PLANNING DELIVERY ZONE 1
Work Package 7
Trench PDZ.01
Trench PDZ1.02/03
Trench PDZ1.04
Trench PDZ1.05
Trench PDZ1.06/07
Trench PDZ1.08
Trench PDZ1.09

E15

London Borough of Newham

Archaeological evaluation report

November 2008

REGISTERED IFA ORGANISATION

MUSEUM OF LONDON Archaeology Service

PRE-CONSTRUCT ARCHAEOLOGY

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Archaeological evaluation report

Site Code: OL-01106
National Grid Reference: 538569 177921

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Summary (non-technical)

This report presents the results of an archaeological evaluation carried out by the Museum of London Archaeology Service and Pre-Construct Archaeology (MoLAS-PCA) within the Olympic, Paralympic and Legacy Transformations Planning Applications: Planning Delivery Zone 1 (Work Package 7), London Borough of Newham, London E15. The report was commissioned from MoLAS-PCA by Capita Symonds Limited on behalf of the client the Olympic Delivery Authority (ODA).

Following the recommendations of the previous Detailed Desk-Based Assessment compiled for the Planning Delivery Zone, and subsequent consultation with the Greater London Archaeology Advisory Service, six evaluation trenches were excavated along the western edge of PDZ1 (following the outline of a proposed new river wall). The evaluation results have helped to refine the initial assessment of the zone's archaeological potential. The trenches were, wherever safely permitted, excavated to the level of the natural gravels. The evaluation has shown that undisturbed deposits survive intact beneath the 19th –20th century made ground in the vicinity of the Waterworks River wall. These deposits comprise prehistoric land surfaces with evidence of associated occupation and evidence for a river channel, perhaps a former course of the Waterworks River, and its abandonment.

The results confirm and also expand the information already obtained from elsewhere in this zone, and the records and samples taken from the site have good potential to contribute to our understanding of the prehistoric and later evolving environment and human activity within it.

The site spans the low terrace and the deeper part of the valley floor, where migrating channels formerly existed, which are likely to include the precursor of the Waterworks River. Trench PDZ1.09, located in the extreme south of the site, lies on the low terrace. Evidence for prehistoric occupation was found associated with a buried land surface horizon in this trench, indicating a continuation of the activity previously recorded upslope elsewhere in PDZ1. There is potential for further evidence of human activity to be recovered in this area and it is also possible that associated wetland archaeology also lies buried in the deeper areas adjacent to the river terrace, although no evidence for such activity was found during the evaluation.

The deposit sequence in the lower-lying part of the site resembles that found to the east, with thick sand deposits, accumulated as sand bars within and at the margins of a former river channel forming a series of ridges, interspersed with and overlain by peaty clays and organic silts, accumulated in backwaters and marshy hollows left behind as the river migrated away from the edge of the terrace. There is good potential for past environment reconstruction from seeds, snails, insects and ostracods, all of which the evaluation has shown to be preserved in bulk samples taken from PDZ1.06/07. Microfossils, and in particular pollen and diatoms, are likely to be preserved in the monolith and augerhole grab samples taken through the wetland deposits from PDZ1.06/07 and PDZ1.08.

No radiocarbon dates have yet been obtained, although there is good potential for radiocarbon dating samples from PDZ1.06/07 and PDZ1.08. This would help to clarify the timing of river activity and wetland development in the southwest part of PDZ1 and tie the information in with the evidence for channel migration that appears to have taken place between the Neolithic and early Roman period elsewhere in PDZ1.

The sands and organic deposits found above the floodplain gravel in the lower-lying trenches (that is, all but PDZ1.09) and the dry land surface recorded in PDZ1.09 were all overlain by alluvial clay. The clay is likely to represent different

environments both laterally and through time. The oxidised characteristics of the clay in PDZ1.09 suggest that here it might represent a generally dry accretionary soil, built up gradually during episodes of prolonged flooding. In contrast good preservation of organic remains and its thickness in PDZ1.01, PDZ1.06/07 and PDZ1.08 suggest it accumulated in more permanently wet conditions, closer to the river and here it might represent intertidal mud. There is potential for examination of biological remains from the alluvial clay deposits in PDZ1.06/07 and PDZ1.09, where samples were taken, to infer its depositional environment and its date, both of which are likely to vary across the site.

A key question to be addressed regarding the alluvial sequence is when and in what way did estuarine incursion reach this part of the Lower Lea. The encroachment of estuarine environments and tidal water up the Lea Valley would have had a significant impact on the activities of people living in and exploiting the locality. There is good potential for the samples obtained from the evaluation to provide dates and useful information (such as from ostracods, diatoms and forams) from which we can infer the timing and nature of the transition from a freshwater to tidal river.

In addition to dating the deposit sequence and examining the biological remains preserved within the samples, there is very good potential for more detailed examination of the trench records to contribute to our understanding of the past topography and evolving environment, by inputting the stratigraphic information into the Olympics geoarchaeological database and modelling the semi interpreted data in ARC GIS.

Timber posts and timber, metal and concrete revetments, all of increasingly late post medieval date truncated the alluvial deposits The deposits and features of archaeological interest were subsequently sealed by 19th–20th century made ground and landfill deposits covered by concrete

In the light of revised understanding of the archaeological potential of the site the report concludes that further excavation is unlikely to provide significant additional information about the archaeological remains surviving on the site. However, further archaeo-environmental work on the samples already taken from the site is necessary to assess their potential for past landscape reconstruction. Such off-site work would provide adequate mitigation of the geoarchaeological resource. It is also proposed that the results of this evaluation are assimilated into a project-wide assessment of all archaeological interventions to assign contextual significance and further refine the importance of the archaeological survival. Thereafter the information gained could be assimilated into any publication discussing/disseminating the results.

The decision on the appropriate archaeological response to the deposits existing on the site rests with the Local Planning Authority and their designated archaeological advisor.

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1 Introduction

1.1 Site background

Archaeological evaluation was undertaken within Planning Delivery Zone 1 (PDZ1), of the Olympic, Paralympic and Legacy Transformations Planning Applications, in the London Borough of Newham.

PDZ1 is located roughly in the middle of the valley floor of the River Lea, *c* 3km to the north of its confluence with the River Thames. The site covers a central area within the network of river channels known as the Bow Back Rivers. It is bounded to the north-west by the River Lea, which is tidal for some distance upstream and to the west and south by the canalised Waterworks River. The north-east and east sides of the site are bounded by the Stratford and North London Railway, while the south-east is bounded by the Great Eastern Railway.

The evaluation was broken down into a series of Work Packages, each defined due land availability and project programming. This report deals with Work Package 7, a series of trenches aligned north-south in a c 8m by 800m strip close the river wall of The Waterworks River (evaluation on PDZ1 Work Packages 1–6 are reported on separately under site code OL-01507).

The OS National Grid Reference for the site centre is TQ 538000 184300. The footprints of the Work Packages were defined by former local property boundaries, and the limits of areas within which access was possible to excavate the evaluation trenches. Effectively, the footprint of each Work Package was delimited as a tool for defining the location and potential maximum extent of the group of trenches. Ground level varies from 3.71m OD to 7.15m OD. The site code assigned to the evaluation is OL-01106.

Current proposals for Planning Delivery Zone 1 (PDZ1) comprise the Main Olympics Aquatic Centre. New bridges will be constructed: F09, F10b, and H07; with reprofiling of the 1930s concrete wall (River Wall), and 8 metres of ground between the 1930s river wall and the current wall. Parts of the site will be lowered, and others raised. New roads, services, water supply and drainage will be required.

A *Desk-Based Assessment* was undertaken for PDZ1 (MoLAS-PCA, 2007a), and should be referred to for information on the natural geology, archaeological and historical background of the site, and the initial interpretation of its archaeological potential. A *Method Statement* was prepared for PDZ1 (MoLAS-PCA 2007b), which forms the project design for the evaluation.

1.2 Planning and legislative framework

The legislative and planning framework in which the archaeological exercise took place was summarised in the *Desk Based Assessment* and *Method Statement* which formed the project design for the evaluation (MoLAS-PCA 2007a and 2007b respectively).

1.3 Planning background

In accordance with local and national policies, archaeological evaluation PDZ1 in advance of its redevelopment was required as part of the planning process. Evaluation is intended to define the archaeological potential and significance of any deposits present on the site, so that the Local Planning Authority can formulate responses appropriate to any identified archaeological resource.

The evaluation of the site will be undertaken in support of a condition required by English Heritage and attached to the consent granted by the Olympic Delivery Authority Planning Decisions Team with respect to Olympic, Paralympic and Legacy Transformation Planning Application Reference 07/90010/OUMODA and Site Preparation Planning Application Reference 07/90011/FUMODA. Condition SP.0.38 of planning permission 07/90011/FUMODA states:

The site Preparation Development shall not be commenced until a Written Scheme of Investigation for Archaeological Works has been submitted to and approved by the Local Planning Authority. This shall be in accordance with the Generic Written Statement for Archaeology, the Written Scheme of Investigation for Archaeological Field Evaluation and the relevant Detailed Desk-Based Assessment. The archaeological work shall be undertaken in accordance with the approved Written Scheme of Investigation. If significant archaeological finds are encountered, further archaeological works or design measures may be required to mitigate the impact of development on those remains. This condition may be discharged on a Planning Delivery Zone Basis.

Reason: To ensure that archaeological remains are properly investigated and recorded.

1.4 Origin and scope of the report

This report was commissioned by Capita Symonds Ltd on behalf of the Olympic Delivery Authority and produced by the Museum of London Archaeology Service and Pre-Construct Archaeology Ltd (MoLAS-PCA). The report has been prepared within the terms of the relevant Standard specified by the Institute of Field Archaeologists (IFA, 2001).

Field evaluation, and the *Evaluation report* which comments on the results of that exercise, are defined in the most recent English Heritage guidelines (English Heritage, 1998) as intended to provide information about the archaeological resource in order to contribute to the:

- formulation of a strategy for the preservation or management of those remains; and/or
- formulation of an appropriate response or mitigation strategy to planning applications or other proposals which may adversely affect such archaeological remains, or enhance them; and/or
- formulation of a proposal for further archaeological investigations within a programme of research

1.5 Aims and objectives

The following research aims and objectives for PDZ1 were established in the Method Statement for the evaluation (MoLAS-PCA 2007b) and in the Desk Based Assessment (MoLAS-PCA 2007a) and are intended to address the research priorities established in the Museum of London's *A research framework for London Archaeology* (2002).

- What is the potential for Late Glacial environment reconstruction and/or Late Upper Palaeolithic activity in the Pleistocene deposits on the site?
- What evidence exists for past river channels on the site and how does this contribute to our understanding of the origin of the modern and historic River Lea and Waterworks Rivers?
- What potential is there for reconstructing the evolving river regime from environmental samples taken from the site?
- Is there evidence of past human activity associated with river exploitation or management?
- Is there evidence for past wetland exploitation?
- What environmental evidence suitable for past landscape reconstruction and indirect evidence of past human activity exists within deposits associated with ancient river channels and other wetland areas?
- Is there any evidence for Roman wetland or dryland occupation and other activity within this area of the site? If so, how does it relate to what is known of the settlement pattern further south in the Stratford Market area during the Roman period?
- What evidence for medieval/post medieval land use exists within the site area, including industrial and agricultural evidence?
- How extensive is modern truncation and how thick is modern made ground across the site?

2 Topographical and historical background

The following summary of the geological and archaeological background of the site is based upon the desk based assessment for PDZ1 (MoLAS-PCA 2007a).

2.1 Modern topography and drainage

Planning Delivery Zone 1 is located in the middle of the valley floor of the River Lea, *c* 3km to the north of its confluence with the River Thames. It covers a central sector of a network of river channels known as the Bow Back Rivers. The extent to which these are natural or have been modified or even entirely created by people in the past is not yet known. The patterns of rivers flowing across the site in the past will, however, have influenced its use and hence it's archaeological potential.

The modern topography and drainage of the area has been much modified by man and bears little resemblance to the landscape in historic and prehistoric times. Modern ground raising has obscured the natural land surface by at least two metres of 'made ground'. Similarly, very little remains in the modern landscape of the natural course of the Lea, which today flows through a series of mostly canalised and culverted channels, such as those bounding the site itself.

Modern ground level in PDZ1 is fairly inconsistent. The ground rises slightly from the centre of the area to the north, south and east. Heights vary from 3.74 OD in the centre, to 5.00m OD on the south side, 4.86 at the western side, and 6.40 to the north.

2.2 Natural topography and past landscape setting

The British Geological Survey (Sheet 256: North London) indicates that the site lies on alluvial sediments. These alluvial deposits would have supported a range of different environments from wetland through to dry land, which are likely to have existed within the Lea valley from the Mesolithic period onwards. These environments would have been constantly changing throughout the Holocene period. Gravels and associated deposits of Palaeolithic date underlie the alluvium. The higher ground of the gravel terrace, which forms the western side of the valley, lies some distance to west of the site, on the opposite side of the River Lea.

A previous mapping exercise of the underlying floodplain gravels undertaken during the Lea Valley Mapping Project (Burton, et al 2004), demonstrated that the southern half of site lies on a promontory of the lower terrace, where the gravels occur at around 2m OD. The main channel area of the River Lea exists a few hundred metres further to the west, where the floodplain gravels occur at –1 to –2m OD. The alluvium is underlain by the Lea Valley Gravels, deposited following the scouring-out of the valley floor during the Palaeolithic period (the Pleistocene). The gravels are the most recent in a series of Pleistocene river terrace deposits, which today form an irregular series of steps in the valley side. The Kempton Park Gravels and older Taplow Gravels form the lowest of these river terraces, at the edge of the valley.

Tertiary bedrock, which in this area comprises variably London Clay and Woolwich and Reading Beds, underlies the gravels. The bedrock pre-dates the period of human evolution and thus its surface delineates the extent of potentially archaeologically significant deposits. The landscape of the site in the past bears little relation to the visible landscape of today, with the deposition of made ground deposits completely obscuring the earlier topography.

2.3 Prehistoric

Neolithic land surfaces and Bronze Age worked wood have been identified in the north of PDZ 1, to the east of the site (site OL-00105: MoLAS-PCA 2005). Site OL-00305 in the south of PDZ 1 revealed evidence for an area of slightly higher and therefore drier land which had Bronze Age – Iron Age features, such as post-holes, pits, a ditch and a possible ring gully, cutting through it (MoLAS-PCA 2007c). A small amount of struck and reworked flint and a large amount of burnt flint was also recovered from the site.

Wooden structures such as trackways and jetties may be present within PDZ3. A fragment of possible Iron Age trackway, the precursor to the later Roman road, was recorded in the centre of the zone (GLSMR ref 080875). It should also be noted that watery areas were often a focus for ritual activity, such as the deposition of votive objects, and it is possible that the Neolithic and Bronze Age axes recovered from the neighbouring PDZ 2 are examples of this (GLSMR 061746, 060258).

It is likely that the alluvial deposits will show evidence of environmental change, with moderate potential for palaeo-environmental and other remains of prehistoric date preserved within them. There is moderate potential for disassociated prehistoric finds. The relationship between the alluvial Holocene peats and clay constitute an archaeological horizon, and accordingly are identified as having archaeological potential

2.4 Roman

The Roman road that connected the main port at Londinium (London) with the early military base and Colony at Camulodunum (Colchester) is projected across the western side of PDZ1. A settlement was found to the north-west at Old Ford. Many burials were discovered here, along with a great number of butchered cattle bones and a possible tile kiln. Enough evidence to suggest that the settlement may have played a role in provisioning Londinium (Lakin et al., 2002, 3) has been identified. A Hypocaust system and a number of pottery finds were also uncovered at the Old Ford site at Wick Lane. There is a moderate potential for evidence of a Roman crossing point across the Lea. This may have taken the form of a ford or via timber bridges or raised platforms, crossing the braided channels over the marsh from island to island.

Fragmentary evidence for settlement activity in the near vicinity is associated with this road, possibly indicating a nucleated settlement or several small farms or farmsteads dotting the landscape along with associated field systems. A cemetery, or cemeteries, may also be present. Roman occupation within PDZ1, if present, would be situated on islands of higher ground, due to the increasingly waterlogged nature of the area throughout this period.

2.5 Saxon

Evidence of Saxon activity has been recorded on both sides of the valley at Old Ford, *c* 550m to the west of the site, and at Stratford, *c* 650m to the east. The River Lee will have remained a useful resource and by the late Saxon period mills may have been located along its course. There is a moderate possibility that in situ remains associated with management of the streams and banks of this period survive within alluvial deposits. Recent excavations within PDZ1 revealed a pond feature dated to the Saxon period, which did contain organic material suitable for landscape and environmental reconstruction (MoLAS-PCA 2007c). Other similar features may exist across the site. However modern truncation, caused by ground build up across site may have caused much of this archaeology to be lost.

2.6 Medieval

There are no known sites or finds dated to the later medieval period within the area of proposed development. As with earlier periods, the higher ground on the valley sides west and east of the site would have been the first choice for settlement, providing dry and fertile land with good assess to the rivers and marsh. The nearest primary settlements were located on the sides of the Lea valley at Bow, on the opposite bank of the Lea west of the site, Old Ford *c* 870m to the west, and Stratford and West Ham *c* 700m and *c* 1.1km to the east and south-east of the site respectively.

2.7 Post-medieval

There are no known sites or finds dated to the later medieval period within the area of proposed development. As with earlier periods, the higher ground on the valley sides to the west and east would have been the first choice for settlement, providing dry and fertile land with good access to the rivers and marsh. The nearest primary settlements were located on the sides of the Lea valley at Bow, on the opposite bank of the Lea west of the site, Old Ford c 870m to the west, and Stratford and West Ham c 700m and *c* 1.1km to the east and south-east respectively.

