



MUSEUM OF LONDON ARCHAEOLOGY

C263 ARCHAEOLOGY LATE EAST Method Statement

~~Trench evaluation, sample excavation,
watching briefs, non listed built heritage
recording, and geoarchaeological boreholes~~
Custom House Station

Document Number: C263-MLA-X-GMS-CR145-50001

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2a. Stakeholder (Principal Contractor:

) review required? YES NO

(If NO, strike out sections 2a & 2b and go to section 3)

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This document is acceptable for transmittal to _____ for no objection to the works being executed as described.

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Note for Readers

Various readers of this method statement and risk assessment are likely to be directly interested in different parts of the document. The following table is intended to help readers identify which sections cover their main interests.

Reader's main interest	Most relevant sections
Principal Contractor	2.1, 2.3 3.1 4 5 17 18 19 23
Health, Safety, & Environment	17 18 23
Contractual	1.1 2 4 9 16 20 21 22
Archaeological methodology	1 3 5 6 7 8 9 10 11 12 13 14 15 16

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Fig 1: Location plan of Customs House Station worksite

Fig 2: Proposed excavation method for Archaeological Evaluation trial trenches

Fig 3: Proposed locations of the two boreholes adjacent to the site of trench 4.

1 Introduction

This document sets out the methodology for the archaeological investigations to be undertaken at Custom House Station by Museum of London Archaeology (MOLA). The investigations involve elements of Trench evaluation, sample excavation, watching briefs, Non Listed Built Heritage (NLBH) recording to be undertaken for the Barge public house, and ge archaeological boreholes.

The watching brief will be required for areas outside the 4No trial trenches and within the construction compounds where ground works impact deeper than 101m ATD, and during the demolition of the Barge Public House. The trial trenches are to be undertaken where track lowering and piling works for the surface rail and new station entrance at the corner of Freemasons Road/Victoria Dock Road are likely to impact on the prehistoric floodplain deposits.

The requirements for the archaeological investigations are outlined in the Crossrail Site-specific Written Scheme of Investigation: Custom House Station Archaeology, Crossrail, November 2012, Document No C520-XRL-T1-RGN-CR145 -50001, Revision 5.0)

The tasks covered by this method statement are as follows:

Task	Principal Contractor	Programme
<ul style="list-style-type: none"> • Trial trench evaluation (4 located across the surface rail, where lowering is required) 	C520 Laing O'Rourke	Completed
<ul style="list-style-type: none"> • General Watching Brief (enabling works and service diversion for the eastern site compound) 	C520 Laing O'Rourke	TBC
<ul style="list-style-type: none"> • Sample excavation 	C520 Laing O'Rourke	TBC
<ul style="list-style-type: none"> • NLBH recording (on the Barge public house) 	C520 Laing O'Rourke	Completed
<ul style="list-style-type: none"> • Ge archaeological boreholes 	C520 Laing O'Rourke	2nd quarter 2013

Table 1 Task information.

This Method Statement has been developed in conjunction with the Principal Contractor (Laing O'Rourke) currently appointed, who will be responsible for ensuring that the archaeological works may be carried out as specified. The purpose of the Watching Brief is to mitigate the impact of the enabling and service diversion works upon archaeological remains by making an adequate record of them in advance of and during the specified construction ground works. The trial trenching is intended to

assess the archaeological potential across areas of track lowering across the surface rail. The NLBH recording aims to preserve by record the historic fabric of the Barge Public House prior to demolition.

If the project design or scope/method of working is subject to changes during the works, the Method Statement will be updated and re-issued to the Project Archaeologist and CDM Advisor for approval, in accordance with the specified document control procedures (see 11).

1.1 Site Description

The proposed Custom House Station is located south of Victoria Dock Road near its junction with Freemasons Road. It will replace the existing, disused North London Line station of the same name, adjacent to Victoria Dock Road. Crossrail will run from Victoria Dock Portal, above ground, in a retained cut to join existing track levels immediately to the west of Custom House station (ES, Volume 3, 2005, p373). The Custom House Worksites are shown on Figure 1 and extend from NGR 540625 180925 to 541050 180950.

The Custom House works involves the construction of associated construction compounds and worksites. The existing disused North London Line (NLL) and Custom House station will be demolished; the DLR station will remain. The Custom House station will be replaced with a new Crossrail station with a high level walkway connection to Victoria Dock Road with the station entrance on the site of the Barge Public House, and there will be utility diversions.

The Barge Public House is located at the junction of Freemasons Road and Victoria Dock Road. It is a 2 to 3 storey brick-built public house with a cellar, probably of late-19th century date. The site is shown on Figure 1 and is located at NGR 540672,180973.

1.2 Geological and Topographical setting

The geological and topographical setting for the Custom House Station site was covered in detail in the SS-WSI (Custom House Station Archaeological WSI, March 2011, Document No C520-XRL-T1-RGN-CR145 -50001, Revision 5.0). This information is summarised below.

The site lies on the reclaimed alluvial floodplain of the River Thames, approximately 700m to the north of the Thames. Overlying London Clay are Pleistocene floodplain sands and gravels, deposited when the Thames was a fast flowing braided river, formed of interconnected channels interspersed with higher sand and gravel bars. These floodplain gravels form the 'Holocene Template' on which Mesolithic activity would have taken place, the areas around channels and lakes providing resources attracting a hunter-gatherer population.

During the early Holocene, sea levels rose and lower lying areas were inundated. From the Later Neolithic the braided channels gradually silted up and the conditions were conducive to peat formation. The landscape became predominantly marshland, which was crossed by the Thames as a single meandering channel.

A geoarchaeological deposit modelling exercise (Crossrail DDBA, doc no.CR-SD-PRW-X-IS-00001, Appendix 2) has identified four landscape zones (LZs) in the area

of the site. This deposit model has been updated with information derived from GI Packages 19, 19A and 30 to enable analysis of underlying geology and the archaeological and palaeoenvironmental potential. The four landscape zones are detailed as follows:

- LZ1 is characterised as gravel terrace, at c 98–100m ATD, probably representing the very beginning of the incline up towards the high ground of the second mid Devensian ‘Kempton Park’ terrace to the north and does not extend to the Crossrail works;
- LZ2 consists of a network of braided channels of varying depths, cut into the Late Pleistocene/Holocene land surface. The revised deposit model places the northern boundary of this zone slightly further to the south of the Custom House footprint than previously mapped. In general this zone is characterised by an underlying gravel topography which occurs at c 93.5–97.5m ATD;
- LZ3 represents higher gravel ‘islands’ with potential for dry-land prehistoric activity lying between 98–99m ATD. The updated deposit model suggests that previously identified ‘islands’ within the Custom House site, actually represent one larger area underlying the majority of the west and central areas of the Custom House station Worksite, including the former Barge Public House;
- LZ4 consists of marginal wetland, characterised by thick peat deposits and has potential for waterlogged later prehistoric remains such as timber trackways. This LZ is found at the westernmost 50m and easternmost 200m of the Custom House site. These layered peat deposits are identified above gravels at c 97.5m–98m ATD; and,
- Modern ground level adjacent to the site lies at c 101.5–102m ATD.

1.3 Archaeological and Historic Background

The archaeological potential of the Custom House Station site was covered in detail in the SS-WSI (Custom House Station Archaeological WSI, March 2011, Document No C520-XRL-T1-RGN-CR145 -50001, Revision 5.0). This information is summarised below.

The Custom House Station worksites lie within an Archaeological Priority Zone (APZ) as defined by the LB of Newham. This area is identified as having a high potential for prehistoric remains related to the exploitation of high ground and marginal wetland areas present during this period. The site does not include any scheduled Monuments or listed building.

Prehistoric

The alluvial and peat deposits associated with the Thames floodplain would have been targeted during the prehistoric period by hunter-gatherer groups as an important subsistence resource. Occupation such as makeshift camps may have existed on the higher sand and gravel islands of LZ3, with fishing and other activities being carried out in the surrounding river channels of LZ4. A timber platform and jetty with other remains of Mesolithic-to-Bronze Age date were recorded on a site at the Royal Docks Community School (PRG97), approximately 450m north-east of the Custom House Station worksite.

Roman

There is currently no evidence for Roman activity in the vicinity of the site, despite evidence of dropping water levels. During this period the site was most likely inhabitable salt marsh and intertidal mudflats. As the gravel islands forming LZ3 lay at 98 to 99m ATD, they probably remained inundated during this period.

Medieval

The site is likely to have remained uninhabitable in the early medieval period. The marshy low lying areas were gradually drained and reclaimed during the later medieval period. The higher areas to the north of the site saw the origins of the manors of West Ham and East Ham. The medieval manor of Sudbury is indicated on the GLHER, and may have been located towards the south-east end of the Custom House worksite although its exact location is not known. There is potential for associated features such as field systems or land boundaries to be present within the worksite.

Post-medieval

The North Woolwich Railway line, opened in 1847 was constructed across previously undeveloped marshland. The growth of the docks ensured the area altered in character significantly during the post-medieval period, with the Royal Victoria Dock constructed in 1850 to 1855. There is high potential for industrial, and possibly railway, remains from this period on the site. This period also saw a huge increase in the construction of housing throughout the area north of Victoria Dock Road, including The Barge Public House, formerly the Freemasons Tavern, parts of which were built approximately 1862. The Royal Victoria and Albert Docks Cut (now filled in) is shown on maps of the late Nineteenth Century, and there is potential for this drainage channel at the southern edge of both the portal and Custom House station, and along the DLR diversion. Two smaller channels ran southwards across the Custom House station site into the Docks Cut.

Modern

Although badly damaged during bombing raids of World War II, the docks continued in use until after the war. From the 1960s onwards, the docks suffered from modern improvements in trade, and the move of large shipping to Tilbury docks further downstream. The Royal Victoria Dock ceased to accept commercial shipping in 1980.

2 Interfaces and Communication Plan

2.1 Interface with Project Archaeologist

The Method Statement has been developed jointly with the Principal Contractor and then submitted to the Project Archaeologist and Crossrail Safety/CDM Advisor for approval. Any comments have been incorporated. Regular progress reports will be submitted to the Project Archaeologist and will be augmented by progress meetings and site visits when required, in order to optimise communications and feedback.

2.2 Interface with C263 Contract Administrator

MOLA shall submit documentation in accordance with the C263 Contract to the Contract Administrator.

2.3 Interface with the Principal Contractor C520

MOLA has liaised with the appointed Principal Contractors (Laing O'Rourke) to prepare the Method Statement (see Appendix). The archaeological investigations will take place under the auspices and supervision of the Principal Contractors. This interface extends to joint Health and Safety planning under CDM requirements. MOLA will provide the Principal Contractors with all necessary information to support site start-up (e.g. names of staff for inductions), health and safety planning; and (if required) to support the Principal Contractors' Permits to Dig. The majority of this information will be contained in this Method Statement. MOLA will liaise with the Principal Contractors regarding access, order of works, programme and commencement date. The Principal Contractors shall give MOLA 4 weeks notice of start date(s) for each work area or phase.

2.4 Interface with Project Archaeologist

MOLA shall liaise with the Project Archaeologist, to implement the correct archaeological design specification, described in the SS-WSIs (Section 1 above).

2.5 Interface with External consultees

The Project Archaeologist shall liaise with the London Borough of Newham and the GLAAS regional advisor to inform them of the archaeological works. In particular, the C263 archaeological contractor will inform the Project Archaeologist if significant archaeological and/or palaeoenvironmental remains are exposed within the watching brief works and trial trench evaluations, so that the project archaeologist can invite GLAAS regional advisor to visit the site.

3 Scope of Works

3.1 Planned Fieldwork Events

This Method Statement sets out the methodology and health and safety requirements for the archaeological works on the site of the Custom House Station during the enabling works and trial trench evaluation. The mitigation strategy for the site will be preservation by record.

3.2 Confirmation of Methods and Standards

The archaeological fieldwork and reporting will be conducted in accordance with the following guidance and standards:

- SS-WSI –Custom House Station Archaeology, Crossrail, November 2012, Document No C520-XRL-T1-RGN-CR145 -50001, Revision 5.0)
- Crossrail Code of Construction Practice
- Crossrail Environmental Minimum Requirements (Crossrail 2008)
- Crossrail Archaeology Generic Written Scheme of Investigation (draft July 2009)
- Crossrail Archaeology Specification for Evaluation & Mitigation (including Watching Brief) (CR-PN-LWS-EN-SP-00001)
- GLAAS Standards for Archaeological Work, London Region, External Consultation Draft (2009)
- English Heritage Centre for Archaeology Guidelines, Environmental archaeology: a guide to the theory and practice of methods, from sampling and recovery to post-excavation (2002)
- English Heritage, 2004, Geoarchaeology: using earth sciences to understand the archaeological record
- English heritage 2006. Understanding Historic Buildings: A guide to good recording practice.
- Institute for Archaeologists (IFA) Standards and guidance for watching briefs and field evaluation (IFA 2001a and 2001b)
- Museum of London Archaeological Site Manual (1994)
- Museum of London General Standards for the preparation of archaeological archives deposited with the Museum of London (1998)
- United Kingdom Institute for Conservation's Conservation Guidelines No. 2
- English Heritage, 2006, Understanding Historic Buildings – A guide to good recording practice

3.3 Aims and Objectives

3.3.1 Trial trench evaluation, geoarchaeological boreholes, sample excavation and watching brief works

~~The overall objectives of the trial trench evaluation is to establish whether significant archaeological remains are present within approximately 1.5m to 4.0m below ground level, and their nature, extent and state of preservation. This includes the evaluation of buried industrial and railway structures. The evaluation will help to inform subsequent mitigation work on the site (sample excavation and watching brief)~~

The overall objective of subsequent excavations will be to investigate, record, and take environmental/geoarchaeological samples if required, from a proportion of the Custom House Station Worksite, and from the Barge Public House Worksite. Sample areas within station footprint will be targeted on a selection of the different horizons within the archaeological sequence, and shallower deposits, such as post-medieval archaeology. These aims will be refined from the results of the evaluations, as part of an iterative process if investigation.

The objectives of any additional watching briefs will be to investigate, record, and where appropriate sample, any archaeological remains encountered by works where the extent of the impact is limited, and/or there is only a low potential for the works to encounter archaeological remains. They will also be employed in areas of the Custom House Station Worksites not included in the evaluation trenches or sample excavations. The watching briefs may include geoarchaeological recording and sampling.

Two geoarchaeological boreholes will be sunk to investigate the deposits in the area of trench 4 of the trial trench evaluation. This is required to complete the deposit model as the excavation of trench 4 failed due to ground conditions.

A number of site specific research aims were stated in the Written Scheme of Investigation. These are;

- What is the development of the local landscape, topography and environment of the Thames floodplain? What Palaeoenvironmental data is there to inform on this development?
- Is there any evidence for Palaeolithic activity at the interface between the Pleistocene gravels and early Holocene channel deposits? If so, what form does this take?
- Is there any evidence for Mesolithic activity at the base of the alluvium/surface of the gravels? Is there any evidence of Mesolithic activity on the higher gravel areas of LZ3? If so, what form does this activity take- fishing, hunting, flint working etc?
- If peat deposits can be securely dated, what activity is contained within them, and how does this help to refine knowledge of prehistoric activity, occupation and settlement in the marginal wetland habitats?
- Can buried wood remains identified in the peat deposits be determined to be natural or artefactual in nature? If so is there evidence for prehistoric trackways additional to that already known in the area, and how do they interrelate?

- Is there any evidence for later prehistoric activity or occupation? What is the nature of activity in the marginal marshlands of LZ4? Is there evidence of prehistoric water management or subsistence fishing? What is the nature of activity on the higher grounds of LZ3? Is there evidence of semi-permanent occupation? Roman
- Is there any evidence for Roman activity, in particular for water management, marginal wetland agriculture, flood defences and/or fishing?
- Is there any evidence for Saxon activity, in particular for water management, marginal wetland agriculture, flood defences and/or fishing?
- Is there any evidence for the medieval manor house of Sudbury?
- What can be learned about the process of land reclamation and management of the area from the medieval period until the construction of the docks, in particular in relation to marginal agriculture and water management?
- What can be learned about the development of the docks during the recent historic period? Can details about London's growth as a 'world city' and the contribution of the Docks to this economic growth be further elucidated?
- Are there any surviving remains of the Royal Victoria and Albert Docks Cut, and the channels that fed into it? If so, what can be learned about the methods, materials and techniques employed in its construction?

