*, (Crossrail June 2010).

- C263 Late East, *Non Listed Built Heritage Recording Report – Plumstead Portal, Worksites West and East,* Doc No C263-MLA-X-RGN-CRG07-50025 Version 1 28-09-12

Standard documents / methodology etc.

- *Archaeology, Specification for Evaluation & Mitigation (including Watching Brief) section 7.A.1* (Crossrail, 2009, Doc. No. CR-PN-LWS-EN-SP-00001 Ver. 0.3)

- *Environmental Minimum Requirements* (Crossrail 2008)
- *Archaeology Specification for Evaluation & Mitigation (including Watching Brief)* (Crossrail 2009 CR-PN-LWS-EN-SP-00001; version 3)
- *Crossrail Code of Construction Practice*
- *A Site-specific Archaeological Written Scheme of Investigation (SS-WSI - C156 Plumstead Portal,* Crossrail, Doc. No. C156-CSY-T-RGN-CR148_PT005-00028 Version 4, Dec 2010 and the *WSI Addendum* C122-OVE-T1-RGN-CR148_PT005-50001
- C263 Archaeology Late East, *Method Statement, Archaeological Evaluation, Non Listed Building Recording Assessment and General Watching Brief, Plumstead Portal,* Doc. No. C263-MLA-X-RGN-CRG07-50042 Version 4, 10-07-12

5 Geology and topography of site

The site is situated on the southern fringes of the Holocene alluvial floodplain of the Thames. Just to the south of the site, outcrops of the Tertiary Woolwich and Reading beds form an area of higher ground. The site lies between the high and dry ground towards the south, and the wetland landscape towards the north.

The alluvial deposit sequence across the site was characterised in a previous geoarchaeological deposit model (document no. C263-MLA-X-RGN-CRG07-50001), utilising geotechnical data gathered from ground investigate works. Within the study area three Landscape Zones (LZs) were identified, two of which (LZ2 and 3) fall within footprint of the portal. The characteristics of these zones are as follows:

LZ2- An area of prehistoric peats and wetland deposits that cover the western and far eastern end of the portal footprint. Across this zone the surface of the basal floodplain gravels lies at *c* 98–99m ATD. These gravels belong to the Shepperton Gravel formation and were deposited within a cold climate braded river regime between 18 000 to 15 000 years ago. These gravels mark the base line for deposits of archaeological interest.

The gravels are overlain by thin beds of fine sand and silts, that represent fluvial deposition within a multiple threaded freshwater channel system during the Late Glacial/Early Holocene period, approximately 15 000 to 10 000 years ago. Following climate amelioration, channel stabilisation and down cutting, terrestrial soils may have formed across the surface of these sand and gravels. By the Neolithic period, *c* 6000 years ago, the effects of relative sea level rise resulted in a rise in river levels and the ground waterlogging of these terrestrial land surfaces. This gave rise to peat formation that continued in to the Bronze Age period *c* 4000 years ago. Previous palaeoenvironmental work carried out in the area on these peat deposits demonstrates that the peat formed within semi terrestrial alder carr wet woodland.

By the Iron Age the up stream migration of the tidal head, and the onset of fully estuarine conditions, resulted in a switch from biogenic peat formation, to minerogenic sedimentation. The peats are therefore found to be sealed by clays and silts deposited within intertidal salt marsh and mudflat conditions. This tidal inundation continued into the medieval period, gradually raising and levelling off the undulating topography of the floodplain surface. The upper part of the alluvial sequence displays evidence of soil formation indicative of seasonally inundated accretionary floodplain soils. The entire Holocene sequence measures up to 3m in thickness.

LZ3 -This zone falls across the central section and the majority of the eastern end of the portal footprint. It characterises a major palaeoenvironmental feature orientated on a north south alignment. Across the zone the surface of the floodplain gravels occurs at c 96.5m ATD, and indicates a phase of possible channel incision into the relict gravel surface.

The gravels are overlain by a complex and variable set of channel fills that consist of sands, silts, organic deposits and thin peat lenses. The sand and silts represent fluvial deposition within active parts of the channel belt, while the organics and peats formed

during episodes of channel cut off and abandonment, or in channel marginal areas colonised by aquatic vegetation. Overall the full depth of the channel fills measure up to *c* 3m in thickness.

Just to the south of the site a tributary a channel known as the Great Breach Dyke flows northwards off the high ground before turning to a north easterly direction. It is possible that the palaeochannel feature may represent a former course of this channel. Interestingly, recent excavations to the north of the site on Belmarsh prison also identified a similar channel in terms of depth, level and complexity, also running on a north to south alignment. Despite the uncertainty of the association of these two features with the palaeochannel within LZ3, the palaeochannel probably formed a dominant feature of the landscape from the Early Holocene through to the later prehistoric periods.

The channel sediments are sealed by thick peat deposits overlain by minerogenic clays and silts. These peats and minerogenic deposits are probably associated with the alder carr peats and intertidal muds and salt marsh deposits that accumulated within LZ2. The channel fills and overlying floodplain deposits form a sequence that measures up to 5m in thickness.

6 Research objectives and aims

The overall objectives of the evaluations and watching brief is to establish the nature, extent and state of preservation of any surviving archaeological remains that will be impacted upon by the development. The work also aimed to examine, sample and record the floodplain deposit sequence and assess its level of potential for the reconstruction of past landscapes.

A number of site specific research aims were stated in the Written Scheme of Investigation (Doc. No. C122-OVE-T1_RGN-CR148_PT005-50001 see section 3.3.1). These are:

- What is the development of the local landscape and topography of the Thames floodplain from prehistory to the medieval period? At what level are any peat deposits present and at what date did they form? Is there evidence for stream channels, lakes, etc in the flood plain gravel surface?
- Is there any evidence for prehistoric activity? If prehistoric remains are present, what is their character and what can be learned about the exploitation of the floodplain by prehistoric groups? In particular, is there any evidence for Mesolithic activity at the base of the alluvium/surface of the gravels? Is there any evidence for timber trackways or other structures of later prehistoric date?
- What can be learned about the processes of medieval land reclamation and land management? Can any evidence for medieval activity be associated with the village of Plumstead to the south?
- What is the nature of any evidence for post-medieval activity? Is there any evidence for industrial activities, such as quarry pits?
- Are any remains of early railway infrastructure present, associated with the construction of the NKL in the 1840s?

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7 Methodology of site-based and off-site work

All archaeological excavation and geoarchaeological work and recording during the evaluation was carried out in accordance with the C263 archaeology Late East Method Statement Archaeological Evaluation and Non-Listed Building Recording Assessment Plumstead Portal, November 2011, document number C263-MLA-X-RGN-CRG07-50042, Revision 6.0, and the Museum of London *Archaeological Site Manual 3rd edition* (1994).

The site finds and records can be found under the site code XSW11 in the MOLA archive. They will be stored there pending a future decision over the longer-term archive deposition and public access process for the wider Crossrail scheme.

7.1 Evaluation Methodology

The geoarchaeological boreholes (BH1–6) were located along an east/west transect across the site and monitored and recorded by a MOLA geoarchaeologist. Starter pits were hand excavated down to 1.2m bgl (below ground level) and then bored by a terrier rig to varying depths. The various sediments encountered in the boreholes were logged by a geoarchaeologist according to standard geoarchaeological criteria

The locations of the two trenches were sited to form an adequate sample of the site where archaeology might survive, following the results from the geoarchaeological evaluation where peat and alluvial deposits were identified. The location of Trenches 1 and 2 are illustrated in Fig 1. Both trenches were excavated to the surface of the floodplain gravels marked the baseline for deposits of palaeological/palaeoenvironmental interest.

They were initially located adjacent to the south side of the tunnel wall, but moved 3 metres northwards, due to necessary engineering constraints, specifically the construction of a steel support frame between the tunnel walls.

Trench 1 was, as a result, divided into four areas, designated 1A–1D and measured 25m east–west and varied in width along its length from 3.80–8.00m. The depth of the trench ranged from 0.60m to the west (Trench 1A) and 1.0m at the east end (Trench 1D). The diverse widths of the trench arose during the recording process when it was considered expedient (given the shallow depth of deposits) to extend the excavation areas in order to maximise retrieval of further timbers that may survive within the peat deposits.

Trench 2, located some 75 metres to the east of the Trench 1 was excavated as a continuous strip and benched due to the greater depth of deposits surviving in this part of the site. The trench measured 24m long by 8m wide at the top and sides were stepped (1:1) due to the greater depth of deposits (3m deep) surviving in this part of the site. The base of the trench measured 21m long by 3.30m wide.

The deposits were machine excavated by the Principal Contactor (Hochtief/Murphy), under MOLA supervision to expose the peat and surviving timbers. Further machine excavation continued down to the basal gravels in areas with no timbers present. The deposits and timbers were then recorded by MOLA (C263) to identify their survival, extent and significance.

A MOLA Geoarchaeologist examined sections through the historic alluvial soil, alluvial sediments and peat deposits. The trench sections were sampled with a continuous sequence of overlapping monolith tins, to retrieve undisturbed columns of sediment suitable for offsite sedimentological, and microecofact (ie pollen and diatoms). Adjacent bulk samples (20 litres) were taken at 0.20m intervals. through the deposit succession in order to retrieve plant macro fossils, molluscs, ostracods and identifiable organic remains suitable for radiocarbon dating

7.2 Evaluation Recording Methods

A written and drawn record of all archaeological deposits encountered was made in accordance with the principles set out in the MOLA site recording manual (MOLAS, 1994). The archaeological remains were recorded to best practice standards, in order to achieve archaeological objectives. The site recording included:

- A written record of individual context descriptions on appropriate pro-forma sheets.
- Drawn record: plans and section drawings of appropriate features, and individual contexts (1:5, 1:20 or 1:50).
- A stratigraphic matrix of the sequence of deposits and structures encountered in each trench was produced.
- The photographic record was taken with a digital camera of resolution of 17 megapixels and above. The photographic record included photographs of deposits and samples. Each photograph was recorded on site using a proforma photographic record sheet, showing image number, areas, subject/description (including context numbers), direction of view, and date. In addition, appropriate record photographs were undertaken to illustrate work in progress.
- Temporary Bench Marks - ATD (Above Tunnel Datum) were established by the JV (Hochtief/Murphy) on gallows brackets within the trenches from which all levels for plans and sections were calculated. The location and values of the TBMs were recorded as Levels Data and form part of the field records.
- The locations of the trenches were recorded by the JV (Hochtief/Murphy) and Museum of London Archaeology Geomatics team using GPS. These results were tied into the Ordnance Survey (OS) and the London Survey Grid (LSG). A Survey Report was produced by MOLA Geomatics.

The site finds and records can be found under the site code XSW11.

8 Evaluation results

For trench and borehole locations see Fig 1.

All levels in this interim report are quoted in metres Above Tunnel Datum (m ATD). Tunnel Datum is calculated as being 100m above Ordnance Datum eg 1m OD = 101m ATD.

8.1 Geoarchaeological boreholes

BH1					
Location				**Plumstead Portal**	
London Grid coordinates				**95881.440; 33264.450**	
Surface Level				**103.546m ATD**	
Holocene natural observed (alluvium/peat)				**100.34m ATD**	
Pleistocene natural observed (gravels)				**96.84m ATD**	
Top (m)	**Base (m)**	**Top (m ATD)**	**Base (m ATD)**	**Description**	**Interpretation**
0	1	103.54	102.54	Poorly consolidated crystalline ash clinker with unnatural fibrous pockets (not dissimilar to fibre glass)	Made ground
1	2.3	102.54	101.24	Black sandy silt with coarse sub rounded gravels	
2.3	3.2	101.24	100.34	Soft mid yellowish brown fine sandy clay with moderate fine to medium sub rounded gravels (with pocket of peat at base *c* 3.10)	
3.2	4	100.34	99.54	Soft stiff dark blue grey silty clay with a braided shell fragments.	Alluvium
4	4.6	99.54	98.94	Well formed dark brown humic peat	Wetland peats
4.6	5	98.94	98.54	Blue grey silty clay with v. large chunk of wood at base (5m).	
5	5.6	98.54	97.94	Dark brown Peat.	

