



**DESIGN CONSULTANT FRAMEWORK  
 CONTRACT C122 BORED TUNNELS  
 HAM AND WICK SEWER  
 ARCHAEOLOGICAL SITE-SPECIFIC  
 WRITTEN SCHEME OF INVESTIGATION**

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C122-OVE-T1-RGN-CR094-50003 – Revision 4.0

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		Name	Suzanna Pembroke	Rebecca Smith	Peter Chamley
Signature	<i>Suzanna Pembroke</i>	<i>Rebecca Smith</i>	<i>Peter Chamley</i>		

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## **Executive Summary**

This document forms a Site-Specific Written Scheme of Investigation (WSI), of Ham and Wick Sewer strengthening works near the Pudding Mill Lane Portal, London Borough of (LB) Tower Hamlets as part of the Crossrail development. It was compiled using the latest design information on the Crossrail works and from the Detailed Desk-based Assessment (CR-SD-PML-EN-SR-00001).

The Ham and Wick sewer works involves the construction of two access chambers measuring 10m x 6.5m and 7.5m x 6.5m long respectively, plus a pumping chamber constructed from 2700mm diameter precast rings and work to strengthen the sewers under which will run the two Crossrail running tunnels. Significant to archaeology is the construction of the access chambers and pumping chambers, as these will be an open excavation dug down to depth.

Archaeological potential across the site includes:

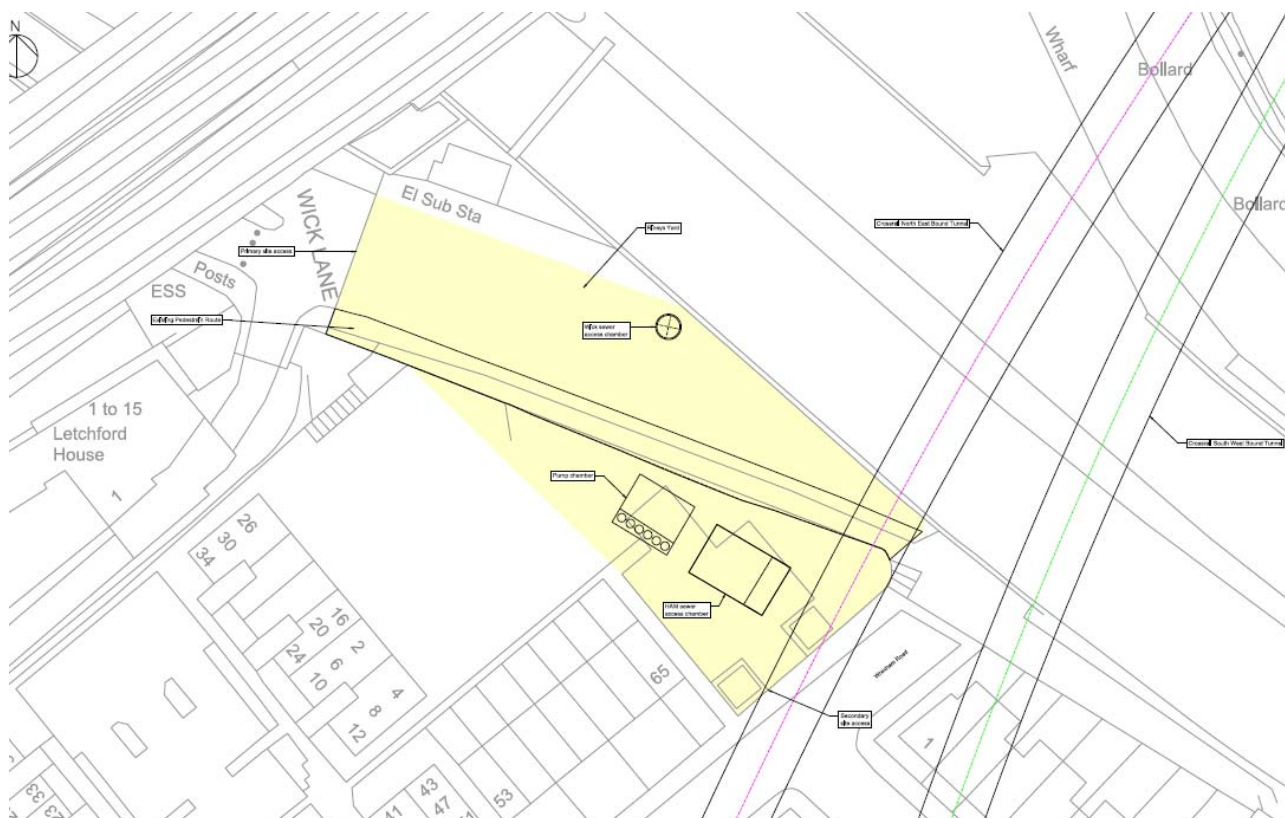
- Moderate to low potential for Prehistoric to Roman occupation deposits, environmental evidence and organic artefacts and structures that may have existed within the area in the past.
- Low potential for archaeological remains relating to post-medieval industrial activity and 19th century residential development, in particular the Grove Hall Lunatic Asylum.

Whilst the potential is not high enough to warrant an archaeological evaluation through trenching, it does require a targeted watching brief due to potential for archaeology. The watching brief will target the surface of River Terrace deposits. This will be undertaken during construction of the two access chambers and the pumping chamber.

## 1 Description of Works

Crossrail is a new pan-London rail link project which will provide new transport routes in the south east and across London. The line will provide a range of both new and improved rail journeys across London and its immediate surroundings. The proposed development will include the construction of seven stations within central London which will have interchanges with other public transport modes including the London Underground, National Rail and the London Bus service; the development will also include the renewal and/or upgrade of existing stations outside central London. The route itself will link Maidenhead and Heathrow in the west with Shenfield in the northeast and Abbey Wood in the south-east. Strengthening works to the sewer are required as part of the construction of the two running tunnels underneath the two existing Thames water sewers near the Pudding Mill Lane Portal.

Two new access chambers, plus a pumping chamber are to be constructed in Wick Lane, and land immediately south of Wick Lane to permit over-pumping between the Ham and Wick sewer during construction. The work site is shown on the worksite layout plan which accompanies this submission (drawing C305-DSJ-T-DDA-CR094\_WS115\_Z-60005) and as illustrated in Figure 1 below.



**Figure 1 – Plan of the CRL works at Ham and Wick Sewer**

The Crossrail works at this position involve the tunnel Construction Contract C305 (Drive Y, Z and G).

A summary of the previous archaeological studies at the Ham & Wick Sewer Diversion is provided in section 2.

## 2 Project background

### 2.1 Summary of Previous Assessment work

The Crossrail Generic WSI (14022008-44ES-P2Z1 – Crossrail, 2008a) outlines how the arrangements and controls for managing archaeology will be met in designing and constructing Crossrail. It also provides a common framework for archaeology which will ensure that the works conform to a common project standard. The Generic WSI is supported by additional documents outlining procedures for non-listed historic buildings (CR-PN-LWS-EN-PD-00010 – Crossrail, 2008b) and specifications for evaluation and mitigation (CR-PN-LWS-EN-SP-00001 – Crossrail, 2008c).

The Crossrail Environmental Statement and supporting Specialist Technical Report (STR), 'Assessment of Archaeology Impacts' (Crossrail, 2005) presents the outcomes of the archaeological studies undertaken as part of the Environmental Impact Assessment (EIA). The archaeological assessment has included an evaluation of the likelihood of archaeological resources being present in land affected by the project, their importance and the extent to which they will be physically affected by the construction and operation of Crossrail.

A Detailed Desk Based Assessment (DDBA) has also been carried out for the site (CR-SD-PML-EN-SR-00001 – Crossrail, 2008d). DDBAs were undertaken on sites that required additional information to enable decisions to be made regarding an appropriate mitigation strategy.