During the 16th and 17th centuries the land in PDZ1 was, as earlier, characterised by marshes and remained pastoral and undeveloped. The 18th century saw huge new reservoirs constructed by the East London Waterworks Company (ELWC). These were further developed in 1808, situated east of Old Ford. A bridge over the waterworks river is still present in the south-west of the site. This brought significant change to the watercourses of the Lee Back Rivers as industry and need for better transportation to London slowly increased in the 19th century. The marsh no doubt hindered development but also attracted increasingly noxious industries so by the later 19th century a large gas works was built in the centre of PDZ1. The development of the Eastern Counties Railway, which forms the southern boundary of site, added to the industrial character of the area. A large brickworks was situated at the south end, and just 270m to the south of the site runs Sir Joseph Bazalgette's Northern Outfall Sewer (still extant, grassed over and known as The Greenway). A large area of the site was taken up by factories, which produced large quantities of chemicals. There is good potential for post medieval finds.

The archaeological deposits are likely to be sealed by a considerable thickness of Victorian and modern made ground. In some places the made ground may infill areas of historic excavation, such as gravel quarries, brick pits and diverted river channels.

3 The evaluation

3.1 Methodology

All archaeological excavation and monitoring during the evaluation was carried out by a joint MoLAS-PCA team in accordance with the preceding *Method Statement* (MoLAS-PCA 2007b) and the MoLAS *Archaeological Site Manual* (MoLAS, 1994).

Six evaluation trenches were excavated, targeting the locations of the impacts from the proposed development: Trenches PDZ 1.01, 1.02/3, 1.05, 1.06/7, 1.08 and 1.09. Two sets of trenches were paired to form single trenches: PDZ1.02/3 and PDZ1.06/7.

Trench PDZ1.04 was not excavated as result of contamination: rapidly flowing water constantly filled the trench after excavation began. The water was contaminated with hydrocarbons.

Each evaluation trench was excavated to the base of modern made ground and/or make up before machining a test slot to the natural gravels where possible. Ground water issues (hydrostatic pressure) were an issue in this area, adjacent to a river wall. A mechanical excavator using a straight edged ditching bucket removed the upper deposit of modern made ground. A toothed bucket was used in limited areas to remove concrete slabs and overburden. Trench sides were supported where necessary by a series of 1.00m deep and 1.2m wide steps for relevant depths. Underlying layers of alluvial clay where present were then graded off with a ditching bucket and the ground reduced whilst being monitored by an archaeologist and banksman at all times. Excavations ceased when the top of significant strata showing signs of archaeological potential were reached. MoLAS-PCA geoarchaeologists visited the trenches during excavation to examine and interpret the deposits in plan and section and to take samples as appropriate.

Work on Trench PDZ1.01 began in the week ending 27 October 2007 and was completed 5 November. Trench PDZ1.02/3 began 14 November 2007 and was completed 23 November. Trench PDZ1.05 began 12 December 2007 and was completed 21 December. Trench PDZ1.06/7 began 18 January 2008 and was completed 24 January. Trench PDZ1.08 began 21 January 2008 and was completed 31 January. Trench PDZ1.09 began 13 December 2007 and was completed 14 January 2008.

The locations of the evaluation trenches were recorded by the MoLAS-PCA surveyor using an EDM. This information was electronically collated and plotted onto the OS grid. Levels were calculated from benchmarks established by Nuttall's engineers along the Waterworks River.

A written and drawn record of all archaeological deposits encountered was made in accordance with the principles set out in the MoLAS site recording manual (MoLAS, 1994).

The site has produced: 1 electronically surveyed overall trench plan; 11 drawn detail trench plans at a scale of 1:20; 78 context records and 8 sections at a scale of 1:20. In

addition, 10 bulk samples, 2 monolith sampled sequences (7 monolith tins) and a series of augerhole grab samples for microfossil examination were collected. Eight of the bulk samples have been partly processed, in order to evaluate their potential. The samples will be retained in the on-site storage facility until a decision has been taken on their requirement for environmental assessment and analysis.

The site finds and records can be found under the site code OL-01106 in the MoL archive.

3.2 Results of the evaluation

The following results have been reported on within a site-wide chronology (phasing), from the base of the archaeological sequence up to modern day activity. It should be noted that, owing to the diachronous characteristics of alluvial deposits and, as few finds (providing dating evidence were found), only a very broad phasing can be established for most of the archaeological sequence, based on sediment characteristics alone. Thus the alluvial deposits, which cover the period from prehistory to ground reclamation in the later post-medieval period, are treated for the most part as a single phase. Although broad trends in the alluvium may be interpreted across the trenches, further interpretation of the alluvial episodes and changing environment on the site goes beyond the current scope of this report and radiocarbon dating as part of a further phase of work is needed to refine the alluvial sequence and its archaeological significance more precisely.

3.2.1 Evaluation Trench PDZ1.01

Location	Northern end of the River wall within PDZ1
Dimensions	5.96m x 4.60m at base; 4.52m deep
Modern ground level	*c.* 6.75m OD
Base of modern fill	3.21m OD
Depth of archaeological deposits seen (alluvium)	0.99m
Level of base of deposits observed and/or base of trench	2.22m OD
Floodplain gravels observed	Not seen
Environmental samples	None.

Table 1 Trench PDZ1.01 deposit summary

For trench plan and sequence see Fig 3 and Fig 4. PDZ1.01 was not excavated to the surface of floodplain gravels.

3.2.1.1 Upper alluvial clay (Phase 3)

The lowest deposit recorded in the trench comprised approximately 1m of light greenish grey soft alluvial clay, with no inclusions, observed between the base of the trench, at 2.22m OD in [314] and the surface of [313] at 3.21m OD. No sign of any past human activity was found within the clay. Sand lenses in its upper part suggest proximity to the river. An irregular black band lay at the interface of [313] and [314]

and it is likely that this is a post depositional feature (manganese staining), a result of fluctuating ground water levels.

The elevation and characteristics of the alluvial clay correlate with the ubiquitous layer of clay found previously in PDZ1 (OL-00105: MoLAS-PCA 2005), which sealed a more varied sequence of prehistoric alluvial deposits. Contexts [313] and [314] are therefore assigned to Phase 3 of the site sequence.

3.2.1.2 Nineteenth and Twentieth century reclamation and groundraising (Phase 5)

Make-up deposits [311] and [312] of probable Victorian and modern date sealed the alluvium, with a surface at 4.63 m OD.

3.2.1.3 Twentieth century levelling and construction (Phase 6)

The groundraising deposits were sealed by a modern make up or dumping layer [310] at 6.75 m OD. These made ground layers were sealed by a concrete slab associated with the structures present on site prior to demolition preparatory to the Olympic development.

3.2.2 Evaluation Trench PDZ 1.02/03

Location	Site of proposed bridge F09 (east side)
Dimensions	20.52m x 5.86m at base; extended at north end by 2m x 2m; 4m deep
Modern ground level	4.90m OD
Base of modern fill	2.90m OD
Depth of archaeological deposits seen (including alluvium)	1.0m
Level of base of deposits observed and/or base of trench	0.90m OD
Natural deposits observed	0.90m OD
Environmental samples	None

Table 2 Trench PDZ1.02/03 deposit summary

For trench plan and sequence see Fig 5 and Fig 6. PDZ1.02/03 was not excavated to the surface of floodplain gravels. No evidence for prehistoric activity or pre-19th century post-medieval remains was found in the trench.

3.2.2.1 Lower alluvium (Phase 2 and 3)

The earliest deposit recorded in the trench was observed in a sondage at the north end and comprised a sandy layer [332] with mollusc inclusions at 1.2m OD. It was overlain by a mid brown layer of peat [331] measuring 0.2m thick with a top level of 1.4m OD. These deposits are likely to relate to a similar sand and organic sequence observed at a similar elevation in Trench 2 of a previous evaluation on PDZ1 (OL-00105: MoLAS-PCA 2005), where late prehistoric sand bar deposits were recorded, overlain by organic backwater sediments, as the river migrated (it is currently thought) north westwards.

A 0.7m thick layer of light blue grey clay [330], with a surface level of 2.1m OD sealed the migrating channel and backwater deposits. This clay deposit is slightly

lower than the upper alluvial clay recorded in PDZ1.01, PDZ1.06/07, PDZ1.08, PDZ1.09 and probably accumulated in a backwater pools or intertidal mudflat location.

Owing to very poor visibility in the sondage and in the trench in general (which was disturbed by a sewer pipe that cut across it) no samples were taken from the alluvial deposits in PDZ1.02/03.

3.2.2.2 Nineteenth century reclamation and river wall construction (Phase 5)

Two stages of wooden revetments were recorded in the trench.

The earliest [323], [324]–[326] comprised 7 *in-situ* posts, measuring up to 1.8m in length with the top level observed at 3.26m OD. The section consisting of [323] and [326] was on a north–south alignment, which at its northern end turned east with elements [327] and [328]. It may be that the northern end defined the side of an inlet, although it would require further investigations to establish this for certain. All the posts were of similar length and width. Five contexts ([323]–[326]) were sealed by re-deposited alluvium [317]. The remaining contexts, ([327]–[328]), were covered by a layer of made ground [316]; and all had been pile driven.

The re-deposited alluvium [317] and made ground [316] was cut by the second stage of revetment posts ([318] - [322]). These were larger and machine cut. They were of a standard, uniform size measuring 0.26m x 0.26m x 2.85m and were made of pine. The revetment was on a north–south alignment with the posts being set approximately 2 meters apart. Some had metal ties connected to a wall as observed with [320] and [322]. The ties were positioned on the west side of the revetment. The top was at *c* 4.0m OD, and was slightly further from the river than its predecessor, although it finished at the north end at about the same point within the trench.

3.2.2.3 Twentieth century levelling and construction (Phase 6)

The latest revetment from phase 5 was sealed by made ground [315] at a level of 4.90m OD. This was capped by a concrete slab that abutted a concrete wall of probable 1930's date.

3.2.3 Evaluation Trench PDZ 1.05

Location	Site of proposed Stratford City bridge at the north-east side of river; west support for proposed bridge F10b
Dimensions	10m x 5.00m x 3m depth
Modern ground level	5.06m OD
Base of modern fill	1.70m OD (limit of excavation)
Depth of archaeological deposits seen	2.78m
Level of base of deposits observed and/or base of trench	2.28m OD
Natural observed	Not fully excavated due to limitations of depth and contamination
Environmental samples	None

Table 3 Trench PDZ 1.05 deposit summary

For trench plan and sequence see Fig 7 and Fig 8. Earlier phases of the sequence were not observed due to ground contamination issues.

3.2.3.1 Nineteenth century reclamation and river wall construction (Phase 5)

The lowest level recorded was at 1.70m OD, where there was still late 19th–20th century made ground. Timber planks and posts could be seen, but these could not be properly recorded because of the contamination problems. The planks and posts appeared to have been shifted from their original location as a result of the construction of a concrete set pipe on an east–west alignment. Its top level was at *c* 3.76m OD. These features were observed within a 19th century made ground/dump layer [340].

3.2.3.2 Twentieth century levelling and construction (Phase 6)

The contemporary concrete revetment structure [339] along the riverbank is the principal feature pertaining to this phase. It was on a north–south alignment across the trench. This was at a top level of 4.41m OD. Sheet metal piling [338] contained the concrete wall for support. Made ground [337] comprising a mid yellowish brown sandy silt formed the fill for the construction cut. It contained occasional 19th–20th century finds, including a moderate amount of CBM. The overlying concrete slab had a surface level of 5.10m OD.

3.2.4 ***Evaluation Trench PDZ1.06/07***

Location	East side of Waterworks River, between PDZ1.05 and PDZ1.08
Dimensions	5.30m x 4.60m at base; 3.61m deep
Modern ground level	4.87m to 4.82m OD
Base of modern fill	3.40m OD
Depth of archaeological deposits seen	1.39m
Level of base of trench	c 1.6m OD
Surface of gravel observed	c 0.9m OD (auger)
Environmental samples	Sequence of 5 monolith tins {77}; Adjacent bulk samples {78} to {82}

Table 4 Trench PDZ1.06/07 deposit summary

For trench plan and sequence see Fig 9 and Fig 10.

3.2.4.1 Pleistocene gravel (Phase 1)

The top of the floodplain gravels was found at *c* 0.9m OD in a hand auger hole and subsequently reached in an adjacent location in a geoarchaeological slot.

3.2.4.2 Alluvial clay (Phase 2 and/or 3)

The 0.7m of deposits overlying the floodplain gravels in PDZ1.06/07, which lay below the base of the trench and were exposed in the geoarchaeological slot, were not examined in any detail owing to rapid water ingress.

However, these deposits comprised predominantly dark grey brown organic silty clay and were sampled in monolith tins. They have been assigned to the lowest part of the basal context recorded in the trench ([372]). Further work undertaken on the monolith tins (tins 4 and 5 of sample {77}), might refine the deposit characteristics. Context [372], as observed in the trench sections, comprised dark blue grey clay with root channels and mollusc fragment inclusions. It was darker and more organic than the overlying clay layers. The surface of [372] lay at 1.77m OD, which suggests that *c* 0.85m of this context exists above floodplain gravel at the trench location. Although further work on the monoliths and their inclusions is needed to interpret [372], it is likely to represent a tranquil channel marginal or backwater location, of uncertain date. Organic remains preserved within the monoliths and in sample {82} taken from [272] would be suitable for radiocarbon dating.

The entire alluvial sequence recorded in PDZ1.06/07 comprised alluvial clay, which became progressively paler and less organic upwards through the profile. The interfaces between the various layers of clay were diffuse and the deposit should be seen as imperceptibly changing through time (in line with the depositional environment it represents) rather than a clear-cut sequence of different deposits, which the stratigraphy sub-divided into contexts, implies. In general, however, the lowest contexts ([372], [369], [368] and [367]) were darker and more humic / organic / manganese stained. These contexts contained numerous fine roots observed in section and in the processed bulk samples, as well as rich assemblages of seeds, insects and snails.

The upper alluvial clay deposits [370] and [357] were paler and minerogenic, but also contained rich assemblages of seeds, insects and snails. This good preservation of environmental remains suggests the clays do not represent intermittent overbank flood deposits accreting on a relatively dry land surface, as has been found on the 'low terrace' immediately to the east (in the southern part of OL-01507 and on OL-00307 for example). Instead the clays in PDZ1.06/07 represent more permanently inundated environments. The clays most probably accumulated at the fringes of the river in backwater and/or intertidal locations. Further work on the monolith and bulk samples taken from the trench is needed to clarify the date and environments represented by the alluvial clays.

The darkest and most organic alluvial clay deposit, recorded below and at the base of the trench ([372]), was overlain by a similar soft dark clay [369], which contained frequent carbonate nodule inclusions. The deposit resembles that recorded in a corresponding stratigraphic position (and at a similar elevation) in a number of the OL-04307 trenches, where it was interpreted as representing a period of falling water levels and drying out of backwater muds. Its surface in PDZ1.06/07 was at c 1.85m OD. The overlying clay layers [368] and [367] were dark brownish blue grey and manganese stained with an irregular surface that undulated between c 2.2m and 2m OD. The characteristics of all these deposits suggest they accumulated in reedbed or similar vegetated areas of standing water at the margins of the river.

The overlying alluvial clay was less humic / manganese stained and paler. It comprised blue grey clay [370] with occasional mollusc fragments, moderate rootlet evidence and occasional manganese speckles and mid brown grey clay [357], which contained frequent snails but few other environmental remains. These clay deposits possibly represent the transition from reedbed or marsh to mudflats or deeper standing water deposits, with mudflats the most likely. Further examination of the

environmental inclusions of bulk samples {78} and {79} and monoliths 1 and 2 of {77}, taken from these deposits should be able to clarify and date the sequence of changing environments represented. The surface of these unquestionably *in situ* alluvial clay deposits was at c 2.75m OD.

The elevation and characteristics of the overlying alluvial clay [356], mid orange / brown silty clay with moderate mollusc fragments, rootlets and gravel suggests it is redeposited, as a result of dredging and other river works. However it might represent *in situ* alluvial clay, weathered as a result of river wall construction, cutting off the former mudflats from inundation. Its surface lay at 3.40m OD. The pre-modern land surface was recorded on the adjacent sites OL-00105 (MoLAS-PCA 2005) and OL-00306 at just below 3m OD, the level of [356] is therefore a little too high for an *in situ* alluvial deposit.

3.2.4.3 19th century reclamation and river wall construction (Phase 5)

A pine timber revetment [378] and a contemporary storm drain structure [375] are likely to be of Victorian or later date. The revetment was built within a construction trench cut into the side of the river bank. Posts [360], [361], [362], and [363] were subsequently driven in, which then had planking secured by bolts resulting in wooden (shuttered) wall [365] and [366], on a north–south alignment. The top of the revetment varied from 3.43m to 3.09m OD. Two further posts [358] and [359] were found to the east, which were probably linked to this revetment as they were positioned parallel to it and appear to be of the same wood. The top levels of these posts were at 3.17m and 3.42m OD respectively.

The drain structure [375] consisted of a timber shuttered square box [364] with a cast iron drain [376] inside. Its cut was filled with a dark blue grey silty clay [374], which contained pottery, ceramic building material (cbm) and wood fragments (see

Appendix 3: Finds assessment below). This deposit lay at 2.30m OD and had a thickness of 0.60m. The pipe itself was not fully excavated and appears to have gradually filled up with mid orange brown silty clay [373] containing cbm, wood and metallic corrosion material. This filled the drain to a level of 2.80m OD and had a thickness of 0.50m. A similar fill [376] was found in-between the iron drain and the wooden box structure. This butted up against revetment [378] to the south.