5.6	6.7	97.94	96.84	Very wet greyish yellow fine sands .	Early Holocene Channel deposits
6.7	7	96.84	96.54	6.70 V.hard gravels	Shepperton Gravel formation

BH2					
Location				**Plumstead Portal**	
London Grid coordinates				**95932.398; 33267.432**	
Surface Level				**103.447m ATD**	
Holocene natural observed (alluvium/peat)				**100.85m ATD**	
Pleistocene natural observed (gravels)				**97.55m ATD**	
Top (m)	**Base (m)**	**Top (m ATD)**	**Base (m ATD)**	**Description**	**Interpretation**
0	1.0	103.45	102.45	Firm light brown grey sandy silty clay with frequent large brick fragments. Sharp horizontal contact with unit below.	Made ground
1.0	2.35	102.45	101.1	Loose black ash clinker with rare brick fragments. Sharp horizontal contact with unit below.	
2.35	2.60	101.1	100.85	Dark blue grey Silty clay with moderate fine sub rounded - sub angular gravels, CBM and ash clinker. Sharp horizontal contact with unit below.	
2.60	2.95	100.85	100.5	Soft mid yellowish brown silty clay. Grades into unit below.	Alluvium
2.95	4.00	100.5	99.45	Hard mid blue grey silty clay with mid brown mottles at top dark flecks and Mn staining (smaller flecks from 3.5m)	
4.00	5.00	99.45	98.45	Heavily compressed dark blue grey silts with rare humified plant fibres.	
5.00	5.48	98.45	97.97	Compacted (by drill) mid brownish grey silt with rare ephemeral plant fragments, branch fragments at base. Irregular boundary	Wetland peats
5.48	5.64	97.97	97.81	Soft mid grey brown to	

				reddish brown poorly formed organic silt with abundant visible plant fragments (twigs and wood fragments)	
5.64	5.72	97.81	97.73	Dark brown grey silty fine sand with rare roots (presumably from above)	Late Glacial to mid Holocene channel fill complex
5.72	5.80	97.73	97.65	Fairly well compacted light grey slightly silty fine sand. No visible bedding	
5.80	5.90	97.65	97.55	Light brownish yellow medium sand with some coarse particles	
5.90	6.00	97.55	97.45	Sands and gravels	Shepperton Gravel formation

BH3					
Location				**Plumstead Portal**	
London Grid coordinates				**95971.991; 33269.404**	
Surface Level				**103.474m ATD**	
Holocene natural observed (alluvium/peat)				**101.62m ATD**	
Pleistocene natural observed (gravels)				**98.97m ATD**	
Top (m)	**Base (m)**	**Top (m ATD)**	**Base (m ATD)**	**Description**	**Interpretation**
0	1.25	103.47	102.22	Fairly well compacted light greyish brown sandy clay with freq mortar, large red and yellow brick fragments, large abraded flint fragments and yellow mortar	Made ground
1.25	1.30	102.22	102.17	Firm black clay with abundant ash clinker and occasional medium sub rounded gravels.	
1.30	1.43	102.17	102.04	Orange medium sand (looks like builders sand)	
1.43	1.50	102.04	101.97	Black friable ash clinker with moderate fine to medium sub angular to sub rounded gravels	

1.50	1.75	101.97	101.72	Coarse light greyish yellow sand extremely uniform	
1.75	1.85	101.72	101.62	Black medium sand and ash with fine sub angular pebbles	
1.85	2.40	101.62	101.07	Firm light yellow-reddish brown clay with Fe staining , pebbles and ash pushed in at top.	Alluvium / Recent channel
2.40	2.53	101.07	100.94	Soft light greyish yellow silty fine sand with occasional medium sub angular gravels and bands of Fe staining	
2.53	2.64	100.94	100.83	Medium orange sands with freq (4-5cm) sub rounded gravels	
2.64	2.67	100.83	100.8	fine yellow sand	
2.67	2.70	100.8	100.77	Soft light yellow grey slightly silty clay with Fe streaks diffuse boundary	
2.70	2.88	100.77	100.59	Well consolidated yellow orange medium sandy clay with frequent matrix supported fine to medium sub rounded gravels, and fine sub angular gravels poorly sorted. sharp boundary	
2.88	2.94	100.59	100.53	Well consolidated slightly soft light grey sandy clay with frequent fine sub angular and coarse sub rounded gravels irregular	
2.94	3.10	100.53	100.37	Stiff hard dark blue grey silty clay some flecks of charcoal	
3.10	4.50	100.37	98.97	Dark blue grey clayey silt no visible inclusions	
4.50	4.50	98.97	98.97	Wet sand (not captured water at 4.50	Late Glacial to mid Holocene channel fill complex

BH4					
Location				**Plumstead Portal**	
London Grid coordinates				**96026.989; 33272.079**	
Surface Level				**103.469m ATD**	
Holocene natural observed (alluvium/peat)				**99.89m ATD**	
Pleistocene natural observed (gravels)				**97.07m ATD**	
Top (m)	**Base (m)**	**Top (m ATD)**	**Base (m ATD)**	**Description**	**Interpretation**
0	1.30	103.47	102.17	Black ash clinker with super abundant brick fragments about 5cm in length	Made ground
1.30	1.50	102.17	101.97	Mid black to brown friable slightly silty ash clinker Diffuse boundary	
1.50	1.73	101.97	101.74	Soft blue grey fine sandy silt (with quartz sand)	
1.73	3.30	101.74	100.17	Coarse yellowish orange sand with moderate fine to medium sub rounded with piece of ?Victorian blue and white porcelain at base	
3.30	3.35	100.17	100.12	Yellow sands and gravels	
3.35	3.58	100.12	99.89	Black silty fine sand	
3.58	3.63	99.89	99.84	Light brown humic silty clay diffuse boundary	Alluvium
3.63	4.00	99.84	99.47	Dark blue grey silty clay with Mn flecks	
4.60	5.00	99.47	98.47	Heavily compressed soft mid blue grey silty clay with less Mn from 4.90	
5.00	5.55	98.47	97.92	soft mid blue silty clay	
5.55	5.60	97.92	97.87	Dark blue grey wet silt with frequent sub angular gravels	Wetland peats
5.60	5.70	97.87	97.77	Soft blue grey silty clay with peat pockets	
5.70	6.40	97.77	97.07	Soft mid brown peat with moderate plant fragments and rare bands of sandy silt ~3cm wide	
6.40	6.40	97.07	97.07	Gravels (drill refused at 6.40)	Shepperton Gravel formation

BH5					
Location				**Plumstead Portal**	
London Grid coordinates				**96061.645; 33290.099**	
Surface Level				**103.435m ATD**	
Holocene natural observed (alluvium/peat)				**100.44m ATD**	
Pleistocene natural observed (gravels)				**97.74m ATD**	
Top (m)	**Base (m)**	**Top (m ATD)**	**Base (m ATD)**	**Description**	**Interpretation**
0	1.30	103.44	102.14	Brick and concrete fragments. Sharp boundary	Made ground
1,30	1.50	102.14	101.94	dirty firm light greyish pink with patches of dark grey silty clay with freq bricks	
1.50	1.90	101.94	101.54	Loose mid yellowish grey sandy silty clay with frequent modern building material and glass fragments, large flint fragments	
1.90	2.00	101.54	101.44	Large Piece of wood which smelled strongly of hydrocarbons.	
2.00	2.60	101.44	100.84	Fairly well compacted dark brownish red ash clinker with silt pockets, fine sub angular gravels and iron fragments.	
2.60	2.70	100.84	100.74	Frequent CBM fragment Fe fragments and pockets of silt.	
2.70	2.80	100.74	100.64	Soft light greyish yellow fine sandy slit with some Fe staining SHARP boundary.	
2.80	3.00	100.64	100.44	Soft dark grey to black ash clinker and clay	
3.00	3.30	100.44	100.14	Soft blue grey clayey silt with some Fe staining	Alluvium
3.30	3.70	100.14	99.74	Firm light reddish brown clay mottled with dark grey blue frequent Fe staining	
3.70	4.75	99.74	98.69	Soft blue grey silty clay with freq Mn flecks	
4.75	4.88	98.69	98.56	Soft black -brown humic silty clay with patches of small	Wetland peats

				plant material	
4.88	5.00	98.56	98.44	Dark brown peat with freq fine humified vegetation fragments occasional Branches and roots	
5.00	5.15	98.44	98.29	Soft dark brown humic silt with plant fragments 5.10-5.15m	
5.15	5.25	98.29	98.19	Black silty poorly formed peat with frequent vegetation matter	
5.25	5.45	98.19	97.99	Soft dark brown humic silt with plant fragments 5.10-5.15m	
5.45	5.60	97.99	97.84	Soft dark brown humified peat.	
5.60	5.70	97.84	97.74	Hard well formed peat with recognisable plant fragments	
5.70	6.00	97.74	97.44	Light green yellow medium sand with fine to coarse sub angular gravels	Shepperton Gravel formation

BH6					
Location				**Plumstead Portal**	
London Grid coordinates				**96106.810; 33292.620**	
Surface Level				**103.82m ATD**	
Holocene natural observed (alluvium/peat)				**101.12m ATD**	
Pleistocene natural observed (gravels)				**97.92m ATD**	
Top (m)	**Base (m)**	**Top (m ATD)**	**Base (m ATD)**	**Description**	**Interpretation**
0	0.85	103.82	102.97	Concrete and brick fragments with a band of ash clinker at base.	Made ground
0.85	0.92	102.97	102.9	Reddish brown sands with frequent large smashed tile fragments	
0.92	1.0	102.9	102.82	Mottled dark blue grey-reddish brown silty clay	
1.0	1.5	102.82	102.32	Soft light yellowish grey	

				slightly silty fine sand with charcoal and brick flecks	
1.50	2.70	102.32	101.12	Loose Clayey silty sand with frequent fine to medium sub angular to sub rounded gravels, charcoal, ash, plant tile and brick fragments Sharp boundary	
2.7	3.40	101.12	100.42	Firm mid yellowish grey silty clay with Fe staining and charcoal flecks	Alluvium
3.40	4.00	100.42	99.82	Soft mid blue grey silty clay with Mn flecks.	
4.00	4.62	99.82	99.2	Soft (compacted by drill) light white grey silt. diffuse boundary	
4.62	4.78	99.2	99.04	Soft blue grey silt. diffuse boundary	
4.78	4.85	99.04	98.97	Humic silt with pockets of peat at base sharp	Wetland peats
4.85	5.00	98.97	98.82	Dark brown peat with moderate chunks of wood	
5.64	5.74	98.82	98.08	Fine light yellowish grey slightly silty sand with occasional medium sub rounded gravels at base	Late Glacial to mid Holocene channel fill complex
5.74	5.90	98.08	97.92	Mid greyish yellow coarse sand with frequent fine to coarse sub rounded gravels	
5.90	6.00	97.92	97.82	Well consolidated bright orange medium to coarse sand with frequent fine sub angular and medium sub rounded gravels.	Shepperton Gravel formation

Interpretation and summary
Six terrier rig boreholes were undertaken in a west (BH1) to east (BH6) transect across the site (Figs 4 and 5). The surface of the basal Pleistocene gravels was encountered at 96.54m ATD in BH2 at its lowest, to the west. At its highest, the gravel was encountered at 98.71m ATD in BH4, to the east. The surface of the fluvial sands was encountered at 96.80m ATD in BH2 at its lowest, to the west. At its highest, the sand was encountered at 98.82m ATD in BH6, to the east. The surface of the peat was encountered between *c* 98.5 and 99.5m ATD and undulates along the transect. The surface of the alluvial clays was encountered between *c* 100 and 101m ATD and rises towards the east. Overall the transect roughly agrees with that present in the previous deposit model suggesting a large incised channel later filled by the complex deposits of smaller migrating channels or tidal creeks. The transect created by the geoarchaeological boreholes shows the eastern half of the incised channel feature only.

8.1.1 Deposit Model construction and Landscape Zones

In order to create and update the deposit model the geotechnical data was entered into a digital (Rockworks 15) database. A total of 54 sedimentary logs from geotechnical boreholes, window samples and test pits were included in the original deposit model (Crossrail 2011). Added to these were the six geoarchaeological boreholes and data from the east and west ends of the two archaeological trenches. The distribution of the data is illustrated on Fig 4. The geotechnical data was entered into the database with the prefix XRail_Pk'x' with 'x' denoting the package number. The utilities works were entered with the prefix XRail_U, with U denoting utilities. The MOLA data was entered with the prefix MOLA.

Each identified lithological unit (gravel, sand, silt etc) was given a unique colour and pattern allowing cross correlation of the different sediment and soil types across the site. By examining the relationship of the lithological units (both horizontally and vertical) correlations can be made between soils and sediments, and associations grouped together on a site-wide basis. The grouping of these deposits is based on the lithological descriptions, which define distinct depositional environments, coupled with a wider understanding of the Thames floodplain sequence gained from non-Crossrail archaeological and geoarchaeological investigations undertaken in the surrounding area. Thus a sequence of stratigraphic units, representing certain depositional environments, and/or landforms can be reconstructed both laterally and through time for the site. By this method a series of Landscape Zones (LZs) can be defined which are determined by characteristic types of deposit sequences made up of one or more of these stratigraphic units. The landscape zones are illustrated on Fig 9.

The vertical deposit succession is illustrated on the transect drawn across the site (Fig 5). This figure illustrates a straight line correlation between the stratigraphic units identified within each data point. The original deposit modelling identified 7 major stratigraphic units (Crossrail 2011). In this update to the deposit model only five of these major stratigraphic units. These five units are summarised in the table below, and listed in stratigraphic order from the oldest to the most recent.

Table 1: Summary of stratigraphic units

Stratigraphic unit	Lithology/Description	Chronology	Environment of deposition
Shepperton Gravel formation	Coarse grained sands and gravels	Late Devensian, c 18–15,000 BP	Cold climate braided river regime
Late Glacial to mid Holocene channel fill complex	Sands and silts, often laminated, organic muds, peat lenses	Late Glacial to mid Holocene 15–3,000 BP	Freshwater single thread meandering channel
Wetland peats	Wood and reed peats, organic muds	Neolithic to Bronze Age *c* 5–3000 BP	Alder carr floodplain woodland, reed swamp and marshland
Alluvium	Gleyed clays and silts	Iron Age to historic, *c* 2000 BP	Overbank flood deposits and intertidal muds
Recent channel and tidal creeks	Gleyed clays, silts and fine sands	Iron Age to historic, *c* 2000 BP	Tidal creeks, anthropogenic channels

An important aspect of the vertical deposit succession is the identification of the pre-Holocene surface. This is essential in defining the major landforms present within the floodplain that may have influenced later sedimentation rates, depositional environments, landscape development and by consequence areas of anthropogenic activity. In the case of the present study area, by plotting the surface of the basal Pleistocene gravels and earlier Tertiary deposits an indication is given of the undulating topography which existed at the beginning of the Early Holocene (*c* 10,000 BP) (Fig 6). This is archived by transferring the Rockworks data to Arc GIS v.10 where the Spatial Analyst module is used to generate a surface plot.