3.3.2 ~~NLBH recording~~

~~With regard to the NLBH recording the overall objective is to secure preservation by record of the barge Public House of 1862 or later. This will be done to a level 2 in accordance with the specification set out in the English Heritage Guidelines (EH 2006). The recording aims to answer;~~

- ~~• Is there any evidence for the development sequence of the Public House?~~
- ~~• What are the surviving fixtures and fittings, both internally and externally?~~

~~Further to the specified aims above are the following objectives:~~

- ~~• To investigate the fabric of the structure before demolition/alteration/refurbishment, with the aim of elucidating its structural history, and record and analyse the resulting evidence for this history using applicable archaeological methods.~~
- ~~• To make a record of the existing building in its present condition, by means of photography, measured survey where necessary and annotated sketches.~~
- ~~• To carry out an appropriate level of documentary research in order to give a written account of the structure.~~
- ~~• To report the results in suitable form in accordance with Crossrail requirements, and archive the records.~~

~~The survey will therefore concentrate on capturing a detailed record of the structures in their present state, prior to demolition or alteration, ensuring that the overall layout and extent of the structures are represented, along with the various fabrics used in their construction. Particular attention will be given to fixtures and fittings.~~

3.4 Event Codes

The site code for the Custom House Station archaeological investigations is **XTI13**.

4 Site Management Plan

4.1 Tools and Equipment

Tools and equipment appropriate for the archaeological works will be ordered by the Supervising Archaeologist and delivered to site by the MOLA Equipment Officer from the MOLA central store. See Section Appendix 1, section 9.2 for details.

4.2 Training and Certification

MOLA provides Safety Training for its staff as follows:

- Induction Training for all staff (undertaken on joining MOLA, and as appropriate on individual projects).
- General H&S Training for supervisory staff (an H&S awareness course targeted at Field and Support Staff).
- Specialist H&S Training (designed to cover specialist areas and to update professional knowledge; as appropriate to deployment)

All MOLA staff on site will be competent to carry out their archaeological work. On site all staff will be supervised by a competent person. The trial trench evaluation, sample excavation, General Watching Brief, and NLBH recording will be undertaken by a MOLA Supervisor (Grade 5)/Senior Archaeologist (Grade 4) and supervised by a MOLA Field Director (Grade 3) or Contracts Manager/Assistant Contracts Manager via regular site visits, advice and mentoring.

For certain specific aspects of MOLA work only those members of staff with the relevant training and certification will be allowed to undertake them. These include Cable and Pipe/Underground Service Location, Chainsaw use, Confined Spaces and Power Auger use. It is anticipated that only Confined Spaces will be required on this site.

At present the profession of Archaeologist is largely covered by the CSCS, Construction Related Organisation CRO White Card for Archaeological Technician (Code 5363); other cards are available for site visitors etc. All MOLA staff have passed a CITB Health and Safety Test to operative level and carry the CSCS card on site at all times.

All staff will have their MOLA ID cards with them (see Appendix 1, section 7.1).

4.3 Site Monitoring

The site will be monitored by the Fieldwork Director (Mike Smith) and Contracts Manager (David Divers) via site visits, as and when required, in order to provide advice and support to the MOLA Supervisor. MOLA H & S Advisor (Ian Grainger) will also regularly monitor the site, see 18.4.

The results of the H & S advisor's monitoring, and the monthly HS&E incident summary form, along with monthly environmental audits will be submitted to Crossrail.

4.4 Progress Reporting

MOLA has agreed a programme of weekly written progress reports, and progress meetings (if appropriate) with the Project Archaeologist. MOLA shall provide information describing progress on-site to date, the processing of samples and artefacts and feedback from initial assessment.

4.5 Resource Plan

Trial trench evaluation, geoarchaeological boreholes, sample excavation and General Watching Briefs

- ~~• The trial trench evaluation, sample excavation, general watching briefs, and NLBH recording will be supervised by a MOLA Supervisor (Grade 4 or 5) assisted by members of the MOLA field team (Grade 6) with support from MOLA Geomatics and Photographic team members when required. Other archaeological specialists (Grade 8, e.g. geoarchaeologists or osteologists), may be called in if necessary.~~
- ~~• The NLBH team will consist of James Wright and Azizul Karim with the photographer, Maggie Cox.~~
- The named Supervisor(s) will be confirmed with the client/contractor before the start of the works. Other staff to be assigned when required.
- The geoarchaeological boreholes will be taken by Geotechnics Ltd, under the archaeological supervision of MOLA Grade 8 geoarchaeologist Virgil Yendell.

Staff will be drawn from the pool of CVs submitted to Crossrail for approval.

All archaeological staff are direct MOLA employees, ordinarily full time. The working hours are set out in 4.7 below.

4.6 Programme

The trial trench evaluation and NLBH have been completed. The programme for the sample excavation, watching brief, and recording has yet to be confirmed. The geoarchaeological boreholes are programmed for the second quarter of 2013.

4.7 Working Hours

Work on site shall only take place within the core Crossrail working hours, which are between 0800 to 1800 on weekdays and 0800 to 1300 on Saturdays as specified in the Environment Requirements (Section 4 of Works Information Vol 2). Operations anticipated to cause disturbance are limited to these hours (or as specified within a Section 61 consent obtained by the Principal Contractor), in order to minimise disruption to local residents and the general environment.

MOLA will provide a site attendance when required during these specified periods, so that all the relevant Principal Contractor's ground works defined in this MS are monitored and recorded.

4.8 Timesheets

During General Watching Briefs, Targeted Watching Briefs, and NLBH recording MOLA will supply timesheets included in the weekly progress reports to Crossrail.

4.9 Access

Access to work areas to be determined as they become available. See Appendix 1, section 7.1. MOLA staff will comply with the Principal Contractor's site rules on security, access, safe walking routes, etc.

For all the proposed areas of work (Evaluation, excavation, Watching brief, and NLBH recording) MOLA staff will inform the Laing O'Rourke's construction manager on a daily basis as to their presence on the site and the nature of the intended works. This is to insure all MOLA staff and the Principal Contractor are aware of the activities being undertaken and can co-ordinate appropriately.

During the watching brief the MOLA archaeologist will liaise directly with the engineer or foreman undertaking the ground works.

4.10 Requirements from Principal Contractor

These are listed in Appendix 1, section 9.1. They include welfare facilities, currently predicted to be for up 1–3 MOLA staff for the evaluation, excavation and Watching brief.

5 Fieldwork Methodology

5.1 ~~Archaeological trial trench evaluation methodology~~

The trench evaluation will take place during the main C520 works contract.

Trenches are located in two areas of the site. Trench 1 is located on the site of the Barge Public House, and Trenches 2–4 are located along the main station platform adjacent to DLR Custom House station (see Figure 1).

All trenches will measure 4m x 2m at the base, and will be c 4m deep. The trenches will be shored with a proprietary trench box (fig 2).

In order to get an archaeologically robust profile the following methodology is proposed:

- ~~Excavate an agreed depth (approx. 1m) of soil longitudinally and leave an approximately 0.5m thick section against full perimeter of the trench.~~
- ~~Allow thin section to be recorded by archaeologists~~
- ~~Remove this strip and repeat excavation to 2nd agreed depth (approx 1m)~~
- ~~Repeat recording and excavation process until base depth of trench is reached.~~

Trench 1

~~Trench 1 is to be placed within the area of the Barge public house. This will take place after the pub has been demolished, and therefore at a later stage in the project, after trenches 2–4 have been excavated. This trench is in LZ3 – sand and gravel islands, and will be excavated in order to assess the potential for archaeological survival in the higher gravel areas. This trench is predicted to be c 4.5m deep.~~

Trench 2

~~Trench 2 is located at the western end of the station, in the higher gravel island (LZ3). This trench is predicted to be c 4m deep.~~

Trench 3

~~Trench 3 is located in the centre of the Custom House Station site to assess the transition from LZ3 to LZ4. This trench is predicted to be c 4m deep.~~

Trench 4

~~Trench 4 is located at the eastern end of the proposed new platform, to assess the potential for woody deposits identified in the Geotechnical investigations in LZ4. This trench is predicted to be c 4m deep.~~

~~The Principal Contractor (C520) is required to allow the archaeological contractor appropriate access to the site.~~

~~All the trenches will be excavated to the surface of the floodplain gravels. The surface of these deposits marks the base line for deposits of archaeological/palaeoenvironmental interest.~~

5.2 ~~Site specific evaluation methodologies and procedures~~

~~The Principal Contractor will design and provide the necessary shoring/sheet piling to enable the excavation of the trenches to the required depth. All necessary equipment to provide a safe working environment (i.e. lighting, trench access, pumping, spoil~~

removal and gas monitoring equipment) within the trench will also be provided and supervised by the Principal Contractor.

The method of the trench construction and machine excavation will provide adequate exposures of the archaeological/alluvial deposits in conditions that enable examination and recording to be carried out in a safe and workable environment.

The ground will be scanned for UXO prior to and during the excavation as deemed necessary by the UXO contractor, appointed and supervised by the Principal Contractor.

Prior to the controlled archaeological excavation, machine removal of the concrete slab and modern overburden will be carried out by the Principal Contractor over the whole area of each trench excavation. A toothless bucket (where possible) will be used to clear back modern overburden to minimise damage to the underlying surface of archaeological strata. Clearance should be carried out progressively towards the spoil removal/collection point, preferably in an archaeologically sterile area, and will be monitored by MOLA staff under watching brief conditions.

If features or structures of industrial significance (i.e. railway/industrial archaeology) are identified machining will cease. Features and structures will be cleaned and defined by hand sufficiently to determine type, planform and relationship. A MOLA standing buildings specialist will be on standby to record and advise on any significant structural remains.

Features and structures will be recorded and photographed following standard MOLA procedures. Structures and features will be located and planned from a base line or surveyed in by MOLA surveyors.

Once significant features are adequately recorded machining will continue in order to reveal earlier features and/or structures. The excavation will cease when the base of the made ground (with the potential to contain industrial archaeology) is reached.

Once the level of undisturbed floodplain stratigraphy has been reached, excavation will proceed by machine under MOLA supervision. The alluvial deposits will be removed in spits measuring c 0.1 m in thickness, using a toothless machine bucket. A temporary standing section may need to be left every c 1m in depth to allow recording of the vertical section and sampling of the sedimentary.

The archaeologists will vacate the trench while each spit is being machined out. The spoil removed from each spit will be piled in a safely accessible place away from the trench for inspection, to facilitate the recovery of artefacts. This spoil will be examined by the archaeologists with hand tools to establish whether remains of archaeological interest survive within the alluvium. The MOLA site supervisor will advise when examination of the spoil from each spit is completed and ready to be disposed of.

Geoarchaeological sampling will be undertaken by monolith and adjacent bulk samples on the most representative part of the trench sequence. The sampling will aim to take continuous samples through the whole of the Holocene alluvial sequence. Further details on the geoarchaeological sampling strategy and investigation are outlined in Section 6.

Excavation of the spits will cease on instruction of the MOLA supervisor to allow examination and hand cleaning of the deposits sufficient enough to ascertain the

~~absence or presence of archaeological material within each exposed horizon. Provision will be made by the Principal Contractor to remove any spoil generated by hand excavation. This may require the installation of a bucket hoist.~~

~~If archaeological features/structures are encountered, recording and excavation will follow the procedures outlined below.~~

~~Adequate provision for the pumping and removal of water ingressing into the trench will be made by the Principal Contractor. If water ingress becomes excessive the excavation will cease (see also H&S assessments below).~~

5.3 Survey and setting out method

~~The location of trenches will be set out by MOLA Geomatics staff. If the trench locations are required to be set out on Crossrail London Survey Grid co-ordinates, then Crossrail surveyors will, with sufficient advance notice, supply MOLA Geomatics with the relevant survey control and mapping to allow for survey preparation. In the event of MOLA Geomatics staff setting out trenches without Crossrail survey control, then they will reference locations to OSGB36 co-ordinates, using GPS/GNSS.~~

~~Where a Permit to Dig has been issued, it may be more appropriate for the Principal Contractor to set out the trenches that they will be opening up and to supply MOLA with the co-ordinates. MOLA will then additionally survey in the as dug trenches.~~

5.4 Evaluation Recording Methods

~~The archaeological remains will be recorded to best practice standards, in order to achieve archaeological objectives. The site recording will include as a minimum:~~

- ~~• The written record of individual context descriptions on appropriate pro forma sheets.~~
- ~~• The drawn record: including, plans and section drawings of appropriate features, structures and individual contexts (1:10 1:20 or 1:50). Isolated archaeological remains (artefacts) may be spot located in plan and a height provided where possible. Deposits which are regular in plan (pits and ditches) may be located though co-ordinates, annotated with dimensions, and may be recorded digitally.~~
- ~~• A stratigraphic matrix of the sequence of deposits and structures encountered in each trench will be produced.~~
- ~~• The photographic record: photographs taken with a digital camera of resolution of 12 megapixel or greater, providing similar resolution to a conventional 35mm SLR. The photographic record will include photographs of archaeological features, appropriate groups of features, structures, and quaternary deposits. Each photograph will be recorded on site using a proforma photographic record sheet, showing image number, area/test pit, context number(s), subject/description, direction of view, and date. In addition, appropriate record photographs will be undertaken to illustrate work in progress.~~
- ~~• Levels on plans, sections and other fieldwork records shall be related to Tunnel Datum.~~
- ~~• The location of all evaluation trenches, temporary grids and baselines will be electronically surveyed by MOLA Geomatics staff. After fieldwork a digital trench location plan will be produced.~~

~~Other appropriate drawn and written records will be produced (for environmental sampling etc).~~

5.5 Targeted Watching Brief Methodology

A targeted watching brief comprises the observation and recording of the Principal Contractor's or their sub-contractor's works with specific operations carried out under the supervision of a MOLA Senior Archaeologist. Targeted watching briefs are carried either out in areas where the density of archaeological features or deposits are not considered of sufficient significance to warrant investigation in advance of construction, or they may be carried out in areas where access prior to construction has been impossible and where, as a result, there is a possibility of unexpected discoveries (Crossrail 2009 Archaeology Specification for Evaluation & Mitigation (including Watching Brief) CR-PN-LWS-EN-SP-0001, version 3).

It should be noted that during a targeted watching brief, the Archaeological Contractor may impose constraints on, or require changes to, the Principal Contractor's or his sub-contractor's method of working to enable the archaeological investigation to take place alongside construction works. These constraints may include restrictions on the type of equipment used, the methodology employed, stopping excavation works to allow time for recording and the installation of temporary works or other attendances such as pumping out, in order that the archaeologists may enter the works excavations safely.

In addition to anthropogenic deposits, some assessment and basic recording of any naturally deposited levels will be necessary, e.g. alluvial deposits. This may require the attendance of a MOLA Geoarchaeological specialist to record and sample the deposits. Normally if the remains are localised the Principal Contractor's works may continue in other areas (subject to a safe method of working and monitoring. It is expected that the Principal Contractor will make allowance in their work programme to take account of the delays that a targeted watching brief may cause.

During a targeted watching brief MOLA staff will compile a basic record consisting of notes, measurements, drawings and photographs consistent with an observation role; e.g. depth, character, date and survival/truncation of deposit sequence, height of natural geology.

If potentially very significant (but localised) remains are exposed, such that they cannot be recorded adequately under the scope of the targeted watching brief, then subject to the Project Archaeologist's approval, additional archaeological resources and time may be required at that location (to allow for more detailed follow-up recording and perhaps limited excavation).

In the event that significant archaeological remains are the works are likely to require controlled machine excavation under MOLA supervision. This will need to be undertaken by a large 360 degree excavator fitted with a wide bladed bucket (ditching or similar) with no teeth. Once levels of archaeological significance are exposed hand cleaning will be undertaken in order to carry out recording as outlined in section 5.8.

5.6 General Watching Brief Methodology

A General Watching Brief consists of a basic monitoring presence to observe the works carried out either by the Principal Contractor or their sub-contractor without constraint on their working methods (Crossrail 2009 Archaeology Specification for Evaluation & Mitigation (including Watching Brief) CR-PN-LWS-EN-SP-0001, version 3). This includes making a basic record of notes, measurements, drawings and photographs consistent with an observation role; eg depth, character, date and survival/truncation of deposit sequence, height of natural geology.

Monitoring and recording during a general watching brief will generally be made by observation from ground level. During a general watching brief MOLA staff will only enter the trench or area of excavation by agreement with the Principal Contractor or their sub-contractor (providing that there is proper access and that it is safe to do).

It is likely that the watching brief will require recording of natural floodplain deposits. Therefore, if possible, profiles through the alluvium will be examined in section. If access into the trenches is not feasible, the alluvial deposits will be recorded by examining spoil brought up from the excavation by machine bucket. Depths of the sequences will be recorded by measuring down from the side of the excavation if safe to do so.