### 2.2 Geology

Information on existing Ground Investigation (GI) boreholes, including historic third party boreholes and boreholes carried out as part of the Crossrail ground investigation packages. Please refer to the following drawings for the locations of boreholes, archaeological sites and for deposit summary sketches mentioned in this section:

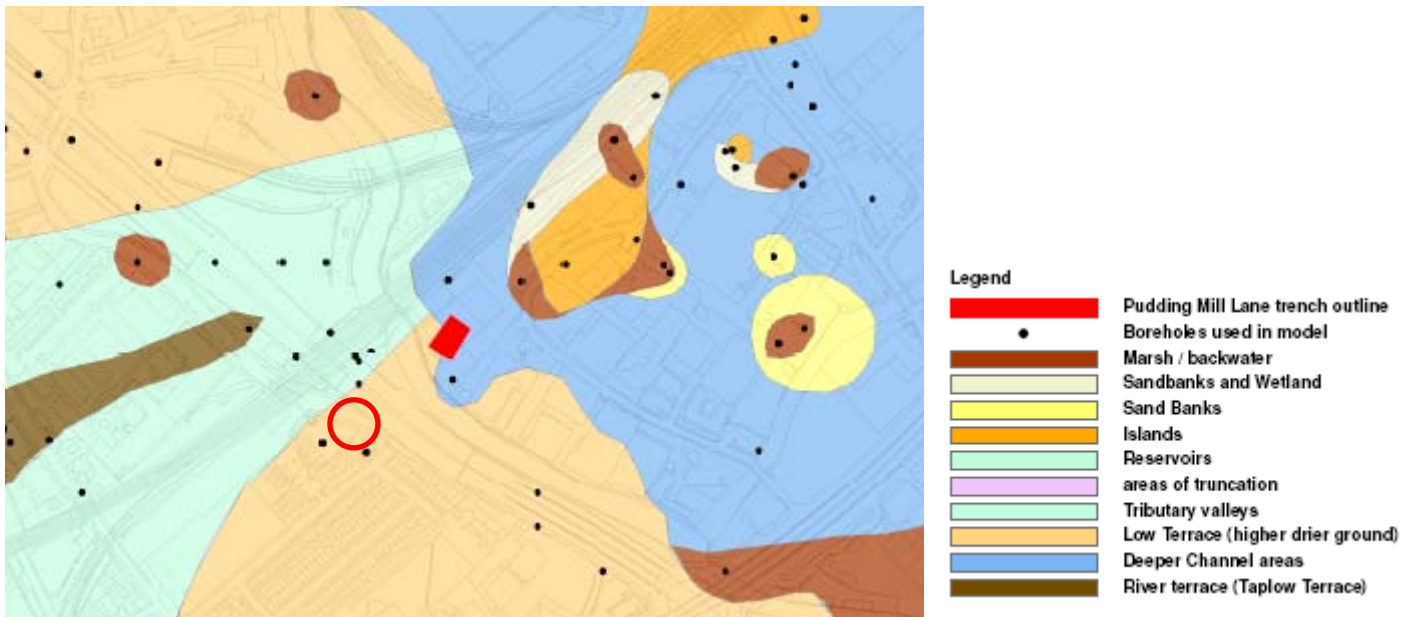
- Geotechnical boreholes: P30101-C1M00-G00-D-50013 & P30103-C1M62-G00-D-50802.
- Archaeological sites: P30103-C1M61-E00-D-50011

Also refer to *Crossrail MDC3 Archaeology, Geoarchaeological Deposit Model*:

- *Pudding Mill Lane* (D0101-C1G00-00505) for further details of the geology at the HAM & Wick site area.

An Updated geological deposit model (fig 2 below) shows an early Holocene tributary running to the north of the work site. The work site itself is located on an area interpreted as a low terrace, high drier ground to that located to the east and north. The red circle on figure 2 below shows the area of the Ham & Wick Lane sewer works.





**Figure 2 – Deposit model showing early Holocene landscape zones**

Overlying superficial deposits range from 1-4 metres above London clay. Geotechnical borehole PML 5A from the 2004 Liverpool Street to Bow and Isle of Dogs GI indicates between approximately 1-2m of Made Ground may be present across site overlying River Terrace Deposits (see Cad File C122-OVE-G-DDA-CR001\_Z-81032). River Terrace Deposits at PML 5A, were recorded to occur for a depth of 1.6m before coming onto weathered London Clay.

A summary of the archaeological and historical development is set out below.

### 2.3 Wick Lane Archaeological and Historical Development

Historically, the sub-site comprised large bounded fields with nearby trees until in the early 19th century significant development took place within the surrounding area and the Great Eastern Railway was constructed adjacent to the site. The Bryant and May match factory was located to the south in the late 19th and 20th centuries and included a siding adjacent to the rail-line, presumably for the loading/unloading of timber for use in the production of matches. The East London Waterworks reservoir was located just to the east of the site. Wick Lane was formerly named Old Ford Road.

The Grove Hall Lunatic Asylum, visible on the 1896 and 1862 OS maps, was established circa 1820 for ex-servicemen and functioned as an asylum through the 19<sup>th</sup> century. By the early 20<sup>th</sup> century the land had been sub-divided and formed part of the timber yards adjacent to the railway line or converted to housing. The two southern chamber sites may sit on the edge of the Grove Park lunatic asylum land, though any buildings were cleared during land sub-division.

The shaft site lies directly adjacent to the approach to the Blackwall Tunnel northern approach, adjacent to the Electricity Sub-station. The Wick sewer access chamber is to be located in Wick Lane while the pump chamber and HAM sewer access chamber are located to the south of this. The Blackwall Tunnel is a large infrastructure feature which was constructed in 1958-60 and includes the Northern Approach Road (A12) which runs past the site.



Despite being close to the post medieval remains relating to the Bryant & May match factory it is unlikely given the extent of recent works carried out in the area that archaeological deposits exist in the area.

The presence of Made Ground overlying River Terrace Deposits is characteristic of the higher drier ground to the west of the River Lea that has been identified in the MoLAS geoarchaeological deposit model for Pudding Mill Lane (Crossrail 2008). The deposit model identified the area as having the potential for prehistoric deposits, although environmental evidence and organic artefacts are likely to be poorly preserved in this area due to the drier soils on the western side of the Blackwall Tunnel. The potential for archaeology is considered to be low as post-medieval industrial development from the mid 19th century onwards may have removed much of the horizontal stratigraphy.

Archaeological investigations carried out to the north of the site for the Pudding Mill Lane site located prehistoric features directly above the River Terrace Deposits.

Much of the industrial activity has since been cleared from the site. The construction of the Blackwall Tunnel would have had a substantial effect on the area. However the presence of archaeology noted at Pudding Mill lane indicates increased potential for archaeology to be located at similar depths within the Ham and Wick Sewer site, specifically the top of the River Terrace Deposits.



### 3 Construction Impact Summary and Outline Mitigation Design

The proposed works involve the installation of a continuous steel liner into the HAM sewer over a length of approximately 50m where the proposed Crossrail tunnels pass below the sewer. The purpose of the lining is to strengthen and protect the existing masonry lining to mitigate the effects of ground movement and mechanical damage caused by the tunnelling operation.

The temporary works involve the construction of an access chamber, located opposite 65 Wrexham Road, at the northern extent of the proposed lining. The chamber will be approximately 10m long x 6.5m wide x 9m deep and will be used to insert and weld lengths of lining into place within the HAM sewer. It is envisaged that the chamber will be constructed of sheet piles.

Excavated material from the works will be removed by road from the work site.

Once the piles are inserted the chamber will be excavated and propped from top down until the sewer level is reached and the sewer is exposed. The top of the sewer will then be carefully removed over the length of the chamber to provide access and the base will be filled with concrete to support rams and welding equipment.