8.1.2 Reliability of the model

Along the line of the portal itself the spread of geotechnical data within the previous deposit model (MOLA 2011) gives a good representation of the nature of the deposits and topography. In general the data points within the direct vicinity of the portal have provided an accurate and well recorded window into the sub-surface stratigraphy, as confirmed by the archaeological trenches. The data set forms an east to west linear spread, allowing the deposits to be characterised along what is essentially a single vertical slice. This results in a reliable model within the portal and to the east and west but reduced reliability as it moves further north or south of the portal. This is particularly relevant when trying to attribute an orientation to the channel features identified within LZ3.

8.2 Trench 1A

Photo 1 Sampling Monolith <1>: peat [2] and gravels [1] in Trench 1A (looking northeast)

Trench 1A (Fig 2)	
Dimensions	6.60m x 8m x 0.70m
Modern Ground Level	103.45m ATD
Modern subsurface deposits	99.78m ATD
Level of base of archaeological deposits observed and base of trench	99.08-99.44m ATD
Pleistocene natural observed (gravels) not truncated	99.08m ATD
Extent of modern truncation	Truncation to peat and overlying alluvial deposits from engineering ground reduction, prior to laying of piling mat.
Georchaeological sequence	**Dating Evidence, Finds, and Samples**
Fluvial sand [1] at 98.08m ATD	Dating: Early Holocene/late Pleistocene Finds: none Samples: Monolith <1>, and bulk <2>
Woodland peat [2], at 99.30-46m ATD	Dating: prehistoric, ?Bronze Age Finds: none Samples: Monoliths <1>, and bulks <3> and <4>
Interpretation and summary	
The area revealed a sequence of natural fluvial sand from 98.08m ATD in the base of the trench overlain by a 0.40m depth (truncated) of woody peat. The overlying alluvial deposits were removed during engineering works for the construction of the piling mat. No finds were recorded.	

8.3 Trench 1B

Photo 2 South section Trench 1B: peat [7] and gravels [8], [9], timber [10] (looking south)

Photo 3 Trench 1B: Excavating timber [11] in the southeast corner (looking southwest)

Trench 1B (Fig 2)	
Dimensions	5.45m x 10m x 0.60m
Modern Ground Level/top of the slab	103.35m ATD
Modern subsurface deposits	100.49m ATD
Level of base of archaeological deposits observed	97.64-97m ATD
Pleistocene natural observed (gravels) not truncated	99.64m ATD
Extent of modern truncation	Truncation to peat and overlying alluvial deposits from engineering ground reduction, prior to laying of piling mat.
Geoarchaeological remains	**Dating Evidence, Finds, and Samples**
Gravel [9] at 99.64m ATD	Dating: Early Holocene/late Pleistocene Finds: none Samples: Monoliths <13> and <14>
Fine gravel/sand	Dating: prehistoric Finds: none Samples: Monolith <13>, <14> Samples: C14 bulk<15>
Woodland peat [7] at 100.09m ATD	Dating: prehistoric Finds: none Samples: Monolith <13>, <14> Samples:C14 bulk <16>; Timber species ID: <22>, <32>, <33>
Interpretation and summary	
The area revealed a sequence of natural fluvial deposits from 97.64-97m ATD in the base of the trench overlain by a 0.30m depth (truncated) of woody peat. Three timbers [10], [11] and [38] were recorded within the fluvial deposits and peat deposit are indicative of fallen and water sorted round wood and timber. The overlying alluvial deposits, seen in other areas of the trench were removed during engineering works for the construction of the piling mat, but the sequence recorded probably represents the seasonal flood deposits of the River Thames. No finds were recorded.	

8.4 Trench 1C

Photo 4 Trench 1C: Recording timber [29]) (looking northeast)

Photo 5 Trench 1C: Recording postholes [13] and [15] (looking south)

Trench 1C (Fig 2)	
Dimensions	6.60m x 8m x 0.70m
Modern Ground Level/top of the slab	103.35m ATD
Modern subsurface deposits	100.00m ATD
Level of base of archaeological deposits observed and base of trench	99.08-44m ATD
Pleistocene natural observed (gravels) not truncated	99.08-44m ATD
Extent of modern truncation	Truncation to peat and overlying alluvial deposits (survives 0.25m depth by 0.60m length in southeast corner of the area) from engineering ground reduction, prior to laying of piling mat.
Geoarchaeological remains	**Dating Evidence, Finds, and Samples**
Gravelly sand [41] at 99.08-44m ATD	Dating: Early Holocene/late Pleistocene Finds: None Samples: None
Woodland peat [40] at 99.41-60m ATD	Dating: prehistoric Finds: none Samples: Timber species ID <18>, <19>, <21>, <23>, <25>, <31>
Silty clay [39] at 99.74-84m ATD	Dating: ?prehistoric Finds: none
Interpretation and summary	
The area revealed fluvial deposits at the base varying between 99.08 and 99.44m ATD overlain by layers of woody peat, sealed beneath silty clays. Three postholes with peat fills [13], [15], and [25] in the southwest corner were recorded cutting the natural gravel and are likely to be anthropogenic in origin. Two shallow cut features, [17] and [19], were recorded in the same area, and are probably evidence for natural rooting. Elsewhere, timber "stakes" [20], [22], [26], [27] were found embedded within the gravelly sand and remains of trees [23], [28], [29] and [30] were recorded across the area within the peat deposits. These are likely to be indicative of fallen and water sorted round wood and timber. The sequence probably represents the seasonal flood deposits of the River Thames. No finds were recorded.	

8.5 Trench 1D

Photo 6 Trench 1D Sampling Monoliths <6>(top) and <7> (bottom) alluvium [4], peat [5] and [6] looking northeast).

Photo 7 Trench 1D Charred and worked timber [37] (looking southwest)

Trench 1D (Fig 2 & Fig 7)	
Dimensions	6.50m x 7.60m x 1.00m
Modern Ground Level/top of the slab	103.35m ATD
Modern subsurface deposits	100.11m ATD
Level of base of archaeological deposits observed	99.46-86m ATD
Pleistocene natural observed (gravels) not truncated	99.46-86m ATD
Extent of modern truncation	Truncation to peat and overlying alluvial deposits (survives 0.4m depth on the east of the area) from engineering ground reduction, prior to laying of piling mat.
Geoarchaeological remains	**Dating Evidence, Finds, and Samples**
Silty - gravelly sand [6] at 99.46-86m ATD	Dating: Early Holocene/late Pleistocene Samples: Monolith <7> and bulk <10>, <11>, Samples:C14 bulk <12> ,<17>
Woodland peats [5] at 99.61-99.81m ATD	Dating: prehistoric ?Bronze Age Finds: Burnt ovoid suspected "hammer stone" Samples: Monolith <7>, and bulk <10>, <11> Samples:C14 <12>
Silty clay [4] at 99.80-93m ATD	Dating:?prehistoric Finds: none Samples: Monolith <5>, <6>, and bulk <8> Samples:C14 bulk <9>
Interpretation and summary	
The fluvial deposits at the base of this area varied between 99.46 and 99.86m ATD overlain by layers of wetland peat, sealed beneath silty as seen in the sectional drawing through the sequence (Fig 7). A number of timbers [31], [32], [33], [34] and [35] were recorded across the area are likely to be indicative of fallen and water sorted round wood and timber. However, timber [36] was not naturally broken but had one neatly bevelled end left from either cross cutting or felling with a metal axe (Goodburn 2012). Similarly timber [37] was also found to have traces of working. The tip may have been roughly cross cut with an axe and was charred leaving a blunt point. A stone, initially suspected to have been used as a “hammer stone,” demonstrated no specific evidence for this interpretation on closer off site	

examination. The sequence probably represents the seasonal flood deposits of the Thames with evidence for human interaction within the area.

Photo 8 Trench 1D Cleft half log [36] (see arrow) (looking east)

Photo 9 Trench 1D Timbers [32] (left) and [34] (right)

8.6 Trench 2

Trench 2 (Fig 3 & Fig 8)	
Dimensions	22m x 3.30 x 3.68m deep
Modern Ground Level	103.45m ATD
Modern subsurface deposits	101.80m (W) – 102.34m (E) ATD
Level of base of archaeological deposits observed and base of trench	98.66 (W) - 98.52m (E) ATD
Pleistocene natural observed (gravels) not truncated	98.66 (W) - 98.52m (E) ATD
Extent of modern truncation	Regularly spaced piles, *c* 2m apart were located along the length of the trench
Georchaeological sequence	**Dating Evidence, Finds, and Samples**
Fluvial sand [42] at 98.96-99.22m ATD	Dating: Early Holocene/late Pleistocene Finds: none Samples: Monolith <34>, and bulk <38> Samples: C14 <38>
Woodland peat [43], at 99.30-55m OD	Dating: prehistoric, ?Bronze Age Finds: none

	Samples: Monoliths <34>, <35> and bulks <39> , <40> Samples: C14 <39> <40> Timber ID & dendro <49>to <53>
Prehistoric to historical alluvial silts [44] at 100.59-83m ATD	Dating: Late Prehistoric to historic Finds: none Samples: Monoliths <34>,to<37>; bulks <41> to <45> Samples: C14 <41> to <45>
Alluvial soil [45] at 100.87m ATD	Dating: Historic Finds: none Samples: Monoliths <37>, <47> and bulks <46>, <48> Samples: C14 <46>
Interpretation and summary	
The area revealed a sequence of natural fluvial sand between 98.96 and 99.2mm ATD in the base of the trench overlain by a 0.30–0.60m depth of wetland peat (see sectional detail in Fig 8). Within the peat deposits a series of naturally deposited timbers, [48], [49], [50], [51], and [52], and one [53] initially thought to have anthropogenic origins, were recorded. The overlying alluvial deposits were 1.30m thick. The sequence probably represents the seasonal flood deposits of the Thames with evidence for human interaction within the area during the prehistoric to early historic period. A series of late 19th or early 20th-century dumps sealed the sequence. Contained within these were glass and metal fragments, including two ex-situ railway rails.	

Photo 10 Trench 2: West end showing the sequence of deposits and timber [48] (looking south–west)

Photo 11 Trench 2: Sampling Monoliths <36> prehistoric alluvium (bottom) and <37> historic alluvium (top), timber [48] at bottom of picture (looking south)

Photo 12 Trench 2: Sampling Monoliths <34> fluvial sand and peat (bottom) and <35> alluvium (top), timber [48] at bottom of picture (looking south–south–west)

Photo 13 Trench 2 vertical Timber [53] in (looking north)

8.7 Watching Brief

A targeted watching brief was conducted during the engineering works and ground reduction at the western end of the Plumstead Portal in order to determine the nature of the deposit sequence. Natural orange terrace gravels were observed overlain by grey/green fine sandy fluvial gravels, in turn overlain by peat, truncated during the piling activity. Roots and occasional fragments of trees were noted penetrating the fluvial deposits (*see Photo 14*). As the watching brief continued in an easterly direction, the same sequence of deposits was observed (*see Photo 15*). Following completion of the second evaluation trench, further ground reduction to the east was monitored under a general watching brief. The deposit sequence to the east reflected that found during the targeted evaluation work in Trench 2; the natural sands and gravels overlain by peat, but the overlying alluvial silt had survived to a greater depth (*c* 1m) and was sealed by *c* 1.20m depth of post-medieval dump deposits. No further worked timber or archaeological remains were found during ground reduction of the Plumstead Portal.

Photo 14 View through the deposits during ground reduction at the west end of the site (looking north east

Photo 15 View through the deposits during ground reduction at the east end of the site (looking southeast)

8.8 Marmadon Sewer General Watching Brief

A General Watching Brief was conducted on the ground reduction at the far eastern end of the Plumstead portal (chainage 92100) following the rerouting of the Victorian Marmadon Sewer. This enabled the reduction of this area which had not been accessible previously. The aim of the watching brief was to observe any remains of the Great Breech Dyke and the character of the surviving deposits. Due to the nature of the works, all observations were made from the top of the Portal. The sequence of the deposits is described in the table below.

from (m ATD)	to (m ATD)	Thickness	Deposit description	Interpretation
103.74	102.34	1.4	Void - removal of made ground during portal construction	
102.34	101.74	0.6	Concrete slab, Terram and concrete crush	Modern construction material
101.74	101.34	0.4	Loose black ashey clinker with rare animal bone, glass and rare white glazed pottery	Made ground –19th/20th century

101.34	100.24	1.1	Brown silty clay with some organics and rooting. Slightly peaty at base. (deposits quite mixed)	Weathered alluvium – possibly redeposited
100.24	99.24	1.0	Blue grey clayey sand turning into mixed clayey peaty sand with patches of golden sand in places. Highly variable and mixed. Large concrete slab *c* 4.00m bgl	Alluvial deposits – possible reworked.

The area appears to be heavily modified in places either by intrusive dumping or later remodelling of the site this is especially true at the eastern end of site where large concrete blocks were uncovered at c.4.0m bgl and large deposits of made ground intruded throughout. No archaeological remains or worked timbers were uncovered during the works. The sequence in this area of site differs from that encountered in the borehole survey and earlier ground reduction in that there has been heavy interference either while in use as a testing ground by the Woolwich Arsenal or while it was a vacant plot. Although natural sediments remain they have been heavily reworked.