Generally monitoring will only be undertaken when areas or trenches have been dug down to the level of potential archaeological interest. For this reason, a flexible approach will be taken and kept under review. The monitoring presence may alternate between full and part-time depending upon the Principal Contractor's programme (eg the nature and intensity of ground works) and the archaeological results. For example, any areas where the Principal Contractor's works prove to be of insufficient depth to affect significant archaeological deposits will be scoped out of the Watching Brief. The MOLA Senior Archaeologist undertaking the monitoring will make an appraisal inspection during the Principal Contractor's initial breaking out, removal of overburden etc. in order to determine at what depth the relevant deposits (if present) occur.

The MOLA monitoring archaeologist will maintain regular contact with a nominated member of the Principal Contractor's team on site regarding the overall work programme and progress, including any changes to the proposed depths of excavation. The frequency of visits will be adjusted as necessary as work progresses to take into account areas where it can be shown that existing disturbance has already removed archaeological deposits, or where there are areas of unexpected archaeological survival.

If potentially significant (but localised) remains are exposed, such that they cannot be recorded adequately under basic monitoring, then the status of the fieldwork event will be reviewed by the Project Archaeologist and it may be redefined as a Targeted Watching Brief (see 5.5). This redefinition, if authorised by the Project Archaeologist, would permit additional resources in terms of staff and attendance to allow for more intensive recording.

5.7 General watching brief tasks

A General Watching Brief (GWB) will be required on works in the main Custom House Worksite which involve ground disturbance to depths below c.101m ATD. This is to ensure any surviving historic railway features are identified and recorded. Works of limited extent and or depth outlined in the RIBA F Constructability Report, will

require a general watching brief. These are all part of the Main Custom House worksite.

5.8 General Watching Brief Recording Methods

The archaeological remains will be recorded to best practice standards, recognising the special circumstances of a watching brief which demand flexibility in order to achieve archaeological objectives and requirements within the construction environment.

The recording will include as a minimum:

- The Event Code and chainage/location of the area observed
- The date(s) of the observations
- Personnel employed on site
- A description of the works observed
- The works (sub) contractor and personnel undertaking and supervising the construction activity
- Depths and extents of excavation works observed
- Measure of confidence that any archaeological remains would have been observed and reasons
- Reasons why any particular area of works was not observed, noting those areas not subject to disturbance from construction
- Location and description of any archaeological remains
- Location and description of any modern remains
- The written record of individual context descriptions on appropriate pro-forma.
- The drawn record: including, plans and section drawings of appropriate features, structures and individual contexts (1:50 1:20 or 1:10). Isolated archaeological remains (artefacts) may be spot located in plan and a height provided where possible. Deposits which are regular in plan (pits and ditches) may be located through co-ordinates, annotated with dimensions, and may be recorded digitally.
- Other appropriate drawn and written records will be produced (for environmental/geoarchaeological sampling etc.).
- The photographic record: photographs taken with a digital camera of resolution of 12 megapixels or greater, providing similar resolution to a conventional 35mm SLR. The photographic record will include photographs of archaeological features, appropriate groups of features, structures, and quaternary deposits. Each photograph will be recorded on site using a proforma photographic record sheet, showing image number, area/test pit, context number(s), subject/description, direction of view, and date. In addition, appropriate record photographs will be undertaken to illustrate work in progress.

5.9 Survey

The watching brief observations will be located manually by MOLA staff on a suitable hardcopy site plan. Observations can be related to features included on the OS mapping (e.g. adjacent structures or property boundaries), or chainage events located on the contractors CAD drawings. In event of significant features being

uncovered, MOLA Geomatics staff will be called upon to carry out the survey using GPS/GNSS.

5.10 Further archaeological works

Further works may be necessary to be completed under Principal Contractor C520 by Archaeological Contractor C263 following completion of evaluation trenches. Results of the archaeological evaluation will inform the iterative mitigation design, and will constitute preservation-by-record (e.g. archaeological excavation and/or watching brief). Additional archaeological mitigation (if required) would be undertaken commensurate with main works. These mitigation measures are described in the Crossrail Archaeology Generic Written Scheme of Investigation (Crossrail, 2007).

In the event of significant archaeology being located, a further phase of works for mitigation excavation will be required, and will be programmed to begin as soon as possible upon discovery, pending approval of next phase of works by Crossrail Central. The programme for the second phase is likely to begin immediately following discovery. The works are likely to require controlled machine excavation under MOLA supervision. This will need to be undertaken by a large 360 degree excavator fitted with a wide bladed bucket (ditching or similar) with no teeth. Once levels of archaeological significance are exposed hand cleaning will be undertaken in order to carry out recording.

6 Geoarchaeological methodology

Geoarchaeology is the study of soils and sediments in either a natural or anthropogenic context, that either contain human cultural material or are contemporary with human habitation within the region being studied (i.e. the Pleistocene/Lower Palaeolithic and later). It can include techniques of landscape reconstruction such as palaeobotany, palynology and soil micromorphology.

Given the likely impact on the floodplain deposits, a geoarchaeological approach shall be adopted in recording any floodplain soils and/or sediments uncovered during the watching brief works and trial trench evaluation. Deposits will be recorded according to standard sedimentological criteria in order to ascertain the depositional environment and site formation processes. This will involve characterising the visible properties of each deposit, in particular relating to its colour, compaction, texture, structure, bedding, inclusions, clast-size and dip. Geoarchaeological recording will be undertaken by and/or under advice of a MOLA Senior geoarchaeologist.

As the floodplain sequences are likely to be fairly uniform and laterally extensive, the geoarchaeological recording of the floodplain sequence can be selective, focusing on the most representative part of an exposed deposit sequence. Any major unconformities within the sequence will be recorded as these may indicate distinct landforms and features; for example tidal creeks/channels dissecting the wetlands, or terrestrial soils within the alluvium.

Significant features and/or layers of alluvial stratigraphy revealed during the investigations may require sampling if deemed necessary by the Project Archaeologist and/or the GLAAS Scientific Advisor. The sampling methodology is set out in section 7. This work will be conducted under the geoarchaeological and palaeoenvironmental sampling strategy (archaeological science strategy) as set out in WSI's for the Custom House Station Worksites.

7 Sampling strategy

It is unlikely that sampling will be required during the watching brief work, unless archaeological features or floodplain deposits of significance are encountered. In the event of required sampling, it will be targeted to establishing the palaeoenvironmental potential and significance of the deposits. The aim of this sampling is to evaluate the degree of preservation and range of environmental remains preserved within the archaeological/palaeoenvironmental deposits, assess their potential to address the overall site objectives and identify any additional research aims that might also be addressed by the archaeological deposits surviving on the site.

In general, sampling will be undertaken by the archaeologists. However, a geoarchaeologist will be on call to visit the site, advise and where necessary record and take samples from selected deposits.

General Methodology

Where significant features and/or alluvial layers are encountered the Contract Manager and MOLA Supervisor will ensure the following with the support of a MOLA Environmental Archaeologist / Geoarchaeologist:

- That a range of suitable samples are collected from the site for the recovery of an appropriate range of environmental evidence that will contribute to the research strategy that underpins the requirement for the watching brief and recording.
- That the environmental procedures outlined in the *Archaeological Site Manual* (MoL 1994) and *Environmental archaeology: a guide to the theory and practice of methods, from sampling and recovery to post-excavation* (English Heritage 2002) are followed.
- That general bulk samples, 40 litres in size (20L if waterlogged) will be the standard samples taken and that the processing methods are designed to recover a wide a range of materials from the same deposit in a single sample. In addition, as a number of post-excavation analytical techniques will be employed on the material recovered, a number of different sampling approaches will be required. These might include: gridded/spatial bulk samples, to sample horizontal stratigraphy where it survives (i.e. prehistoric soils and activity horizons), the sample size will depend on feature; column bulk samples (c 2-20L) to sample ditches, deep cut features and natural deposit profiles; spot samples for dating; monolith and micro morphology samples to recover *in-situ* blocks of sediments or complex strata.

Sample	Sampled by	Material	Processing
Hand Collected	archaeologist	Human Bone	Hand washing
	archaeologist	Large/small mammal, bird, fish	Power hosed
Bulk (general 40 litre sample), for cut features	archaeologist	Large/small mammal, bird, fish, reptile, amphibian, marine molluscs, eggshell, plant macrofossils	Flotation or wet sieving
		Insects	Paraffin flotation
		Artefacts	Hand Washed

Sample	Sampled by	Material	Processing
Column bulk (20 litre), at 0.1m intervals down deposit profiles	Archaeologist on advice of geoarchaeologist	Freshwater and terrestrial molluscs, ostracods,	Disaggregated and wet sieved
		Plant macrofossils	Flotation or wet sieving
		Insects	Paraffin flotation
Monolith	geoarchaeologist	Sediments	Laboratory cleaning
		Pollen and Diatoms	Sub-sampled for external Specialist
Kubiena	geoarchaeologist	Soils/complex strata	External Specialist
Spot/Grab	archaeologist	Coprolites, unidentified organic materials	Specialist
	geoarchaeologist	Pollen, diatoms, ostracods, forams, radiocarbon	Sub-sampled from for external specialists

- The sampling strategy will be monitored throughout the works and adapted in light of the preservation and the type of features encountered. A MOLA Environmental Archaeologist/Geoarchaeologist will undertake site visits to provide advice and additional advice will be sought from the EH Regional Archaeological Science Advisor when necessary. A MOLA Environmental Archaeologist/Geoarchaeologist will be on site during any visit made by the EH Regional Archaeological Science Advisor.
- As a general policy, uncontaminated negative features will be bulk sampled and bone collected by hand. Horizontal stratigraphy if it survives will be sampled on a spatial basis where appropriate. Unstratified contexts, make-up layers and contexts thought to have a high degree of residual or intrusive material will not be sampled. Bulk samples may also be taken to recover artefacts such as evidence for metalworking and/or other industrial activity.
- If encountered, human burials will be recovered individually, with separate parts of the body (i.e. right arm, torso, left leg etc.) bagged separately on site. Samples will be taken for analysis of the abdominal area if the soil conditions are wet or moist. Control samples will also be taken by consultation with the appropriate Specialist. Cremations will be excavated in consultation with specialists.

~~8 Non Listed Built Heritage recording methods~~

~~8.1 The levels of record~~

~~The overall mitigation strategy stated in the WSI (Crossrail Ltd. 2012) is preservation by record and in accordance with English heritage guidelines for historic building recording (EH 2006), a Level 2 record is required for the Barge Public House.~~

The historic building recording survey will therefore be carried out to a Level 2 standard in accordance with the site-specific WSI (Crossrail Ltd. 2012) and other guidance for such work (eg English Heritage guidance 2010 and EH 2006), other applicable standards and guidance (especially RCHME 1996, and IFA Standard and guidance for archaeological investigation of standing buildings or structures, 1999), and using as appropriate the terms and methods specified in the Museum of London Archaeological site manual (3rd edition 1994).

A Level 2 survey as described by English Heritage in Understanding Historic Buildings, a guide to good recording practice (EH 2006) is described in the following terms:

Level 2 is a descriptive record, made in circumstances similar to those of Level 1 but when more information is needed. It may be made of a building which is judged not to require any fuller record, or it may serve to gather data for a wider project. Both the exterior and the interior will be viewed, described and photographed. The record will present conclusions regarding the building's development and use, but will not discuss in detail the evidence on which these conclusions are based. A plan and sometimes other drawings may be made but the drawn record will not normally be comprehensive and may be tailored to the scope of a wider project.

8.2 Specific record method statements

8.2.1 The level 2 recording of the Barge Public House

The level 2 record will encompass the entire building and any outbuildings and extensions.

8.2.2 The drawn record

A search will be made for extant plans and sections of the building. If found they will be checked on site for accuracy and omissions, and amended as necessary. If no extent drawings are located, floor plans and cross-sections will be surveyed by direct measurement on site. These will be drawn up in CAD to produce scaled drawings. Elevation drawings may be made of specific architectural detail if deemed to be of significance. Drawn elevations of the exterior or interior walls will not be made.

8.2.3 The photographic record

In addition to the measured and annotated drawings made on site photographs will be taken by MOLA on site. These have a dual purpose in that they enable close analysis of the structure at a later stage by the MOLA buildings team, as well as providing a further visual and archival record of the structure, prior to demolition. A visit by a member of the MOLA photography team will be made to the site to capture high definition and quality photographs for archive purposes. This is in addition to the photographs taken by the MOLA standing buildings team taken for analytical purposes.

The Project Manager and Site Supervisor(s) will therefore be responsible for ensuring that the following methodologies are employed:

- The record will include photographs taken externally by the MOLA standing buildings team, using Digital cameras. The photographic record will be

sufficiently thorough and detailed to illustrate all significant phases, structures, important stratigraphic and structural relationships, and individual items of interest.

- The images will include, as necessary, one or more external views of each elevation and of the structure generally in its present setting, and further close up views to show the general character of the building, its fabric and details of features with significance for construction, use and modification of the structure.
- Significant fixtures, fittings and decoration of the exterior will be noted and recorded at an appropriate level of photographic detail.
- Photographs will be taken of the principal rooms and circulation areas to show their form and relation to each other.
- Significant fixtures, fittings and decoration of the interior will be noted and recorded at an appropriate level of photographic detail. This will pay special attention to pre-modern features such as the bar area, staircases, and pre-modern doorcases, doors, skirtings, dados and picture rails.
- Photographs taken by field staff will in time be passed to the photographic section for processing and inclusion in the photographic archive.
- A computerised photographic index will be compiled, relating image number, context numbers (if relevant), survey area, direction of view and other related information.

8.2.4 Documentary archive research

A survey of documentary sources for the history of the structure will be undertaken, aimed at presenting evidence for dates of construction and major modifications. Research may also include, as required, published comparative material to help identify and date the fixtures, fittings, materials, techniques and decoration in the building.

9 Geoarchaeological boreholes

The excavation of trench 4 of the trial trench evaluation had to be stopped because of water ingress undermining the trench. It was therefore not possible to sample the peat, or to determine the depth of the gravel. The full sequence of geoarchaeological deposits were sampled in trenches 2 and 3 to the west during the trial trench evaluation. These were located on a raised gravel island in zone LZ3, the gravel being encountered at 98.06m ATD and 97.60m ATD. The deposit model indicated that trench 4 ought to lie within a zone LZ4 deep channel. This suggestion could not be proven in trench 4, as the excavation of the trench failed at 97.84m ATD. It is proposed to sample the peat down to the top of the gravel by means of two boreholes to recover sleeved samples. The bores will be located at either end of the site of trench 4 (fig 3).

Two geoarchaeological boreholes will be drilled across the site by a sub-contracted drilling crew, supervised by a MOLA geoarchaeologist, through the Quaternary

sequence down to the surface of the Pleistocene river gravels (c 4–5m depth). The location of the boreholes will be set out by MOLA surveyors, related to Ordnance Survey Grid and the ground level adjacent to the boreholes tied into Ordnance Survey Datum. The boreholes will be set out at either end of the site of the evaluation trench 4 (Fig 3). The location of the boreholes will be decided on site in order to be sufficiently close to trench 4 in order to sample the same deposit horizons, but at a sufficient distance not to have been disturbed by its excavation. It is expected that this will be within 2m to 4m of either end of the location of trench 4.

The pile mat in the locations of the two boreholes will be stripped by the principal contractor by mechanical excavator prior to the arrival of the terrier rig – see Fig 3.

The boreholes will be undertaken by a Dando Terrier Rig. Continuous cores will be collected through the made ground and alluvial deposits. The cores recovered will be undisturbed 1m long Perspex tubes, roughly 100mm diameter. The cores will be slit open and the sequence of sediments recovered in each borehole will be described on site, with the nature (where possible) and depths of the interfaces between the different sedimentary units noted. A preliminary interpretation of the soil and sediment characteristics of the cores will be made and an overview of the stratigraphy produced that will characterise the deposit sequence and identify soil / sediment processes. The borehole logs will be drawn on standard MOLA borehole proforma sheets and / or polyester based drawing film.

Up to c2 sequences will be selected to be retained for further analysis off-site, if and when required (potentially at the post-excavation stages). They will be selected on the basis of length of sequence, representation of the overall site sequence(s), type of deposits present, and suitability of deposits for later analysis (if required). This further analysis will form part of the mitigation for the portal, and would be conducted as part of the post-excavation assessment process.

The holes will be backfilled with gravel, and capped with bentonite.

The stratigraphic data will be added to an Access / Excel compatible database (RockWorks 2006). This data will be used to update and revise the previous geoarchaeological deposit model. The borehole sequences will be examined in site-wide working transects and the deposits ascribed to a stratigraphic sequence. This semi-interpreted data will be transferred to ARC GIS for modelling of the buried topography (top of sands and gravels – the ‘pre-Holocene template’) and deposit distribution, as appropriate.

A Geoarchaeological evaluation report will be prepared. The report will summarise the results of the survey, illustrate the sub-surface topography and characteristics of the sediments present on the site and indicate the potential of the core samples taken from the site for past environmental reconstruction.