3.2.4.4 Twentieth century levelling and construction (Phase 6)

A layer of dark grey brown sandy silt [355] containing brick, glass and wood fragments (not retained) is likely to represent modern levelling and make-up. The top level reached 4.77m OD and the deposit had a thickness of 1.60m. It was sealed by a concrete slab that linked in to the river wall of the 1930's.

3.2.5 ***Evaluation Trench PDZ1.08***

Location	East side of the Waterworks River, south of trench PDZ1.06/1.07 and north of PDZ1.09.
Dimensions	7m x 7m at top; 4.70m x 3.84m at base; 4.13m deep
Modern ground level	5.06m OD
Base of modern fill	2.83m OD
Depth of archaeological deposits seen (including alluvium)	1.90m
Level of base of deposits observed and/or base of trench	0.93m OD
Floodplain gravel observed	Auger result at –1.1mOD
Environmental samples	Approximately 50 small grab samples taken throughout the augerhole sequence for pollen and diatom examination (and radiocarbon dating)

Table 5 Trench PDZ1.08 deposit summary

For trench plan and sequence see Fig 11 and Fig 12.

3.2.5.1 Pleistocene gravel (Phase 1)

The surface of the floodplain gravels was at *c* -1.1m OD in a geoarchaeological power auger hole, drilled to log the alluvial deposits that existed below the base of the trench. This is considerably lower than seen elsewhere in OL-01106 and is likely to reflect the downcutting at the interface between the low terrace to the east and deepest part of the valley floor (which lies within PDZ2).

3.2.5.2 Lower alluvium (Phase 2)

The lowest alluvial deposits were seen only in the augerhole. They comprised an interbedded series of shelly sand and humic clay deposits, approximately 1.6m thick, lying between +0.5m and the floodplain gravel at –1.1m OD. These deposits are likely

to represent a bar developed within or at the margins of an active river channel. They probably correspond with the thick sandy deposits recorded in section in the OL-00105 trenches and also seen in the northern part of OL-01507, to the north-east. The OL-00105 sands were thought to represent a migrating channel, leaving behind a series of sandy ridges and peaty clay-filled swales (MoLAS-PCA 2005). The interbedded shelly sand and humic clay deposits in PDZ1.08 are likely to be part of the same episode, which radiocarbon dates from OL-00105 suggest took place between the Neolithic and Roman period.

A series of humic peaty clay deposits overlay the sands, between *c* 0.5m and 1.8m OD. These deposits probably accumulated in the swale, or hollow, created as the river channel migrated away from the trench location. The uppermost of these deposits were recorded at the base of the trench as dark red brown, peaty silty clay [387] and soft mid grey brown humic clay [386] containing mollusc and wood fragments.

A radiocarbon date (undertaken as a further stage of work) from the base of the organic deposits, as obtained from the augerhole sub-samples, would help to tie the sequence from PDZ1.08 into the migrating channel sequence seen across OL-00105 (MoLAS-PCA 2005).

3.2.5.3 Upper alluvial clay (Phase 3)

A sequence of clay deposits between 1.8m and 2.6m OD are likely to represent a more sediment laden river, perhaps as a result of estuarine incursion at the trench location. These deposits, which may have accumulated in an intertidal mudflat location, comprised soft blue grey clay [385], with occasional mollusc fragments, measuring 0.20m thick from a surface of c 2m OD; mid grey brown silty clay with gravel lenses and occasional mollusc inclusions [384], with a surface at c 2.2m OD; and soft, mid blue grey silty clay [383], with occasional mollusc and fine mixed gravel inclusions, with a surface at c 2.6m OD. No samples were obtained from these deposits to clarify their environment of deposition.

3.2.5.4 Nineteenth century reclamation and river wall construction (Phase 5)

A mid blue grey silty clay gravel lens layer [382] covered the alluvium up to 2.73m OD and was 0.20m thick.

3.2.5.5 Twentieth century levelling and construction (Phase 6)

A layer of redeposited mid grey brown silty clay [381], containing occasional molluscs and black manganese staining was present above the alluvium. This was at 3.05m OD with a thickness of 0.38m. It abutted north–south wall [379] parallel to the river revetment. The wall was constructed of orange/red and mid yellow/brown machine made bricks in an English cross pattern. There were also two metal tie backs attached to the wall at 3.81m OD measuring 1.25m long. The overlying made ground [380] was a dark blue grey gravely sandy silt, with occasional glass and brick fragments. There was a cast-iron container within this layer, which contained 2 plastic 25-litre vessels, which may have held chemicals. A blocked cast-iron drain ran through the made ground, with a concrete block sealing the access point. This layer had a top level of 4.92m OD and was 1.81m thick. It was sealed by a concrete slab

with a level of 5.06m OD and a thickness of 0.11m. The latter was only observed in section 30.

Modern cut [388], which was filled with modern dump material [389] had been dug out in 2007–2008 for the new river wall and to widen the current river channel. This also accommodated a crane base.

3.2.6 ***Evaluation Trench PDZ1.09***

Location	Site of proposed bridge H07 (west support). North of railway, west of Warton Road and east of Waterworks channel.
Dimensions	6m x 5.15m at base; 3.62m deep
Modern ground level	5.36m – 4.31m OD
Base of modern fill	2.40m OD
Depth of archaeological deposits seen (including alluvium)	2.78m
Level of base of deposits observed and/or base of trench	1.76m OD
Floodplain gravel observed	c1.8m OD
Environmental samples	2 monolith tins forming sample {71} 4 bulk samples {73} to

Table 6 Trench PDZ1.09 deposit summary

For trench plan and sequence see Fig 13 and Fig 14.

3.2.6.1 Pleistocene deposits (Phase 1)

Pleistocene gravels were recorded at the base of the trench with a surface at c 1.6m OD.

They were overlain by a sequence of clayey sand and sandy clay deposits [347] and [346], which are likely to be Pleistocene alluvium, associated with the low terrace and deposited on the floodplain at some time in the Late Glacial period, prior to downcutting.

3.2.6.2 Prehistoric land surface and activity and alluvial clay deposits (Phase 2 and 3)

It is likely that soil formation during the Holocene took place in the clayey sand deposits [347] and [346], which would have formed the prehistoric land surface, with a surface at *c* 2m OD. The bulk samples taken from these deposits ({76} and {75} respectively) preserved few biological remains and produced no flot, as might be expected from a dry weathered surface.

The cut for a possible Late Bronze Age (LBA) pit [352] with a fill [351] containing pottery and occasional struck flint, charcoal, and bone (see Appendix 2) was observed cutting into the sandy clay / clayey sand buried land surface deposits at 1.98m OD. The oval pit cut was 1.04m x 0.30m and was 0.12m deep. It sloped down on a south–north orientation. The fill [351], a soft mid grey black, sandy silt, was sampled with bulk {72}, which should be processed as a further stage of work. The pit was clearly

visible cutting through the sandy clay deposits [346] and [347], but could not be clearly differentiated in the overlying alluvial clay. Thus it is uncertain where it was cut from.

The prehistoric land surface was subsequently buried by alluvial clay ([345], [344] and [343]), which is likely to have accumulated very gradually through later prehistory and the historic period when it settled out of standing water during periods of prolonged flooding and was subsequently incorporated into the accreting soil profile as a result of bioturbation. The clay deposits might also have accumulated to some extent by soil creep downslope from the low terrace in the east towards the river in the west.

The alluvial clay deposits in PDZ1.09 are therefore likely to have built up imperceptibly through time and to represent a relatively dry land surface. They comprised: [345], oxidised soft mid orange / brown clay; [344], soft, mid brown grey, silty clay with occasional gravel and moderate root evidence and [343] (which may be of post medieval date). The poor conditions for survival of organic remains in a dry land surface would also account for the lack of biological remains in bulk samples {74} and {73} from the alluvial clay deposits.

3.2.6.3 Post-medieval activity (Phase 4)

An isolated timber post [353] of post-medieval date was present on the north side of the trench at 2.32m OD. It was angled east–west and measured 0.63m by 0.11m. The post was inserted into alluvium [344] and appeared to be sealed by [343], a soft mid blue grey silty clay with the occasional gravel and black staining, possibly representing a buried soil, developed in alluvial clay. This layer had a top height of 2.69m OD and was 0.54m thick.

3.2.6.4 19th century reclamation and river wall construction (Phase 5)

Cut [349] truncated the later post medieval made ground. A friable dark brown grey sand silt with occasional stones and cbm inclusions [348] filled the cut. This was sealed by a loose, mid yellow-brown sandy silt [342] containing occasional gravel and cbm inclusions. The surface of the layer lay at 3.40m OD and the thickness varied between 0.64m and 0.10m.

3.2.6.5 Twentieth century levelling and construction (Phase 6)

Layer [342] was covered by loose dark grey brown clay silt [341], with occasional cbm, pot (not retained) and gravel lenses. This was interpreted as a layer of 20th century made ground. Its surface lay at 5.22m OD to 4.29m OD sloping from west to east. This was in turn sealed by a concrete slab with a top level of 5.36m OD.

3.3 Stratigraphic interpretation of the site

3.3.1 Overview of the natural environment of the site

OL-01106 spans the low terrace, an area of formerly higher (and thus drier) ground running below the floodplain down the eastern side of the Lea Valley north of Stratford, and the deeper part of the valley floor, where migrating channels and wetland areas formerly existed.

The characteristics of the deposit sequences recorded in the OL-01106 trenches are similar to those recorded on other PDZ1 sites: OL00107, OL-01507 and OL-00305. The OL-01106 trench results confirm and also expand the information already obtained from this zone.

Essentially, PDZ1.09 in the extreme south of the site lies on what is likely to be a west-projecting promontory at the edge of the low terrace, and possibly close to where the higher ground slopes down into the deeper part of the valley floor. Evidence for prehistoric occupation was found associated with a buried land surface horizon in this trench, indicating a continuation of the activity previously recorded upslope in OL-00305 (MoLAS-PCA 2007c).

In contrast, all the other trenches lie within the lower lying part of the valley floor. Here the deposit sequence resembles that found in OL-00105 (MoLAS-PCA 2005), with thick sand deposits, accumulated as sand bars within and at the margins of a former river channel forming a series of ridges, interspersed with and overlain by peaty clays and organic silts, accumulated in backwaters and marshy hollows left behind as the river migrated away from the edge of the terrace.

The date of the sand bars and peaty hollows in the OL-00105 trenches ranged from the Neolithic to Roman period and their distribution suggested that the river had migrated towards the north west (MoLAS-PCA 2005). No radiocarbon dates have yet been obtained from the OL-01106 trenches, although samples from PDZ1.06/07 and PDZ1.08 would help to clarify the timing of river activity and wetland development in the southwest part of PDZ1.

The sands and organic deposits found above the floodplain gravel in the lower-lying OL-01106 trenches (that is, all but PDZ1.09) and the dry land surface recorded in PDZ1.09 were all overlain by alluvial clay. Although difficult to distinguish by eye from its sediment characteristics in section, the clay is likely to represent different environments both laterally and through time. The oxidised characteristics of the clay in PDZ1.09 suggest that here it might represent a generally dry accretionary soil, built up gradually during episodes of prolonged flooding. In contrast good preservation of organic remains and its thickness in PDZ1.01, PDZ1.06/07 and PDZ1.08 suggest it accumulated in more permanently wet conditions, closer to the river and here it might represent intertidal mud. However, examination of biological remains from the alluvial clay deposits is needed, both to infer its depositional environment and its date both of which are likely to vary across the site.

The level of the pre-modern land surface was difficult to identify, as in several trenches it is likely to have been truncated by river wall construction and other recent development. It is also uncertain in some trenches whether the uppermost alluvium is

in situ or redeposited (for example in PDZ1.06/07, context [356]). However, it is likely that the alluvium will be thicker and reach higher levels in OL-01106 than it does in locations further from the river (OL-00105, OL00305, OL01507), as overbank, intertidal and foreshore deposits probably built up more thickly closer to the river than further away.

Thus, the uppermost alluvium recorded in PDZ1.01 (at *c* 3.2m OD), in which soil development was observed might give an indication of pre-modern ground surface levels close to the river, although turf lines, which pre-dated modern ground raising were recorded on OL-00107 at just below 3m OD. In landscape terms, though, this difference is very slight.

3.3.2 Phase 1: Pleistocene deposits

Pleistocene deposits were recorded in section in PDZ1.09, which lies on the low terrace recorded down the eastern side of the floodplain north of Stratford. Here a shallow sequence of clayey sand and sandy clay deposits ([347] and [346]) about 0.20m thick, with a surface at c 2m OD lay above the floodplain gravel. These fine-grained deposits are likely to have accumulated on the Late Devensian floodplain and were preserved when Late Glacial downcutting eroded sediments from the western side of the valley floor, but left the eastern side relatively intact, creating the low terrace.

Where reached by sondage or augerhole, the surface of floodplain gravel was recorded at significantly lower elevations in the remaining trenches, which lay within the part of the floodplain impacted by Late Glacial river scour. Here the gravel surface was irregular, however, and varied between -1.1m OD in the augerhole drilled in PDZ1.08 and 0.9m OD in the sondage dug in PDZ1.06/07.

The significance of the undulations in the gravel surface might be better understood when the deposits have been input to the Olympic geoarchaeological database and modelled for the entire PDZ1 zone and its surrounding area. This will provide a more robust context for the deposits, which might then be viewed from a better-informed perspective.

3.3.2 Phase 2: Prehistoric activity and lower alluvium

The deposit sequence in PDZ1.09 resembles that of OL-00305 immediately to the east, where a dry land surface developed at roughly 2.3m OD on the low terrace, overlooking the lower wetland parts of the valley floor, during prehistory (MoLAS-PCA 2007c). Evidence for Mesolithic to Bronze Age activity was associated with the land surface at OL-00305. It appears that this occupation extended downslope to PDZ1.09, which lay at a slightly lower elevation and closer to the river, as a Late Bronze Age pit was recorded cutting a buried land surface (developed in Late Pleistocene clayey sand deposits) in PDZ1.09, at *c* 2m OD.

The sands ([332] in PDZ1.02/03 and the augerhole sequence in PDZ1.08) and organic sediments ([331] in PDZ1.02/03; [372] to [367] in PDZ1.06/07 and [387], [386] and the uppermost augerhole deposits in PDZ1.08) recorded above floodplain gravel in PDZ1.02/03, PDZ1.06/07 and PDZ1.08 were not seen in PDZ1.09.

These lower alluvial deposits appear to correspond with similar deposits recorded in OL-00105 (MoLAS-PCA 2005), where they were interpreted as sandy channel bars and peaty hollows, left behind as the river migrated away from the river terrace.

Radiocarbon dating suggested that this episode of river migration spanned (at least) the Neolithic to early Roman period. Although the date of the sand and peaty deposits in OL-01106 is not yet known, organic remains preserved in augerhole grab samples taken from the sand sequence in PDZ1.08 and from monoliths and bulks taken through the wetland/backwater deposits forming the lower alluvium in PDZ1.06/07 should be able to tie the OL-01106 active channel and wetland deposits in with those from the Aquatics Centre.

It is during this Neolithic to early Roman period that estuarine water is likely to have reached the Lower Lea and the river became tidal. The encroachment of estuarine environments and a tidal river up the Lea is likely to have had a significant impact on the prehistoric environment and the communities who relied on it. Thus it is important to establish from diatoms, ostracods, insects and snails preserved within the lower alluvial deposits whether the river they relate to was freshwater or brackish within this period. The lower alluvial sequence in OL-01106 lies between the surface of floodplain gravel and *c* 2m OD.

3.3.3 Phase 3: upper alluvial clay

Above roughly 2m OD the alluvial deposits in the OL-01106 trenches comprise predominantly clay, typically minerogenic (ie non peaty). Its characteristics vary laterally and through time and although difficult to differentiate from on-site observation of the deposits it is likely to represent a range of different depositional environments. In PDZ1.09 this clay ([344] and [343]) was oxidised and samples taken from it ({73}), {74}) preserved no biological remains, suggesting it was subject to episodes of weathering when organic material within it would decay. It is likely to have accumulated through temporary episodes of flooding of an otherwise dry land surface. It is probably late prehistoric to post medieval or more recent in date.

In contrast, preserved biological remains were abundant in the alluvial clay from trenches PDZ1.01 ([313] and [314]), PDZ1.06/07 (356], [357] and [370]) and PDZ1.08 ([383], [384], [385]) and a wide range of seeds and other plant remains, insects, snails and ostracods were observed in the samples processed from PDZ1.06/07 ({78} and {79}). It is likely that this clay represents more permanently waterlogged environments. It probably represents mudflats, saltmarsh or fringing sedge fen-type environments associated with the tidal river, but confirmation is needed from the biological remains preserved within the bulk and monolith samples.

3.3.4 Phase 4: Post Medieval

A presently undated post-medieval post was found in the upper alluvial layers of PDZ1.09. Weathered alluvium and other signs of soil formation recorded in the upper part of the alluvial sequence in trenches PDZ1.01, PDZ1.06/07, PDZ1.08 and PDZ1.09 indicate that a post medieval or later land surface might have survived below the nineteenth and twentieth century ground raising deposits. However, in most cases it was not possible to be certain that these uppermost alluvial deposits were not redeposited alluvium, as a result of historic river works.