Photo 16 View through the deposits during ground reduction at the eastern end of the site in the Marmadon Sewer (looking south

9 Assessment of results against original expectations and review of evaluation strategy

GLAAS guidelines (English Heritage, 1998) require an assessment of the success of the evaluation 'in order to illustrate what level of confidence can be placed on the information that will provide the basis of the mitigation strategy'. The recommendations suggest that there should be:

Assessment of results against original expectations (using criteria for assessing national importance of period, relative completeness, condition, rarity and group value)(Guidance Paper V, 4 7).

Department of the Environment guidelines for assessing the importance of individual monuments for possible Scheduling include the following criteria: *Period*; *Rarity*;

Documentation; *Survival/Condition*; *Fragility/Vulnerability*; *Diversity*; and *Potential*. The guide lines stresses that 'these criteria should not be regarded as definitive; rather they are indicators which contribute to a wider judgement based on the individual circumstances of a case'.

Criterion 1: period

In the absence of datable finds the deposit sequence will have to be subjected to further analysis involving radiocarbon dating which will be undertaken as part of a strategy for the Late East route. The archaeological sequences of the trenches span from the early Mesolithic to the later historic, with recent truncation of the later historic sequence. The basal natural deposits represent late Pleistocene to early Holocene fluvial sands. At this time the palaeo-landscape would have been dominated by a braided river regime. The overlying peats are likely to be of a Neolithic and Bronze Age date and the overlying alluvial silty clays are likely to be of an Iron Age to historic date. The upper sequence of made up ground is dated to the late post medieval period and indicative of construction associated with the railway.

Criterion 2: rarity

The geoarchaeological sequence recorded on the site is typical of the Thames floodplain sequence, and therefore cannot be viewed as rare in itself, but is still of considerable interest when considered as part of the wider landscape.

Criterion 3: documentation

Documentary research would not be relevant as the majority of the sequence is prehistoric. However, the remains of the power station chimney and cooling tower (Crossrail C263 Late East Document Number *Doc No C263-MLA-X-RGN-CRG07-50025 Version 1 28-09-12*) and the late post-medieval deposits could be related to cartographic sources to illustrate the development of the site from rural to industrial use.

Criterion 4: group value

Taken as an individual site the floodplain deposits are unlikely to hold much value if taken in isolation. However, if the deposits and the palaeoenvironmental material these deposits are likely to preserve are viewed within the wider context of the Thames floodplain, the information could contribute to the development of a basin wide model for the evolution of the Thames Holocene floodplain. Subtle differences in the topographic template, the sediment profile and the palaeoenvironmental remains can be compared with other Crossrail sequences to investigate changes in the wider floodplain landscape due to anthropogenic and climatic forcing.

Criterion 5: survival/condition

The evaluation trenches have demonstrated that relatively full sequences of natural Holocene deposits survive across the site. The good state of preservation is largely due

to the absence of any major development on the site in the late-20th century, and overburden covering the site from the Railway development.

Criterion 6: diversity

Given its consistency, state of preservation and potential group value it is likely that the sequence extends across the site. Diversity would be represented mainly by possible changes in landscape position, whether within the channel, on the margins or on one of a number of localised floodplain islands identified within this and previous work.

Criterion 7: potential

The potential of the site is associated with the possibility of the deposit sequences recorded and sampled to shed further light on the ecological and landscape story of these early prehistoric to historic channel proximal locations; river banks, wetlands and wooded islands. Such locations would have been ideal settings for early human hunting and gathering base camps. From the records and samples future work will be able to infer differing environmental configurations across the landscape and investigate how such environmental variables would have influenced past populations utilising the Thames River and the adjacent floodplain. In addition to this, such floodplain sites with a mosaic of different channel, wetland or dry island environments would have been sensitive to local and regional environmental and landscape changes. Such sensitivity would allow larger themes concerning climate change and the effect of RSL on river levels and vegetation to be investigated alongside the potential indirect evidence of human induced vegetation and landscape change that such sequences could record. When viewed in isolation such data has the potential to further our knowledge of the development of the past landscape in this eastern part of the Crossrail project. However, when this data is combined with the archaeological findings from the wider span of the Late East data set the information from this site can be placed in a fuller and more varied spatial and chronological context. Evidence for past human activity can then be placed in a context of changing landscape conditions, showing how the evolution of the floodplain landscape influenced human behaviour, settlement patterns and the exploitation of this landscape.

While some evidence for wood working was identified on the timbers, there were few tool marks and therefore little potential for further study or for detailed comparison with other contemporary timbers recovered from other sites in the area.

The evaluation methodology has allowed a representative sample of the buried site stratigraphy to be assessed and the results appear to be consistent, giving a good confidence rating.

10 Statement of potential archaeology

Excavation on the site has shown that there is good geoarchaeological survival of early prehistoric to historic alluvial sediments. As a result, the information from the evaluation and geoarchaeological boreholes indicates potential for the recorded sequences and retained samples to provide further understanding of the sub-surface deposits in the Late East Crossrail route

The sediments sampled in Trench 1 (LZ2) and Boreholes 5 and 6 have high potential for palaeoenvironmental and topographic evidence. The peats and organic deposits will preserve pollen and plant macro fossils useful for past landscape and palaeoecological reconstruction on both an intra and inter site basis, and provide dating material to ascertain a chronological framework. The minerogenic deposits will preserve molluscs, ostracods, diatoms and foraminifera which can be utilised to reconstruct the fluvial depositional environments and identify the transition from freshwater to brackish river systems.

The channel fills and overlying deposits within the channel (LZ3) and recorded within the geoarchaeological boreholes (BH1, 2, 3 and 4) and archaeological Trench 2 may measure up to 4m in thickness and therefore potentially preserve a long record of palaeoenvironmental change extending back to the early part of the Holocene. The channel fills have the potential to contain good levels of chronological resolution, especially within channel areas which became rapidly abandoned and infilled gradually with sediments (such as BH4). Highly active parts of the channel are more likely to have reworked and disturbed earlier sediments, giving less resolution and reliability to palaeoenvironmental reconstructions. Despite these potential problems and uncertainties this zone should be regarded as containing a high level of palaeoenvironmental potential based on the depth of the deposit sequence and the length of the chronology. The organic and minerogenic deposits will preserve a wide range of proxy palaeoenvironmental indicators useful for reconstructing past landscape palaeoecology, channel morphology, environmental change and depositional history. Species identification, dendrochronology and carbon dating of the timbers will provide information on not only the palaeoecology, but a date range for land clearance in the prehistoric period.

Assessment of the samples recovered during the evaluation and borehole survey need to be considered in conjunction with other sample sets taken from different alluvial sites along the Late East route. This will allow a targeted approach to the investigation of distinctive deposit sequences. Once all fieldwork has been completed samples sets can be selected for further work based on topographic location, likely chronological resolution and deposit succession variations.

The timbers have the potential to inform on the nature of wood selection and possibly woodland management, but the limited evidence for woodworking leaves little potential for detailed study of tool marks or comparisons with woodworking technologies identified on other sites in the area, such as at Belmarsh Prison to the north of the site.

The deposits exposed during the General Watching Brief on the removal of the Marmadon Sewer have no potential for further archaeological work.

The archaeological remains are assessed as being of local significance in terms of the development of this part of London, increasing to regional significance when placed within the wider context of the Late East data set.

11 Realisation of original research objectives and aims

- *What is the development of the local landscape and topography of the Thames floodplain from prehistory to the medieval period? At what level are any peat deposits present and at what date did they form? Is there evidence for stream channels, lakes, etc in the flood plain gravel surface?*

The Pleistocene Early Holocene sands and gravels indicate a prehistoric channel and braided river system overlain by peat formation of Neolithic to Bronze Age date and sealed by alluvial clays accumulating from the Iron Age through to the medieval period. An Early Holocene soil horizon with charcoal inclusions was identified and sampled for micromorphology. The surface of the peat in was encountered between 98.85m and 99.50m ATD to the east and found to undulate along the borehole transect. Between Trenches 1 and 2, the peat values were recorded between 99.30m and 100.09m ATD.

- *Is there any evidence for prehistoric activity? If prehistoric remains are present, what is their character and what can be learned about the exploitation of the floodplain by prehistoric groups? In particular, is there any evidence for Mesolithic activity at the base of the alluvium/surface of the gravels? Is there any evidence for timber trackways or other structures of later prehistoric date?*

No direct evidence for Mesolithic activity was found, but evidence of human activity such as vegetation clearance may be found in the palaeoenvironmental. Evidence of human activity in later prehistoric periods (Neolithic/Bronze Age) was evidenced by thin beds of peat and organic clays. Within the peat, timbers were recorded, which may have formed structures such as trackways and jetties, constructed to cross the wetlands. Some of the timbers showed signs of having been worked or shaped with an axe. The evidence for woodworking indicates that there was some clearly human activity on the site but it appears to have been low key perhaps the remains of something like a temporary platform used during hunting or foraging trips into the wet carr type woodland and bog.

- *What can be learned about the processes of medieval land reclamation and land management? Can any evidence for medieval activity be associated with the village of Plumstead to the south?*

No archaeological structures or artefacts were recorded within the historic alluvial deposits associated with Plumstead village. Pollen and macro-botanical remains from the sequence could record evidence of human activity on the flood plain at this time. Ostracod and diatom evidence would indicate conditions on the site, regarding waterlogging and salinity and whether the land was suitable for crops or pasture. Untruncated historic alluvial sediments were recorded in Trench 2, the top of which was recorded at 100.09m ATD. The boreholes also record alluvium, however further analysis of the sediments would have to take place in order to determine whether they are of historic date. Initial interpretation of the deposits suggests historic alluvial water meadow developing into historic alluvial soil. Stabilisation such as this could be attributed to post-medieval drainage and land reclamation.

- *What is the nature of any evidence for post-medieval activity? Is there any evidence for industrial activities, such as quarry pits?*

Post-medieval activity was evidenced by a series of 19th/20th century rubbish dumps up to 1.20m in thickness and are associated with the development of the railway in the 19th and 20th centuries. No evidence for industrial activity was found during the excavation and watching brief.

- *Are any remains of early railway infrastructure present, associated with the construction of the NKL in the 1840s?*

Contained within the late 19th-century/ early 20th-century rubbish dumps were two ex-situ railway rails.

12 Conclusions

12.1 Landscape zones

Three major landscape zones were identified in the previous deposit model (Crossrail 2011). These were:

LZ1 consisting of outcropping Tertiary deposits and gravel units that form the high ground of the valley sides.

LZ2 defining the typical Thames Holocene floodplain succession, characterised by Late Pleistocene/Early Holocene basal sands and gravels, overlain by prehistoric wetland peats, and sealed by late prehistoric to historic estuarine deposits.

LZ3 characterising a complex set of deposits infilling a large palaeochannel feature of Early to mid Holocene date.

Changes to these landscape zones in respect to the geoarchaeological boreholes and archaeological trenches are discussed in greater detail in the sections below.

12.2 High ground of the valley sides (LZ1)

LZ1 is located *c* 400m from the western end of the portal. It consists of an area of high ground with an elevation ranging from *c* 106m ATD in the west sloping eastwards to *c* 102m ATD. This higher relief topography is created by raised Tertiary deposits consisting of the Woolwich Beds, underlain by Thanet sands. This zone is covered in detail in the previous deposit model (Crossrail 2011) but does not lie within the portal or within the area covered by the geoarchaeological boreholes or archaeological trenches.

12.3 Prehistoric peats and wetland floodplain deposits (LZ2)

12.3.1 Late Pleistocene / Early Holocene (18,000–15,000 BP)

LZ2 covers the western and eastern end of the portal footprint and defines a zone of alluvial/fluvial sediments and organic wetland deposits mainly associated with the Holocene floodplain. Trench 1 and Boreholes 5 and 6 fall within the western end of this zone.

The basal deposits noted in the geotechnical boreholes consist of coarse sandy gravels that can be attributed to the Late Devensian Shepperton Gravel formation (Gibbard, 1994). The main phase of aggradation for these sediments occurred between 18,000 to 15,000 BP following the Last Glacial Maximum of the Dimlington stadial. The sediments are indicative of a cold climate braided river regime, which consisted of higher relief channel bar macroforms interspersed with low lying multiple channel threads. The irregular gravel topography created by the mosaic of gravel bars and low lying channel threads influenced later channel patterns and morphology across the floodplain.

The surface of this undulating gravel topography lies at between *c* 98–99m ATD. Where the lowest levels of around 98m ATD occur, the sedimentary records note an accumulation of sands and fine silts above the gravels. Within Trench 1 these silty sands to gravel sands graded down into the underlying Shepperton Gravels indicating a continuous phase of sedimentation, albeit within a channel system where stream power, sediment supply and discharge rates were reduced.

These Late Glacial/Early Holocene interface sediments reflect a change in the fluvial conditions and channel morphology influenced by climatic forcing and amelioration (Törnqvist, 2007). During this time the Thames would have adopted fewer channels within a partially braided channel system. These multiple threaded sand and silt filled channels are clearly shown occupying the low lying areas of the gravel surface topography outside of the main channel fill complex within the modelled transect (Fig 5). With continued climatic stabilisation into the Early Holocene, and an overall reduction in discharge into the fluvial system many of these former channel threads will have become isolated and formed pools of standing water and marshy areas across the floodplain surface One lithic was recovered from the surface of the sands in Trench 1 (see section 8) and a possible Early Holocene soil horizon with charcoal inclusions was identified and sampled for micromorphology

12.3.2 Mesolithic (12,000–4,000 BC)

Across the majority of this zone it is likely that the gravel and sand deposits formed a fully terrestrial land surface by the Mesolithic period. By the Early Neolithic this dry floodplain surface would have begun to experience the upstream impact of allogenic forcing (i.e. Holocene climate change, and relative sea level rise) on the lower Thames basin. Previous time depth estimates for this process of increased ground waterlogging due to rising sea level have suggested that by 5,600BP land surfaces above 97–96m ATD started to become waterlogged (Bates and Whittaker, 2004). The 'ponding back' effect of rising sea levels in the lower Thames estuary, caused ground waterlogging in the upper freshwater reaches of the basin, leading to widespread peat formation by a process of paludification.