All elements of the borehole investigation will be carried out to an acceptable archaeological standard in accordance with the relevant Institute of Field Archaeologists Standards and Guidance. The work will also be guided by the recommendations outlined in the English Heritage Guidelines for Environmental Archaeology and Geoarchaeology (EH 2002; 2004 respectively). The sub-contractor and terrier rig details are outlined below.

9.1 Terrier rig

- The Terrier rig and supervising engineer will be supplied by Geotechnics Ltd, The Geotechnical Centre, 203 Torrington Avenue, Tile Hill, Coventry, CV4 9AP. The rig is operated by a two-man crew. The operatives are protected with hard hats, ear defenders, safety boots, gloves and protective glasses/goggles. The relevant sub-contractor Crossrail form will be submitted to the C263 Contract Administrator.
- The Drive Sampling Rig is a Dando Terrier 2002. The Rig is transported between sites in a fully enclosed long wheel-base transit type van that complies with Crossrail vehicle requirements. The rig is crawler mounted and is off loaded using a set of specially designed steel ramps.
- Overall length mast down: 2.70m, overall height mast assembled 2.4m – 2.85m, the whole mast and wheels can be detached from the main super structure for operation remotely in restricted access locations.
- The rig is tracked to each borehole position by the operative using a set of gearbox controls.
- Before any intrusive works begin a visual check on the up to date service plans is made to ensure there are no underground apparatus in the area. The area will then be CAT and Genny scanned by a trained operative. If the visual scan of the service diagrams and the CAT scan are negative a permit to dig form will be filled out signed by the Geotechnics Ltd engineer and passed to the Laing site agent for approval and signing. Laing will also provide a permit to dig for each window sample location.
- To set up the rig ready for drilling, two front legs are slotted into the base of the mast and secured with locking pins. The mast is then mechanically raised into a vertical position.
- A hand dug pit will then be excavated with care to a depth of 1.20m to clear service to that depth. The pit will be excavated by the drilling crew and is likely to measure approximately 300-500mm square. A CAT scan will then be undertaken at the bottom of the pit.
- Boring is advanced by a drop hammer, which is completely enclosed within a steel cage. The plates produce a noise level of between 85 and 101db.
- 1 metre long rods are extended with each metre until the required depth has been achieved.
- On completion of the borehole the rods will be withdrawn and the hole backfilled with bentonite.

Our Safe working procedures and risk assessment for the works are attached in Appendix 3.

10 Deliverables and Submission Programme

MOLA shall provide the following reports to the Project Archaeologist in accordance with the Crossrail, 2009 Archaeology Specification for Evaluation & Mitigation including Watching Brief CR-PN-LWS-EN-SP-0001, version 3 and the WSI (see section 1) or as otherwise instructed by the Project Archaeologist:

- Organisation of site monitoring visits, as and when requested by the Project Archaeologist.
- A weekly illustrated progress report to the Project Archaeologist containing the information required at part 5.10 of the C263 Contract.

- A short illustrated interim statement within 1 week of the completion of fieldwork if required.
- A survey report within 2 weeks of the completion of fieldwork.
- A Fieldwork Report will be prepared within 6 weeks if required. This will include the results of the Geoarchaeological investigation and an assessment of the deposits sampled. All Co-ordinates cited in these reports should be based on the London Survey Grid, apart from archive copies which will use OS National Grid.
- MOLA will produce monthly progress photographs of archaeological work on the sites in this method statement to contribute to the 30 per month required across the whole of the C263 contract (see 17.3).
- MOLA will complete an SMR (OASIS) Summary Sheet for the works (ie one per fieldwork event). This Summary Sheet will be included in the Fieldwork Report if required.
- A Summary report of no more than 500 words for the works shall be prepared by MOLA for submission to the Project Archaeologist for subsequent publication within the London Archaeologist Annual Fieldwork Round-up.

11 Document Control and Record Keeping

MOLA will access the Crossrail eB control system for transmitting reports and other deliverables. The primary report deliverables (as per 10) will be submitted to the Project Archaeologist (and Crossrail CDM Advisor in the case of Method Statements) in draft form (Version 1.0). Any tracked changes or comments added by the Project Archaeologist and/or Crossrail CDM Advisor will then be incorporated and future dated versions (2.0 etc) will be returned via eB accompanied with the appropriate Checklist with Contractor's responses.

12 Artefact Recovery and Conservation

All finds recovered during the archaeological work will be dealt with under the following professional standards:

- MOL Archaeological Finds Procedure Manual (2006)
- Relevant English Heritage Centre for Archaeology Guidelines eg on Environmental Archaeology (English Heritage 2002)
- Guidelines of the Society of Museum Archaeologists for the Selection, Retention and Dispersal of Archaeological Collections (SMA 1993).
- IFA Guidelines to the standards for recording human remains (2004)
- Minimum Standards for the Processing, Recording, Analysis and Publication of Post-Roman Ceramics produced by the Medieval Pottery Research Group Occasional Paper 2, (Slowikowski, A, Nenck, B. and Pearce, J 2001)

In general all material from stratified archaeological deposits is retained unless it is clearly residual or part of a large but routine assemblage, in which case samples of both typical and diagnostic items are retained.

Due allowance will be made for occasional specialist attendances which may be needed on and off-site to complete the investigation to the appropriate specified standard. These would only be called upon on a case-by-case basis, if significant structures or strata are revealed. Such attendances may include artefact conservation, photography, surveying, environmental sampling, finds assessment, Geoarchaeology and scientific dating. MOLA has a full range of in-house specialists and can therefore deploy such resources at short notice, if needed, eg to advise on sampling strategies.

All finds and samples will be treated in a proper manner and to Museum of London standards. They will be exposed, lifted, cleaned, conserved, marked, bagged and boxed in accordance with the guidelines set out in the United Kingdom Institute for Conservation's Conservation Guidelines No. 2 and the Museum of London's Standards for the Preparation of Finds to be permanently retained by the Museum of London. Metal objects will be x-rayed and appropriate objects then selected for conservation.

12.1 Retention and Disposal

The finds retrieval policies of the Museum of London will be adopted. An adequate and representative sample of finds and deposits as advised by appropriate MOLA specialists who will be available to attend site as required (see 14.1).

13 Treasure

All finds falling within the definitions of treasure (Treasure Act 1996) shall be reported immediately to the Project Archaeologist and all subsequent works must be undertaken in accordance with the relevant legislative requirements as set out in the Environmental Requirements (archaeology) section of the relevant package Works Information.

To protect the finds from theft, MOLA shall record the finds and remove them to a safe place. Where recording and removal is not feasible or appropriate on the day of discovery, MOLA shall ensure, on liaison with the Project Archaeologist that adequate site security is provided by the Principal Contractor.

14 Archaeological Science Strategy

Where necessary, the strategy for sampling archaeological and environmental deposits and structures (which can include soils, timbers, animal bone and human burials) will be developed by MOLA in accordance with English Heritage and IFA guidelines. Advice will be sought from appropriate MOLA specialists and if additionally required from English Heritage. Subsequent on-site work and assessment of the processed samples and remains will be undertaken by MOLA Specialists.

If necessary, samples for absolute dating such as C14 or timber samples for dendrochronology will be submitted to nominated MOLA external laboratories. This will only be done with the prior approval of the Project Archaeologist where there are

particular research objectives to be addressed by such dating. See section 7 for the site-specific sampling strategies.

14.1 Specialist Strategy

An appropriate programme of ceramic dating and study of other excavated artefactual and environmental materials (including deposits of Geoarchaeological significance) will be undertaken by MOLA Specialists as their contribution to the Fieldwork Report.

14.2 Excavation and Recording of Human Remains

Human remains are unlikely to be present on the Custom House Station site. If any human remains were to be found, they will be treated in accordance with the procedures in section 7.3 of the site specific WSI (SS-WSI – Custom House Station Archaeology, Crossrail, November 2012, Document No C520-XRL-T1-RGN-CR145 - 50001, Revision 5.0).

Crossrail procedures for dealing with discoveries of human remains shall identify any specific individual roles or actions that are relevant to the works. If removal of human remains were to be required, an Exhumation Licence would be required from the Coroner's Office of the Ministry of Justice, under the terms of the 1857 Burial Act. This would be obtained by the archaeological contractor, unless otherwise required by the Project Archaeologist.

15 Archiving and Dissemination Method

The required methodology for off-site work including specialist method statements, assessment, analysis, publication and archive is set out in the SS-WSI's and is not repeated here.

The site-specific publication and archive requirements will be agreed in conjunction with the Project Archaeologist in the light of the overall approach being developed for the Crossrail project (eg publication format and the extent to which individual sites may be grouped spatially or thematically; and degree to which the archive will be systematised and deposited as a single whole).

16 IT Capability – Digital Survey Recording, Data Capture and Curation

The required methodology for IT (including site survey) will be carried out in accordance with the C263 Contract and project standard survey requirements.

16.1 Survey

- For dispersed Watching Briefs occurring on large sites the Principal Contractor's survey controls may not yet have been installed (e.g. for service diversions etc. at the early enabling works stage). Here the primary aim will be to use digital techniques (such as direct survey capture of works locations and archaeological features) to speed recording and data handling and so minimise any risk of delay to the Principal Contractor.
- For Targeted Watching Briefs, TTE and NLBH it is proposed that Principal Contractor's surveys assist with the location of temporary base lines and the plotting of significant archaeological features where appropriate.
- Upon completion of the fieldwork a Site Survey Report will be compiled.

17 Additional Details

17.1 Standards and Guidance

See Section 3.2.

17.2 Unexpected and Nationally-important remains

In cases where unexpected discoveries cannot be preserved *in situ*, the response plan would revert to the normal Crossrail mitigation strategy of further archaeological investigation (*preservation by record*). The aim would be a rapid and commensurate response, targeted to just those remains unavoidably affected by the works.

Recording and sampling methods would also be proportionate to the significance of the remains. Additional archaeological resources would be deployed to achieve this, in order to minimise any delay to the Principal Contractor's works. With flexibility and good communication it is often possible for the development works to continue in other areas while localised discoveries are recorded.

17.3 Progress Photographs

In addition to the archaeological photography specified in the SS-WSI and this Method Statement MOLA will submit a monthly professional photographic record of the progress of the archaeological scope of works. The photographs from the sites in this method statement will form part of the 30 required each month across the whole of the C263 contract.

17.4 Management of Consents

In the event of the unexpected discovery of human remains on site, MOLA will obtain a Burial Licence from the Ministry of Justice.

18 Health and Safety

18.1 CDM Responsibilities and Reporting

- MOLA will be supporting and reporting to the Principal Contractor (Laing O'Rourke) and to the Crossrail Project Archaeologist and CDM Co-ordinator.
- MOLA will be implementing archaeological designs in the SS-WSI prepared by the appropriate FDC consultant, therefore not acting as CDM Designer under the Construction (Design and Management) Regulations 2007.

MOLA will provide:

- A current health and safety policy, including defined operational procedures and managerial responsibilities, risk assessment/control, and measures to ensure that a safe method of working is implemented by the archaeological team on site, including appropriate advice and support from office-based managers.
- Adequate safety information in the MOLA site accommodation including the WSI, current Health and Safety Policy, Health and Safety at Law Poster, Data Protection Compliant Accident Book, and copies of Public and Employers Liability Insurance. The Supervisory Archaeologist is responsible for ensuring that this information is made available.
- Compliance with current legislation and HSE guidance; including the Construction Design and Management Regulations (CDM) 2007 (not as a Designer); and the Principal Contractor's Health and Safety Policy, safety inductions and fire and emergency procedures.
- Field staff qualified to operative level (or higher) of the CITB Health and Safety test and therefore eligible to carry a Construction Related Organisation (CRO) White Card for Archaeological Technician (Code 5363).
- Services of a Contract Manager, Project Officer and Supervisory Archaeologist to manage site investigations, including liaison with the Principal Contractor's Health and Safety Co-ordinator and Principal Contractor, attendance at site meetings etc. The Supervisory Archaeologist will act as principal liaison with the Principal Contractor.
- Services of a professional health and safety consultant to attend site when required; reporting to the Supervisory Archaeologist and Project Officer, with any concerns or recommendations copied to the Principal Contractor's site manager
- A safety monitoring/reporting procedure. This should include accident reporting by the Supervisory Archaeologist to non RIDDOR and RIDDOR standard and any necessary liaison and follow-up of agreed safety actions with the Principal Contractor's site manager
- All necessary staff supervision, training and personal protective equipment (PPE) including tool box talks and safety inductions for new staff.
- Review and compliance with the Principal Contractor's Construction Phase Plan under the CDM Regulations 2007.
- Trained First Aiders, 'Where to get First Aid' poster and a First Aid kit (to be located in the MOLA site accommodation). The Principal Contractor will also have first aid facilities on site.

The Principal Contractor will provide:

- Overall control and supervision of the site and a safe working environment. The archaeological organisation will be unable to complete the specified works in any area where this is not provided.
- Technical services and attendances to the archaeologists as required. These services may include providing, site accommodation, plant for the excavation of trenches and other equipment such as lighting, handrails, shoring and ladders. These requirements are listed in detail in Appendix 1 section 9.1.

The CDM Co-ordinator will provide:

- Overall co-ordination of health and safety planning and management.
- A communications structure; including contact details for key personnel, meetings, reporting, etc.
- Supply of material information: e.g. services and contamination reports; any relevant requirements regarding rights of way, noise, hours of operation, etc.

18.2 Rail Sites

The works on the Western worksite site will be undertaken near to live rail lines. MOLA staff will comply with the procedures for working in such areas as set out in the Principal Contractors Health and Safety Management Plan.

18.3 Highway Sites

The works are not being undertaken on a highway.

18.4 Health and Safety Reporting

Adherence to health and safety procedures will be monitored by the MOLA Health and Safety Consultant, Contract Manager, Project Officer and Site Supervisor. The consultant will attend site for regular monitoring visits and, on each occasion, will supply a report on the archaeological work, containing any necessary health and safety recommendations. This will be forwarded to the Principal Contractor's site manager. Where appropriate to the scale of work, regular on-site progress meetings will be held between MOLA, the Project Archaeologist and the Principal Contractor at which any safety issues may be discussed, agreed and actioned.

18.5 Liaison with Principal Contractor

The MOLA supervisory archaeologist will act as the principal point of contact with the Principal Contractor's site manager throughout the periods of site investigation. Contact details will be exchanged. The supervisory archaeologist will be supported and advised by the MOLA Fieldwork Director and project management team as needed.

18.5.1 C263 MOLA Project Management team contact details

- David Divers, Contracts Manager
ddivers@mola.org.uk
Direct Line: 020 7410 2253
Mobile: 07867 783310
- Michael Smith, Fieldwork Director Contracts Manager
msmith@mola.org.uk
Direct Line: 020 7410 2283
- Site Supervisor (Senior Archaeologist) tbc

18.6 Behavioural Safety BMOS

Mobile phones, personal CD players, iPods, and similar will not be used by MOLA staff in archaeological trenches or areas of work. Smoking and naked flames are/is not permitted in the trenches or areas of work. Alcohol is not permitted on site. This aspect will be monitored by the MOLA Supervisor and H and S Advisor (see 4.3).

19 Emergency Response

19.1 Emergency Preparedness & Response Plan

A General Emergency Preparedness Plan (EPP) is currently being prepared within the MOLA Health and Safety Plan for C263. This should be referred to for generic emergency and accident issues.

Site-specific issues are as follows:

- For the Watching Brief MOLA staff will comply with the Principal Contractor's (Laing O'Rourke) Emergency Plan

Employers Incident Response Contact	Crossrail helpdesk 0345 602 3813
Principal Contractor Incident Response Contact	Neil Hutchison – 07917214396 Or Chris Warren - 07789924651
MOLA Incident Response Contact	David Divers, Contracts Manager ddivers@museumoflondon.org.uk Direct Line: 020 7410 2253 Mobile: 07867 783310
Local A&E location	<i>Full A & E at:</i> Newham General Hospital Glen Road E13 8SL Tel: 02074764000

19.2 Training

MOLA provides Safety Training for its staff as in Section 4.2.

The MOLA Experienced Archaeologist will attend all emergency training/inductions on Preparedness/Response Plan provided by the Principal Contractor.

19.3 Emergency & Accident Equipment

- MOLA Archaeologists when working singly on the watching brief tasks will carry a single person First Aid Kit and mobile phone.
- During the evaluation a first aid box will be located in the archaeological office on site.
- It is expected that the Principal Contractor will also provide basic first aid facilities on site.

19.4 Monitoring & Testing

MOLA staff will comply with Crossrail requirements.