3.3.5 Phase 5: Nineteenth century reclamation and river wall construction

This phase comprised two phases of wooden revetting. Both were seen in PDZ1.02/1.03 where the wooden posts were damaged as a result of erosion and water action. Considerable depths of 19th century dumped deposits were also present across the site

3.3.6 Phase 6: Twentieth century levelling and construction

The modern river-wall had needed re-enforcement. It originally comprised an iron and concrete revetment found in PDZ1.05, dated to before the 1930s, when a concrete river wall was constructed.

3.4 Evaluation of environmental evidence

3.4.1 Introduction

Several visits were made by MoLAS-PCA geoarchaeologists to examine, record and sample the natural sequence exposed within each evaluation trench. During these visits a hand auger hole and sondage were excavated in PDZ1.06/07 and a power augerhole drilled in PDZ1.08 to sample the alluvial deposits surviving below the base of these trenches. The geoarchaeologists' description and interpretation of the deposits form part of the trench results and stratigraphic interpretation in sections 3.2 and 3.3 above.

A sequence of monolith tins was taken from PDZ1.06/07 ({77} and PDZ1.09 ({71}) and a series of bulk samples was also taken adjacent to the monolith tins to provide sediment of off-site examination of deposit characteristics macrofossils, microfossils and radiocarbon dating, as described below. The prehistoric pit feature excavated in PDZ9.1 was also sampled with a bulk ({72}).

The stratigraphy recorded in a representative profile of the trench sequence, as drawn and described by the geoarchaeologist, will be entered into the MoLAS-PCA geoarchaeological stratigraphic database of the Lower Lea as part of the assessment. This database will be used in post excavation stages of the project, to reconstruct the evolving past environment of the Olympics site and to target samples and locations for analysis.

3.4.2 Sediment characteristics

Monolith samples were taken through the natural deposit sequence, as exposed in trenches PDZ1.06/07 ({77} and PDZ1.09 ({71}). These samples provide undisturbed columns of sediment, as revealed in the trench sections, for off-site examination. Representative profiles were selected for sampling, intended to gain a better understanding of the changing environments represented by the Holocene deposits across the site as a whole.

The samples will be suitable for sedimentary techniques such as loss on ignition, magnetic susceptibility and soil micromorphology, as well as microfossil examination. The monoliths will be retained until environmental assessment is

undertaken, when sub-samples for pollen and diatoms will be examined to determine their potential for past environment reconstruction (see below).

Further retention until the analysis stage of the project is likely to subsequently be required, as this is when more detailed sedimentary techniques will be carried out.

3.4.3 Microfossils

The alluvial deposits may preserve microfossils, in particular pollen and diatoms, but also cladocera, chironomids and other remains. Such evidence can provide valuable information about the evolving past environment (for example, vegetation, water characteristics, and indirect evidence for human activity, in particular landscape clearance, cultivation and other disturbance), which is likely to be complimentary to the macro-remains from bulk samples.

Preservation in the alluvial clay may be poor, as a result of oxidation and weathering, however. The survival and potential of microfossils in the deposits (as sampled in the monoliths and in the grab samples from the PDZ1.08 augerhole) needs to be assessed as a further stage of work.

3.4.4 Bulk sample processing

Environmental bulk soil samples were collected for the potential recovery of macro-biological remains, for information on the character of the local environment and possible evidence of human activities in the area. Any such information could compliment the potential ecological data from micro-biological material contained within monoliths sampled through sedimentary sequences at the site and establish possible spatial and temporal changes in the character of the environment on both a local and regional scale. The aim of the evaluation was simply to establish the presence and/or absence of biological remains and whether a full assessment of any such materials should be carried out.

Eight samples each from different contexts, associated with two of the OL-01106 trenches (PDZ1/06/07 and PDZ1.09), were selected and processed for the evaluation.

The samples were mainly ten litres in size with five litre sub-samples from each deposit being processed for the evaluation. The five litres from each sample was floated onto a 0.25mm sieve with the residue from this fraction wet-sieved through a 0.5mm mesh. Five litres of soil was retained from each sample for further work. Five of the samples produced organic flots, ranging in size from 3ml to 50ml. The flots were stored wet to prevent possible deterioration of any fragile organic material while the wet-sieved fractions were dried and sorted for any biological and artefactual materials. Processing details are shown in Table 7.

A visual examination of the whole flot, or fractions of the larger flots, was carried out to establish the potential for the survival of different forms of biological evidence and establish whether further detailed assessment was necessary. The wet flots were divided into fractions by washing through a stack of sieves and scanned using a binocular microscope with general comments on the biological remains being noted. The results are shown in Table 8 and Table 9. This information has been used to determine the most appropriate strategy for assessment (see below).

3.4.5 Radiocarbon dating

Although some idea of the date of the deposits excavated has been inferred from their characteristics and level and very occasional dateable finds, as well as by comparison with the dated sequence in OL-00105 (MoLAS-PCA 2005), no reliable date has yet been obtained for the sequence. Environmental evidence, unlike artefacts, is not intrinsically dateable and the information about the past landscape preserved in the deposit sequence means little unless it is tied in to an archaeological timeframe.

In general, few artefacts suitable for spot dating were recovered from the alluvial sequence (excepting the uppermost part of the alluvial clay and the pit feature in PDZ1.09). However, the deposits excavated contained seeds, twigs and other plant remains, from which radiocarbon dates might be obtained. No samples specifically for radiocarbon dating were taken, however, the sequence of bulk samples (and the monoliths if necessary) should provide sufficient material for the extraction of single entity organic remains suitable for radiocarbon dating by AMS (Accelerator Mass Spectrometry).

3.4.6 Plant remains

All the flots produced waterlogged plant remains, with two samples (79, 80) producing rich waterlogged plant assemblages in terms of numbers of identifiable fruits and seeds with moderately high to high species diversity.

A large quantity of the identifiable fruits and seeds were from wetland (particularly aquatic) species, for example water plantain (*Alisma* spp.), pondweeds (*Potamogeton* spp.), crowfoots (*Ranunculus Batrachium* gp), dropwort (*Oenanthe* spp.), celery-leaved crowfoot (*Ranunculs sceleratus*), branched bur-reed (*Sparganium erectum*), sedges (*Carex* spp.), spike-rush (*Eleocharis* spp.) and gypsy-wort (*Lycopus europaeus*). Plants of disturbed (including cultivated) ground and waste places, included stinging nettle (*Urtica dioica*), goosefoots (*Chenopodium* spp.), stinking mayweed (*Anthemis cotula*), docks (*Rumex* spp.) and buttercups (*Ranunculus* spp.).

Trees and shrubs were noted in several samples, including alder (*Alnus glutinosa*), which grows in wetland environments and other woodland/shrub species included hazel (*Corylus avellana*), elder (*Sambucus nigra*) and brambles (*Rubus* spp.). Waterlogged wood was found in {79}, {80} and {81}, with most of this material being very fragmented.

Occasional moss fragments were noted in {80} and {81}, while roots/rootlets were noted in varying amounts in virtually all the flots.

Flecks of very fragmented charcoal was present in {79}, {81} and {82}.

3.4.7 Insect remains

Rich assemblages of insect (beetle) fragments were noted in {79} and {81} and {79} also contained rich waterlogged seed remains. Moderate amounts of beetle fragments were also present in {80}.

3.4.8 Molluscs and ostracods

Large amounts of freshwater snails were noted in {80} and {81} with moderate quantities in {78}. Occasional ostracods were noted in {80}.

context	Sample	Proc vol (l)	Bulk vol (l)	Wet sv vol (l)	Wet sv mesh size	Flot	Flot vol (ml)	Comment
343	73	0		5	0.5	N		Y
346	75	0	10	5	0.5	N		Y
347	76	4	10	5	0.5	N		Y
357	78	0		5	0.5	Y	5	Y
367	80	0	10	5	0.5	Y	50	Y
369	81	0		5	0.5	Y	50	Y
370	79	0	10	5	0.5	Y	40	Y
372	82	0		5	0.5	Y	15	Y

Table 7 Processing details of selected bulk soil samples

					CHD	CHD	CHD	WLG	WLG	WLG	
					Grain	Chaf	Wood	Seed	Misc	Wood	
sample	Context	Proc vol.	Flot vol (ml)	Proc	A D	A D	A D	A D	A D	A D	Comments
78	357		5	F							MOLLUSCS++
79	370	0	40	F				3 2		3 1	MOD GOOD BEETLES,SEEDS
80	367	0	50	F				3 2		2 1	>MOLLUSCS,GOOD SEEDS,MOD BEETLES
81	369	0.02	50	F			1 1	2 1		2 1	GOOD INSECTS, MOLUSCS, OCC SEEDS
				W			1 1				PDZ 1.06/07; 25% SCANNED
82	372	0	15	F			1 1				V LITTLE,VIRT ALL ROOTS

Table 8: Botanical remains in processed soil samples

context	Sample	process	Constituent	Abundance	diversity	Comment
357	78	F	MOLSC FW	2	1	
	78	W	MOLSC FW	1	1	
367	80	F	INV BEETLES	2	1	
	80	F	INV OSTRACOD	1	1	
	80	F	MOLSC FW	3	1	
	80	F	WLG MOSS	1	1	
	80	F	WLG SEEDS	3	2	PTM,ALI,SPAER,CHRSE,RAN,SON,GRAM,CALPA
	80	F	WLG WOOD	2	1	
369	81	F	CHD WOOD	1	1	V SMALL FRAGS
	81	F	INV BEETLES	3	1	
	81	F	MOLSC FW	3	1	
	81	F	MOLSC TR	1	1	
	81	F	WLG MOSS	1	1	
	81	F	WLG ROOTS	2	1	
	81	F	WLG SEEDS	2	1	SON,GAL,CAR
	81	F	WLG WOOD	2	1	
	81	W	CHD WOOD	1	1	
	81	W	MOLSC FW	1	1	
370	79	F	INV BEETLES	3	1	
	79	F	MOLSC FW	1	1	
	79	F	WLG ROOTS	2	1	
	79	F	WLG SEEDS	3	2	SON,ALI,B/S,RUM,CAR,ZANPA,CHRSE
	79	F	WLG WOOD	3	1	
372	82	F	CHD WOOD	1	1	FLECKS,SMALL FRAGS
	82	F	MOLSC FW	1	1	
	82	F	WLG ROOTS	3	1	

Table 9: Biological remains from processed soil samples

3.5 Assessment of the evaluation

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 which will provide the basis of the mitigation strategy'.

As a result of on-site conditions, several of the trenches were amalgamated and one trench was not excavated.

Where floodplain gravels were reached it is considered that the full post-Palaeolithic archaeological sequence has been examined, as the gravels represent a horizon beneath which no deposits of Mesolithic and later archaeological significance are likely to be found. The full Holocene (Mesolithic to modern) archaeological sequence was not observed in every trench, owing to issues of contamination and depth, which led to difficulties of access. In one evaluation trench the floodplain gravels were exposed in section and in two others small sondages and augerholes found the depth of the gravel surface, in one at 0.7m and in the second at 2.2m below the base of the trench. In the remaining three trenches an unknown depth of alluvium of uncertain archaeological potential remained below the base of the trench. However, deposit modelling, based on previous borehole data should be able to gain information about the evolving environment that would off-set the lack of information from the archaeological trenches.

The alluvial deposit sequences observed in each trench correspond with those previously examined on OL-00105 and OL-00305, suggesting that despite the limited exposures in a number of trenches the results obtained are likely to be reliable. Furthermore the results provide information about the western extremes of PDZ1, which lie at the interface of the low terrace and main channel areas of the valley floor and thus extend the information previously obtained, rather than repeat it.

Apart from spot dates from finds from a prehistoric pit and from the made ground, dating of the archaeological sequence has not been undertaken as part of the evaluation and this should form part of any further stage of work. Without a chronological framework the results of the evaluation will be of little value.

The areas exposed in the evaluation trenches represented a minimum of 5% of the areas to be impacted upon by construction works. The trenches thus satisfy the original requirements of the evaluation as stated in the Written Scheme of Investigation (MoLAS-PCA 2007b).

4 Archaeological potential

4.1 Realisation of original research aims

The extent to which the evaluation has been able to address the individual research objectives established in the Method Statement for the evaluation is discussed below:

Analysis of borehole data suggests that the course of the Late Pleistocene, (Late Glacial) River Lea may in part be mirrored, by the Waterworks River. Can this be demonstrated through fieldwork?

Modelling of the floodplain gravel surface, as a further stage of work (to refine the current models with the results of the evaluation), should be able to examine the correspondence of the Late Pleistocene channel of the Lea and the recent courses of the Waterworks River.

Sand deposits above floodplain gravels in PDZ1.02/03 and PDZ1.08 demonstrate that a prehistoric or/and historic river lay close to the modern river channel. However, until dating and modelling of these deposits is undertaken (in tandem with modelling similar deposits observed in OL-00105 and OL-01507, to the east of the site, in PDZ1 and those recorded to the west in PDZ2) it is not possible to determine the course of the predecessor of the Waterworks River and of its tributaries.

Most of the archaeological evidence along the Waterworks channel found during the evaluation post dates at least the 18th century.

A butchered horse bone and fragments of worked wood of Neolithic date were recovered from the interface of gravel and overlying peat at the south of Site 25 whilst a circular structure of probable late Bronze Age/Early Iron Age was recorded at Site 26. Can it be further demonstrated that the south side of the construction zone has higher potential for prehistoric occupation?

A pit of probable LBA date was recorded in Trench PDZ1.09, located on the south west side of PDZ1. The deposits present in this trench indicate that it lies on the low terrace and in a similar landscape position to adjacent sites. It confirms that this promontory of higher ground overlooking the wetland of the lower-lying parts of the valley floor has good potential for the recovery of prehistoric occupation evidence. It should be possible to map the extent of this higher ground as part of the geoarchaeological deposit modelling proposed as part of the site-wide assessment.

The London to Colchester Roman road was not located within the Site 25 (Phase 1) site or at Site 26. Will work on the CZ1a River Walls provide evidence for the course of the road in the gap between the two investigations? What evidence is there for post-Roman exploitation, in particular is there evidence for inundation and water management? If so how are these activities characterised?

There was no evidence any Roman or later activity found within the site.

Are there any in situ deposits of archaeological significance within the made ground or does it exclusively comprise 19th/20th century dump and make-up deposits?

There were in-situ deposits of older river revetments along the riverbank seen in PDZ1.02/1.03 and PDZ1.05 and PDZ1.06/1.07. The majority of the remains comprised 19th–20th century dumps associated with land reclaiming and managed drainage of the Lea floodplain.

Is there evidence of pre-20th century industrial features?

There is no evidence for pre-20th century industrial features. The only evidence of this nature is of 20th century date.

What is the date and significance of the redeposited alluvium?

There were two examples of re-deposited alluvium. One was recorded in Trench PDZ1.02/03. This probably indicates the use of alluvial material from the riverbed in the construction of the bank and base for the 1930s concrete wall. The other was in Trench PDZ1.09 where it was used to fill the cut for the 20th-century wall.

Did the construction work undertaken as part of the 1930's remodelling of the Waterworks River destroy all archaeological horizons within the construction corridor?

The 1930's remodelling of the Waterworks River did not destroy all archaeological horizons within the construction corridor. The 1930s canalisation of the waterworks river appears to have narrowed the channel and to have had a relatively limited impact on the existing deposits.

4.2 General discussion of potential

The evaluation has shown that undisturbed deposits survive intact beneath the 19th – 20th century made ground in the vicinity of the Waterworks River wall. These deposits comprise prehistoric land surfaces with evidence of associated occupation and evidence for a river channel, perhaps a former course of the Waterworks river, and its abandonment.

OL-01106 spans the low terrace and the deeper part of the valley floor, where migrating channels formerly existed, which are likely to include the precursor of the Waterworks River. The characteristics of the deposit sequences recorded in the OL-01106 trenches are similar to those recorded on other PDZ1 sites: OL00107; OL-01507 and OL-00305. The OL-01106 trench results confirm and also expand the information already obtained from this zone and the records and samples taken from the site have good potential to contribute to our understanding of the prehistoric and later evolving environment and human activity within it.

Trench PDZ1.09, located in the extreme south of the site, lies on the low terrace. Evidence for prehistoric occupation was found associated with a buried land surface horizon in this trench, indicating a continuation of the activity previously recorded upslope in OL-00305 (MoLAS-PCA 2007c). There is potential for further evidence of human activity to be recovered in this area and it is also possible that associated wetland archaeology also lies buried in the deeper areas adjacent to the river terrace. Although all of the trenches except PDZ1.09 lie within this lower lying, wetland, part

of the valley floor, evidence of prehistoric and later activity was not recovered. It is unknown whether wetland archaeology is genuinely absent or survives at depth in this area, as none of the trenches were fully excavated down to the surface of floodplain gravel.

The deposit sequence in the lower-lying part of the site resembles that found in OL-00105 (MoLAS-PCA 2005), with thick sand deposits, accumulated as sand bars within and at the margins of a former river channel forming a series of ridges, interspersed with and overlain by peaty clays and organic silts, accumulated in backwaters and marshy hollows left behind as the river migrated away from the edge of the terrace. There is good potential for past environment reconstruction from seeds, snails, insects, ostracods – all of which the evaluation has shown to be preserved in bulk samples taken from PDZ1.06/07. Microfossils, and in particular pollen and diatoms, are likely to be preserved in the monolith and augerhole grab samples taken through the wetland deposits from PDZ1.06/07 and PDZ1.08.

No radiocarbon dates have yet been obtained from the OL-01106 trenches, although there is good potential for radiocarbon dating samples from PDZ1.06/07 and PDZ1.08. This would help to clarify the timing of river activity and wetland development in the southwest part of PDZ1 and tie the OL-01106 information in with the evidence for channel migration that appears to have taken place between the Neolithic and early Roman period in OL-00105 (MoLAS-PCA 2005).