12.3.3 Neolithic to Bronze Age (4,000–600 BC)

This peat unit is recorded within Trench 1 and Boreholes 5 and 6. Previous work suggests that it is likely that pollen analysis will show that the lower part of the peat unit displays evidence of fully terrestrial Neolithic woodland consisting predominately of oak, elm and hazel. The upper part of the peat, which is commonly dated to the Bronze Age, may represent a transition to wetter floodplain woodland dominated by alder with some oak still surviving but this needs confirming (Sidell et al, 2000, Grant et al, 2011).

Across LZ2 and specifically within Trench 1 this peat unit measures between 0.5 and 1m in thickness, with the upper horizon occurring at between 99–100m ATD. The geotechnical log descriptions commonly describe this peat as woody and fibrous between 0.5 and 1m testifying to its formation within densely wooded floodplain environments. Other descriptions note 'reed' peat or organic clays indicating the presence of wetter reed swamps within this extensive floodplain woodland. Little evidence of reed peats was evident in trench 1 as recent works on site had truncated the natural deposits to the surface of the peats. Therefore any reed peat or interface with the overlying clays may have been removed. The peat deposits recorded worked timbers (see section 8) which may have formed parts of structures such as trackways, bridges, platforms and jetties constructed to access and traverse the wetlands. Two Neolithic timber structures were also recently discovered *c* 400m to the north of the portal within the grounds of Belmarsh prison. One of these structures was thought to be a north to south aligned trackway, and may have been linking up to the higher ground of the Tertiary outcrops just to the south of the portal footprint.

The sediment logs across this zone record a gradual transition from Neolithic/Bronze Age peat formation to alluvial minerogenic sedimentation from about 99m ATD. This marks a switch to fully estuarine conditions, and the formation of mudflat or saltmarsh environments within an intertidal zone

12.3.4 Iron Age (600 BC–AD 43)

During the Iron Age the majority of the floodplain became fully intertidal, with woodland cover now restricted to the drier interfluves and raised terrace (Sidell et al, 2000, Wilkinson, 2000).

This estuarine inundation continued into the historic periods, gradually raising and levelling the flooding surface and removing any topographic relief that remained. As the surface topography was raised regular tidal inundation became less frequent and tidal mudflats gradually transformed into seasonally inundated floodplain soils. The upper alluvial deposits were truncated prior to the excavation of Trench 1 but are sampled and recorded in the geoarchaeological boreholes and in Trench 2.

12.3.5 Modern (AD 1800–present)

Overlying all sediments across the site was a series of dumps and make-up layers *c* 1.20m thick, associated with the railway development and goods yard. The layers of made-ground generally heterogeneous in nature and in most areas are for the purposes of making up and levelling an area prior to the construction of the rail track and buildings in the vicinity, including the foundations of a former chimney and furnace and a concrete cooling tower. The 19th-century Marmadon Sewer at the east end of the Portal had removed all previous deposits down to at least formation level.

12.4 Channel feature (LZ3)

LZ3 represents a major feature within the floodplain landscape that covers the central part of the portal footprint. Archaeological Trench 2 and geoarchaeological Boreholes 1, 2, 3 and 4 lie within LZ3. Although minor channels and creeks of unknown chronology are likely in LZ2, the fills of these ‘discrete’ features are largely indistinct from the alluvial intertidal deposits. LZ3, in comparison forms a large incised channel measuring in excess of 200m across, infilled with a complex set of variable deposits. The topographic plot of the early Holocene surface (Fig 6) indicates the form of this feature and the landscape zones (Fig 7) clearly define its likely boundaries. A small cluster of boreholes aligned north to south within this zone, indicate that this channel feature may extend on a roughly north to south axis.

This feature undoubtedly formed a major part of the floodplain landscape from the Early Holocene, and probably became a major route of drainage when the other early Holocene channels identified in LZ2 became abandoned. The basal sediments within this channel fill complex consist of relatively coarse silts and sands, then becoming more variable and difficult to correlate higher in the profile. However, these generally consist of alternating beds of very fine sands and silts, with thin beds of peats and organic clays. Overall the full depth of the channel fills measure up to *c* 3m in thickness. Only the surface and upper portion of these sands were encountered in the trenches. However, the geoarchaeological boreholes recorded more complete sequences and refined the

eastern boundary of the channel (Figs 6 and 7) bringing it slightly further westward than the previous model (Crossrail 2011) depicted.

The previous deposit model (Crossrail 2011) associated the north to south alignment of the channel feature with a tributary channel running off the higher ground towards the south, the 'Great Breach Dyke'. It is possible that the channel defined within LZ3 forms an abandoned arm of a former course of the Great Breach Dyke, which existed from the Early Holocene into the Bronze Age period. Interestingly a large palaeochannel was also identified on the Belmarsh site also flowing on a north south axis. This could lead to speculation that the Belmarsh channel and the LZ3 channel are associated.

The complex of channel fills is overlain by peat deposits which measure up to 1m in thickness with an upper surface occurring at between 99 and 100 m ATD. These peats are likely to be contemporary with the Bronze Age peat formation in LZ2, given the similar elevation. However, whereas the peats within LZ2 formed as a result of allogenic forcing and resultant paludification, the peats across LZ3 may have developed by a different agency. Detailed palaeonenvironmental analysis specifically pollen, diatom and ostracod analysis will be able to investigate the different agencies involved. The peats identified in Borehole 4 are very low with a base at 97.07m ATD (Fig 5) and may indicate very early abandonment of the eastern fringe of the channel. Radiocarbon dating of this unit should be a priority in order to provide a chronology for the channel fill complex. Generally the peats uniformly seal the channel fills and suggest that the channel finally became completely abandoned. Eventually this peat formation ceased, as the zone was inundated by intertidal muds. The characteristics and chronology of these intertidal deposits are the same as in the LZ2. These alluvial units measure up to 2m in thickness and occur to c. 101m ATD. In some areas possible historic tidal creeks may have eroded away the peat deposits. The deposits recorded within Borehole 3 indicate the presence of such a tidal creek. Palaeoenvironmental investigation of this sequence could provide further information on the evolution of such tidal creeks within the chronology of the site and wider landscape.

This feature was a major waterway and would therefore have provided a useful means of transport and access through the wetlands and out into the wider Thames estuary. Despite a moderate to high potential for timber structures and artefacts associated with river management and exploitation only one worked timber was located within Trench 2 (see section 8.6 and photo 13).

13 Recommendations for appropriate mitigation strategy

A significant area within the Plumstead Portal has now been evaluated, and the archaeology identified during the evaluation has been excavated during the targeted watching brief. The Project Archaeologist will produce recommendations for further work if necessary.

Recommendations for further work specific to Plumstead portal site are given below. However this work should also be undertaken in the context of understanding the wider landscape along the Late East route with comparison to other sites in the area and alluvial sites on the Early East route.

- The sediments sampled in Trench 1 and Boreholes 5 and 6 have high potential for palaeoenvironmental and topographic evidence. The peats and organic deposits will preserve pollen and plant macro fossils useful for past landscape and palaeoecological. The sequence in Trench 1 although truncated is associated with archaeology and should be the priority of any assessment. Two pollen and two diatom samples should be taken from the c. 0.5m sequence in Trench 1 for assessment purposes. In addition, one radiocarbon date should be taken from the base of this sequence in order to give a preliminary chronological framework and investigate the time-transgressive nature such wetland deposits.
- The channel fills and overlying deposits recorded in the geoarchaeological boreholes (BH1, 2, 3 but particularly BH4) may measure up to 4m in thickness and therefore potentially preserve a long record of palaeoenvironmental change extending back to the early part of the Holocene and good levels of chronological resolution. It is recommended that four pollen and diatom samples are taken for assessment from the best/longest sequence (most likely BH4), as well as a radiocarbon date from the base of the sequence as a comparison to that from Trench 1 and further preliminarily investigate the time-transgressive nature such wetland deposits.
- The thick deposits recorded alongside limited archaeology in Trench 2 will also preserve a wide range of proxy palaeoenvironmental indicators useful for reconstructing past landscape palaeoecology, channel morphology, environmental change and depositional history. In addition, this trench will bridge the gap between the two landscapes represented by the drier environment in Trench 1 and the low lying channel feature (BH1, 2, 3 but particularly BH4). Therefore it is recommended that four pollen and diatom samples are taken for assessment a radiocarbon date from the base of the sequence as a comparison to the other two sequences.
- Assessment should include dendrochronological dating of an oak sample and the species identification of 12 wood samples associated with human activity on the site.
- Assessment of the samples recovered during the evaluation and borehole survey need to be considered in conjunction with other sample sets taken from different alluvial sites along the Late East route. This will allow a targeted approach to the investigation of distinctive deposit sequences.

- No further work is required within the footprint of the Marmadon Sewer.

14 Publication and dissemination proposals

The initial evaluation results will be disseminated via this report and the supporting site archive of samples and records (including digital data). Any publication proposals will be considered in the wider context of archaeological potential and results within the scheme.

15 Archive deposition

The site archive containing original records and finds will be stored temporarily with MOLA pending a future decision over the longer-term archive deposition and public access process for the wider Crossrail project.

16 Glossary of terms

Anastomising channel	The division of a river into a stable system of several smaller channels which successively meet and redivide, with levées and backswamps with large, stable islands between the channels. Anastomising channels tend to avulse as the channel threads age and lose transport efficiency.
Avulsion	A lateral shift in stream channels typically occurring when the existing channel is incapable of carrying all of the water and sediment supplied to it. Streamflow spills out of the banks of an existing channel and a new channel may be eroded. This may occur abruptly or gradually and is common in braided and meandering rivers systems.
BP	Years before present, conventionally taken to be 1950
Braidplain	The active extent of a braided river, which consists of multiple channel threads, separated by raised in-channel bars. Braided channels have high sediment loads and are typical of arctic regions today.
Bronze Age	*c* 2000–650 BC
Carr	North European wetland, a fen overgrown with trees
Colluvium	Colluvial or hillwash sediments eroded and transported down-slope, mainly by gravity. Colluvium often accumulates at the break of slope on valley sides, at the junction of valley side and valley floor and can interleave with alluvium deposited by a river on the floodplain.
Devensian	The last major cold stage of the Pleistocene dating from 70,000 to 10,000 BP
Ecotone	A transition area between two adjacent ecological communities (ecosystems). Changes in the physical environment may produce a sharp boundary, as in the example of a shoreline or the interface between areas of forest and cleared land, or a more gradually blended interface area where species from each community will be found together as well as unique local species.
Eyot	A small island (in this work, one within the existing or former courses of the Thames or its tributaries)

Gley	Greenish grey and bluish waterlogged soil or sediment. The greenish colour indicates the presence of iron phosphates or secondary iron alumino-silicates, and bluish tints are caused by the formation of vivianite (ferrous phosphate). Groundwater gleys are influenced from underneath by groundwater, surface water gleys are water-saturated from above, often with water ponding on the surface.
Holocene	Geological epoch from 10,000 BP to the present day, defining a temperate interglacial
Interfluves	A ridge or area of higher drier ground separating two or more channels which belong to the same drainage/catchment system
Iron Age	*c* 650 BC–AD 43
Late Glacial	The period following the Last Glacial Maximum and lasting until the climatic warming at the start of the Holocene, c 15,000 to 11,000BP. In Britain this period is subdivided into a warm 'interstadial' episode the Windermere Interstadial, followed by a renewed cold ('stadial') episode, in which local ice advances occurred (the Loch Lomond Stadial).
Last Glacial Maximum	The last major cold stage of the Devensian Glaciation known as the Dimlington Stadial which reached its peak at *c* 20 000–18 000 BP
m OD	Metres above Ordnance Datum (Newlyn). To obtain Tunnel Datum heights (m TD) add 100m to OD heights.
m ATD	Above Tunnel Datum (Crossrail project datum, same as LUL datum, see above)
Mesolithic	*c* 12,000–4000 BC
Neolithic	*c* 4000–2000 BC
Paludification	Process of peat formation caused by ground waterlogging of previously terrestrial land surfaces. Onset of peat formation occurs without a fully aquatic phase.
Palaeochannel	Deposits representing a former stream channel
Ped	A unit of soil structure
Pedogenesis	Soil formation, due to biological and chemical weathering
Pleistocene	Geological epoch from 2,000,000 to 10,000 BP, characterised by fluctuating cold (Glacial) and warm (Interglacial) climatic cycles
Post-medieval	AD 1485 to present
Quaternary	The most recent major sub-division (series) of the geological record, extending from around 2.6 million years ago to the present day and characterised by climatic oscillations from full

	glacial to warm episodes (interglacial), when the climate was as warm as if not warmer than today. The observed pattern is of long glacial stages with cold and warm perturbations (stadials and interstadials) and short interglacials (usually less than 10,000 years). Human evolution has largely taken place within the Quaternary period.
Roman (Romano-British)	AD 43–*c* 410
Saxon (early-medieval)	AD 410–1066
Solifluction	In periglacial environments, surface thawing results in a saturated surface layer overlying a frozen substrate. Where this occurs on valley sides it can result in the surface layers sludging down-slope over the frozen subsoil.
Tertiary	A geological Period from approximately 65 to 2.6 million years ago (mya) between the Cretaceous and the Quaternary Periods. The term 'Tertiary' (third age) covers the Palaeogene and Neogene and marks the beginning of the Cainozoic (from the Greek 'new life').