A pump chamber will be constructed just to the north of the access chamber. This will be approximately 7.5m long x 6.5m wide x 9m deep and will be formed with sheet piles as above. The chamber will incorporate a 2m (approx.) deep sump extending below the sewer invert, within which 6 pumps will be sited. The wall of the sump and the base of the excavation will be formed with insitu concrete. A manual penstock valve will be fitted to the downstream outlet within this chamber to close off flows to the HAM sewer downstream.

The pump chamber will be covered over with a temporary portable enclosure when sewage is flowing through the sewer to restrict odours escaping from the site.

A third chamber will be constructed directly over the Wick sewer adjacent to the pumping chamber (and within Wick Lane). This will be used to gain access to the Wick sewer in order to discharge the flows from each of the above mentioned pumps via a number of rising mains. This chamber will be constructed with 2700mm diameter precast rings using top down construction to a depth of 9m. When the Wick sewer is exposed it will be underpinned with mass concrete in the base of the chamber before the top is opened up and the rising mains are installed. It is envisaged that the rising mains will be buried at shallow depth between the HAM and Wick sewers.

#### 3.1 Construction Summary

The works are programmed to start in March 2012 and do not require any demolition activities.

#### 3.2 Permanent works

The permanent works comprise of the 7.5m x 6.5m long pump chamber and the 2700mm diameter precast ring Wick sewer access chamber.



### **3.3 Temporary works**

Construction of the 10m x 6.5m wide access shaft.

### **3.4 Outline Mitigation Design**

The overall mitigation strategy for the site is preservation by record. This is discussed in further detail in Chapter 5.



## 4 Research Design Objectives of the Investigation and Research Aims

Research themes, derived from *A Research Framework for London Archaeology 2002* (Nixon et al, 2003) have been identified in the *Assessment of Archaeological Impacts* (Crossrail 2005a), and are set out below. Archaeological investigation and mitigation within the HAM and Wick Lane Sewer Diversion Site have the potential to contribute to the following themes:

- The Mesolithic/Neolithic transition: understanding the significance of horticultural experimentation at this time, and the transition from hunter gatherers into farmers; and

### 4.1 Objectives of the Investigation

The overall objectives of the investigation are to establish the nature, extent and state of preservation of any surviving archaeological remains that will be impacted upon by the development.

Specifically, archaeological investigations at the Ham and Wick Lane Sewer Diversion have the potential to recover:

- Potential for prehistoric occupation and agricultural deposits although environmental evidence and organic artefacts and structures are likely to be poorly preserved in the dry soils that existed within the development sites in the past. The emphasis will be on evidence surviving in the surface of the gravel river deposits.
- Post medieval foundation evidence associated with the Grove Hall Lunatic Asylum.



## **5 Scope of the Investigation**

Discussions were held with Greater London Archaeological Advisory Service (GLAAS) regarding the proposed method of watching brief in April 2011 and January 2012. It was agreed that a combination of general and targeted watching brief would be appropriate given an understanding of the archaeological potential and construction impact.

### **5.1 Archaeology**

The 'main contractor' refers to the main contractor appointed under Crossrail contract C305. The main contractor will be responsible for allowing archaeologists access to the site to undertake the targeted watching brief to record features if they are exposed. The main contractor is also responsible for providing machinery, and for providing welfare etc.

The 'archaeological contractor' refers to the archaeological contractor who will be appointed under the archaeological contract relevant to the construction area. The archaeological contractor will have responsibility for delivering archaeological mitigation as outlined in this specification. They will also be responsible for control of mechanical excavators during excavations of the archaeological evaluation trial trenches.

The 'Project Archaeologist, Crossrail Archaeologist, refers to the Crossrail Project Archaeologist. Further responsibilities are outlined in Section 6.

### **5.2 Watching brief**

A Targeted Watching Brief (TWB) will be required on shaft works. This is to ensure any surviving historic and archaeological features are identified and recorded. Works will be carried out under general watching brief conditions until the lower deposits which directly overlie the River Terrace Deposits, the target deposits, are reached. At that point a Targeted Watching Brief will commence.

There is no need for a non-listed built heritage works as no buildings currently stand on site.

## 6 Programme for the Investigation

Site possession for the Ham and Wick sewer works commences in the second quarter of 2011.

The Archaeology Contractor when appointed is to request a Crossrail archaeological site code, in accordance with the LAARC Site Code system, from the Project Archaeologist prior to commencement of works.

### 6.1 Archaeological Investigation

Site-specific evaluation and mitigation measures are presented using the following phasing:

- **CRITICAL phase** advanced archaeology works which need to be undertaken prior to the Enabling Works (this may apply to very significant archaeological remains where complex mitigation is required and where early site access is required);
- **Phase 1** archaeological evaluation or excavation works to be undertaken commensurate with the programme of Enabling Works;
- **Phase 2** archaeological mitigation (excavation or watching briefs) works to be undertaken commensurate with the Main Works;
- **Phase 3** archaeological works to be undertaken after the Main Works phase (e.g. post-excavation assessment, analysis, publication and dissemination).

### 6.2 Phase 2 Archaeological Mitigation Works (Targeted Watching Brief)

A targeted watching brief shall be carried out during construction of the following:

- The 10m x 6.5m access shaft located opposite Wrexham road;
- The 7.5m x 6.5m long pump chamber; and
- The 2700mm diameter precast ring Wick sewer access chamber.

The watching brief shall be carried out to archaeologically sterile ground, specifically, within the River Terrace Deposits. Archaeological interest is predicted to be at the interface with the Terrace gravels. Further details on the scope of the watching brief can be found in Sections 7.7, 7.9 and 7.10.

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. The programme for the second phase is likely to begin immediately following discovery. For these recording and excavation works a period of not less than 28 days would be determined in consultation with the relevant statutory authorities and having due regard to the construction programme (Crossrail Environmental Minimum Requirements, Planning and Heritage Memorandum, 7.2.3).

### 6.3 Site Accommodation and Facilities

The *Main Contractor* shall provide the following site accommodation facilities for the use of archaeological operatives, inclusive of any hardstanding and services required:

- toilets, with drying and washing facilities;



- first Aid; and
- temporary office and secure storage facilities.





## 7 Specification for archaeological evaluation and mitigation

### 7.1 Generic Standards

The archaeological evaluation and mitigation works and scope of any archaeological scientific methods shall be designed and undertaken in accordance with the Generic WSI and relevant best practise guidance (and any subsequent revisions) i.e.:

- Crossrail standards and specifications;
- Institute for Archaeologists – Standard and Guidance for archaeological field evaluation, 2008 (revised);
- Institute for Archaeologists – Standard and Guidance for archaeological excavation, 2008 (revised);
- Institute for Archaeologists – Standard and Guidance for an archaeological watching brief, 2008 (revised);
- Museum of London collections and archive policies and guidance;
- English Heritage – Geoarchaeology, 2007;
- English Heritage - Archaeological Science at PPG16 interventions: Best Practice Guidance for Curators and Commissioning Archaeologists, 2003;
- GLAAS Archaeological Guidance Papers 1999;
- Corporation of London archaeology guidance – Planning Advice Note 3, 2004;
- Museum of London Archaeology Service site recording manual (MOLAS 1994); and
- English Heritage – Understanding Historic Buildings – A guide to good recording practice, 2006

### 7.2 Potentially nationally important remains

Where unexpected, potentially nationally important archaeological remains (as defined in the Crossrail Generic WSI) are identified during the works, the Archaeology Contractor shall undertake works in accordance with the Environmental Requirements (archaeology) section of the relevant package Works Information and shall adhere to procedures as set out in the SS-WSI.

The Archaeology Contractor for C263 shall submit to the Crossrail Project Archaeologist the details of their procedure for excavating and recording potentially nationally important remains in the Archaeology Contractor's Method Statement.