19.5 Emergency & Accident Incident Reporting

All accidents and emergencies must be reported to the Principal Contractor's Emergency Co-ordinator (Steve Holdaway, 07887624900, Laing O'Rourke) who will call the emergency services, if required. They will also be reported to the Crossrail Helpdesk (24 hour helpline) Call: 0345 602 3813 or helpdesk@crossrail.co.uk

All accidents and emergencies must be reported to the following personnel at Crossrail and MOLA:

- Jay Carver, Project Archaeologist, Crossrail Central, Crossrail Ltd, 25 Canada Square, London E14 5LQ
DD 0203 229 9258 Int 2258
Mobile 07870 191 705
- Nick Dyball, CDM Advisor, Crossrail Central, Crossrail Ltd, 25 Canada Square, London E14 5LQ
Mobile 07718861942
- George Dennis, Senior Contracts Manager, Museum of London Archaeology, Mortimer Wheeler House, 46 Eagle Wharf Road, London N1 7ED
DD 0207 410 2200 Int 2256
- Ian Grainger, Field Manager, Museum of London Archaeology, Mortimer Wheeler House, 46 Eagle Wharf Road, London N1 7ED
DD 0207 410 2200 Int 2271

20 Environmental Management

The archaeological works will be carried out whilst the Principal Contractor is in possession of the site. MOLA will comply with the Principal Contractor's Environmental Management System as documented in their Environmental Management Plan, and contribute to their EMS reporting if required.

If any remedial action is needed, eg controls for dust, water, noise or controlled waste, this will be agreed with and undertaken by the Principal Contractor as part of the required attendances (see 18 and Appendix section 9.1). In addition an updated MOLA corporate Environmental Management Plan is currently being prepared for submission to Crossrail.

The nominated environmental person is: Alison Telfer, atelfer@museumoflondon.org.uk, 020 7410 2276.

20.1 Contamination

MOLA staff will not disturb or damage asbestos, or undertake asbestos removal from a building, structure, or buried material. If asbestos is found the Principal Contractor will be responsible for having it dealt with by a licensed contractor.

20.2 Water Disposal

The Principal Contractor is responsible for disposal of any ground water pumped from the trenches or other excavations, in accordance with their environmental management plan, with which MOLA will comply.

20.3 Site Waste Management Plan

MOLA staff will adhere to the Principal Contractor's site waste management plan.

20.4 Vehicles/Motorised Equipment

MOLA staff will liaise with the Principal Contractor to provide safe access for MOLA vehicles if required to attend site. There is no on-site parking, the nearest pay and display car park being at the ExCel:

- Ford Silver Transit (Medium Wheelbase) – EA55 NBJ – Harry Matthews, Equipment Officer, 07730 646063.
- 1.7 Turbo Diesel Astra Estate – KC54 XTZ – Sarah Jones, Geomatics Manager, 0207 410 2200 Int 2287.

20.5 Other Requirements

MOLA staff will always be courteous with any members of the public they have dealings with.

21 Quality Assurance Plan

An updated Quality Assurance Plan has been submitted to Crossrail in accordance with the format specified at part 5.4 of the C263 contract. Records will be kept and supplied to Crossrail in accordance with procedures set out in Crossrail Specification CR-PN-LWS-EN-SP-00001, as amplified by the SS-WSI's.

22 Community Relations

MOLA will co-operate with the Principal Archaeologist and Principal Contractor regarding any notified community relations issues in relation to the Construction Community Relations Strategy Framework as defined in the Works Information.

MOLA will in the first instance refer any media enquires or community relation issues to the Crossrail Helpdesk and the Project Archaeologist.

23 Responsible Procurement

A draft Responsible Procurement Plan document was submitted to Kelly Hussey, Crossrail on 28th April 2011. The MOLA responsible procurement representative is Dawn Jackson, who is a member of the Senior Management Group.

24 Appendix 1: Health and Safety Method Statement

1. Introduction and Purpose

1.1. Project Background

Archaeological investigations are to be carried out on this site by Museum of London Archaeology (MOLA). The requirements are set out in a Crossrail Site-specific Written Scheme of Investigation (SS-WSI – Custom House Station archaeology written scheme of investigation, Crossrail, November 2012, Document No C520-XRL-T1-RGN-CR145_50001, Revision 5.0)

2. Scope of Document

This Method Statement sets out the specific MOLA safe methods of working to be applied to:

- GWB (general watching brief) and TWB (Targeted Watching Briefs) for the Custom House Station Worksite and associated construction compounds
- Trial trench evaluation
- Sample excavation
- NLBH (Non Listed Built Heritage)

This method statement has been developed with information supplied by the Principal Contractor, who will be responsible for ensuring that the archaeological works may be carried out as specified.

3. Responsible Persons and Site Management

3.1. Site Management

The MOLA Senior Archaeologist/Site Supervisor will ensure that a copy of the MOLA Welfare, Health & Safety Method Statement is made available to the appropriate Principal Contractor at the site. Where further changes or additions to the WH&S Method Statement are required and agreed these should be appended to the site master copy by the MOLA Senior Archaeologist/Site Supervisor.

All changes to the WH&S Method Statement will be signed off by the Project Archaeologist, Crossrail H & S Advisor, MOLA Senior Contract Manager and MOLA Field Manager.

4. Scope of Works

The scope of archaeological works is set out in section 2 of the appendix and in section 1 of the method statement, above.

5. Methodology, Programme and Sequence

The provisional programme is set out in section 4.6 of the method statement, above.

The timetable, length of programme and sequence of tasks are to be confirmed by the Principal Contractors.

5.1. Trial Trench Evaluation

The starting date is to be confirmed by the Principal Contractor.

5.2. General Watching Brief

The starting date is to be confirmed by the Principal Contractor.

5.3 Targeted watching brief

The starting date is to be confirmed by the Principal Contractor

5.4 NLBH Recording

The starting date is likely to be 27th March 2013.

6. Risk Assessments

Overall and site specific risk assessments for the General Watching Brief and the trial trench evaluation are included in the following section.

6.1. MOLA Risk Assessment – General Watching Brief

Site – Customs House Site		Type of Work		General Watching Brief
Persons Affected	No	Classification	No	
Employees		Experienced	1	
Other workers		Inexperienced		
Public		Disabled		

Known and Suspected Hazards on site (tick as appropriate)

Mobile Plant	x	Power Auger		Ionising radiation	
Moving Machine Parts		Access equipment		Lasers	
Moving objects		Hazardous Substances		Ultraviolet	
Falls from height	x	Contamination	x	Temperature	
Falls on level	x	Micro organisms		Noise	x
Manual Handling	x	Vermin/Weil's Disease	x	Vibration	
Buried services	x	Fumes/Gas		Weather	x
Electrical		Lone working		Hot/cold objects	
LPG etc		Welfare		Physical attack etc	
Fire/Explosion		Confined spaces	x	Vehicles	
Chainsaw		Hand Tools	x	Human Remains	
UXO	x			On/Near Water	

Control Measures Required

Compliance with H&S at Work Act 1974, Construction(Design and Management) Regulations 2007 and MOLA H&S Policy

Compliance with MOLA Generic or Site Specific Risk Assessment(s) for the Hazards marked above
Compliance with Principal Contractor's safety policy, site specific method statement, permits to work, instructions.

Attendance of Principal Contractor's induction on first day at work

Implementation and attendance of tool box talks by Principal Contractor and MOLA

MOLA supervisors to be trained and competent.

Certified First Aider on site.

Assessment of Remaining risk (Low, Medium, High) (see notes on reverse)

	L	M	H		L	M	H		L	M	H
Mobile Plant		x		Power Auger				Ionising radiation			
Machine Parts				Access equipment				Lasers			
Moving objects				Hazardous Substances				Ultraviolet			
Falls from height	x			Contamination		x		Temperature			
Falls on level	x			Micro organisms				Noise	x		
Manual Handling	x			Vermin/Weil's Disease	x			Vibration			
Buried services		x		Fumes/Gas				Weather	x		
Electrical				Lone working				Hot/cold objects			
LPG etc				Welfare				Physical attack etc			
Fire/Explosion				Confined spaces		x		Vehicles			
Chainsaw				Hand Tools	x			Human Remains			
UXO	x							On/Near Water			

Emergency action/additional assessment required for remaining medium/high risk

See Site Specific Risk Assessments for Mobile Plant, Buried Services, Confined Spaces

Competent Person(s) appointed to take action:	Report seen by (initials)	
	PM GD	Archaeologists

MOLA Supervisor	SA(s) TBC	
	Client JC/RD	
	Contractor	
	Other	

6.2 MOLA Risk Assessment – Targeted Watching Brief

Site – Customs House Site		Type of Work		Targeted Watching Brief
	Persons Affected	No	Classification	No
	Employees		Experienced	1
	Other workers		Inexperienced	
	Public		Disabled	

Known and Suspected Hazards on site (tick as appropriate)					
Mobile Plant	x	Power Auger		Ionising radiation	
Moving Machine Parts		Access equipment		Lasers	
Moving objects		Hazardous Substances		Ultraviolet	
Falls from height	x	Contamination	x	Temperature	
Falls on level	x	Micro organisms		Noise	x
Manual Handling	x	Vermin/Weil’s Disease	x	Vibration	
Buried services	x	Fumes/Gas		Weather	x
Electrical		Lone working		Hot/cold objects	
LPG etc		Welfare		Physical attack etc	
Fire/Explosion		Confined spaces	x	Vehicles	
Chainsaw		Hand Tools	x	Human Remains	
UXO	x			On/Near Water	

Control Measures Required

Compliance with H&S at Work Act 1974, Construction(Design and Management) Regulations 2007 and MOLA H&S Policy
 Compliance with MOLA Generic or Site Specific Risk Assessment(s) for the Hazards marked above
 Compliance with Principal Contractor’s safety policy, site specific method statement, permits to work, instructions.
 Attendance of Principal Contractor’s induction on first day at work
 Implementation and attendance of tool box talks by Principal Contractor and MOLA
 MOLA supervisors to be trained and competent.
 Certified First Aider on site.

Assessment of Remaining risk (Low, Medium, High) (see notes on reverse)

	L	M	H		L	M	H		L	M	H
Mobile Plant		x		Power Auger				Ionising radiation			
Machine Parts				Access equipment				Lasers			
Moving objects				Hazardous Substances				Ultraviolet			
Falls from height	x			Contamination		x		Temperature			
Falls on level	x			Micro organisms				Noise	x		
Manual Handling	x			Vermin/Weil’s Disease	x			Vibration			
Buried services		x		Fumes/Gas				Weather	x		
Electrical				Lone working				Hot/cold objects			
LPG etc				Welfare				Physical attack etc			
Fire/Explosion				Confined spaces		x		Vehicles			

Chainsaw			Hand Tools	x		Human Remains		
UXO	x					On/Near Water		
Emergency action/additional assessment required for remaining medium/high risk See Site Specific Risk Assessments for Mobile Plant, Buried Services, Confined Spaces								
Competent Person(s) appointed to take action:			Report seen by (initials)					
MOLA Supervisor			PM GD			Archaeologists		
			SA(s) TBC					
			Client JC/RD					
			Contractor					
			Other					

6.3 MOLA Risk Assessment – Trial Trench Excavation

Site – Customs House Site		Type of Work		Trial Trench Excavation
Persons Affected	No	Classification	No	
Employees		Experienced	1	
Other workers		Inexperienced		
Public		Disabled		

Known and Suspected Hazards on site (tick as appropriate)

Mobile Plant	x	Power Auger		Ionising radiation	
Moving Machine Parts		Access equipment		Lasers	
Moving objects		Hazardous Substances		Ultraviolet	
Falls from height	x	Contamination	x	Temperature	
Falls on level	x	Micro organisms		Noise	x
Manual Handling		Vermin/Weil's Disease	x	Vibration	
Buried services	x	Fumes/Gas		Weather	x
Electrical		Lone working		Hot/cold objects	
LPG etc		Welfare		Physical attack etc	
Fire/Explosion		Confined spaces	x	Vehicles	
Chainsaw		Hand Tools	x	Human Remains	
UXO	x			On/Near Water	

Control Measures Required

Compliance with H&S at Work Act 1974, Construction(Design and Management) Regulations 2007 and MOLA H&S Policy

Compliance with MOLA Generic or Site Specific Risk Assessment(s) for the Hazards marked above
Compliance with Principal Contractor's safety policy, site specific method statement, permits to work, instructions.

Attendance of Principal Contractor's induction on first day at work

Implementation and attendance of tool box talks by Principal Contractor and MOLA

MOLA supervisors to be trained and competent.

Certified First Aider on site.

Assessment of Remaining risk (Low, Medium, High) (see notes on reverse)

	L	M	H		L	M	H		L	M	H
Mobile Plant		x		Power Auger				Ionising radiation			
Machine Parts				Access equipment				Lasers			
Moving objects				Hazardous Substances				Ultraviolet			
Falls from height	x			Contamination		x		Temperature			

Falls on level	x		Micro organisms			Noise	x		
Manual Handling			Vermin/Weil's Disease	x		Vibration			
Buried services		x	Fumes/Gas			Weather	x		
Electrical			Lone working			Hot/cold objects			
LPG etc			Welfare			Physical attack etc			
Fire/Explosion			Confined spaces		x	Vehicles			
Chainsaw			Hand Tools	x		Human Remains			
UXO	x					On/Near Water			

Emergency action/additional assessment required for remaining medium/high risk
 See Site Specific Risk Assessments for Mobile Plant, Buried Services, Confined Spaces

Competent Person(s) appointed to take action: MOLA Supervisor	Report seen by (initials)	
	PM GD	Archaeologists
	SA(s) TBC	
	Client JC/RD	
	Contractor	
Other		

6.4 MOLA Risk Assessment – Non-Listed Built Heritage Recording

Site – Customs House Site		Type of Work		Non-Listed Built Heritage Recording
Persons Affected	No	Classification	No	
Employees		Experienced	3	
Other workers		Inexperienced		
Public		Disabled		

Known and Suspected Hazards on site (tick as appropriate)

Mobile Plant		Power Auger		Ionising radiation	
Moving Machine Parts		Access equipment		Lasers	
Moving objects		Hazardous Substances		Ultraviolet	
Falls from height	x	Contamination		Temperature	
Falls on level	x	Micro organisms		Noise	x
Manual Handling		Vermin/Weil's Disease	x	Vibration	
Buried services		Fumes/Gas		Weather	x
Electrical		Lone working		Hot/cold objects	
LPG etc		Welfare		Physical attack etc	
Fire/Explosion		Confined spaces	x	Vehicles	
Chainsaw		Hand Tools		Human Remains	
UXO				On/Near Water	

Control Measures Required

Compliance with H&S at Work Act 1974, Construction(Design and Management) Regulations 2007 and MOLA H&S Policy
 Compliance with MOLA Generic or Site Specific Risk Assessment(s) for the Hazards marked above
 Compliance with Principal Contractor's safety policy, site specific method statement, permits to work, instructions.
 Attendance of Principal Contractor's induction on first day at work
 Implementation and attendance of tool box talks by Principal Contractor and MOLA
 MOLA supervisors to be trained and competent.
 Certified First Aider on site.

Assessment of Remaining risk (Low, Medium, High) (see notes on reverse)												
	L	M	H		L	M	H		L	M	H	
Mobile Plant		x		Power Auger				Ionising radiation				
Machine Parts				Access equipment				Lasers				
Moving objects				Hazardous Substances				Ultraviolet				
Falls from height	x			Contamination				Temperature				
Falls on level	x			Micro organisms				Noise	x			
Manual Handling				Vermin/Weil's Disease	x			Vibration				
Buried services		x		Fumes/Gas				Weather	x			
Electrical				Lone working				Hot/cold objects				
LPG etc				Welfare				Physical attack etc				
Fire/Explosion				Confined spaces		x		Vehicles				
Chainsaw				Hand Tools				Human Remains				
UXO								On/Near Water				

Emergency action/additional assessment required for remaining medium/high risk
 See Site Specific Risk Assessments for Mobile Plant, Buried Services, Confined Spaces

Competent Person(s) appointed to take action: MOLA Supervisor	Report seen by (initials)	
	PM GD	Archaeologists
	SA(s) TBC	
	Client JC/RD	
	Contractor	
	Other	

6.4 MOLA Risk Assessment – Geoarchaeological boreholes

Site – Customs House Site		Type of Work		Geoarchaeological boreholes
Persons Affected	No	Classification	No	
Employees	1-3	Experienced	3-5	
Other workers	2	Inexperienced		
Public		Disabled		

Known and Suspected Hazards on site (tick as appropriate)					
Mobile Plant	x	Power Auger		Ionising radiation	
Moving Machine Parts	x	Access equipment		Lasers	
Moving objects		Hazardous Substances		Ultraviolet	
Falls from height		Contamination		Temperature	
Falls on level	x	Micro organisms		Noise	x
Manual Handling	x	Vermin/Weil's Disease	x	Vibration	
Buried services	x	Fumes/Gas		Weather	x
Electrical		Lone working		Hot/cold objects	
LPG etc		Welfare		Physical attack etc	
Fire/Explosion		Confined spaces		Vehicles	x
Chainsaw		Hand Tools		Human Remains	
UXO		Terrier rig	x	On/Near Water	

Control Measures Required

Compliance with H&S at Work Act 1974, Construction(Design and Management) Regulations 2007 and MOLA H&S Policy
 Compliance with MOLA Generic or Site Specific Risk Assessment(s) for the Hazards marked above
 Compliance with Principal Contractor's safety policy, site specific method statement, permits to work,

instructions.
 Attendance of Principal Contractor's induction on first day at work
 Implementation and attendance of tool box talks by Principal Contractor and MOLA
 MOLA supervisors to be trained and competent.
 Certified First Aider on site.