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19 OASIS ID: molas1-137966

Project details

Project name	Plumstead Portal -C263 Archaeology Late East
Short description of the project	A field evaluation was carried out by the Museum of London Archaeology (MOLA) on the site of Plumstead Portal, White Hart Avenue, London SE28, in the London Borough of Greenwich. This work was being undertaken as part of a wider programme of assessment along the Crossrail route. The sequence within Trenches 1 and 2 shows gravels and sands overlain by peats and sealed by alluvial clays. The surface of the Pleistocene/Early Holocene indicates a series of braided river channels within a low lying area on the western margins of a main channel The extent of the channel was confirmed with a borehole survey, and is more than 200m wide c 3m deep. It formed a major part of the floodplain landscape from the Early Holocene, and a major route of drainage and may be an abandoned arm of a former course of the Great Breach Dyke, which existed from the Early Holocene into the Bronze Age period. The Mesolithic period indicated a terrestrial land surface followed by peat formation in the Neolithic/Bronze Ages. The peat deposits recorded worked timbers which may have formed parts of structures such as trackways, bridges, jetties and wharfs constructed to access and traverse the wetlands. The overlying alluvial deposits range from Iron Age to the historic period representing floodplain soils. Post-medieval rubbish dumps sealing the area were associated with the construction of the rail track and buildings in the vicinity, including the foundations of a former chimney and furnace and a concrete cooling tower.
Project dates	Start: 11-04-2012 End: 17-10-2012
Previous/future work	No / No
Any associated project reference codes	XSW11 - Sitecode
Type of project	Field evaluation
Site status	Area of Archaeological Importance (AAI)
Current Land use	Transport and Utilities 2 - Other transport infrastructure
Monument type	CHANNEL Mesolithic
Monument type	FLOODPLAIN Neolithic
Monument type	PEAT Neolithic

Monument type	FLOODPLAIN Bronze Age
Monument type	PEAT Bronze Age
Monument type	FLOODPLAIN Iron Age
Monument type	WATER MEADOWS Early Medieval
Monument type	PASTURE Medieval
Monument type	RUBBUISH DUMPS Post Medieval
Significant Finds	RAILWAYS Modern
Significant Finds	WORKED WOOD Bronze Age
Methods & techniques	"'Environmental Sampling'","'Targeted Trenches'"
Development type	Rail links/railway-related infrastructure (including Channel Tunnel)
Prompt	Planning condition
Position in the planning process	After full determination (eg. As a condition)

Project location

Country	England
Site location	GREATER LONDON GREENWICH WOOLWICH Plumstead Portal
Postcode	SE28
Study area	3050.00 Square metres
Site coordinates	TQ 45546 78885 51 0 51 29 22 N 000 05 47 E Point
Height OD / Depth	Min: 98.00m Max: 99.00m

Project creators

Name of Organisation	MOLA
Project brief originator	Crossrail

Project design originator	Crossrail
Project director/manager	David Divers
Project supervisor	Portia Askew
Project supervisor	Robert Hartle
Type of sponsor/funding body	Crossrail Ltd
Name of sponsor/funding body	Crossrail

Project archives

Physical Archive recipient	LAARC
Physical Contents	"Environmental", "Stone/lithics"
Digital Archive recipient	LAARC
Digital Contents	"Survey"
Digital Media available	"GIS","Images raster / digital photography","Survey","Text"
Paper Archive recipient	LAARC
Paper Contents	"Stratigraphic","Survey","Wood"
Paper Media available	"Context sheet","Diary","Drawing","Matrices","Photograph","Plan","Report","Section","Survey","Unpublished Text"

Project bibliography 1

Publication type	Grey literature (unpublished document/manuscript)
Title	Ce63 ARCHAEOLOGY LATE EAST, Fieldwork Report, Evaluation and Watching Brief, Plumstead Portal - XSW11

Author(s)/Editor(s)	Portia Askew
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Date	2012
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20 OASIS:

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Appendix 1 – Prehistoric waterlogged wood

Dr DM Goodburn Ba Phd AIFA Archaeological Woodwork Specialist

13/8/2012

20.1 Background

The flood plain east of the City of London is well known for its waterlogged prehistoric deposits. In these deposits a range of structures of worked roundwood and timber have been found, mostly of the Bronze Age period. These structures occur mainly in peat and estuarine clay silts deposits. For example, a recent civil engineering project, the expansion of the A 13, exposed a number of such structures including trackways, platforms, bridges, fences and possible building walls. However, both these types of deposits are also well documented as containing natural deposits of fallen and water sorted round wood and timber. Typically wetland woodland seems to have colonised areas of the flood plain when the water levels were low enough only to be drowned and killed by rising water levels. Large trees fell apart slowly and sometimes whole groups of trees were blown over together into the increasingly soft and saturated bog or estuary shores growing up around them. The upper faces of lying logs are effected by extra decay, not being continually waterlogged which, combined with compression often gives the appearance of having been flattened somewhat by human action. When trees or boughs fall they may split or cause adjacent trees to split creating cleft surfaces resembling those made by deliberate human splitting, such as that needed for half logs for trackways etc. Finally, structures were also created by beavers where the tributary channels reached the main floodplain which have been mistaken for human constructions. These various natural events frequently create an impression of human activities and can operate alongside true human workmanship creating a confusing picture which is the case with the assemblage of woodwork retrieved here.

Of course, the natural, mixed or totally artificial assemblages all have the potential to provided evidence of past extinct woodlands and dating for the deposits in which they occur.

20.2 The waterlogged wood

First impressions during excavation was that the possible ‘posts’ resembled photos of the excavation of small Bronze Age piled bridges found in the Thames floodplain (at Freemasons Rd, and Ebsfleet). However, on the close examination of the lifted timbers this proved not to be the case, though different evidence of limited human activity was found, and is described below.

20.2.1 Quantification and recording

A total of 16 double wrapped wood samples recovered from the site. The bagged material was all opened, cleaned where necessary and examined in good raking light for cut marks or other signs of ancient working. Some of the material was wood species identification samples which were listed, reduced to manageable size and rebagged. Others sections of timbers or whole pieces of roundwood were examined thoroughly for

working traces and natural shaping. Those naturally shaped or probably naturally shaped by tree fall, differential decay etc, where briefly recorded on pro forma 'timber sheets'. Whilst the humanly worked items were drawn to scale and recorded in full on timbers sheets, with one half log [36] being reserved for detailed photography prior to discard. All the material was provided with a wood species identification or dendrochronology sample which can also double as a C14 sample.

20.2.2 The worked material and examples of 'naturally shaped timber'

What appears to have been a possible plank-like cleft timber stake during the excavation, timber [10] was closely examined and found to be a fragment of wind torn timber from a large tree (prob alder?). The section comprised a thin tapering torn slice of sapwood and thick bark up to 240mm wide by up to 80mm thick and 0.75m long. It tapered to a featheredge tip of sapwood and bark, with no cut marks visible.

However, lifted half log end [36] was not naturally broken but had one neatly bevelled end left from either cross cutting or felling with a metal axe. It was found set on its bark face with the flatter cleft side uppermost and had been c. 3m long. The lifted section was 0.21m long by 175 mm wide and compressed down to c. 90mm thick. The smooth 'gob' cut was on the underside as found and had been heavily compressed by the overburden weight but very faint axe stop marks could be seen and traces of the uncut 'hinge' left at the end of cutting two opposed 'V's. The timber appeared to have been the end of a log deliberately spit in half after being axe cut to length. Initially it seemed to bear faint traces of charring on the upper face but that is proved uncertain after washing. Such a cleft and trimmed log could have had many uses, with use in a trackway or platform being the most likely. This log end was drawn, sampled and set aside for further photography of the gob cut. Like most of the material lifted it was soft very fragile and had been pierced by later plant roots.

A section of partially decayed oak roundwood item [37], which was found in near vertical position apparently used as a stake, was also found to have traces of working of a kind. The tip may have been roughly cross cut with an axe and was certainly charred leaving a blunt point. Although decayed it would appear that the impromptu stake had been made from a roughly cleft section of a small oak log where just over half the log was used. It survived 0.25m long by 80mm by 60mm.

We must also note that it is possible that other horizontal logs may also have been worked but no clear worked surfaces were found such as log [34] where the upper face was flatted apparently by decay.

20.2.3 Summary

In sum, from the lifted woodworking evidence, there is clear evidence of human activity in the area examined but it appears to have been low key perhaps the remains of something like a temporary platform used during hunting of foraging trips into the wet carr type woodland and bog. This is also supported by the finding of heat fractured foreign stone. Unfortunately the tool mark survival is too limited to suggest a dating other than from the early Bronze Age to Iron Age on toolmark, condition and stratigraphic grounds. A small possibility for tighter dating lies in the existence of a sample of slow grown oak with full sapwood timber [31] retained for dendrochronological dating.

20.2.4 Further work

It is suggested that it would be useful to carryout microscopic species identification of the samples that were not clearly oak and to attempt a tree ring dating of the oak sample.

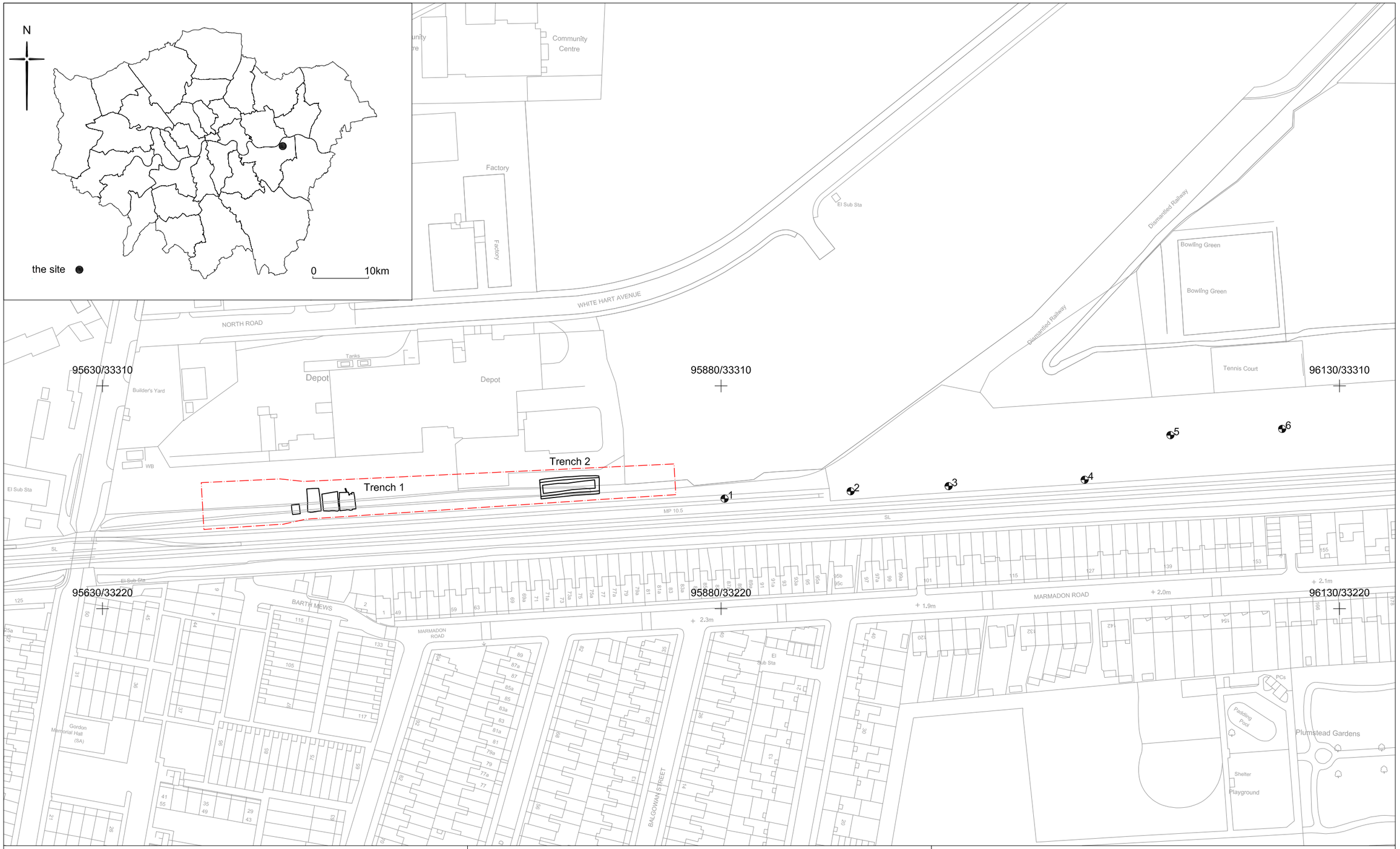

Fig 1 Plan of site

Evaluation trenches

Watching brief area

3 Boreholes

1:1500 @ A3

0 75m

N

95703/33264

95736/33264

[38]

[31]

[35]

[36]

section 1

[25]

[22]