The sands and organic deposits found above the floodplain gravel in the lower-lying OL-01106 trenches (that is, all but PDZ1.09) and the dry land surface recorded in PDZ1.09 were all overlain by alluvial clay. Although difficult to distinguish by eye from its sediment characteristics in section, the clay is likely to represent different environments both laterally and through time. The oxidised characteristics of the clay in PDZ1.09 suggest that here it might represent a generally dry accretionary soil, built up gradually during episodes of prolonged flooding. In contrast good preservation of organic remains and its thickness in PDZ1.01, PDZ1.06/07 and PDZ1.08 suggest it accumulated in more permanently wet conditions, closer to the river and here it might represent intertidal mud. There is potential for examination of biological remains from the alluvial clay deposits in PDZ1.06/07 and PDZ1.09, where samples were taken, to infer its depositional environment and its date, both of which are likely to vary across the site.

A key question to be addressed regarding the alluvial sequence is when and in what way did estuarine incursion reach this part of the Lower Lea. The encroachment of estuarine environments and tidal water up the Lea Valley would have had a significant impact on the activities of people living in and exploiting the locality. There is good potential for the samples obtained from the evaluation to provide dates and useful information (such as from ostracods, diatoms and forams) from which we can infer the timing and nature of the transition from a freshwater to tidal river.

In addition to dating the deposit sequence and examining the biological remains preserved within the samples, there is very good potential for more detailed examination of the trench records to contribute to our understanding of the past topography and evolving environment, by inputting the stratigraphic information into the Olympics geoarchaeological database and modelling the semi interpreted data in ARC GIS.

4.3 Significance

The evaluation of PDZ1 Work Package 7 has added useful information to the archaeological understanding of the area. It has extended the area of known prehistoric occupation westwards and shown that the low terrace was occupied to the western limit of PDZ1 in this area, which is of local significance.

It has demonstrated the lack of a Roman road in this part of the Lea Valley, which is also of at least local significance, as the logistics of the Roman river crossing needs to be understood in order to put the evidence for Roman occupation at Stratford and Old Ford into its landscape context.

The information will assist in landscape reconstruction models being developed for the Lower Lea Valley and in considerations of the relationship between the changing environment and human activity. It is certainly of local significance and collectively when integrated with similar information from other sites on the Olympics as a whole, would be regionally significant, however, there is nothing to suggest that they are of national importance.

5 Assessment by EH criteria

The recommendations of the GLAAS 1998 guidelines on *Evaluation reports* suggest that

'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)

A set of guide lines was published by the Department of the Environment with criteria by which to measure the importance of individual monuments for possible Scheduling. These criteria are as follows: *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'.[1]

In the following passages the potential archaeological survival described in the initial Assessment document and Section 3.2 above will be assessed against these criteria.

Criterion 1: period
Taken as a whole, archaeology of the site is not characteristic of any particular period. The Evaluation indicates a multi period site.
Criterion 2: rarity
There is nothing to suggest that any of the likely archaeological deposits are rare either in a national or regional context.
Criterion 3: documentation
There may be considerable contemporary documentation for the post-medieval period of the site and there may be some possibility that some of this could be specific enough to relate to individual features.
Criterion 4: group value
The prehistoric landscape features relate to and are part of the wider pattern seen within the Olympic Park and elsewhere in the Lea Valley. Full interpretation is only possible in that context. The location of this site, close to the former confluence of the Lea and the Thames, has a bearing on the understanding of the past environment of the Thames' floodplain. The post-medieval survival is remnants of part of the spread eastwards from the City of London and the urbanisation of the site area, combined with the linking of the former villages of Stratford and Mile End.
Criterion 5: survival/condition
The evaluation results have demonstrated that geoarchaeological and archaeological remains (including prehistoric activity) were preserved beneath several metres of modern made ground, although locally within areas of development these will have been truncated to dramatically different levels.
Criterion 6: fragility
Experience from other sites has shown that isolated and exposed blocks of stratigraphy can be vulnerable to damage during construction work.
Criterion 7: diversity

[1] Annex 4, DOE, Planning and Policy Guidance 16, (1990). For detailed definition of the criteria see that document. Reference has also been made to Darvill, Saunders & Startin, (1987); and McGill, (1995)

Clearly, taken as a whole, the deposits at the site do not represent a diverse and heterogeneous group of archaeological remains of all types and periods. However, this diversity is in itself the product of a random process of vertical and horizontal truncation and separation. There is no reason to suggest that the diversity per se has any particular value which ought to be protected.

Criterion 8: potential

(*the term Potential in this context appears to mean that though the nature of the site, usually below-ground resources, cannot be specified precisely, it is possible to document reasons predicting its existence and importance*)

The evaluation has shown that variable depths of alluvium overlying late Pleistocene/early Holocene gravels are likely to exist elsewhere in the local vicinity.

Some features of probable prehistoric date were present within the lowest parts of the alluvial sequence, and together with cultural deposit including pottery, could link indicate a more intensive occupation/exploitation of the vicinity in this period. This is linked to OL-00305 (south of Warton Road) where Late Bronze Age activity was found in 2006 (MoLAS-PCA 2007c). Also there is evidence from the adjacent work packages in PDZ1 (Trench PDZ1.12) of settlement on dryland to the east of the Waterworks River (Lea Valley).

Further examination of samples already taken from the alluvial deposits on the site hold the potential to enhance current understanding of the natural and manmade environment of this part of the Lea Valley, from the early prehistoric to modern periods.

6 Proposed development impact and recommendations

Detailed architectural and engineering designs are not yet available, but current proposals for development include construction of three bridges: F09, F10b, and H07; reprofiling of the 1930s concrete wall (River Wall), and 8 metres of ground between the 1930s river wall and the current wall. In summary the archaeological remains located within the site will be severely impacted, if not completely removed by the planned construction works, which are certain to include a considerable amount of deep excavation. The construction methods for these works will locally disturb and destroy all archaeological deposits within their footprints.

The evaluation does not suggest that preservation *in situ* would be an appropriate mitigation strategy, but the depth of the deposits of interest and issues of water ingress as well as health and safety preludes more detailed examination and excavation of the deposits of interest. However, where samples have been taken from these deposits during the evaluation there is good potential for off-site work on the samples to provide information that will contribute to a better understanding of the prehistoric and later environment and river regime. Crucially this work should involve a programme of radiocarbon dating to correlate the stratigraphy recorded in each individual trench across the site itself and tie it in to an archaeological chronology. In order to clarify the potential of the archaeological resource identified and to refine the research aims the samples might be able to address, it is recommended that:

- A programme of radiocarbon dating is undertaken on key deposits in order to correlate the stratigraphy across the site, clarify the site sequence and relate it to an archaeological chronology. It is suggested that a total of 10 radiocarbon dates taken from the sampled sequences will provide an adequate dating framework for the site stratigraphy. The radiocarbon dates should be obtained by AMS on identified twigs, seeds or other plant material likely to have received its carbon from atmospheric sources. Deposits to target for dating should include those representing the:
  - waterlogging of the buried land surface (PDZ1.09);
  - deposition of the sandy deposits in PDZ1.08;
  - onset of humic / organic deposits over the sands in PDZ1.08 and the floodplain gravel in PDZ1.06/07;
  - transition between organic lower alluvium and upper alluvial clay in PDZ1.06/07 and PDZ1.08;
  - changing characteristics within the wetland / marsh deposits in PDZ1.06/07 and PDZ1.08
  - organics within the alluvial clay in PDZ1.06/07 and PDZ1.09.
- The bulk samples (10 samples) are processed by wet sieving, paraffin flotation and water flotation for the assessment of plant remain, snail, ostracod and insect assemblages;
- The two monolith sampled profiles (7 tins) and the augerhole grabs are sub-sampled and assessed for microfossils (pollen, diatoms). It is likely that *c* 8 sub-samples for assessment of pollen and diatoms are required from each

sequence, in total assessment of *c* 24 sub-samples for each pollen and diatoms is likely to be needed;

- The stratigraphic, dating and sample assessment data is entered into the MoLAS-PCA geoarchaeological stratigraphic database and used to update the current GIS themes;
- Research aims that might realistically be addressed by the samples are identified.

It is also recommended that the results of this evaluation and of the proposed environmental mitigation are assimilated into a site-wide assessment of all archaeological interventions to assign contextual significance and further refine the importance of the archaeological survival, and thereafter assimilated into any publication discussing/disseminating the results.

The decision on the appropriate archaeological response to the deposits revealed within the evaluation rests with the Local Planning Authority and their designated archaeological advisor (GLAAS).

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9 Appendix 1: NMR OASIS Archaeological report form

OASIS ID: molas1-54224

Project details

Project name	Olympic Planning Applications: Planning Delivery Zone 1, PDZ1A (River Wall)
Short description of the project	MoLAS-PCA evaluation of Olympic, Paralympic and Legacy Transformations Planning Applications: Planning Delivery Zone 1 (Work Package 7) London E15 for the ODA. Trenches PDZ1.01,1.02,1.03,1.04/5, 1.06/7,1.08, 1.09. Evaluation has shown that undisturbed deposits survive beneath the C19th - C20th made ground in the vicinity of the Waterworks River wall. These comprise prehistoric land surfaces with associated occupation and evidence for a river channel, perhaps a former course of the Waterworks River, and its abandonment. The deposit sequence in the lower-lying part of the site resembles that found to the east, with thick sand deposits, accumulated as sand bars within and at the margins of a former river channel forming a series of ridges, interspersed with and overlain by peaty clays and organic silts, accumulated in backwaters and marshy hollows left behind as the river migrated away from the edge of the terrace. Microfossils, and in particular pollen and diatoms, are likely to be preserved in the monolith and auger hole grab samples taken. Timber posts and timber, metal and concrete revetments, all of increasingly late post-medieval date truncated the alluvial deposits The deposits and features of archaeological interest were subsequently sealed by 19th-20th century made ground and landfill deposits covered by concrete.
Project dates	Start: 04-11-2007 End: 30-01-2008
Previous/future work	No / Not known
Any associated project reference codes	OL-01106 - Sitecode
Type of project	Field evaluation

Site status	Local Authority Designated Archaeological Area
Current Land use	Industry and Commerce 1 - Industrial
Monument type	BURIED LAND SURFACE Uncertain
Monument type	WATER CHANNEL Uncertain
Monument type	PIT Late Bronze Age
Monument type	POST Post Medieval
Monument type	WOODEN REVETMENT Post Medieval
Monument type	CONCRETE REVETMENT Modern
Monument type	WALL Modern
Significant Finds	POTTERY Late Bronze Age
Significant Finds	PLANT MICRO REMAINS Uncertain
Significant Finds	FLAKE Late Prehistoric
Significant Finds	POST Post Medieval

Project location

Country	England
Site location	GREATER LONDON NEWHAM NEWHAM Olympics PDZIA (River Wall)
Postcode	E15

Study area	0.64 Hectares
Site coordinates	TQ 380000 843000 51.5402085938 -0.00985814432685 51 32 24 N 000 00 35 W Point
Height OD / Depth	Min: 4.90m Max: 5.36m

Project creators

Name of Organisation	MoLAS/PCA
Project brief originator	London Development Agency
Project design originator	MoLAS/PCA
Project director/manager	Kieron Tyler
Project supervisor	Tristran Adfield
Type of sponsor/funding body	Client
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Project archives

Physical Archive recipient	LAARC
Physical Archive ID	OL-01106

Digital Archive recipient	LAARC
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Digital Contents	'Animal Bones','Ceramics','Environmental','Glass','Metal','Wood','Worked stone/lithics'
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Project bibliography 1

Publication type	Grey literature (unpublished document/manuscript)
Title	Planning Delivery Zone 1, Work Package 7, Arcaheological Evaluation Report
Author(s)/Editor(s)	Adfield T, Yendell V and Corcoran J
Date	2008
Issuer or publisher	Molas/PCA
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Description	Client report - Evaluation report

Entered by	Pat Miller (pmiller@museumoflondon.org.uk)

Entered on 20 January 2009

10 Appendix 2: Glossary

Alluvium. Sediment laid down by a river, and usually well-sorted. Can range from sands and gravels deposited by fast flowing water and clays that settle out of suspension during overbank flooding. Other deposits found on a valley floor are usually included in the term alluvium. Peat develops when there is little mineral sediment deposition and impeded drainage, which limits biological decay; and tufa accumulates when springs rich in calcium carbonate discharge in damp well-vegetated situations.

Arctic Beds. Cold climate deposits, pre-dating the Last Glacial Maximum and sometimes found within the gravels of the Lower Lea. They may survive within parts of the floodplain not reworked by the river during the Late Glacial.

Ecotone. A zone that lies between areas of contrasting environment, such as on the wetland/dryland margins.

Holocene. The most recent epoch (part) of the Quaternary, covering the past 10,000 years during which time a warm interglacial climate has existed. Also referred to as the 'Postglacial' and (in Britain) as the 'Flandrian'.

Knickpoint. A fall in base level (such as the low sea level at the end of the Pleistocene) gives rise to a discontinuity in the longitudinal profile of a river ie: steepening of the downstream channel gradient. The river tends to adjust to such a change by increased flow, which leads to increased erosion in the steepened section of the river and this results in the steepened section (knickpoint) cutting back in an upstream direction.

Last Glacial Maximum. The height of the glaciation that took place at the end of the last cold stage, around 18,000 years ago.

Late Glacial. The period following the Last Glacial Maximum and lasting until the climatic warming at the start of the Holocene. 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).

Pleistocene. Used in this report to refer to the earliest part of the Quaternary, the period of time until the start of the Holocene, about 10,000 years ago. However, since the present Holocene epoch is almost certainly only a warm interglacial episode within the oscillating climate of the Quaternary, it is often seen as being part of the Pleistocene epoch, in which case the terms Pleistocene and Quaternary are interchangeable. As it is necessary, in this report, to differentiate between the events that took place at various times during the last cold stage and earlier in the Quaternary and those that took place during the Holocene, the Pleistocene is used to refer to the parts of the Quaternary pre-dating the climatic amelioration that took place at the start of the Holocene.

Quaternary. The most recent major sub-division (period) of the geological record, extending from around 2 million years ago to the present day and characterised by climatic oscillations from full glacial to warm episodes, when the temperate was as warm as if not warmer than today. To a large extent human evolution has taken place within the Quaternary period.

11 Appendix 3: Finds assessment

11.1 Struck flint

Barry Bishop
A single struck flint came from context [351], this comprises a retouched flake possibly representing a piercer, taken from a flint pebble. It has a pronounced bulb of percussion, and plain striking platform, suggesting the use of a hard hammer. It has few dorsal scars, and measures 35mm in length by 26mm in width. The colour of the flint is grey and original cortex is present along one edge. A later pre-historic date would be compatible with this piece. No further work is recommended.

11.2 The prehistoric pottery

Mike Seager Thomas

11.2.1 Introduction

A small amount of untempered / organic tempered wares were recovered from the fill of an isolated pit. In itself this does not merit further work. If other prehistoric features are identified in the vicinity then the feature and the associated finds should be considered as part of the larger assemblage.

Context	Description	Estimated date
351	FMF (PDR)-short everted neck of ?shouldered bowl, thin bodied burnished sherds, Untempered/organic tempered sherds	LBA

Table 10 Trench PDZ1.12 prehistoric pottery spot dating index

11.3 The Post-Roman pottery

Chris Jarrett
Standard Museum of London pottery codes were used to classify the pottery and the assemblages were recorded in an Access database.

11.3.1 Introduction

There are six sherds of post-Roman pottery (and none are unstratified from site OL-01507, PDZ1.06/07 dating to the 19th century onwards. The pottery is generally in a good condition, and vessel shapes can be identified. There is little or no abrasion despite probable secondary or tertiary deposition processes. The pottery derived from two contexts. Standard Museum of London pottery codes were used to classify the pottery and the assemblage was recorded in a database.

11.3.2 Distribution

Table 1 shows the distribution of the pottery in the contexts it was recovered from, the number of sherds and a spot date for each deposit.

Trench	Context	Sherd count	Spot date
1.06/07	[373]	4	1800-1900+
1.06/07	[374]	2	1830-1900+

Table 11Post Roman Pottery spot dating index

11.3.3 Significance, potential and recommendations for further work

There is little or no significance to the stratified pottery at a local level. The ceramic profile of the assemblage is typical of the period with industrial finewares (19th-century white earthenware, its transfer-printed ware version, English porcelain and English stoneware with a Bristol-glaze). The material mostly derives from a Midlands source. The principal potential of the pottery is to date the contexts it occurs in. None merits illustration or photographing. The pottery is mundane and there are no unusual fabrics. There are no recommendations for further work.

11.4 The Glass

Chris Jarrett

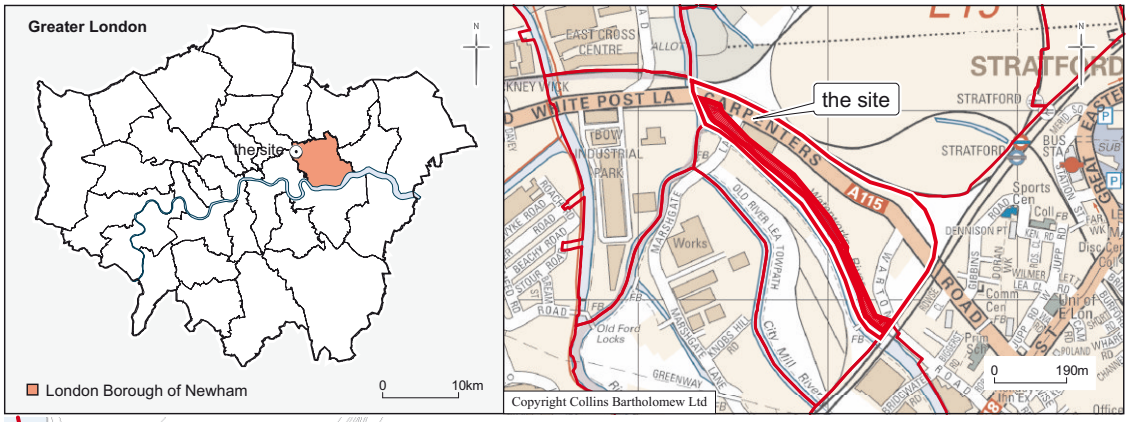
11.4.1 Introduction

A single sherd a light bluish green bottle base was recovered from context [374]. The bottle was moulded and therefore dates to after *c* 1830. The vessel is of no significance, has some potential to date the context it was found in, but there are no recommendations for further work.