Assessment of Remaining risk (Low, Medium, High) (see notes on reverse)

	L	M	H		L	M	H		L	M	H
Mobile Plant		x		Power Auger				Ionising radiation			
Machine Parts		x		Access equipment				Lasers			
Moving objects				Hazardous Substances				Ultraviolet			
Falls from height				Contamination				Temperature			
Falls on level	x			Micro organisms				Noise	x		
Manual Handling	x			Vermin/Weil's Disease	x			Vibration			
Buried services		x		Fumes/Gas				Weather	x		
Electrical				Lone working				Hot/cold objects			
LPG etc				Welfare				Physical attack etc			
Fire/Explosion				Confined spaces				Vehicles	x		
Chainsaw				Hand Tools				Human Remains			
UXO				Terrier rig		x		On/Near Water			

Emergency action/additional assessment required for remaining medium/high risk

See Site Specific Risk Assessments for Mobile Plant, Buried Services, Confined Spaces

Competent Person(s) appointed to take action:

MOLA Supervisor

Report seen by (initials)

PM GD

SA(s) TBC

Client JC/RD

Contractor

Other

Archaeologists

7. Health and Safety Control Measures

7.1. Site Access/Vehicle Movements

On a daily basis, all MOLA site staff will report to the Laing O'Rourke construction manager to register their attendance on site to ensure activities can be co-ordinated. During the NLBH recording of the Barge Public House, all MOLA staff shall comply with the Principal Contractor's access procedure. All MOLA staff working on site will carry identification and CSCS cards.

Safe access routes from the site gate to work Areas and any offices and/or facilities will be erected and maintained at all times throughout the course of the archaeological monitoring of the works by the Principal Contractor.

7.2. Services and Ground Hazards

The location and making safe of live services before or during archaeological works is the responsibility of the relevant Principal Contractor in control of the site. MOLA staff will exercise care and due diligence and report any discovery of unexpected services or other ground hazards promptly to the Principal Contractor, Project Archaeologist and MOLA H & S Officer.

8. Safety of Excavations

8.1. Entering the Trench during Evaluations

- MOLA staff will not enter any excavation until the Principal Contractor has issued a Clearance to Enter Permit confirming that it is safe to do so and that there is safe access/egress to the archaeological investigation areas. The Principal Contractor will also ensure that the excavations are maintained in safe condition for the duration of the archaeological investigation. The Principal Contractor will supply attendances as required in 9.1.

8.2. Confined Spaces

- The trenches may be designated confined spaces if sufficient depth is reached. All MOLA staff working in such designated areas will be trained to work in Confined Spaces. See Appendix, section 6.7.
- The Principal Contractor or appointed specialist sub-contractor is responsible for monitoring and control of Confined Spaces, and for provision of gas monitoring, rescue equipment, and other equipment or procedures required. The appointed PC/sub-contractor 'top man' will carry out an initial assessment of the confined space atmosphere and continually monitor at regular intervals, recording this as excavation progresses. All personnel will be trained in confined space working and deemed to be competent.

- All personnel entering the excavation will be required to wear a harness and be trained in the use of escape sets. The number of personnel entering the excavation at any one time is to be kept to an absolute minimum, sufficient only to carry out the task in hand.

8.3. Machine Excavation

- Machine excavation will be monitored by MOLA Senior Archaeologist/ Site Supervisor, but will at all times be under the control of the Principal Contractor.

8.4. Hand Excavation during Evaluation

- Hand excavation will be limited to selected times/areas defined by the MOLA Senior Archaeologist/ Site Supervisor, with the agreement of the Principal Contractor, and will be properly fenced, demarcated and signed.

8.5. Lone Working

- MOLA Supervisor will not attend works or enter excavations when the Principal Contractor is not present.

8.6. Contamination

- Any necessary remedial action will be agreed with the Principal Contractor as part of the H & S Plan and supplied as an attendance item (9.1 below). Wherever possible such action must be undertaken by the Principal Contractor prior to MOLA commencement on site. If this is not done there may be operational constraints on the MOLA safe method of working that could restrict achievement of the archaeological scope of works set out in the SS-WSI.

8.7. Ordnance

- In the event of MOLA not having been issued with an Ordnance Report from the Principal Contractor all MOLA Staff shall comply with the PC's rules. If Ordnance is unexpectedly found the MOLA Supervisor shall inform the PC immediately and withdraw to a safe place outside the area designated by the PC.

8.8. Site Rules

- All MOLA Staff will comply with the Principal Contractor's site rules and with the MOLA single person watching brief rules (when applicable).

9. Planning and Resources

9.1. Principal Contractor's Supply of Attendances

The site specific requirements for services, facilities and attendances to be provided by the Principal Contractor, to enable MOLA to undertake the defined archaeological works are set out below. Those items in **bold will be required** for this site – others may be required, depending on site conditions, which will be reviewed on site by the MOLA Supervisor in conjunction with the Principal Contractor's nominated Site Manager:

- **general site security** including hoardings, gateway, warning notices, etc; to create a secure site perimeter, sufficient to prevent unauthorised access. If the Principal Contractor has retained security guards, it is recommended that the archaeological investigation areas be added to their schedule for regular patrols, particularly out of hours.
- **specific site security**: it may be necessary to separately secure individual archaeological trenches via a physical barrier (such as Heras fencing) eg if there are public areas nearby or human remains are encountered.
- **providing safe access** to the site and the specified archaeological investigation areas via separately identified pedestrian routes, signing, safety guard-rails, secure ladders etc. This includes segregating these areas from any vehicles and plant operating nearby eg via a robust physical barrier.
- **adequate ventilation** and protection from noise, fumes and dust where plant is in use, especially within standing buildings
- **managerial services** – nominated points of contact for Principal Contractor and other key members of development team.
- **technical advice** to be available if required (eg via client or Principal Contractor's consulting engineer) ré protection of adjacent streets and buildings, removal of obstructions, depth of excavation, live services etc.
- **site accommodation and welfare facilities with electricity and water**. To include at the worksite furnished main base cabin as work space; separate male/female changing areas, toilets and washing facilities; plus additional steel cabin for secure storage of MOLA PPE, equipment, camera and paperwork and finds. For the basic monitoring component of a small watching brief, these facilities would normally be shared with the Principal Contractor's site establishment and separate work space is not normally required. For the general watching brief on combined utilities, shared desk space and lockable storage (eg small cabinet) for site paperwork will be required.
- **site preparation and clearance**. Removal of structures, vegetation, rubbish, spoil heaps, demolition materials, slab, modern obstructions, infill, made ground, etc. as required, prior to and during the archaeological investigation. The majority will be mechanical excavator, under archaeological

supervision, but occasional hand work by labourers may be needed (eg clearing individual obstructions or removing spoil from investigation areas if the machine cannot re-enter).

- **transport/mounding/storage of spoil** from archaeological investigation areas. This includes removal from site, if necessary.
- **filling back and reinstatement** upon completion (trenches are normally backfilled, for safety reasons, unless there are client instructions to the contrary).
- **supply of plant and equipment**; principally a mechanical excavator of appropriate size; supplied with driver, breaker, toothed digging bucket and toothless ditching blade. Other plant such as dumpers, compressor/breakers, hoist and pumps may also be needed.
- **accreditation and supervision of operatives, plant and equipment**, including supply of sufficient qualified banksmen/supervisors to control plant movements and adequate certification for plant and operatives.
- **temporary support**: design, installation and maintenance of appropriate temporary support to excavations, where deeper than c 1.2 m (or as required in unstable ground). This will be via benching/battering back and/or shoring, depending on depth and ground conditions.
- **other safety measures in deep excavations**: monitoring of air quality and provision of rescue facilities and equipment in any areas defined by the Principal Contractor as a confined space. Where hoists are used in shored trenches, MOLA staff shall leave the excavation before hoisting of bucket takes place and not under normal operations re-enter until bucket is lowered back into position: Unless:
 - suitable space or protection is afforded within the trench so that staff will not be at risk should the bucket fall;
 - **a banksman or topman** is constantly present to ensure that the bucket is not re-lowered or suspended over the trench while staff are working in the trench;
 - there is clear agreement that the hoist or machine operating as a hoist will not be in operation for a specified time period at that location and will not in any case recommence operations without the agreement of the MOLA supervisor or suitable deputy.
 - Where mechanical or electrical hoists are in use in larger excavation trenches, the area in which the hoist is in use must be clearly demarcated and no staff will enter this area while the hoist is being raised or lowered or in the interval between these operations except under the circumstance specified above.
- **pumping-out**: a suitable method to keep the trenches dry, eg pumping into a previously investigated trench, to create a sump.

- *temporary roofing (not required)* to archaeological excavations (eg clear plastic sheets on scaffolding frame). Needs to have adequate water drainage and ventilation. Local, portable frames would only be required if significant remains are present. There is no need for routine roofing of all excavation areas.
- **110v. site lighting and power supply** for access routes to excavations, plus individual task lighting within trenches (eg tripod-mounted spotlights) if required. The need for lighting depends on the depth, season and weather conditions or on ambient light level if working inside a standing building
- **locating and making safe any live services or hazardous substances (above or below ground)**: preliminary services searches should be carried out by the Principal Contractor via the statutory undertakers etc, plus on-site inspection and testing where required. Where there is reason to believe from previous uses that the ground or adjacent buildings may be contaminated the Principal Contractor should make arrangements for advance inspection, sampling, testing and where necessary specialist remediation. The results of such surveys should be forwarded to MOLA *prior to commencement on site*. Any identified hazards will be addressed in the health and safety planning. Any unexpected hazards encountered during the investigations will also need to be made safe by the Principal Contractor before archaeological fieldwork may continue. In the event of the accidental disruption of a live service by archaeologists or sub-contractors under archaeological supervision the MOLA supervisor will inform both their project manager and the Principal Contractor and, when appropriate, call the relevant emergency number.
- **development of a safe method of working**: archaeologists will not be able to work within excavations whilst attendances (such as installing temporary support or removing spoil) are taking place, and when demolition, construction or heavy plant activity occurs adjacent or overhead.
- **First Aid**: provision of First Aid facilities, and an emergency plan. On evaluations or watching briefs with small numbers of staff, MOLA may not be able to supply a first aider. In that case, the services of the Principal Contractor's qualified first aider(s) may be required.

9.2. Equipment

Equipment will be supplied by the MOLA equipment central store:

- First Aid Kit
- Hand tools, dumpy levels, stationary, grid pegs, digital camera, etc.
- Power auger if required

Any specialised equipment such as power augers will have certification of maintenance kept at MOLA headquarters.

9.3. PPE

All MOLA staff are supplied with and will wear or use the following PPE where required and as appropriate:

Safety Helmets (EN397)
Ear Defenders (EN 352-3)
Safety spectacles (EN166)
Dust masks plain and valved (EN149 2001)
Hi-visibility vests (EN471)
Gloves Nitrile and latex disposable, PVC, EN374
Safety footwear - steel toecap and mid-sole boots and Wellingtons EN345-47 (No riggers are allowed)
Flame retardant overalls

9.4. Staff

The timing and overall duration of the evaluation and the various watching brief/evaluation tasks listed earlier will be determined by the contractor's programme and the nature and extent of any surviving remains. It is envisaged that General and Targeted Watching Briefs will be initially carried out by one MOLA Supervisor, with a second archaeologist coming in to assist with any recording work if required. The evaluation will be supervised by one MOLA Supervisor assisted by an adequate number of field staff, if required. Other archaeological specialists may be called in if necessary.

The Non Listed Built Heritage survey is expected to start on 27th March 2013, and to last for 2 days. The staff will consist of 2 buildings' archaeologists assisted by a photographer on the second day.

10. Briefing Arrangements

10.1. MOLA Staff Induction – New Starters

- All MOLA staff shall receive a full induction including Health and Safety on commencement of their first day of work with the organisation. A record of the induction is kept.
- The MOLA Supervisor will be briefed by MOLA Contracts Manager/Assistant Contracts Manager on all relevant aspects of work before work commences. This briefing will include all SS-WSI, Method Statements (PC's and including this document.
- The MOLA Supervisor will be responsible for briefing any other MOLA staff on site before they commence work on all aspects of the work and documents.

10.2. Site Specific Inductions, Weekly Briefings and Tool Box Talks

- Where a site is under the control of a Principal Contractor (as in this case), MOLA staff will attend all initial site inductions and subsequent toolbox talks as required and managed by the Principal Contractor.
- Irrespective of whether the site is controlled by MOLA or a Principal Contractor, on larger projects, e.g. those with more than 2-3 staff and of a week or longer duration, regular toolbox talks will be given by the MOLA Senior Archaeologist or other suitable member of staff using the CITB: construction site safety tool box talks manual. As a minimum requirement these talks will occur 1-2 times per week and be of 10-15 minutes duration.

11. First Aid

11.1. Trained First-Aid Personnel

During the evaluation there will be at least one MOLA staff, who is a qualified First Aider (i.e. 3 day F.A. at work course) present on site.

11.2. First Aid Documents

The MOLA site safety documents will be located with the first aid kit in the site office/mess hut/canteen. The safety documents will include a minimum of:

- Current Health and Safety at Law Poster for display where legislation requires
- Accident Book compliant with the Data Protection Regulations.
- MOLA Public Liability Insurance & Employers Liability Insurance for display

- Where To Get First Aid poster – to be displayed if required.
- Current MOLA Health and Safety Policy
- A copy of the site Welfare, Health and Safety Method Statement, extracted from the Site WSI, and modified as agreed during the course of the site.

11.3. First Aid Equipment

A MOLA First Aid kit, of an appropriate size for the site, will be located in the site office/mess hut/canteen or in the case of a small watching brief a 'bum bag' will be carried by the MOLA Supervisor at all times.

12. Accident, Incident, Near Miss and Environmental Incident Reporting

12.1. Reporting of Accidents/Incidents and Dangerous Occurrences

The Reporting of Injuries, Diseases and Dangerous Occurrences (RIDDOR) Regulations, 1995 sets out requirements for the reporting of certain types of accidents. RIDDOR notifiable accidents will be reported immediately by the MOLA site supervisor as specified in Section 19.5 (main document).

12.2. Documentation

In order to identify quickly problem areas and allow corrective action to be taken all accidents, dangerous occurrences and near misses, including those that do not cause injury, will be reported immediately to Section 9 (main document):

- Principal Contractor's Site Manager
- MOLA supervisor
- MOLA H & S officer
- MOLA Senior/Contracts Manager
- Crossrail Project Archaeologist
- Crossrail Helpdesk.

The site accident book for both the Principal Contractor and MOLA should be filled in giving details of the incident.

12.3. Investigation of Accidents and Dangerous Occurrences

MOLA will comply with the Principal Contractor's and Crossrail procedures.

MOLA will also initiate internal procedures as follows:

- Initial accident/incident report to MOLA Senior Contract Manager and Field Manager and action taken as appropriate.
- Non Riddors investigated by Senior Contract Manager/Field Manager.

- Riddors investigated and reported on to Senior Management Consultant by MOLA H & S Consultants.

12.4. Key MOLA Project Personnel

- George Dennis, Senior Contracts Manager, MOLA
- David Divers, Contracts Manager, MOLA
- Michael Smith, Fieldwork Director, MOLA

13. Emergency Procedures – Site General

All MOLA staff will comply with the Principal Contractor's procedures as outlined at the Site Specific Induction.

14. Emergency Services Contact Details

Full Accident and Emergency:
Newham General Hospital
Glen Road
E13 8SL

Tel: 02074764000

The MOLA supervisor will dial 999 for fire, ambulance and police in the case of an emergency if the Principal Contractor's Site Manager or his deputy is not present on site.

15. Route to Hospital

The Principal Contractor will advise on route to hospital at their site specific induction. The location and directions will also be displayed in the site offices and canteen.