[33]

[26]

[27]

[32]

[29]

[19]

[23]

[20]

[15]

[17]

[28]

[30]

[37]

[34]

[13]

[11]

[10]

1A

1B

1C

1D

Fig 2 Plan of archaeological features in Trench 1

Watching brief area

Trench edge

Modern truncation

[11] Archaeological features

Wood

Section line

1:100 @ A3

0 5m

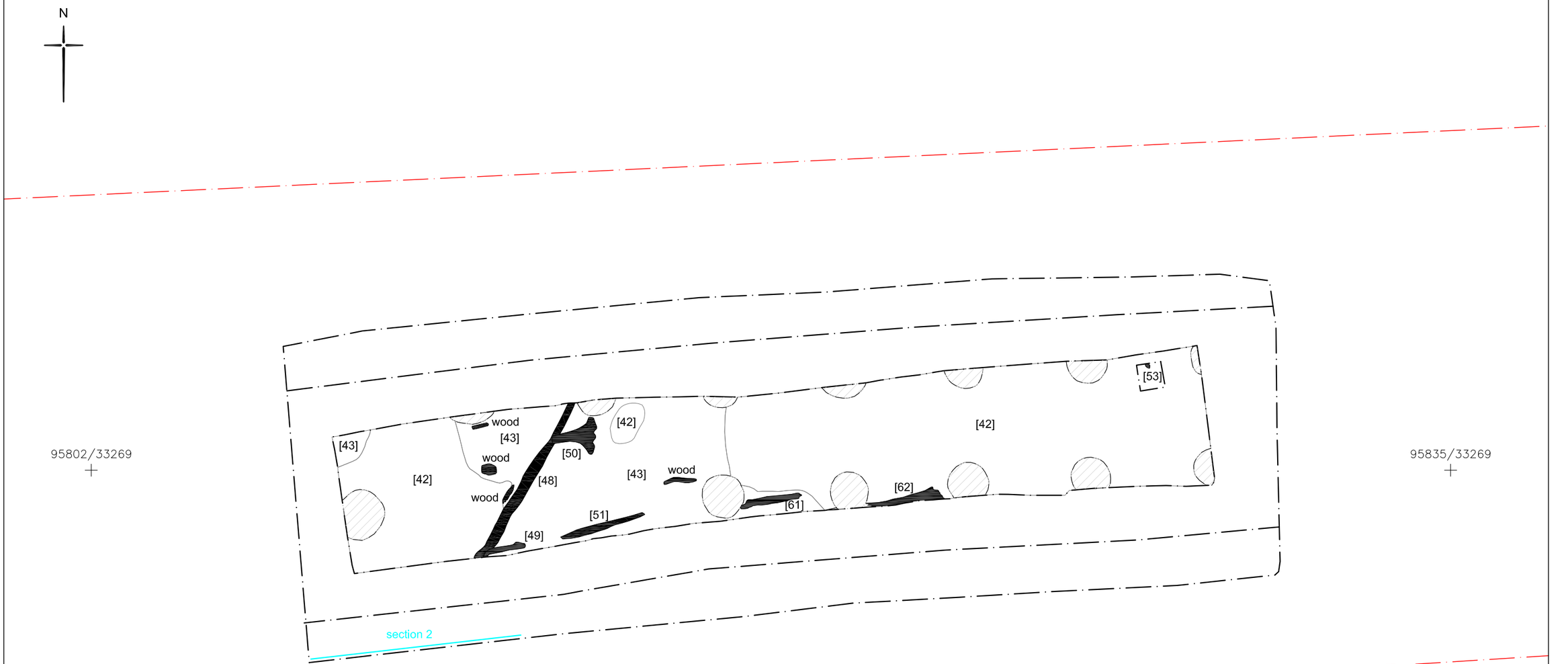

Fig 3 Plan of archaeological features in Trench 2

Watching brief area
Trench edge
Modern truncation
[11] Archaeological features
Wood
Section line