12 Appendix 4: Context index

Trench	Context	Plan	Section	Type	Description	Provisional Date	Phase
1.01	310		21	Layer	Made ground	20th century	6
1.01	311		21	Layer	Made ground	19th century	5
1.01	312		21	Layer	Made ground	19th century	5
1.01	313	18	21	Layer	Alluvium	Build up of river	2
1.01	314	18	21	Layer	Alluvium	Build up of river	2
1.02/1.03	315		22 + 23	Layer	Made ground	20th century	6
1.02/1.03	316	22	23 + 23	Layer	Made ground	19th century	5
1.02/1.03	317	22	22	Layer	Alluvium	19th century	5
1.02/1.03	318	22	22	Timber	Post	19th century	5
1.02/1.03	319	22		Timber	Post	19th century	5
1.02/1.03	320	22		Timber	Post	19th century	5
1.02/1.03	321	22		Timber	Post	19th century	5
1.02/1.03	322	22		Timber	Post	19th century	5
1.02/1.03	323	22		Timber	Post	19th century	5
1.02/1.03	324	22		Timber	Post	19th century	5
1.02/1.03	325	22		Timber	Post	19th century	5
1.02/1.03	326	22		Timber	Post	19th century	5
1.02/1.03	327	22		Timber	Post	19th century	5
1.02/1.03	328	22		Timber	Post	19th century	5
1.02/1.03	329			Timber	Plank	19th century	5
1.02/1.03	330		23	Layer	Alluvium	Build up of river	2
1.02/1.03	331		23	Layer	Peat	Build up of river	2
1.02/1.03	332	22	23	Layer	Sandy Layer	Natural	1
1.02/1.03	333			Timber	Timber Plank	19th century	5
1.02/1.03	334	22	22	Cut	Cut	19th century	5
1.05	337		26	Layer	Made ground	20th century	6
1.05	338	PDZ1.05		Fill	Piles Revetment	20th century	6
1.05	339	PDZ1.05		Cut	Piles Revetment	20th century	6
1.05	340	PDZ1.05	26	Layer	Made ground	19th century	5
1.09	341		27	Layer	Made ground	20th century	6
1.09	342		27	Layer	Made ground	19th century	5
1.09	343		27	Layer	Alluvium	Post medieval	4
1.09	344	PDZ1.09	27	Layer	Alluvium	Build up of river	2
1.09	345	PDZ1.09	27	Layer	Alluvium	Build up of river	2
1.09	346	PDZ1.09	27	Layer	Organic layer	Build up of river	2
1.09	347	PDZ1.09	27	Layer	Natural	Natural	1
1.09	348		27	Fill	Made ground	19th century	5
1.09	349		27	Cut	Made ground	19th century	5
VOID	350		VOID	VOID	VOID		
1.09	351	PDZ1.09		Fill	Pit	Late Bronze Age	3
1.09	352	PDZ1.09 + 352		Cut	Cut of Pit	Late Bronze Age	3
1.09	353	PDZ1.09		Timber	Post	Post medieval	4
1.09	354	PDZ1.09		Cut	Cut of Post	Post medieval	4

1.06/1.07	355		28	Layer	Made ground	20th century	6
1.06/1.07	356	PDZ1.06/7	28 + 29	Layer	Alluvium	Build up of river	2
1.06/1.07	357		28 + 29	Layer	Alluvium	Build up of river	2
1.06/1.07	358	PDZ1.06/7		Timber	Post	19th century	5
1.06/1.07	359	PDZ1.06/7		Timber	Post	19th century	5
1.06/1.07	360	PDZ1.06/7		Timber	Post	19th century	5
1.06/1.07	361	PDZ1.06/7		Timber	Post	19th century	5
1.06/1.07	362	PDZ1.06/7		Timber	Post	19th century	5
1.06/1.07	363	PDZ1.06/7		Timber	Post	19th century	5
1.06/1.07	364	PDZ1.06/7		Timber	shuttering	19th century	5
1.06/1.07	365	PDZ1.06/7		Timber	Revetment Planks Vertical	19th century	5
1.06/1.07	366	PDZ1.06/7		Timber	Revetment Planks Horizontal	19th century	5
1.06/1.07	367		28 + 29	Layer	Alluvium	Build up of river	2
1.06/1.07	368		28 + 29	Layer	Alluvium	Build up of river	2
1.06/1.07	369		28 + 29	Layer	Alluvium	Build up of river	2
1.06/1.07	370		28 + 29	Layer	Alluvium	Build up of river	2
1.06/1.07	371	PDZ1.06/7		Timber	Revetment Planks Horizontal	19th century	5
1.06/1.07	372	PDZ1.06/7	28+ 29	Layer	Alluvium	Build up of river	2
1.06/1.07	373	PDZ1.06/7		Fill	Storm Drain	19th century	5
1.06/1.07	374	PDZ1.06/7		Fill	Storm Drain	19th century	5
1.06/1.07	375	PDZ1.06/7		Cut	Storm Structure	19th century	5
1.06/1.07	376	PDZ1.06/7		Cut	Storm Drain	19th century	5
1.06/1.07	377	PDZ1.06/7	28	Fill	Backfill of Revetment	19th century	5
1.06/1.07	378	PDZ1.06/7	28	Cut	Wooden Revetment	19th century	5
1.08	379		30	Masonry	Brick Wall	20th century	6
1.08	380	PDZ1.08	30	Layer	Made ground	20th century	6
1.08	381		30	Layer	Redeposited clay	20th century	6
1.08	382	PDZ1.08	30	Layer	Gravel lens	19th century	5
1.08	383		30	Layer	Alluvium	Build up of river	2
1.08	384	PDZ1.08	30	Layer	Alluvium	Build up of river	2
1.08	385		30	Layer	Alluvium	Build up of river	2
1.08	386	PDZ1.08	30	Layer	Alluvium	Build up of river	2
1.08	387	PDZ1.08	30	Layer	Peat Alluvium	Build up of river	2
1.08	388	PDZ1.08		Fill	Crush	2007/2008	7
1.08	389	PDZ1.08		Cut	Crush	2007/2008	7