Upon discovery of Potentially nationally important remains, the Project Archaeologist is to insert the procedure (or reference to the procedure) to be followed in the SS-WSI, identifying any specific individual roles or circumstances that are relevant to the works. Details shall include how relevant parties are to be informed of such discoveries, the criteria to be utilised by the Archaeology Contractor in the assessment of the significance of such discoveries and the timescales to be adhered to.

As a result of the discovery of unexpected, potentially nationally important archaeological remains, the SS-WSI will be updated by the Project Archaeologist to incorporate any additional specific primary fieldwork event aims.

### 7.3 Human Remains

Human remains are unlikely to be present on the Ham and Wick sewer site.

If any human remains were to be found, they will be treated in accordance with the procedures in section 7.A.6 to 7.A.15 of *Archaeology, Specification for Evaluation & Mitigation (including Watching Brief)* (Crossrail, 2009b). 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.

### 7.4 Treasure Act

The Treasure Act 1996 defines 'Treasure' as:

- Any object at least 300 years old when found which is: not a coin, but has metallic content of which at least 10% is precious metal; or
- One of at least two coins with at least 10% precious metal content;
- One of at least 10 coins;
- Any object at least 200 years old designated as treasure by the Secretary of State;
- Any object which would have been 'Treasure Trove';
- Any object found with any of the above.

The Treasure (Designation) Order 2002 extends the definition of treasure to include:

- Finds of at least two base metal objects (other than coins) of prehistoric date; and
- Any object (other than a coin) of prehistoric date with any precious metal content.

All finds falling within the definitions of treasure 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.

Project Archaeologist to insert the procedure (or reference to the procedure) to be followed in the SS-WSI, identifying any specific individual roles or circumstances that are relevant to the works. Details shall include how relevant parties are to be informed of such discoveries, the criteria to be utilised in the assessment of the significance of such discoveries and the timescales to be adhered to.

To protect the finds from theft, the Archaeology Contractor 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, the Archaeology Contractor shall ensure, on liaison with the Project Archaeologist that adequate site security is provided by the Main contractor.

Subject to the Provisions of the Treasure Act 1996, all material that is defined as Treasure is vested in the franchisee or, if none, the Crown.

With respect to Treasure finds, a reward may be payable to the finder, the landowner and/or the occupier. The Crown usually offers finds to a museum.

## **7.5 Health and safety**

Health and Safety will be addressed in accordance with section 7.B of Archaeology, Specification for Evaluation & Mitigation (including Watching Brief) (Crossrail, 2009b).

The Archaeology Contractor shall undertake the works in accordance with the Employer's Health and Safety requirements and the Principal Contractor's Health and Safety Plan. Where specific health and safety constraints or requirements for the Archaeology Contractor's method of work are required, these are set out below and shall be addressed in the Archaeology Contractor's Method Statement (in the Health and Safety Plan).

In addition to the general issues arising from conducting watching briefs on a major construction site, the archaeological contractor, in conjunction with the Principal contractor, will need to address:

- Conducting GWB and TWB on deep, potentially confined, utility shafts.

## **7.6 Location and ground elevation of interventions and survey grids**

The spatial extent of the investigation(s) shall be set out in accordance with the setting out co-ordinates supplied by the Project Archaeologist. All spatial setting out and recording shall be in accordance with The London Survey Grid Standard (formerly Crossrail Survey Grid). See Crossrail standard CR-STD-010.

Interventions shall be located to a horizontal accuracy of +/-500mm in relation to the detail illustrated in the contract drawing(s). The corner points of each excavation or the centre point of each soil core location shall be set out with a Total Station Theodolite or other suitable automated equipment referenced from approved Permanent Ground Marker (PGM) data supplied to the Archaeology Contractor by the Project Archaeologist. The positions of the trenches and survey points shall be verified by the Archaeology Contractor taking additional check measurements to additional known-location points of detail.

Surface heights shall be recorded and related to Crossrail Permanent Ground Markers (PGMs) or approved Ordnance Survey Bench Marks (OSBM). The full descriptions and locations of PGMs and OSBMs known to the Employer will be supplied to the Archaeology Contractor by the Project Archaeologist. Levelling accuracy between OSBMs/PGMs and site Temporary Bench Marks (TBMs) shall be within  $10 \text{ mm} \sqrt{k}$ : where 'k' is the total distance levelled in kilometres. Each TBM shall be levelled as part of a closed loop starting and finishing on approved OSBMs or Crossrail PGMs. Where more than one TBM is required per site the Archaeology Contractor shall establish the TBMs as part of the same closed loop.

The Archaeology Contractor shall include details of their surveying methodology within their Method Statement (see Section 8), including the setting out of the grid and how they intend to provide the project grid co-ordinates to the Project Archaeologist with the Survey Report.

The Archaeology Contractor shall ensure that all trench or excavation limits, and significant archaeology detail are surveyed 'as dug' in relation to the project grid before leaving the site. Ground level height data shall be recorded for each intervention. Survey methodology and a detailed survey record shall be provided to the Project Archaeologist within the Survey Report.

## **7.7 Specification for watching brief**

Watching brief, as defined in the Generic WSI, is a programme of archaeological monitoring (i.e. observation, investigation and recording) which is carried out by a suitably qualified archaeologist during site investigations (e.g. geotechnical test pits, boreholes and utilities trial trenches) and construction works. The purpose of a watching brief is to identify the potential of any archaeological remains that are uncovered in the course of the works and record them appropriately (as far as is reasonably practicable). The watching brief shall result in the preparation of an ordered archive which will be incorporated into the post-excavation works and into publication of the project results.

The Archaeology Contractor shall undertake the watching brief for all areas of ground disturbance which may potentially contain archaeological remains as set out in the SS-WSI. This shall include any activities (including those associated with site set-up and demolition) undertaken by the Main contractor that involve the removal of modern material, made ground and topsoil, subsoils, and superficial geological deposits such as alluvium and colluvium.

Areas that have been previously subject to archaeological excavation and which are known not to contain significant deposits (for example tunnels, cuttings, and areas of known large-scale modern disturbance) shall be excluded from the scope of the watching brief, unless stated otherwise in the SS-WSI. Areas that have been subject to previous assessment and evaluation (e.g. geophysical survey, surface artefact collection, geotechnical survey, trial trenching etc.) shall be included within the watching brief, as appropriate.

Two classes of watching brief are set out in the Generic WSI:

- A General Watching Brief (GWB) shall comprise observation and recording of the Main contractor's works without constraint on their working methods.
- A Targeted Watching Brief (TWB) shall comprise observation and recording of the Main contractor's works with specific operations carried out under the supervision of the Archaeology Contractor. Under targeted watching brief, the Archaeology Contractor may impose constraints on, or require changes to, the Main contractors' or his sub-contractor's method of working to enable the archaeological investigation to take place alongside construction works.

Targeted watching brief shall be used for areas of known occasional, dispersed features which are either not considered to be of sufficient significance to warrant archaeological investigation in advance of construction, or where access prior to construction has not been possible and where, as a result, there is a possibility of unexpected discoveries





Except in cases where unexpected, potentially nationally important, archaeological remains are discovered, the targeted watching brief shall be designed and implemented so as to avoid adverse impact on the construction programme, wherever practicable.

The Main contractor shall make allowance in their activity programme for the completion of any targeted or general watching briefs as set out in the SS-WSIs.

The specification for watching briefs (general and targeted) are set out below:

## **7.8 Scope of Targeted Watching Brief - Constraints on Main contractor's Methodology**

In archaeologically sensitive areas, where the need for a targeted watching brief has been identified in the SS-WSI, the Main contractor will strip soils (which may include modern made ground, topsoil, subsoil, alluvium and colluvium) using a 360 degree excavator and toothless ditching bucket under the supervision of the Archaeology Contractor. The Main contractor will limit their tracking of vehicles and plant within areas specified in the SS-WSI and/or as instructed by the Project Archaeologist. The Main contractor will facilitate mapping and sampling of deposits by the Archaeology Contractor through use of agreed plant, a site share agreement and careful liaison between the Archaeology Contractor's supervising archaeologist and the Main contractor's site supervisor.