25 Appendix 2: Geotechnics Ltd safe working procedures and risk assessments

SAFE WORKING PROCEDURES – SWP 04 – Window Sampling / Dynamic Sampling

This SWP is based on the Company's interpretation of the BDA Guidance for the Safe Operation of Dynamic Sampling Rigs and Equipment, and experience in carrying out this activity. Quotes are taken from the guidance and utilised throughout this document.

Dynamic sampling is a method of driving equipment into the ground and can provide a sample for both geotechnical and Geoenvironmental testing.

The dynamic sampling rig generally utilised by Geotechnics Limited is the Feed Frame Mounted – Drop Weight Type; the **Dando Terrier**.

Feed Frame Mounted – Drop Weight Type:

The main principle of this type of machine is that a drop weight is attached to a sliding carriage, which in turn is mounted onto a feed frame.

The sliding carriage is lifted to its highest position using an integral hydraulic cylinder. The sampling device is then placed under the carriage and connected to a drive collar or drive ring. Before sampling the hydraulic cylinder is fully retracted to allow free movement of the sliding carriage.

The drop weight is moved by a moving chain with an integral latch that allows the weight to be picked up. When the weight reaches the top of its travel it is released allowing it to fall on to an anvil, which in turn drives the tooling into the ground. The drop weight can normally be changed, to allow for the completion of Standard Penetration Testing (SPT), Heavy Dynamic Probing (DPH) or Super Heavy Dynamic Probing (DPSH).

The drop height or free fall height of the weight may also be changed from the standard 760mm to 500mm allowing the different tests indicated above, to be carried out.

The sampling equipment is mounted on a self propelled rubber-tracked chassis. The hydraulics are powered by a diesel engine.

Where the equipment is required to operate in a potentially explosive atmosphere / location; it will be equipped with an overrun valve and spark arrestor.

Regardless of the type of dynamic rig used, the following information applies in respect to the site set up, site operation and demobilisation.

1. The site will be inspected prior to starting work on site (likely to be on the first day of attendance), to ensure that the site entrance/exit is suitable for the equipment to be used, a safe route to the work position is available and that the borehole positions are suitable for the rig and equipment.
2. Before commencing to set up the Window Sampling Rig, a review of the Site Specific Risk Assessment, Method Statement and Buried Services information will be carried out. It is imperative that any significant site specific factors are briefed, understood and followed by all personnel on the site.
3. Where possible to do so, an adequate underground Buried Service search should be / have been carried out. Where available, the service drawings will be / have been inspected before mobilising to site and before any intrusive techniques are employed. An "in-date" calibrated Cable Avoidance Tool (CAT) shall be readily available on site for use at all times as required.
 - 3.1 Borehole positions will be located at a safe distance from any known underground services, discussed and agreed with the Engineer/Client prior to works commencing.
 - 3.2 Following the Buried Service search and review of all available Service Plans of the area or in the absence of Buried Service information being available, a minimum of a Cable Avoidance Tool (CAT) Scan and Inspection pit will be carried out. The borehole location will be scanned with a CAT, by a Competent and appropriately trained person.
4. An Inspection pit will be excavated by hand to a depth of 1.2 metres, and where possible, the base of the inspection pit CAT scanned.
 - 4.1 Generally, mechanical breakers shall be used for surface concrete / tarmac hard standing, and never knowingly over any known Buried Services.
 - 4.2 An inspection pit should always be excavated for the protection of the drill crew.
 - 4.3 Drilling Operatives should also be aware of Buried Service indications, e.g. manhole or inspection covers, hydrants or evidence of prior excavation etc.

SAFE WORKING PROCEDURES – SWP 04 – Window Sampling / Dynamic Sampling

- 4.3.1 Exclusion zones exist around oil and gas pipelines, and no work will be undertaken without prior consent from the appropriate Pipeline Authority.
- 4.3.2 Any excavation will be carried out in such a manner as to aim to comply with the requirements of SWP 15 Underground Services and Health and Safety Guidance (HSG) 47, Avoiding Danger from Underground Services.
- 5. Operational Safety Requirements**
- 5.1 **Rig and Equipment Unloading** – Before commencing to set up the rig, a dynamic risk assessment should be carried out, especially if the rig is to be set up on a slope.
The working area should be prepared to provide a safe and suitable location for the dynamic sampling rig, associated equipment and personnel.
- 5.2 Care must be taken when unloading the dynamic sampling rig from road vehicles or trailers. Any ramps must be suitable for the purpose and secured. Personnel must be trained in the unloading procedures.
- 5.3 Unloading of sampling tools and equipment must be carried out in a safe manner taking into consideration the implications of Manual Handling. Further guidance can be found in SWP 29 – Manual Handling and Lifting.
- 6. Rig Setting Up on Site**
- 6.1 Prior to lowering the jacks, suitably strong supports should be placed under the jacks in order to support the rig and spread the weight. The supports should be substantial and fit for purpose in order to level the rig.
- 6.2 The Mast should then be adjusted to the vertical position and locked into position in accordance with the Manufacturer's Operating instructions.
- 6.3 Sampling tools and equipment should be stored appropriately and safely, e.g. horizontally on trestles as opposed to left lying on the floor presenting a tripping hazard.
- 6.4 Where possible, the engine should be positioned 'downwind' of the borehole in order that the rig crew are not subject to any exhaust fumes.
- 7. Operating the Rig**
- The Dynamic Sampling Rig must always be operated in a safe manner in accordance with the Manufacturers Instructions, and never outside the scope of its designed use.
The Working area should be kept clean and clear underfoot, cuttings should always be placed well to one side in a plastic bag or moved to a skip.
- 7.1 The operation of the rig requires two persons at all times. Regardless of who is working as the crew, both personnel shall be appropriately trained and deemed competent by the Company.
- 7.2 The Lead Driller must ensure that all safety guards and protective devices are fitted and in sound condition and comply with the requirements of the Provision and Use of Work Equipment Regulations. (PUWER)
- 7.2.1 Protective devices and emergency stops must be tested before the operation commences.
- 7.3 In line with the Manufacturers Operation Manual, all aspects of the rig must be checked before drilling commences.
- 7.3.1 In addition and where relevant, elements of the rig must be thoroughly examined and Certificated by a Competent Person in accordance with the Lifting Operations and Lifting Equipment Regulations (LOLER)(minimum of annually).
- 7.4 The Lead Driller must ensure the Drillers hands and feet are clear when lowering tools or casings to the ground. All personnel should keep hands clear of potential entrapment, entanglement or crushing hazards.
- 7.5 Casing tubes and drill thread joints should always be fully screwed home before use in order to minimise any damage to the threads.
- 7.6 Tools should not be left suspended in the mast when the rig is left unattended.
- 7.7 Hand tools should be stored in a safe place when not being used.
- 7.8 Personnel must never look down the borehole whilst tools are suspended overhead. To view the borehole, any

SAFE WORKING PROCEDURES – SWP 04 – Window Sampling / Dynamic Sampling

suspended equipment must be grounded. Prior to looking into the borehole, check that there is no upward flow of air or gases.

- 7.9 If casings or tools become stuck in the borehole and cannot be released by the action of the rig alone, supplementary and suitable extraction systems can be employed. See 8 Extraction Methods.
- 7.10 Before moving the rig on to any public highway all loose mud and dirt should be removed and any components of the rig including items of drilling equipment must be secure.

8. Extraction Methods

- 8.1 On certain feed frame mounted machines, there are integral rams or systems for the extraction of tooling.
- 8.1.1 For hand held or machines without integral extraction systems, the equipment is normally extracted from the ground by the use of either:
- Powered jacks – Pneumatic or hydraulic that may consist of single or double cylinder or hollow cylinder rams;
 - Hand jacking systems.

9. Sampling and In Situ testing Hazards

The process, nature and equipment used in dynamic sampling can give rise to various hazards. To enable consideration to be given to each particular process, foreseeable hazards associated with each process is identified below. The list of hazards is not exhaustive and the drilling crew should be vigilant at all times and report any issues identified during the use or operation of the rig that has not been previously considered to their immediate Line Manager.

9.1 Tool and Equipment Handling

Dynamic sampling tools and equipment are heavy and awkward to handle. It is essential that care must be taken at all times when manually handling these items. Correct lifting procedures should be deployed at all times in accordance with training and SWP 29 – Manual Handling and Lifting.

- Care must be taken to prevent entrapment of fingers, clothing and hair;
- Items of jewellery should not be worn;
- When making up threaded joints operatives shall be vigilant at all times for burrs and sharp edges;
- Appropriate Personal Protective Equipment and Clothing (PPE) should be worn at all times and as appropriate to the element of the process being undertaken at the material time.

9.2 Care of Dynamic Drill / Probe Rods and Tubular Components

Drill / Probe rods and other tubular products used in sampling and in situ testing are designed to last and give trouble free service providing that they are used and maintained in a safe and clean manner. Damage incurred by careless handling, making up and disconnecting threaded joints can severely reduce the working life of the equipment and increase the hazards identified in 9.1.

- Always use drill / probe rods and other tubular products manufactured to the dimensions and physical properties of the rig and their intended use;
- Always clean each pin and box thread before use and ensure that threads are free from burrs and lubricated before connecting together;
- Always use appropriate lubricant;
- If engaging threads under power, avoid excess thrust and Revolutions per Minute (RPM). (Always low torque and low revolutions);
- Check drill / probe rod and casing Outside Diameter (OD) for wear at appropriate intervals, and discard when the OD wears down to the discard limit specified by the Manufacturer.
- Check the straightness of the rods, casings and other components periodically. Any bent or damaged components should be returned back to the Coventry Stores and disposed of appropriately.

9.3 Tooling Recovery

- When jacking equipment from the ground, ensure that the jacks selected are of the correct load capacity and fit for purpose;
- The jacks must be securely positioned on a firm and secure base;

SAFE WORKING PROCEDURES – SWP 04 – Window Sampling / Dynamic Sampling

- Personnel must be kept clear whilst jacking operations are being carried out;
- When jacking, always be aware of the danger of sudden movement or the release of the equipment;
- Recovery jacks must be marked with their load capacity and carry a current test certificate;
- When rod breaking, always use the appropriate laykey, rod spanner or wrap round wrenches;
- When using laykeys, spanners or wrap round wrenches care should be taken to avoid become entrapped.

9.4 Sampler Handling and Emptying

- When handling or emptying all types of samples vigilance should be maintained for any sharp edges on the leading end of the sampler tube, window slots, drive shoes and basket lifters;
- When removing liners from the samples consideration should be given to the potential for split or broken liners;
- Before removing the liner and sample, the sampler should be held securely within the vice mounted on the rig or at a height that enables the liner to be removed safely;
- When using the pliers to initially extract the liner, consideration should be given to 'nipping' the skin or the pliers slipping off the liner as physical 'pulling' is applied;
- If the liner has to be cut, a 'hooked' blade should be used in preference to a straight blade. The cutting process should always be undertaken in the direction away from the body;
- Caution should be taken when handling empty liners in respect to any sharp edges of potential contamination from the ground. Consideration should be given to SWP 10, 11 or 12 in respect to Safe Intrusion into Contaminated or Potentially Contaminated Land.

9.5 SPT Operations

- Care must be taken when lifting the heavy hammer into position;
- Before use, ensure the hammer is free from burrs as impact by the hammer may cause fragments to fly off risking eye injury;
- Always use the correct PPE when using a SPT hammer and keep fingers away from the impact area;
- If using a trip hammer avoid contact with the latches

9.6 Working on Slopes

Where dynamic sampling operations have to be carried out whilst working on slopes, special care has to be taken to ensure the stability of the rig and the safety of the drilling crew.

Prior to work being undertaken on slopes, the drilling crew shall undertake a risk assessment in order to assess the hazards with the site and access and determine the appropriate control measures to be deployed.

The control measures deployed shall consist of, but not be restricted to the following:

- Where possible, the preparation of a flat bench of the appropriate size to accommodate the dynamic sampling rig and a safe operating area of the crew;
- Ensure that the rig is securely chocked in place before commencing operations;
- If it is necessary to erect a temporary working platform which includes the use of a scaffold, the scaffolding must be designed and erected by a competent scaffold company.
Working platforms must be firmly secured and attached to the slope before work commences and be strong enough to carry the weight of the rig, its associated equipment and tools, and the pulling force of the rig itself.
- When tracking the rig on slopes, care must be taken to ensure the slope angle does not exceed that recommended by the Manufacturer.

10. Reinstatement and Site Abandonment

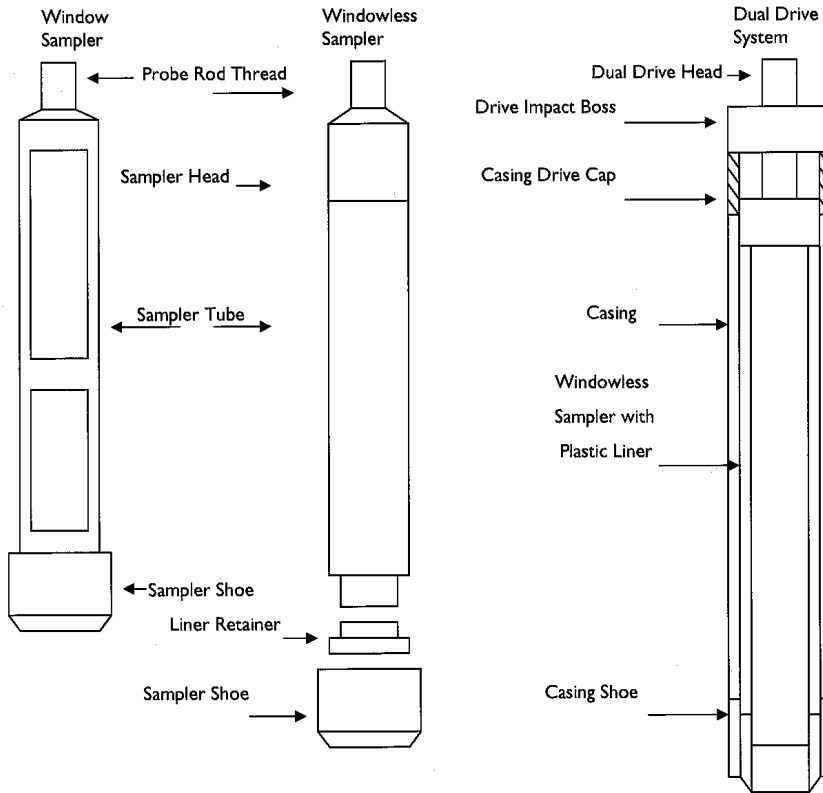
When the dynamic sampling activity is completed, it is important that the site is restored to a safe and satisfactory condition with no hazards left that as a result of the undertakings would have the potential to harm human health, animals or the environment.

Clients should provide the necessary information regarding the extent required for sealing and reinstatement of the borehole.

SAFE WORKING PROCEDURES – SWP 04 – Window Sampling / Dynamic Sampling

Dynamic Sampling Tools and Equipment

Below is a simple guide to the most frequently and universally used tools and equipment when dynamic sampling processes are carried out with a dynamic sampling rig.