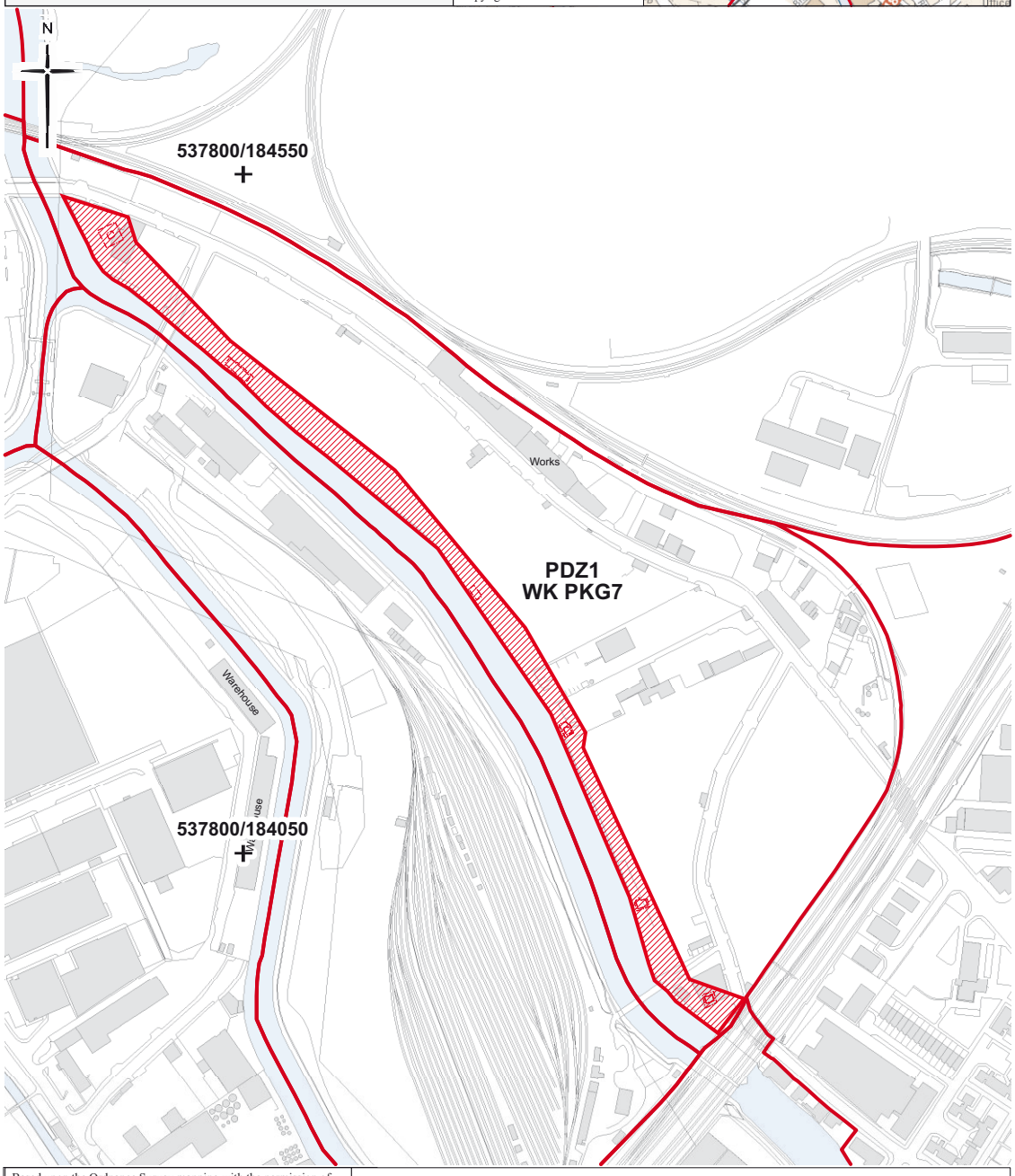


Fig 1 Site location

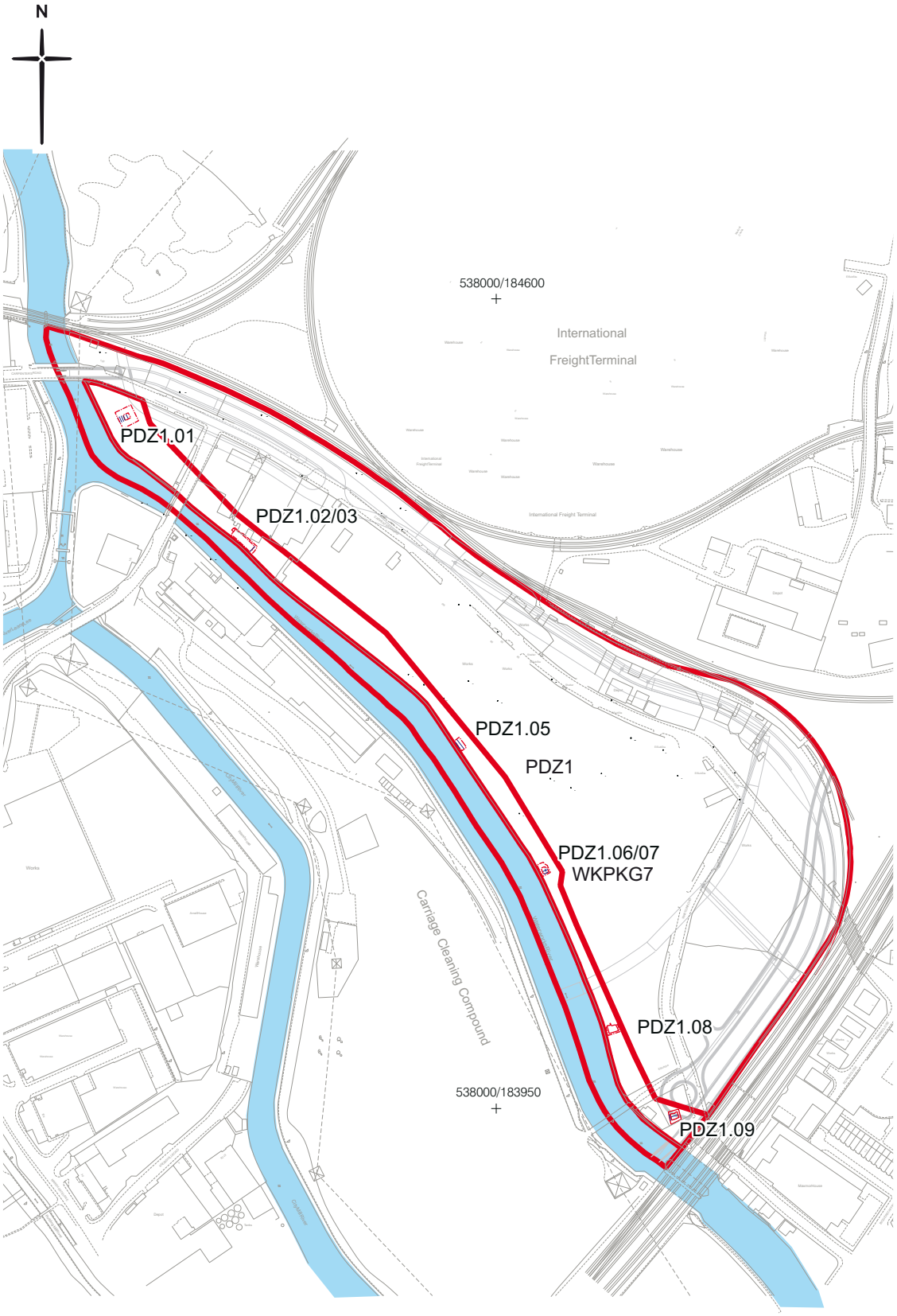


Fig 2 Trench locations

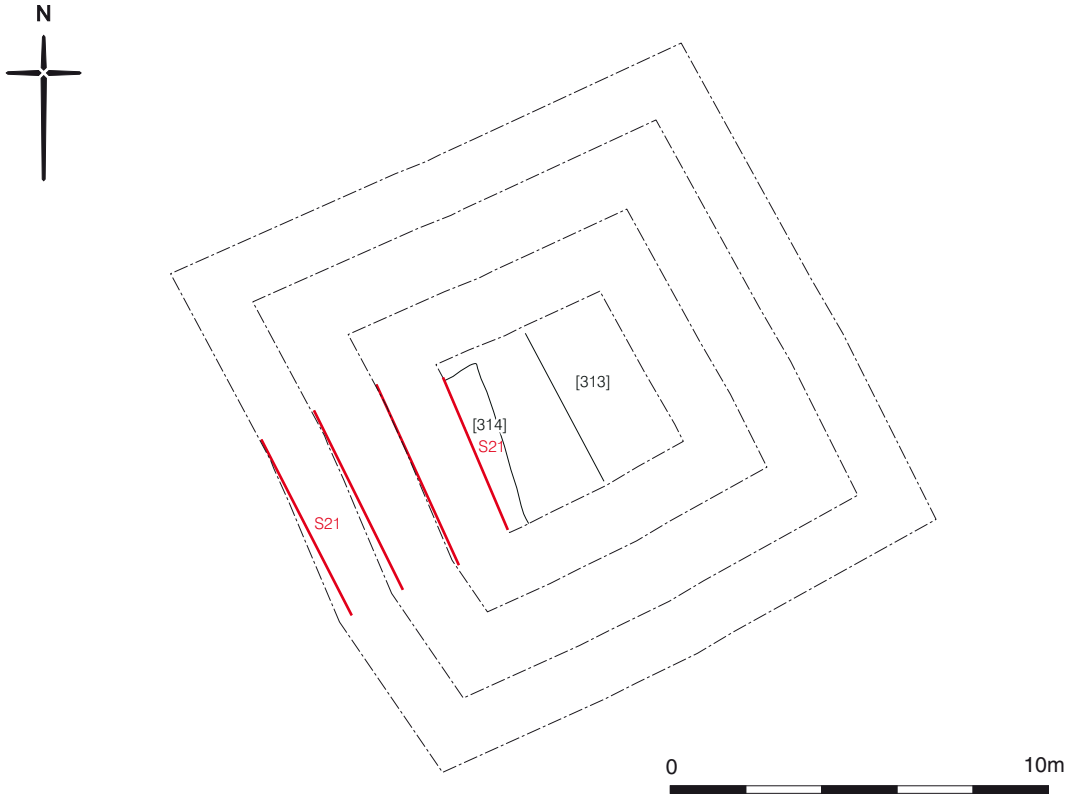


Fig 3 Plan of Trench PDZ1.01

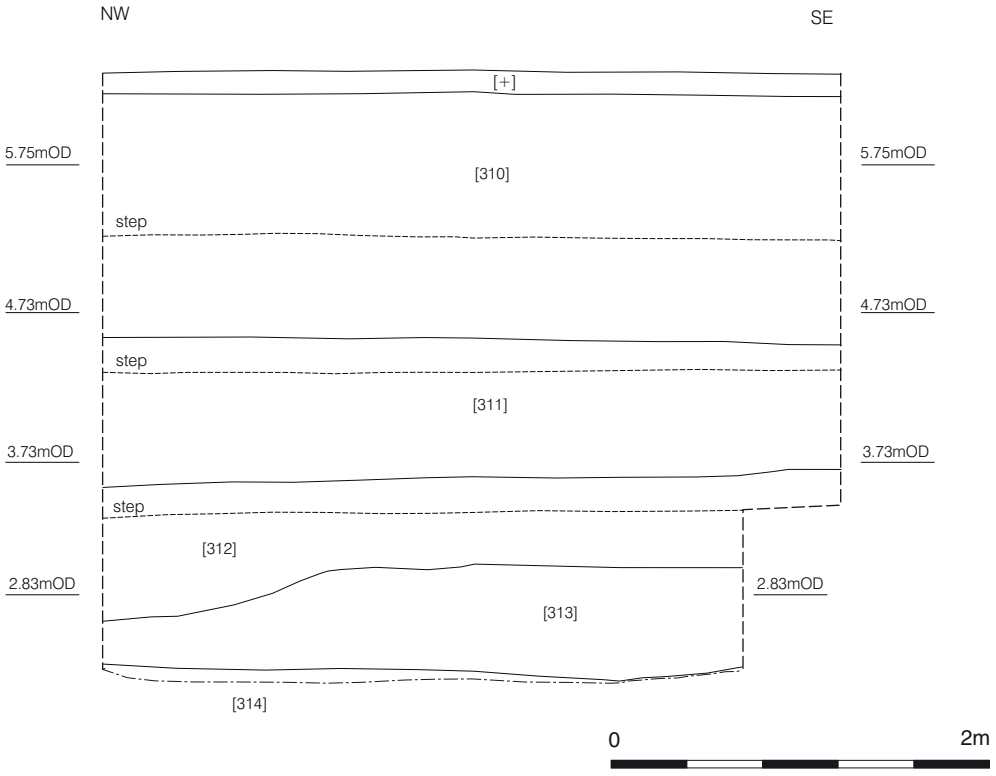


Fig 4 North-east facing section 21 of Trench PDZ1.01

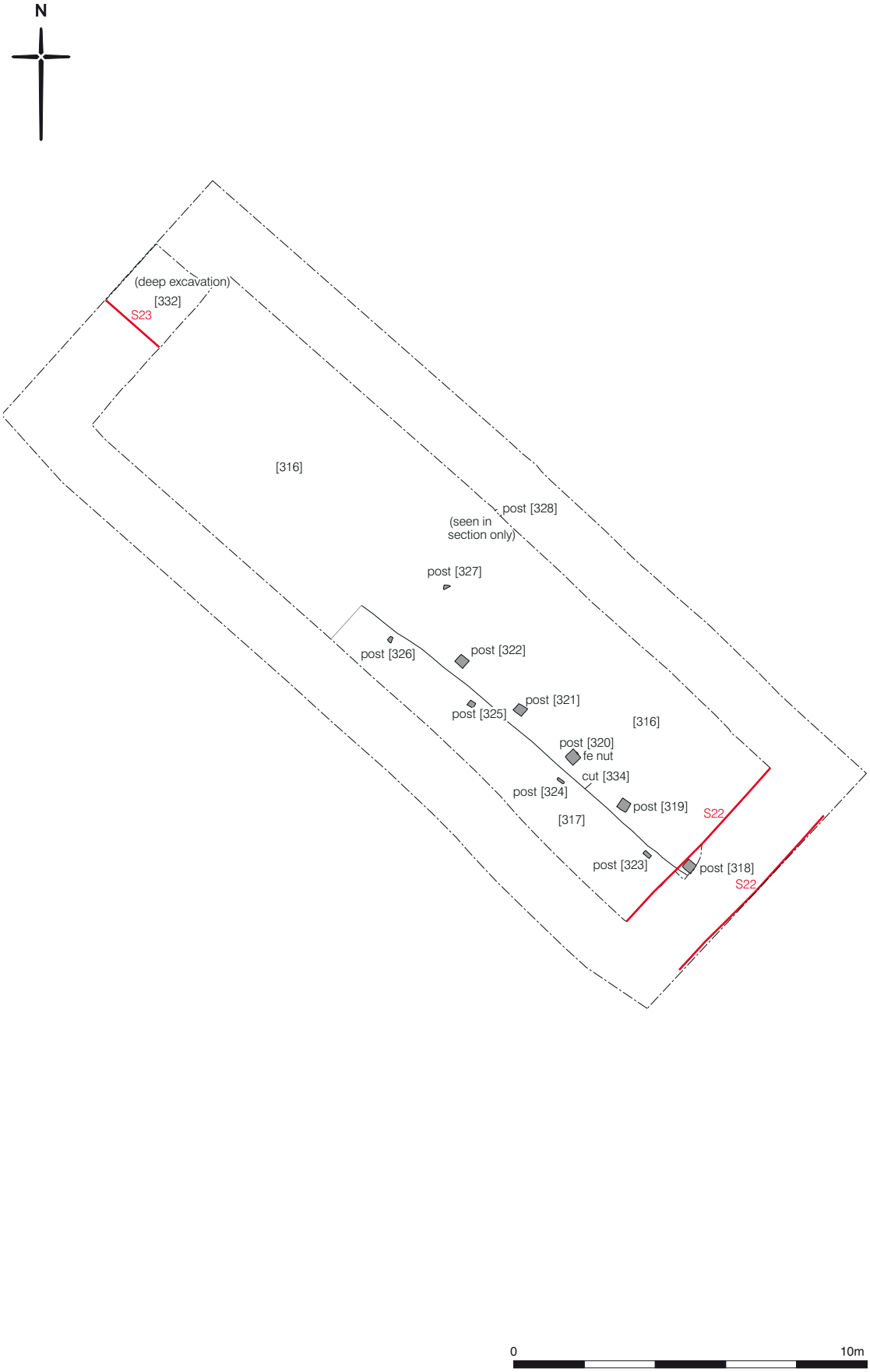


Fig 5 Plan of Trench PDZ1.02/03

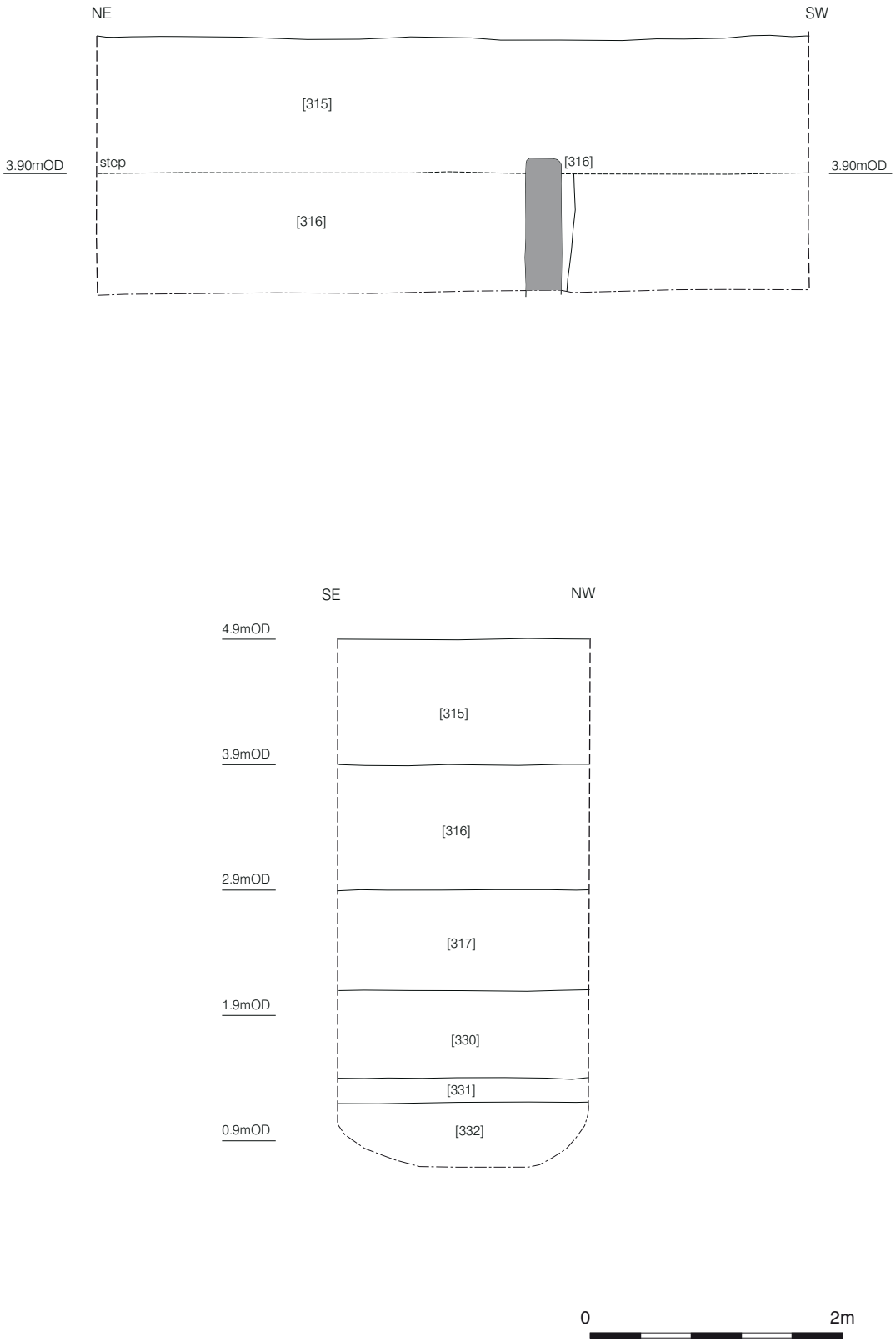


Fig 6 North-east facing section 22 and north-west facing section 23 of Trench PDZ1.02/03