## **7.9 Specification for watching brief**

The Works to be carried out by the Archaeology Contractor shall consist of two parts:

- Watching brief ('observation') following, and without interruption to, the progress of the Main contractor by a core team of archaeologists
- Investigation of archaeology and remains of quaternary geological importance undertaken either:
  - by the core team, following the progress of the Main contractor; or
  - by additional archaeologists (the 'support team'), to be deployed to investigate unanticipated archaeological remains, where appropriate.

The Archaeology Contractor's core team shall consist of the Archaeology Contractor's key person (the field director) and other appropriately experienced archaeologists commensurate with the scale and nature of the Main contractor's works.

The core team shall undertake the observation and any required investigation such as they may reasonably be able to undertake.

The Archaeology Contractor's support team shall consist of additional experienced archaeologist. The size of the support team shall be commensurate with the scale and programme of the Main contractor's works. The Archaeology Contractor shall be required to supply teams of 5 and 10 persons within 24 and 48 hours notice respectively.

The Archaeology Contractor's core and support teams shall be advised where necessary by specialists, as appropriate and as agreed with the Project Archaeologist.

The Archaeology Contractor shall record the following observations on a daily basis. The record shall consist of, as a minimum:

- The Event Code and chainage/ location of the area observed;
- The date(s) of the observation;
- Personnel employed on site;
- A description of the construction 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;
- The areas and horizons (both those containing archaeological or remains of quaternary geological importance and those which do not) unaffected by construction activity (with special reference to archaeological sites identified for preservation in situ);
- The reasons why any particular area of the works was not observed, and noting those areas not subject to disturbance from construction;
- Location and description of any archaeological remains; and
- Location and description of any modern remains.

### **7.10 Investigation undertaken during watching brief**

An appropriate sample shall be excavated from cut features and other archaeological remains of importance. Sampling of cut features shall include feature inter-sections to establish relative chronologies. The extent of sampling shall be determined by the Archaeology Contractor in liaison with the Project Archaeologist (and as discussed with the relevant local authority and English Heritage, and a quaternary specialist, if necessary) but may, for instance, include the sample excavation of a selected number of deposits (both layers and negative, cut features), recording of structural remains, drawn sections and profiles, and/or be aimed at recovering sufficient information to determine function, form, and date. Any specific variations from this specification shall be indicated in The Archaeology Contractor's Method Statement.

Heights for all deposits shall be related to approved Permanent Ground Markers (PGMs) or approved Ordnance Survey Bench Marks (OSBM), where reasonably accessible. Levelling accuracy between OSBMs/PGMs and site Temporary Bench Marks (TBMs) shall be within 10 mm  $k$ : where 'k' is the total distance levelled in kilometres. Each TBM shall be levelled as part of a closed loop starting and finishing on approved OSBMs or URL PGMs. Where more than one TBM is required per site, the Archaeology Contractor shall establish the TBMs as part of the same closed loop. The Archaeology Contractor shall prepare a record of their surveying methodology for inclusion in the archive.

It may not be possible to clean and record the archaeological profile of geotechnical test pits, due to health and safety or access constraints. Every effort shall be made to establish the presence or absence of archaeological deposits by establishing the absolute ordnance datum (AOD) for the height of significant deposits, including the depth of modern intrusions, key stratigraphic components and natural deposits.

### **7.11 Recording standards**

The archaeological remains shall 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 is to include as a minimum:

- The written record of individual context descriptions on appropriate pro-forma.
- The drawn record shall normally include, 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 though co-ordinates, annotated with dimensions, and may be recorded digitally.
- Other appropriate drawn and written records shall also be produced (for environmental sampling etc.).
- The photographic record shall consist of monochrome prints/negatives and colour transparencies. A 35mm format (film or digital) SLR camera is acceptable for all site photography. The Archaeology Contractor shall maintain a minimum of two 35mm SLR cameras on site at all times during working hours. The photographic record shall include photographs and transparencies of archaeological features, appropriate groups of features, structures, and quaternary deposits. Each photograph and transparency shall clearly show details of the above. Each photograph and transparency shall include an appropriate graduated scale, a north arrow, and a header board detailing (as a minimum) the event code and context/feature number. In addition, the Archaeology Contractor shall take appropriate record photographs to illustrate work in progress.

### **7.12 Specification for archaeological investigation**

A sufficient sample of the archaeological features and deposits revealed must be sampled/or fully excavated to allow the resolution of the aims and objectives of the work. Structures, features, or finds which might reasonably be considered to merit preservation in-situ shall not be unduly damaged.

Where modern foundations are likely to be present, the SS-WSI shall identify whether they should be left in-situ for the purposes of the evaluation or removed. Where it is clear that modern foundations have truncated certain archaeological levels they should be removed to assess lower archaeological levels. The Archaeology Contractor shall take all reasonable care to ensure that any damage is limited as far as practicable. If significant damage is likely to occur the work shall be suspended and the Project Archaeologist informed so that a technical solution can be agreed with the Project Manager.

The location and objectives of the trial excavations set out in Section 5 of the SS-WSIs have been established in consultation with the projects' statutory consultees.



Each trial excavation has been assigned a unique ID number by the Project Archaeologist. The Archaeology Contractor shall not vary this number unless agreed by the Project Archaeologist in writing.

The dimensions of each trial excavation in plan, inclusive of the trench support system employed (if required) to secure personnel entry to the excavation, shall be set out in the SS-WSI. Trial excavations shall be excavated to the base of the alluvial sequence or to a depth specified in the SS-WSI (Section 5). This shall be dependent on the agreed objectives of the excavation.

Temporary works and any required hand investigation to address below ground hazards shall be carried out by the Main contractor under supervision by the Archaeology Contractor in accordance with their approved Method Statement and Risk Assessment. All subsequent trial excavations shall be excavated by the Main contractor under supervision by the Archaeology Contractor using a mechanical excavator with toothless ditching bucket, except where the nature of the made ground or surface of the pits is such that an alternative bucket or means of breaking out prior to excavation is required (and the Project Archaeologist has agreed an alternative method).

All machine work and demolition of below-ground obstructions (e.g. removal of Station foundations and surface rail foundations) shall be carried out by the Main contractor under supervision by the Archaeology Contractor. The Main contractor shall cease work when archaeological evidence is revealed and allow the Archaeology Contractor to undertake investigation, as appropriate. An excavator shall not be used to cut arbitrary trial trenches down to natural deposits without regard to the archaeological stratification.

All undifferentiated topsoil, or overburden of recent origin, shall be removed down to the first archaeological layer. An exception to this would be where a focused soil-sampling strategy is proposed to record and collect data from reworked soil contexts above recognisable stratified archaeological contexts. If a mechanical excavator is to be used to remove modern overburden, such as floor slabs or recent levelling layers, this shall be undertaken in spits of c.300mm depth (dependant on specific site conditions), moving along the length of the trench or area. A depth of 500mm should not be exceeded. The Archaeology Contractor's supervising archaeologist shall use their professional judgement to determine the appropriate depth of each spit and will advise the Main contractor accordingly. Any variations to the excavation methodology shall be at the discretion of the supervising archaeologist and recorded in writing for inclusion in the final report to the Project Archaeologist.

The Archaeology Contractor shall undertake hand excavation and cleaning of any archaeologically significant horizons, to fulfil the aims of the work. Within alluvial sequences the Archaeology Contractor shall pay particular attention to establishing the vertical extent of layers of archaeological potential and shall be aware that horizons of cultural activity may be interdigitated with horizons of sterile alluvium. The Archaeology Contractor shall supervise the excavation of each test pit in such a manner so as to allow a cumulative or continuous section to be recorded.