HEALTH & SAFETY - Risk Assessment - Window Sampling/ Dynamic Probing		Form RA015 Rev 2	
Project	Crossrail Custom House	Project No.	
Client	Museum of London	Date	30th May 2013
		Compiled by	
		Activity	Window Sampling

Risk (R) = Likelihood x Severity			Likelihood (L)					Severity (S)					
1 to 6	Low	Ensure control measures are maintained.	Remote=1	1	2	3	4	5	Negligible=1	Minor=2	Absence=3	Major=4	Fatal=5
8 to 10	Medium	Review operations & control measures. Adapt as necessary.	Unlikely=2	2	4	6	8	10	2	4	6	8	10
12 to 25	High	Unacceptable risk, change control measures or abandon task.	Possible=3	3	6	9	12	15	3	6	9	12	15
			Probable=4	4	8	12	16	20	4	8	12	16	20
			Certain=5	5	10	15	20	25	5	10	15	20	25

Activity	Hazard	Effect	L	S	R	Mitigating Action	L	S	R	Comments / Further Actions
Drilling Activities	Buried Services	Fire / explosion / Personal injury - electric shock, flooding	3	5	15	A check for buried services must be made prior to commencing hole. Reference must be made to SWP 03-Trial Pitting - Hand and Machine Excavation, SWP 08-Underground Services and SWP 09-Use of Cable Avoidance Tool and Signal Generator.	1	5	5	A Permit to dig / drill shall be issued prior to breaking ground and excavating to a minimum depth of 1.2 metres.
Transporting on site and setting up / bringing down the rig.	Overturning, uneven ground, slopes, soft ground.	Entrapment beneath rig	3	5	15	Rig to be ideally tracked over firm level ground if practicable.	1	5	5	Route must be walked ahead of the rig to prove route.
Drilling locations are likely to be in busy trafficked area.	Frequent vehicle movements	Collision with vehicles using site	3	5	15	Locations to be in safe areas. Working areas to be delineated where necessary. All personnel to wear high visibility clothing.	1	5	5	Risks to be continually assessed. Care to be taken within car park. Watch for traffic.
Moving Parts	Entrapment in the drop weight mechanism	Personal injury	3	3	9	The drop weight guards shall be securely bolted into position.	1	3	3	All Guards shall be securely fitted in place at all times during drilling activities.
Drilling Activities	It is known that the rig can sometimes exceed the action level requiring hearing protection.	Personal injury – noise induced hearing loss	4	2	8	In order to minimise noise exposure, adequate hearing protection shall be readily available and worn as required.	1	2	2	The lead driller should monitor the noise levels from the rig and shall wear, and instruct the second man to wear, hearing protection as required. As a general guide – if normal speech cannot be heard at 2 metres, hearing protection should be worn.
Drilling Activities	Vibration	Personal injury	2	3	6	It is not envisaged that any vibration generated by the drilling operation will exceed the permitted exposure level.	2	3	6	The lead driller to continually monitor for any changes.
Drilling Activities	Exhaust Fumes	Personal injury – respiratory / eye nuisance and irritation	3	2	6	Consideration should be given to the direction of the prevailing wind during the set up of the rig. Where possible, the rig should be set up so as to allow the fumes being emitted from the exhaust to blow downwind from the driller.	2	2	4	In the event that wind direction changes, or it is not possible to position the rig appropriately, the driller should try to take steps to minimise the fumes from being emitted into the breathing zone of the drilling crew. Regular maintenance may minimise the amount of fumes created by the exhaust.

Dando, Terner



Hammer Energy Test Report

In accordance with BSEN ISO 22476-3:2005

Dynamic sampling uk Ltd
 Unit 8,
 Victory park way,
 Victory road,
 Derby,
 DE24 8ZF

Hammer Ref: 0773
 Test Date: 30/11/2012
 Report Date:
 File Name: 0773.spt
 Test Operator: TP

Instrumented Rod Data

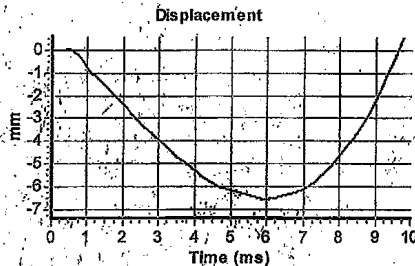
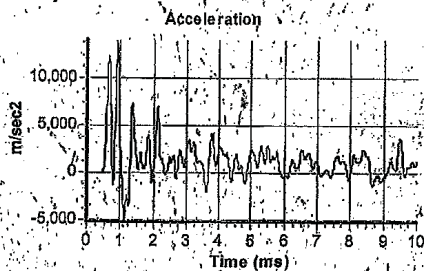
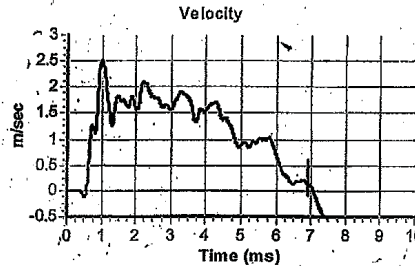
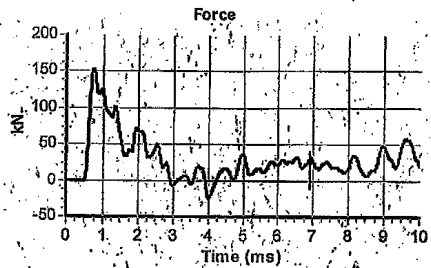
Diameter d_r (mm): 54
 Wall Thickness t_r (mm): 6.9
 Assumed Modulus E_a (GPa): 208
 Accelerometer No.1: 6455
 Accelerometer No.2: 6457

Hammer Information

Hammer Mass m (kg): 63.5
 Falling Height h (mm): 750
 String Length L (m): 15.0

Comments / Location

Geotechnics dando hammer tested at:
 Dynamic sampling yard.



Calculations

Area of Rod A (mm²): 1021
 Theoretical Energy E_{theor} (J): 467
 Measured Energy E_{meas} (J): 350

Energy Ratio E_r (%): 75

Signed: T.parker
 Title: operations manager

The recommended calibration interval is 12 months



DANDO DRILLING INTERNATIONAL LTD

Old Customs House, Wharf Road, Littlehampton, West Sussex, BN17 5DD, United Kingdom
Tel: +44 (0) 1903 731312 Fax: + 44 (0) 1903 730305 email: info@dando.co.uk
www.dando.co.uk

CERTIFICATE OF RIG APPROVAL

Customer Name and Address

Geotechnics Ltd
The Geotechnical Centre,
203 Torrington Avenue
Tile Hill
Coventry
CV4 9AP
Contact: Any Suominen

DANDO Terrier Rig Serial No: DT/0773.
(D13855)

"Dando can confirm that the rig has been fully checked and repaired in accordance with the owner's manual, and has been approved for operation following our inspection and basic function test".

Dated the 28th February 2012

Dando Drilling International Ltd. Registered in the UK No. 1770124 VAT No. GB537665182
Registered Office: Old Customs House, Wharf Road, Littlehampton, West Sussex, BN17 5DD



DANDO TERRIER 2002.	Date	15/3/13
Daily Check List	Initial	PW
Serial No. DT/0773	O.K.	Fault
Engine Oil Level	✓	
Coolant Level	✓	
Hydraulic Oil Level	✓	
Hydraulic Hose Condition	✓	
Track Condition and Tension	✓	
Guards Fitted and Condition	✓	
Anvil Condition	✓	
Emergency Stop	✓	
Additional Comment		

Geotechnics Limited ©
 The Geotechnical Centre,
 203 Torrington Avenue,
 Tile Hill, Coventry. CV4 9AP



activity	background noise level	noise level	distance from activity	duration of activity
window sampling	high background noise (rail) 53dB	85-90dB		60-120secs
dynamic probe	55dB	engine 60dB peak 90-92dB	10m 10m	5 mins in 15mins(Lepd=75dB)
JCB	65dB	85dB 78dB 80-85dB	5.00m 10.00m	constant drone working level
Rotary rig	70-75dB	90dB 90-92 90-92 80-85	central 2.5m from rig, pump operators 2.5m from rig engine 10m radius	constant noise level
Cable Percussion Pilcon 150		106 96 <90	full throttle 1.0m depth	
Cable Percussion Dando		81dB 84 (lmax) 88 (laeq), 99 (peak) 84, 73, 111	at full rev 7.00m distance shelling SPT	

Guidance Noise levels for Window Sampling, Dynamic Probe, Rotary and Cable Percussion

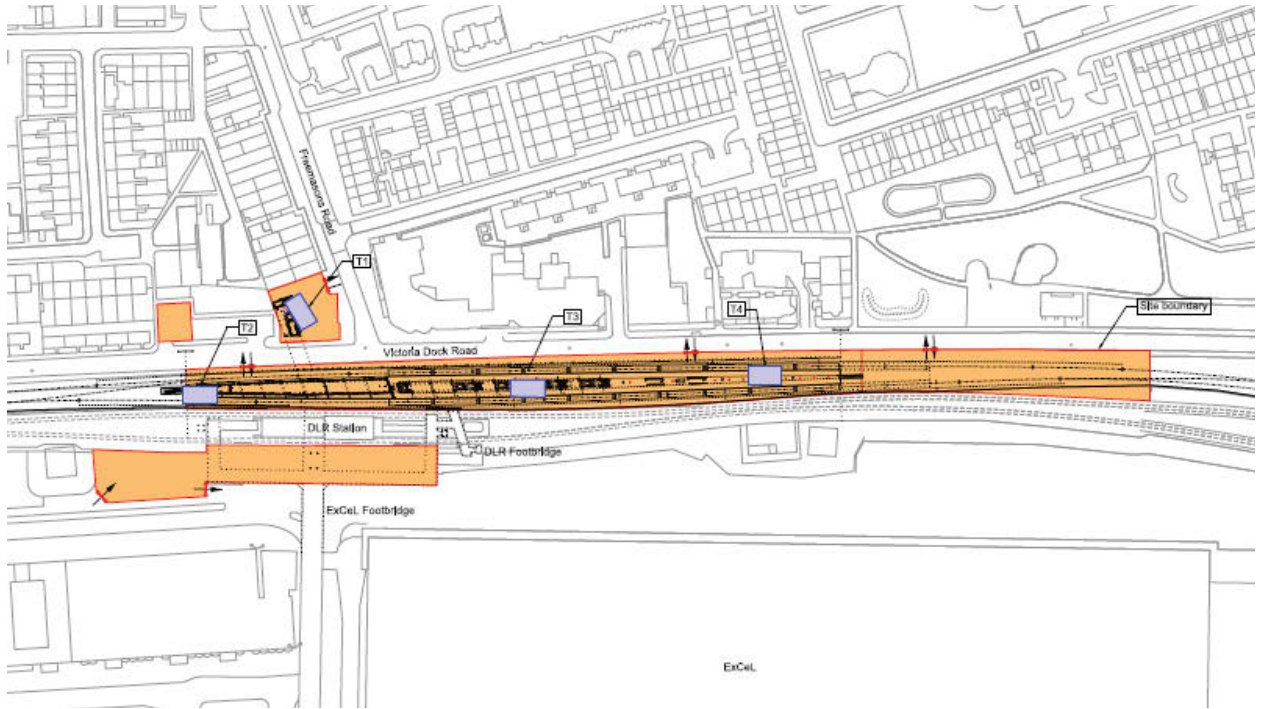


Fig 1: Location plan of Custom House Station worksite

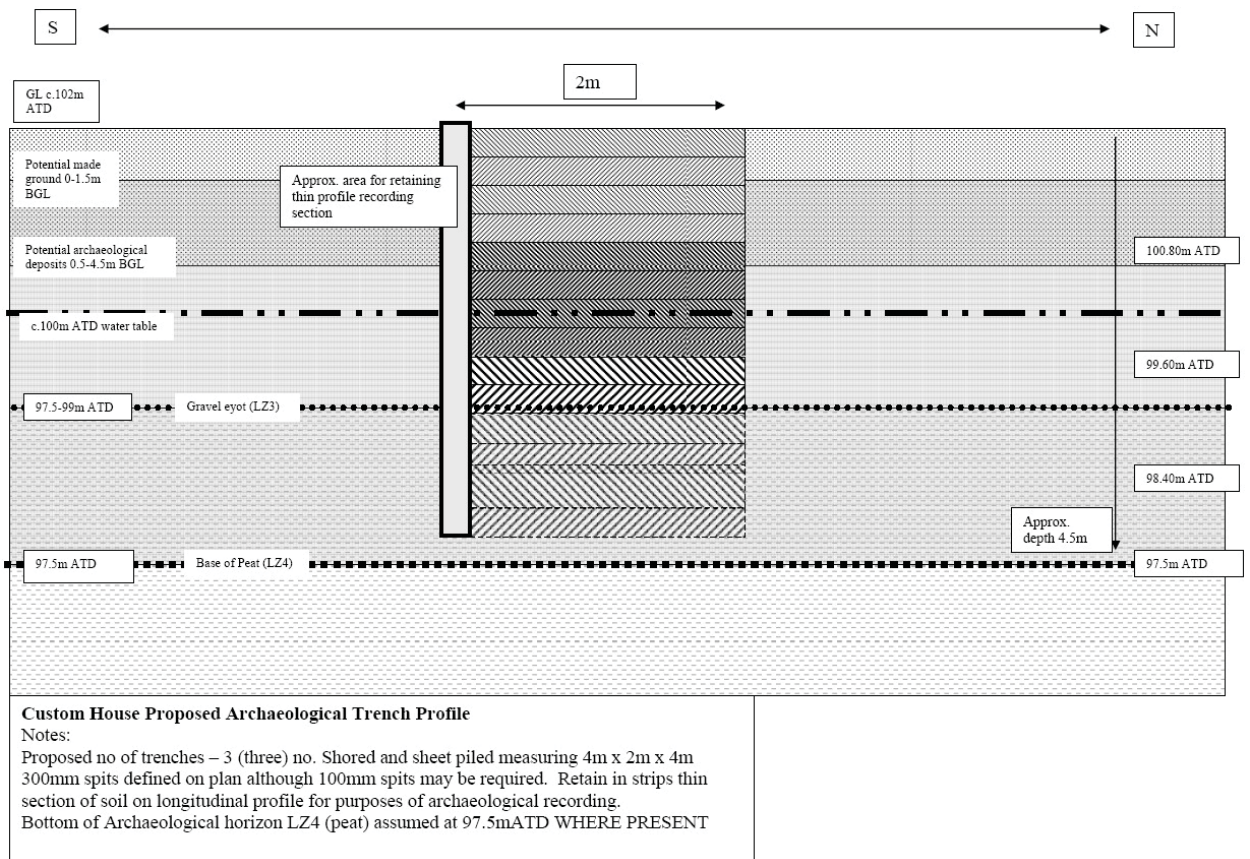


Fig 2: Proposed excavation method for Archaeological Evaluation trial trenches

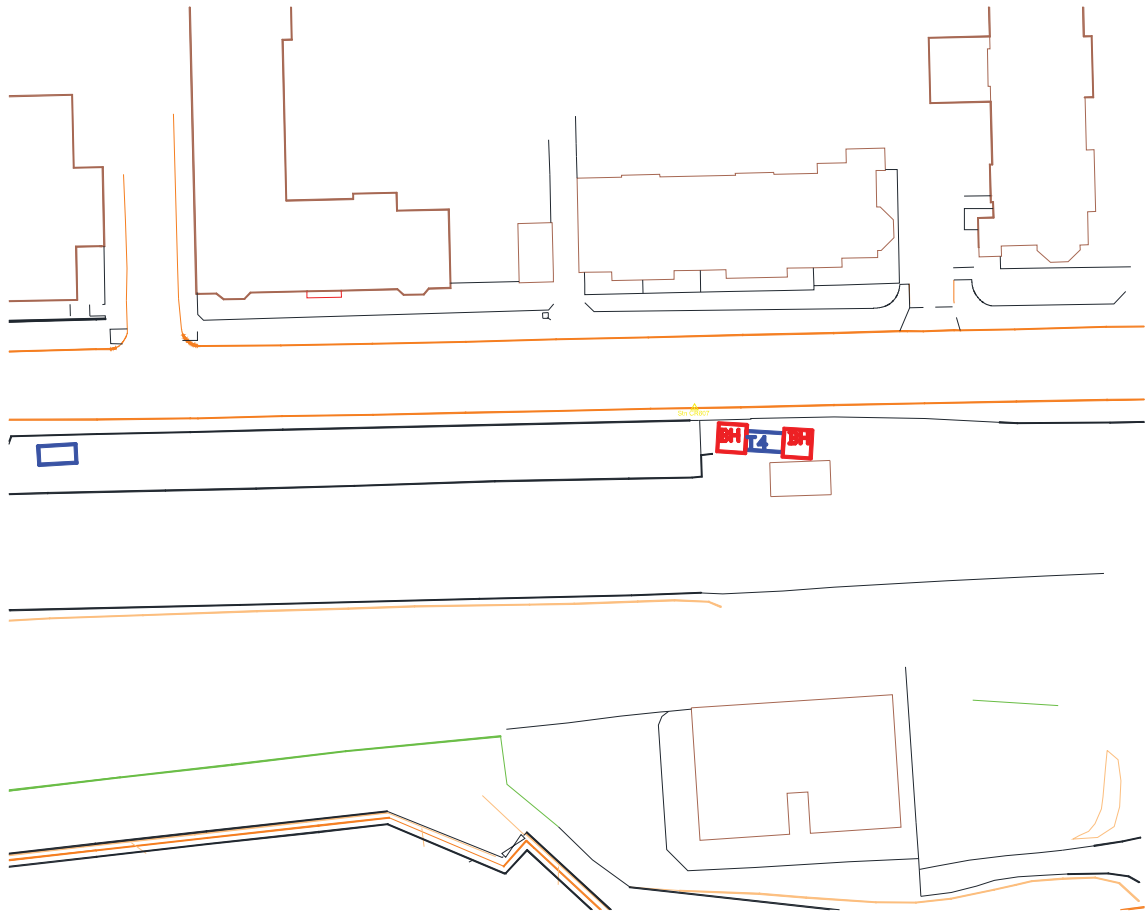


Fig 3. Proposed locations of the two boreholes adjacent to the site of trench 4. The exact location of the boreholes will be decided on site to avoid areas of disturbance but will be within the red areas at either side of the trench location.