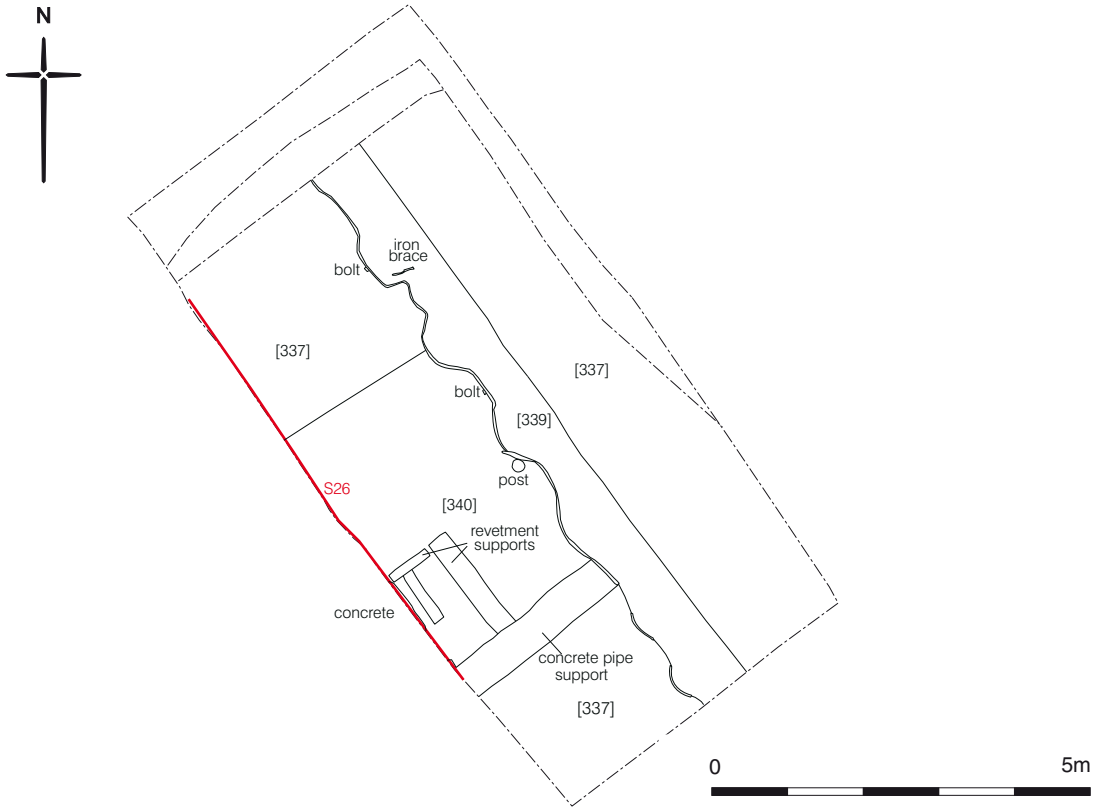


Fig 7 Plan of Trench PDZ1.05

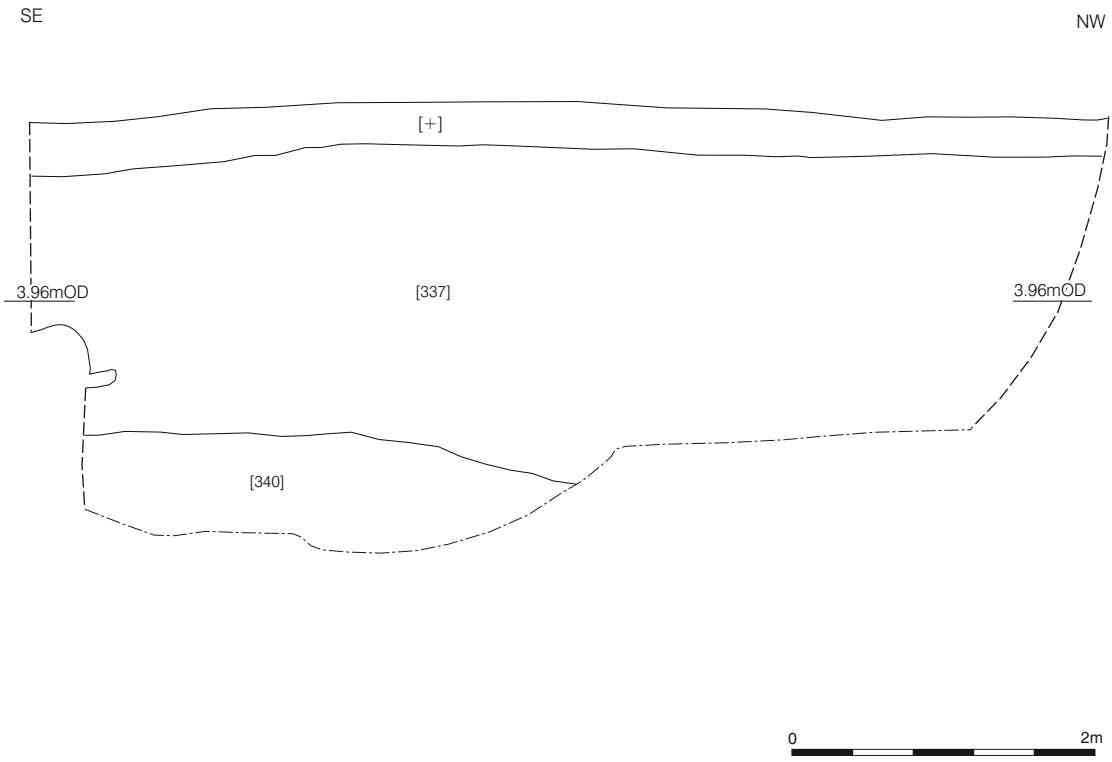


Fig 8 North-east facing section 26 of Trench PDZ1.05

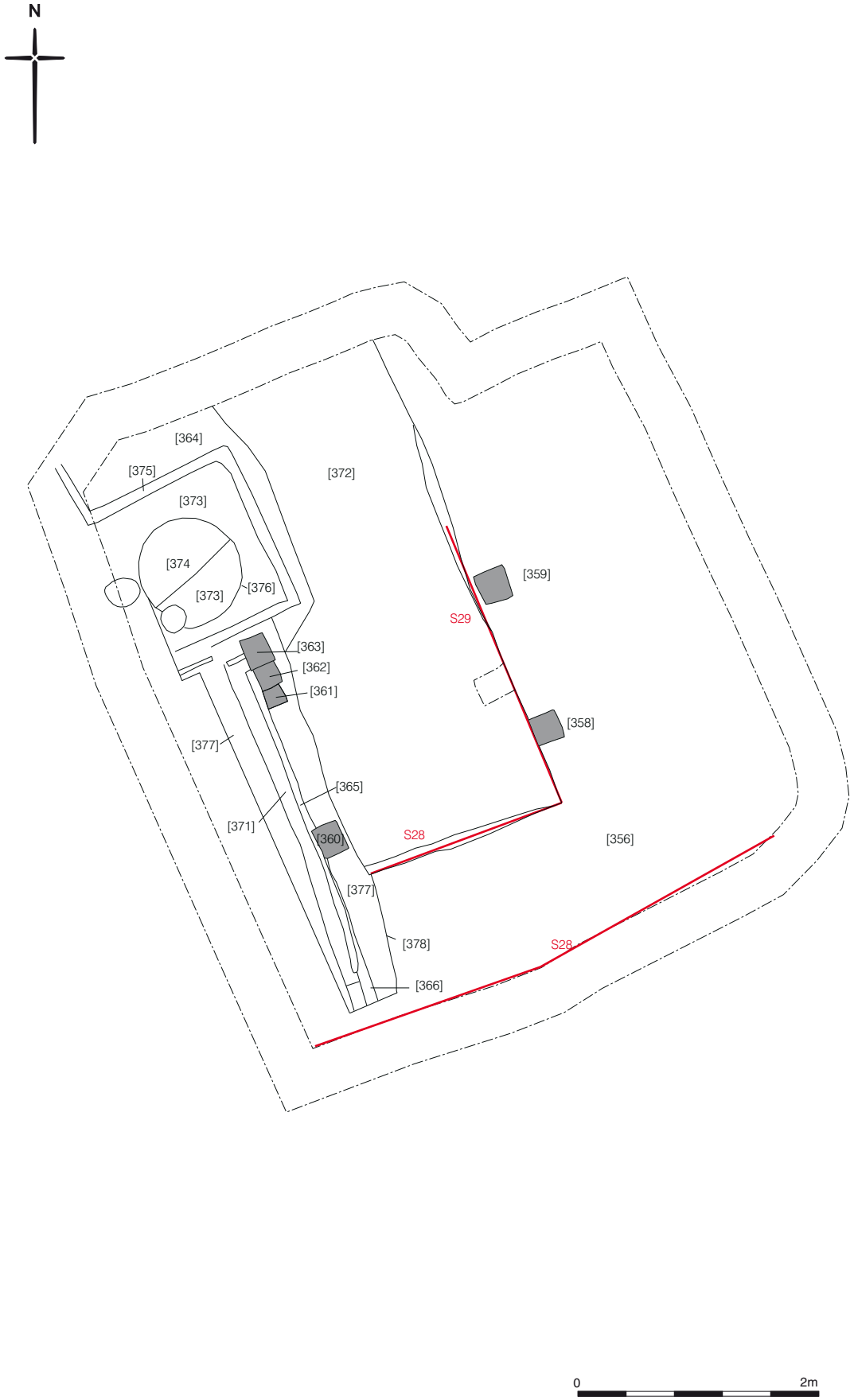


Fig 9 Plan of Trench PDZ1.06/07

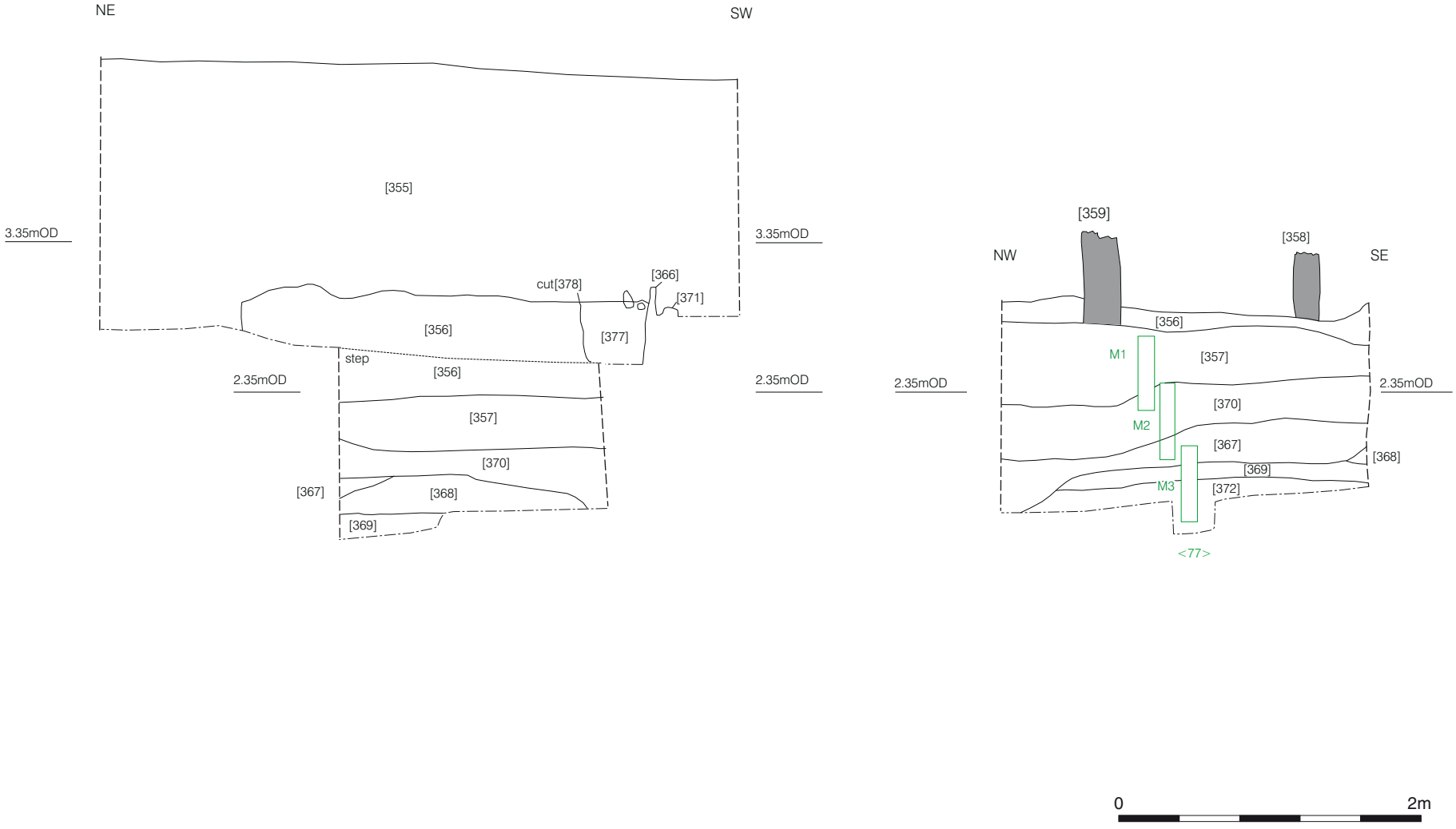


Fig 10 North-west facing section 28 and south-west facing section 29 of Trench PDZ1.06/07

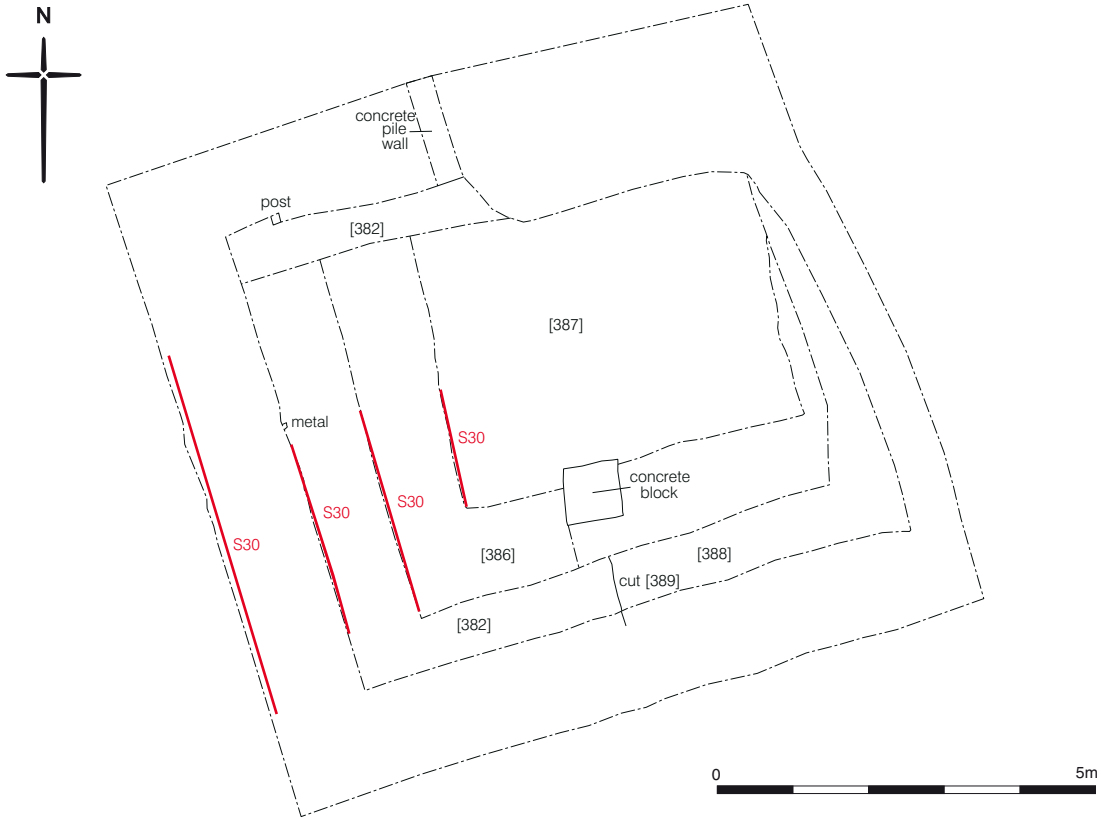


Fig 11 Plan of Trench PDZ1.08

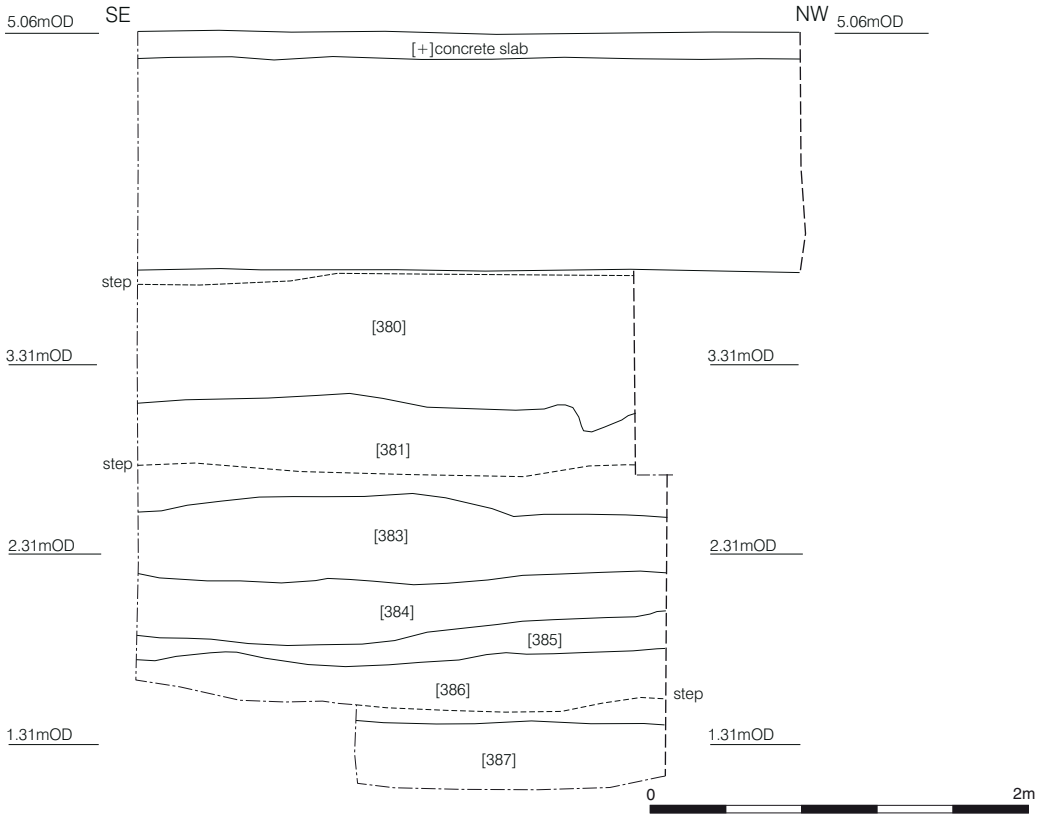


Fig 12 North-east facing section 30 of Trench PDZ1.08

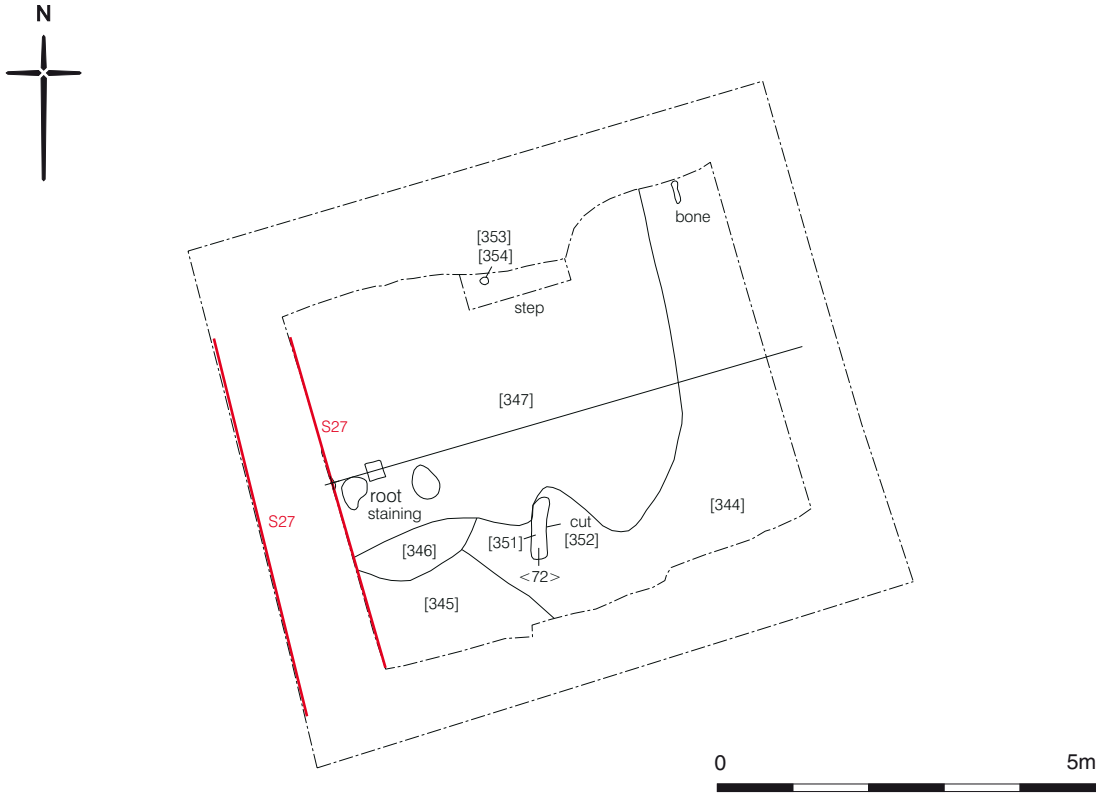


Fig 13 Plan of Trench PDZ1.09

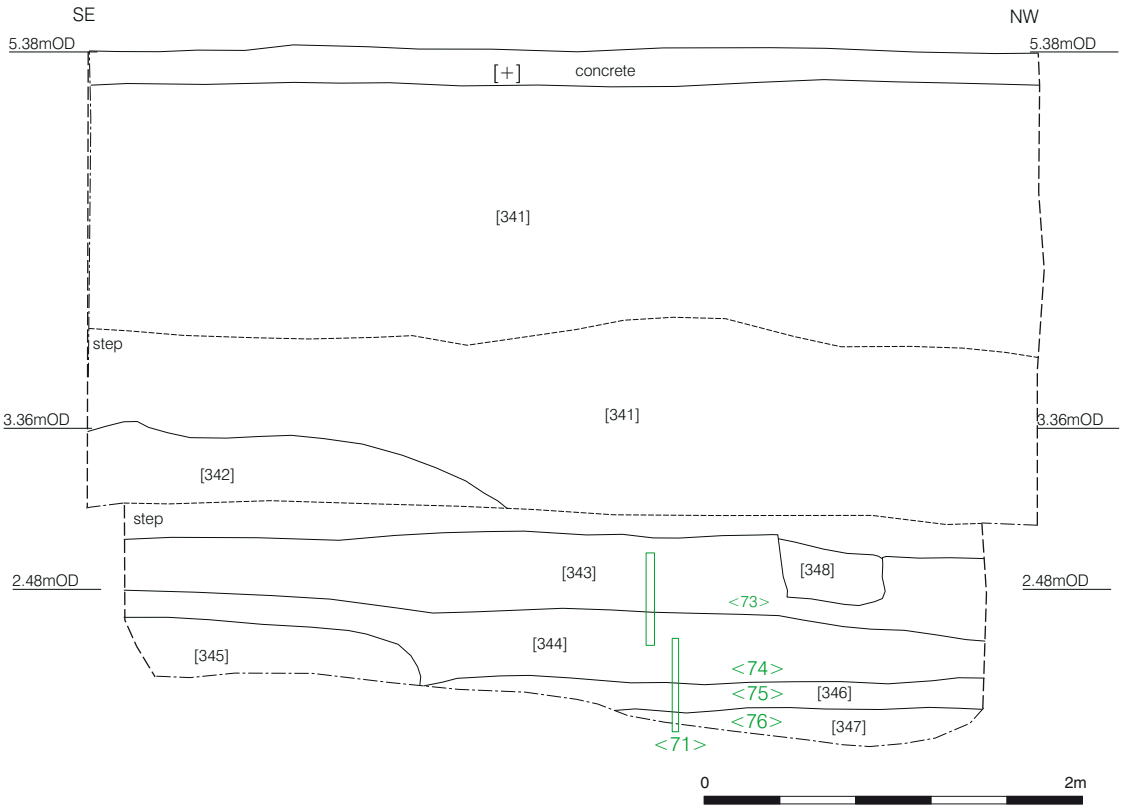


Fig 14 North-east facing section 27 of Trench PDZ1.09