The Archaeology Contractor's excavation, sampling and recording policy shall be included in the Archaeology Contractor's Method Statement. This is to include, as a minimum:

- The recording of individual contexts on appropriate pro-formas;
- Excavation plans at 1:50 scale; planning and section drawing of appropriate single contexts and features (usually at 1:20 scale for plans and 1:10 scale for inhumations and sections);



- Photographs; and other appropriate drawn and written records; and
- Permanent Ground Markers (PGM's), any temporary benchmarks and approved OS benchmarks shall be indicated on the relevant plans.

The Archaeology Contractor's survey and recording policy shall meet the following requirements:

- All levels shall be recorded to London Grid standards and reduced to OS datum;
- All archaeological trial trench locations shall be electronically surveyed with reference to the London Grid and Crossrail PGM's upon the completion of fieldwork by the Archaeology Contractor;
- The locations of archaeological trial trenches shall be plotted on appropriate scale plans related to the London Grid and labelled with six figure Eastings and Northings; and,
- The electronic survey record shall be retained with the project archive.

In alluvial sequences, each trial excavation shall be excavated to the base of the alluvial sequence, and shall be appropriately shored and kept free of water by the Main contractor to allow 'person entry' to the excavations i.e. to allow the Archaeology Contractor to undertake investigation and recording to fulfil the aims of the work.

The Archaeology Contractor shall identify any temporary works and dewatering requirements associated with the archaeological investigation in the Archaeology Contractor's Method Statement and shall agree the detailed arrangements for such with the Main contractor. The Archaeology Contractor will be required to undertake works in accordance with the Main contractor's arrangements for matters such as off site-spoil disposal or storage, on-site facilities and services. Relevant requirements shall be incorporated in the Archaeology Contractor's Method Statement.

Where areas of extensive archaeological stratification are encountered, trial trenches shall not be fully excavated. However, the horizontal and vertical extent of archaeological stratification shall be assessed by the Archaeology Contractor through implementation of an appropriate strategy including, either the excavation of features cut into horizontal stratification, limited test pitting or auguring. The aim shall be to recover suitable stratigraphic data for finds and environmental samples from the full, intended depth of the trench, as far as is practicable. The exact methodology may need to be determined by the Archaeology Contractor during the excavation of individual trenches and agreed with the Project Archaeologist.

A sufficient sample shall be excavated from cut features and other archaeological deposits to fulfil the aims of the work. Sampling of cut features shall include feature intersections to establish relative chronologies.

### **7.13 Recording systems**

The trial excavations shall be recorded by the Archaeological Contractor to the standards of current best practice. The recording systems adopted during the investigations must be fully compatible with those published by the Museum of London Archaeology Service (MoLAS 1994 3rd ED) and Museum of London (MoL 1998).

The recording is to include, as a minimum:

- At least one representative section at (1:10 or 1:20 scale) of each trial excavation from ground level to the base of the excavation;





- The written record of individual context descriptions on appropriate pro-forma;
- Plans at appropriate scales (1:10 or 1:20);
- Single context planning if appropriate; and
- Photographs and other appropriate drawn and written records.
- Other sections, including the half-sections of individual layers or features shall be drawn as appropriate to 1:10 or 1:20.

Site plans shall identify both London Grid and OS co-ordinates. A 'site location plan', indicating site north shall be prepared at 1:1250. Individual 'trench plans' or 'excavation area plans' at 1:200 (or 1:100) shall be prepared which show the location of archaeology investigated in relation to the investigation area.

Section drawings shall be located on the relevant plan and both London Grid and OS co-ordinates recorded. The locations of the OSBM or PGM bench markers used and any site TBM shall also be indicated.

A record of the full extent in plan of all archaeological deposits as revealed in the investigation shall be made; these plans shall be on polyester based drawing film, and be at a scale of 1:10 or 1:20 unless otherwise agreed with the Project Archaeologist. 'Single context planning' shall be used on deeply stratified sites. Drawing information shall be digitised for eventual CAD applications. The GLSMR will accept Autocad DXF or .DWG format of extent of site and location of major features with the completed Sites and Monuments Report Form.

A 'Harris matrix' stratification diagram shall be employed to record stratigraphic relationships (Harris 1993). This record shall be compiled and fully checked by the Archaeological Contractor during the course of the excavations. Spot dating shall be incorporated onto this diagram during the course of excavations.

Recording of structural evidence revealed below ground level will vary according to the level of special interest of the structure and its relationship to below-ground archaeology. Structures of little or no significance shall be noted on a site plan. Detailed element detail drawings of important features revealed in investigations may be required in accordance with the aims and objectives of the investigation.

The Archaeology Contractor shall agree the appropriate level of recording and analysis for discovered standing structures with the Project Archaeologist, in accordance with the Crossrail procedure for non-listed built heritage recording (Document CR-PN-PRW-EN-PD-00010). The Archaeology Contractor shall revise the Archaeological Contractor's Method Statement to reflect any additional requirements for built heritage recording.

The photographic record shall consist of monochrome prints/negatives and colour transparencies. A 35mm format SLR camera (film or digital) is acceptable for all site photography. The Archaeology Contractor shall maintain a minimum of two 35mm SLR cameras on site at all times during working hours. The photographic record shall include photographs and transparencies of archaeological features, appropriate groups of features, and structures. Each photograph and transparency shall clearly show details of the above, and may require the use of artificial lighting to achieve suitable definition. Each photograph and transparency shall include an appropriate graduated scale, a north arrow, and a header board detailing (as a minimum) the project event



code and context/feature number. In addition, the Archaeology Contractor shall take appropriate record photographs to illustrate work in progress.

The transparencies shall be mounted in suitable frames for long-term curation in preparation for deposition with the archive. Digital photography and video recording may be appropriate in some circumstances and the Archaeology Contractor shall set out proposals for such recording in the Archaeology Contractor's Method Statement for approval by the Project Archaeologist.

Where appropriate a photogrammetric record or laser scan record shall be made of complex structures, features and horizons, liable to be damaged in the course of the investigation, such as buildings or parts of buildings. Appropriate technical specification and scales shall be specified in the SS-WSI and addressed in the Archaeology Contractor's Method Statement.

#### **7.14 Specific Requirements for the excavation of Archaeological trial trenches**

The Archaeology Contractor shall ensure that water is discharged and arisings from archaeological excavations are stored in accordance with the Main contractor's environmental protection requirements (as set out in the package Works Information and their Environmental Plan) and any relevant consents for the worksite. The Project Manager shall monitor discharge rates and if necessary conductivity of discharge waters to ensure compliance.

Should any material be excavated that is deemed to be contaminated or potentially contaminated it shall be investigated, controlled (e.g. placed separately from clean material) and removed from the site in accordance with the Main contractor's environmental protection requirements (as set out in their Environmental Plan).

The Archaeology Contractor shall ensure, in liaison with the Project Archaeologist that adequate protection is provided for any archaeological remains. Any specific archaeological requirements relating to backfilling shall be included by the Archaeology Contractor in their Method Statement.

The trenches shall be pumped dry by the Main contractor and any necessary protection measures for archaeological remains (in addition to those for below ground infrastructure, services or utilities) shall be completed prior to backfilling. Backfilling and reinstatement shall be undertaken by the Main contractor as specified in the package works information and in accordance with the approved Archaeology Contractors Method Statement or other instruction from the Project Archaeologist and/or Project Manager. Generally, all backfill material shall consist of non-toxic, uncontaminated, non-putrescible, natural and inert material which shall be compacted and (if necessary) tested (dynamic compaction test or other) in accordance with a specification provided by the Project Manager. Surface conditions shall be reinstated to the required standard.

In order to protect any waterlogged remains during the works, the Archaeology Contractor may identify a requirement for trial excavations to be allowed to refill with water overnight. In such cases, the Archaeology Contractor shall request approval from the Project Manager and shall ensure that any hazards to staff or 3rd parties are minimised.