1:100 @ A3

0 5m

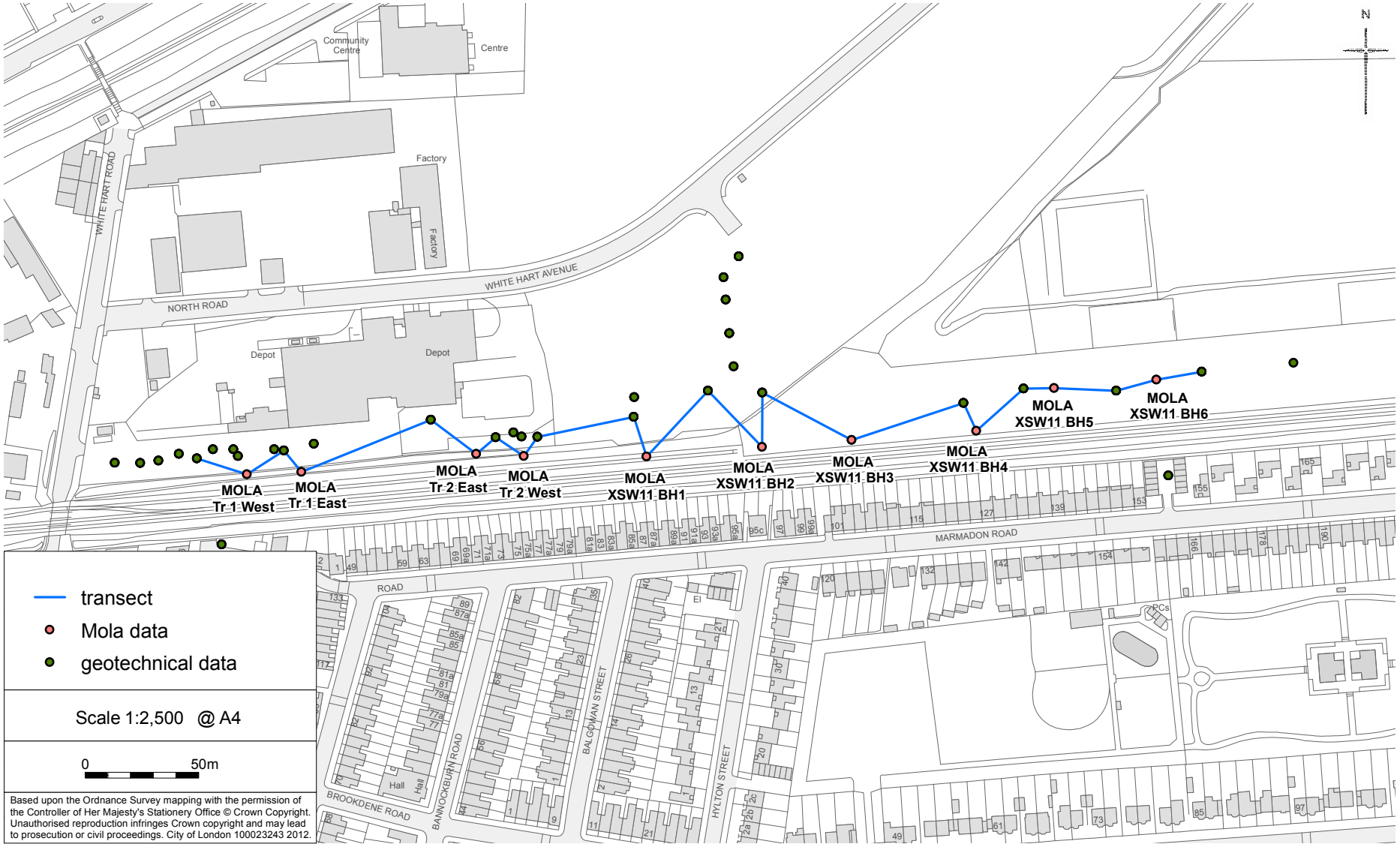

Fig 4 Distribution of data points

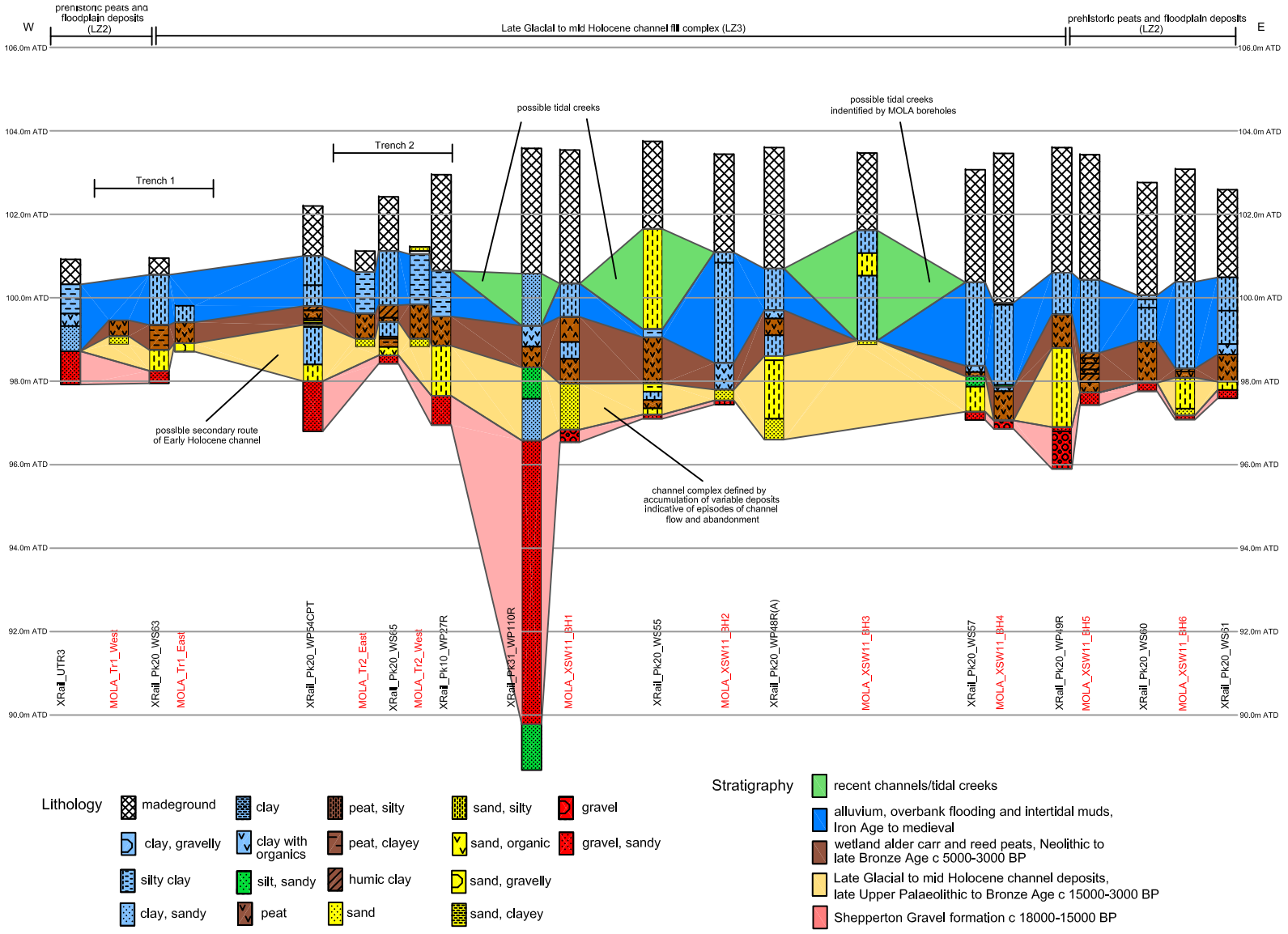

Fig 5 West to east transect

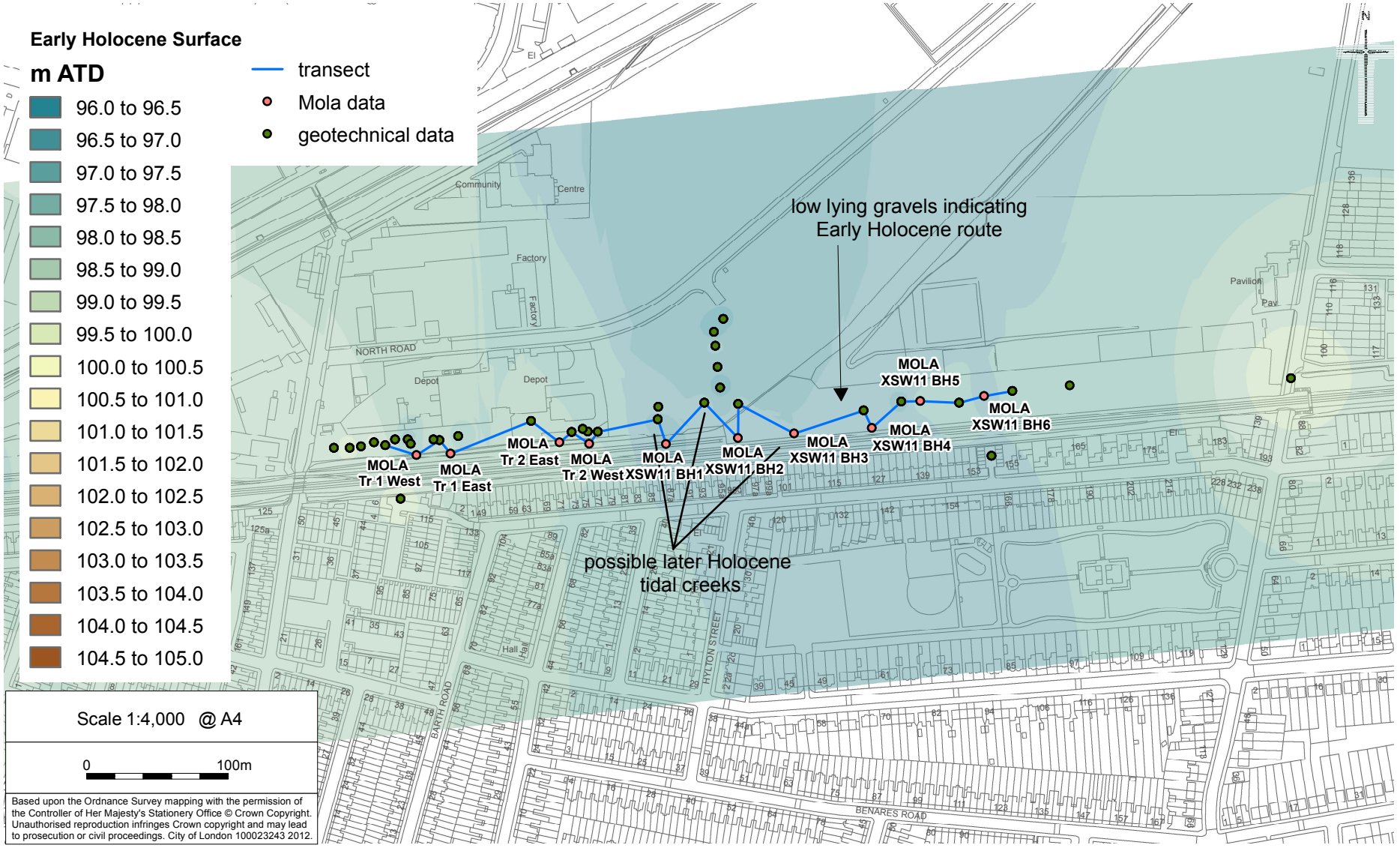

Fig 6 Buried topography of the Early Holocene

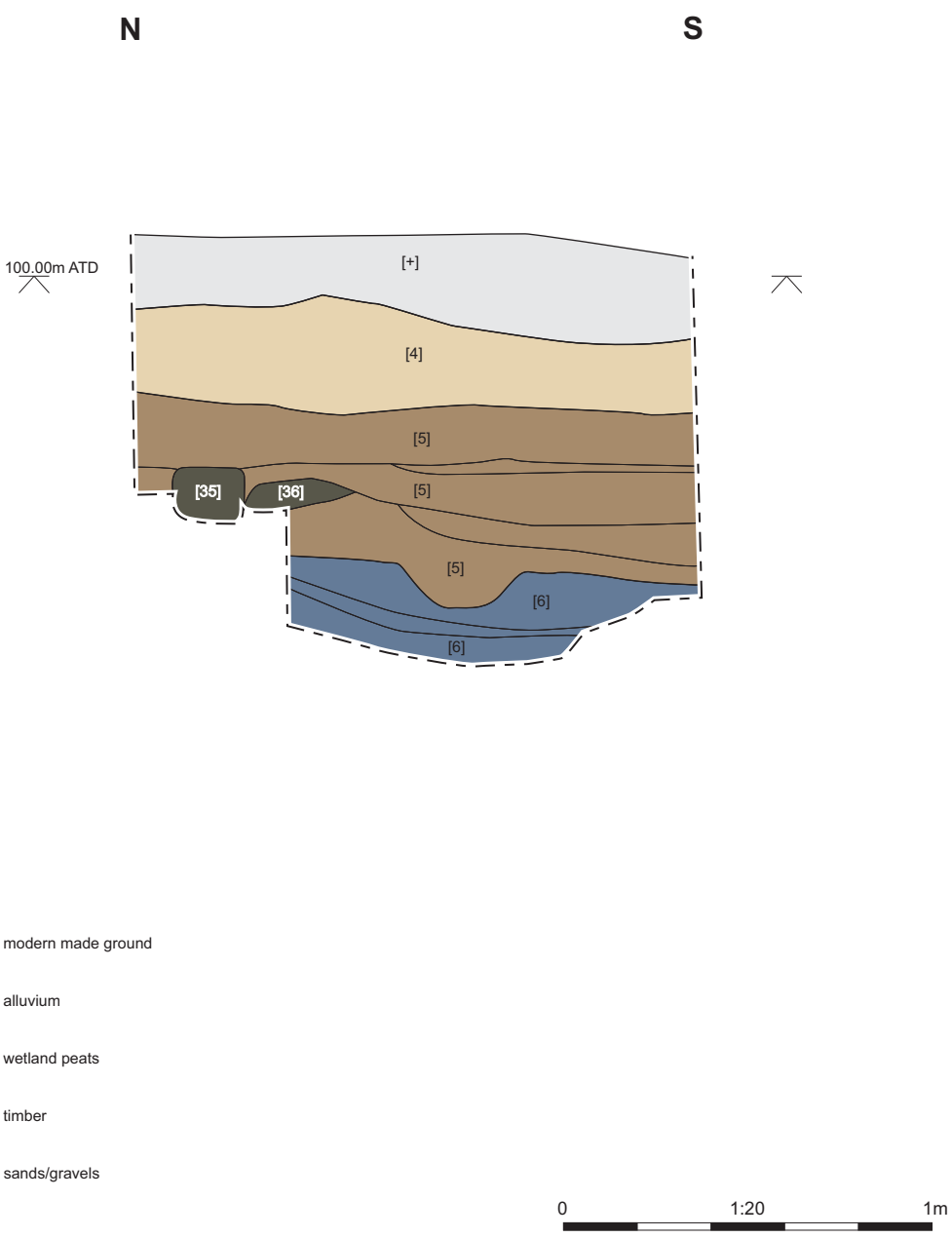

Fig 7 West facing section in Trench 1D

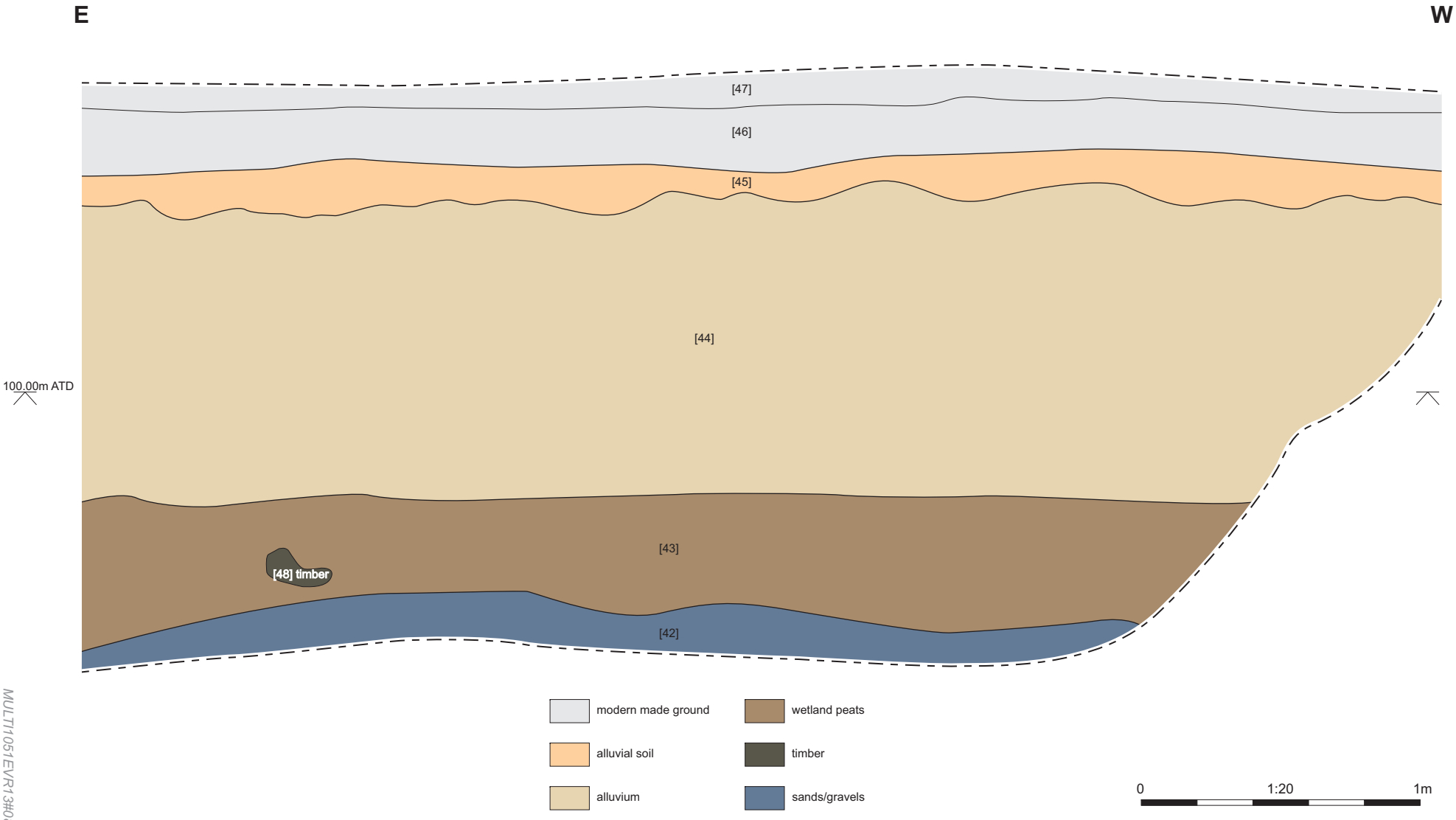

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Fig 8 North facing section in Trench 2

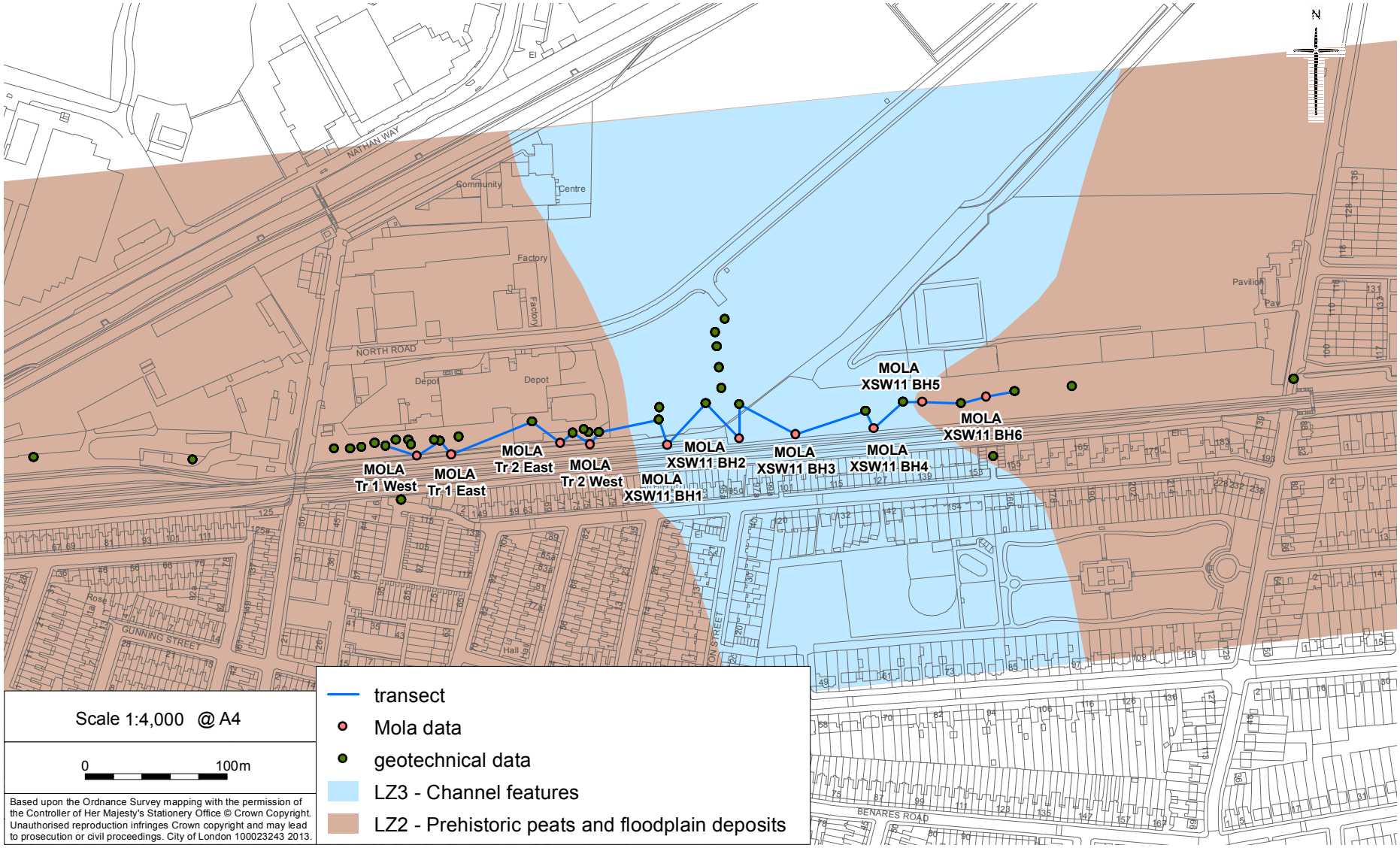

Fig 9 Landscape zones