#### **7.15 Archaeological science**

The strategy for sampling archaeological and palaeo-environmental deposits and structures (which can include soils, timbers, pollen, diatoms, animal bone, human bone etc.) will be developed by the



Project Archaeologist in consultation with English Heritage Regional Science Advisor and the Archaeology Consultant. On-site work and off-site analysis of the processed samples and remains will be undertaken by the Archaeology Contractor's environmental archaeologist as specified in the Archaeology Contractor's Method Statement.

The finds retrieval policies of the appropriate recipient museum will be adopted. In accordance with the collection and retention strategy set out in SS-WSI, all finds (artefacts and ecofacts) visible during excavation shall be collected and processed by the Archaeology Contractor. In some cases, sampling may be the most appropriate strategy. Finds shall be appropriately packaged and stored under optimum conditions, as detailed in the RESCUE/UKIC publication *First Aid for Finds* (Watkinson and Neal 1998).

Where there is evidence for industrial activity, macroscopic technological residues (or a sample of them) shall be collected by hand. Separate samples (c. 10ml) shall be collected for micro-slugs (hammer-scale and spherical droplets). Reference should be made to the Centre for Archaeology Guideline on Archaeometallurgy (English Heritage 2001). Assessment of any technological residues shall be undertaken.

Where appropriate, samples shall be taken for scientific dating (for example radiocarbon dating, OSL, thermoluminescence at the evaluation stage). This may apply where dating by artefacts is insecure or absent, and where dating is necessary for development of the SS-WSI for subsequent mitigation strategies. Procedures and specifications shall follow English Heritage guidance (English Heritage 2008b).

Buried soils and sediment sequences shall be inspected and recorded on site by the Archaeology Contractor's geoarchaeologist, since field inspection may provide sufficient data for understanding site formation processes. Procedures and techniques presented in the English Heritage documents *Environmental Archaeology* (English Heritage 2002) and *Geoarchaeology* (English Heritage 2007) shall be followed. Samples for laboratory assessment shall be collected where appropriate, following agreement with the Project Archaeologist.

Deposits shall be sampled for retrieval and assessment of the preservation conditions and potential for analysis of biological remains following English Heritage guidance (English Heritage 2002). The sampling strategy shall include a reasoned justification for selection of deposits for sampling, and shall be developed by the Archaeology Contractor's environmental archaeologist or recognised bioarchaeologist in liaison with the Project Archaeologist. Flotation samples and samples taken for coarse-mesh sieving from dry deposits shall be processed at the time of the fieldwork wherever possible, to permit variation of sampling strategies if necessary. Sampling strategies for wooden structures shall follow the methodologies presented in Brunning (1996).

Artefacts, biological samples and soils shall be assessed for evidence of site and deposit formation processes and taphonomy and especially for evidence of recent changes that may have been caused by alterations in the site environment.

Assessment of finds assemblages shall include x-radiography of all iron objects (after initial screening to exclude obviously recent debris) and, where appropriate, non-ferrous artefacts (including all coins). Where necessary, active stabilisation /consolidation shall be carried out to ensure long-term survival of the material, but with due consideration to possible future investigations.



Once assessed, all material shall be packed and stored in optimum conditions, as described in First Aid for Finds (Watkinson and Neal 1998). Waterlogged organic materials shall be processed in accordance with: Guidelines for the care of waterlogged archaeological leather (English Heritage/Archaeology Leather Group 1995) and Waterlogged wood: the recording, sampling, conservation and curation of structural wood (Brunning 1996).

Samples for absolute dating shall be submitted promptly to the supply laboratory proposed by the Archaeology Contractor or other supplier as instructed by the Project Archaeologist. Delivery times shall be agreed to ensure that the results are available to aid development of specifications for subsequent mitigation strategies in the SS-WSI. Where it is proposed to date human remains, the time limits for reburial imposed by Schedule 15 of the Crossrail Act (for remains removed from burial grounds) or set out in the relevant burial licence under the Burial Act 1857 (in all other cases) shall be adhered to.

Processing of all soil samples collected for biological assessment, or sub-samples of them, shall be completed as soon as reasonably practicable. The preservation state, density and significance of material retrieved shall be assessed by the Archaeology Contractor's recognised specialist. Special consideration shall be given to any evidence for recent changes in preservation conditions that may have been caused by alterations in the site environment. Unprocessed sub-samples shall be stored in appropriate conditions in accordance with the Archaeology Contractor's Method Statement.

Samples collected for geo-archaeological assessment shall be processed promptly by the Archaeology Contractor's specialist, particularly where storage of unprocessed samples is thought likely to result in deterioration. Appropriate assessment shall be undertaken as agreed with the Project Archaeologist. Where preservation in situ is a viable option, consideration shall be given to minimising the possible effects of compression and loading on the physical integrity of the site and any hydrological or chemical impacts of the proposed construction works (English Heritage 2002).

Animal bone assemblages, or sub-samples of them, shall be assessed by the Archaeology Contractor's specialist with reference to English Heritage guidance (English Heritage 2002).

The results from any specific investigations in Archaeological Science shall be included in the Site Archive and presented in the evaluation report or final fieldwork report. Reports shall include sufficient detail to permit assessment of potential for analysis. They shall include tabulations of data in relation to site phasing and contexts, and include non-technical summaries. The objective presentation of data shall be clearly separated from interpretation i.e. recommendations for further investigations, (both on samples already collected, and at future excavations), shall be clearly separated from the results and interpretation.

## **7.16 Generic specification for Environmental Sampling**

Appropriate features and deposits shall be sampled to retrieve palaeo-environmental and economic indicators. The Archaeology Contractor shall make provision for the sampling of a wide range of contexts for potential assessment and analysis for plant and animal micro/macro fossils and soils/sediments in order to fulfil the aims set out in the SS-WSI.

The Archaeology Contractor shall use ten litre plastic buckets (with lids and handles), or strong polythene bags (double bagged) secured at the neck, for the recovery of bulk 'disturbed'



environmental samples. An adhesive label recording the project event code, context number and sample information shall be securely fixed to a vertical face of the bucket only or attached to the neck of the bag. Labels shall be completed with an indelible ink pen. A duplicate non-adhesive label shall be inserted within the bucket or between the polythene bags.

The selection, preparation for and methods of taking samples together with their size, presentation and processing shall be in accordance with current best practice (e.g. IFA Standard and Guidance for Artefact and Environmental Study, Collection, Research and Conservation 2008d; English Heritage –Geoarchaeology, 2007; English Heritage - Archaeological Science at PPG16 interventions: Best Practice Guidance for Curators and Commissioning Archaeologists, 2003).

The Archaeology Contractor shall be responsible for the protection of all samples and finds and for their transport (including loading and unloading) to the Archaeology Contractor's facilities or other location as agreed with the Project Archaeologist. Samples shall be protected at all times from temperatures below 5 and above 25 degrees Celsius and from wetting and drying out due to weather exposure.

Bulk samples shall normally be in the range of 10-60 litres. The size selected will depend on the likely density of macrofossils in the soil. The lower end of the range (10-20 litres) will be suitable for the recovery of macrofossils from waterlogged deposits. For non-waterlogged deposits the sample volume is likely to be in the middle to higher range (20-40 or 40-60 litres) dependant upon site activity, conditions and preservation. The residue of soil left in the bottom of any inhumations after the removal of human remains shall be retrieved for bulk processing. Vessel or pit fills containing human remains shall be processed as bulk samples to ensure the maximum retrieval of cremated bone. Cremation vessels and deposits of placed human bone within cut features may require excavation in spits. The fill residues from the excavation of these features shall be bulk sampled to ensure maximum retrieval of cremated bone, associated small finds and floral and faunal remains. All work shall be undertaken in compliance with the generic Crossrail standards for Human Remains (see Section 7A) which may require the reburial of human remains within a specific timeframe.

For 'bulk disturbed' samples the limits of the sample zone shall be recorded and identified on plan.

The Archaeology Contractor shall use appropriately sized monolith or kubiena boxes for the recovery of 'undisturbed' monolith samples for geo-archaeological study (pollen, other microfossil and micromorphological studies etc). Care shall be taken to ensure that wherever possible only newly exposed sections are sampled to avoid contamination, desiccation and decalcification. This sampling shall be undertaken under supervision of the Archaeology Contractor's environmental specialist. Boxes shall be wrapped neatly and tightly in bin-liners or plastic sacks and secured with rubber bands. A label shall be attached to the outside (in duplicate) with site name and code, feature/context number and depths of sample.

The Archaeology Contractor shall record the depth of the 'undisturbed' monolith at the top and the bottom of the sample. There shall be a 50mm overlap between each monolith. This information shall be plotted onto a section drawing at an appropriate scale, with all levels reduced to heights relative to Ordnance Datum. Where the sample crosses archaeological context boundaries these shall be noted on the sample recording pro-forma.



Where it is not possible to insert monolith boxes, the Archaeology Contractor shall take a vertical series of small 'spot' samples. Samples shall be at 20mm vertical intervals with no more than 10mm depth being sampled. In the case of deposits with a low organic content it may be necessary to take as much as 5g or even 20g per sample. If so, sampling shall be extended laterally at a given depth in 10mm deep spits.

Where appropriate, the Archaeology Contractor shall take contiguous column samples for the retrieval of macrofossils. The individual sub-samples will be of 1-10kg, depending on the nature of the deposit and the category of material to be retrieved. Where several specialists are involved it may be necessary to take separate sub-samples for a range of palaeo-environmental evidence, for example, insects, molluscs and seeds, to ensure that adequate sub-samples are available for specialist assessment.

## 8 Deliverables

This section sets out what is required from the Archaeological Contractor per event.

General watching brief of utilities and ground excavation within the worksites. These require weekly progress reporting followed by a fieldwork report (section 8.6).

All other requirements such as archiving, summary report for HER and post-excavation should be followed as set out below.

### 8.1 Archaeological Contractors Method Statement

The Archaeology Contractor shall provide a detailed Method Statement for the works for the Project Archaeologist's approval. The Method Statement shall be prepared in association with the Main contractor, taking account of their Environmental Plan and other relevant site information provided by them and requirements for the works set out in the Works Information (e.g. relating to health and safety, security, engineering design requirements and attendances). The Method Statement shall include, as appropriate:

- a) A resource plan and programme and CVs;
- b) The Archaeology Contractor's IT capability and proposed IT plan (including specific survey methods for on-site recording of stratigraphic profiles and sub-surface topographic modelling;
- c) The Archaeology Contractor's approach to Archaeological Science;
- d) The methods for survey and setting out works;
- e) The methods to address the specific event types required (trial trench, area excavation etc);
- f) The safe method of working whilst excavating trenches or pits including any temporary works required;
- g) The method for disposing of water from trenches and test pits in waterlogged ground;
- h) Site management plan to include details of the method for preparing safe access route to the working areas, the proposed site accommodation, services and welfare;
- i) The retention and disposal policies for samples and artefacts recovered during the work;
- j) The method for excavating and recording inhumations and cremations in compliance with the generic Crossrail standards for Human Remains (see Section 7.1);
- k) The method for preparation of the required reports, archive and all associated deliverables;
- l) The procedures for assessment of potential for analysis (post excavation assessment); analysis and publication proposals;
- m) The method for preparation of the digital dataset, digital drawings, and digital report deliverables;
- n) The Archaeology Contractor's methods and approach for undertaking the site based works and off site processes to completion.



- o) The Health and Safety Plan and Site-Specific Risk Assessment (including unexploded ordnance);
- p) The Quality Assurance Plan;
- q) The procedures for on- and off- site security and emergency response plan (including environmental incidents);
- r) The method for complying with project generic and site specific environmental and consent requirements; and
- s) The Archaeology Contractor's requirements and specification for services and facilities and attendances required to be supplied by the Main contractor or the Employer.

## 8.2 Site Archives

The site archive shall be organised to be compatible with other archaeological archives in London, or where outside the greater London area, any specific requirements of the receiving museum. This requirement for archival compatibility includes computerised databases.

For London archives, individual descriptions of all archaeological strata and features excavated or exposed shall be entered onto prepared pro-forma recording sheets which include the same fields of entry on the recording sheets of Museum of London Archaeology. Sample recording sheets, sample registers, finds recording sheets, registered finds catalogues and photographic record cards shall also follow the Museum of London Archaeology equivalents.

Archives shall be prepared to conform with current best practise (e.g. Brown and Duncan 2007; Institute of Field Archaeologists 2008) The archive shall cover all finds, samples and records (drawn, written, photographic and electronic) collected and produced during the works. The archive shall be indexed and internally consistent. The Archaeology Contractor shall complete the site archive and submit to the Project Archaeologist within 8 weeks of completion of a fieldwork event.

The site archive shall be deposited by at a museum to be confirmed by the Project Archaeologist.

## 8.3 Digital Data

The Archaeology Contractor shall produce a digital data archive of all primary field data produced during the works in accordance with ADS guidelines (Richards and Robinson 2001).

The Archaeology Contractor shall prepare and provide field and laboratory data, evaluation or excavation trench and phasing plans showing archaeological features recorded, and report text in digital form, as well as in paper form. Consideration should be given to recording electronic plans during fieldwork.

The digital archive for each fieldwork event shall be copied to CD-R or DVD (recordable laser disc) and submitted to the Project Archaeologist for archiving in the Employer's document management system.

Final reports, site plans and other illustrations shall be prepared in accordance with the Employer's Information Management standards and procedures.



All data files submitted shall be scanned by a virus detection programme updated to the most current version. The disk label shall clearly indicate:

- Confirmation that this check has been carried out (including details of the virus checking programme name and version used) and that the submission is virus free.
- Fieldwork event name and code.
- Supplier company name, date and QA details (as a minimum, the name, position and signature of the approver).

Prior to commencing the works, the Archaeology Contractor shall submit an example hard copy and data output of each of the data formats required (i.e. data, graphic, CAD and text) produced by their current software, for approval by the Project Archaeologist. The Archaeology Contractor shall inform the Project Archaeologist of any changes or upgrades made to approved software prior to processing any works data. The sample disk shall include data from a previous real job or jobs.

A sequential numbering of data issues shall be rigorously adhered to so that no data versions are submitted out of sequence. The organisation of the data prior to submission shall be the responsibility of the Archaeology Contractor. The Archaeology Contractor shall ensure that data originating from different sources within the Archaeology Contractor's organisation is compatible with the project requirements. The Archaeology Contractor shall nominate one person to the Project Archaeologist who is the main point of contact for matters relating to the digital data submissions.

Where errors or inconsistencies are noted in the data, by either the Project Archaeologist or Archaeological Contractor they shall be corrected by the Archaeology Contractor and a corrected data file issued to the Project Archaeologist. When a change or addition is made to the data within an issue, a complete data group shall be re-issued, not just the changed fields. This may not require complete replacement of the whole data set which includes other previous issues.

Where any changes are made to a data record between digital data submissions, the Archaeology Contractor shall record the date of the change and the name of the person carrying out the change. The Archaeology Contractor shall ensure that each data amendment is carried out correctly.

The Archaeology Contractor shall make two identical copies of the digital archive. The first copy shall be retained by the Archaeology Contractor until the expiry of the Contract maintenance period. The second copy shall be issued to the Project Archaeologist.

A digital archive for each Crossrail site (incorporating individual event archives) shall be submitted to a regional or national data archive as agreed with the service provider by the Employer.

#### **8.4 Interim Statement**

Within 7 days of completion of a fieldwork event the Archaeology Contractor shall submit an Interim Statement to the Project Archaeologist.

The Interim Statement shall be brief, and the information contained commensurate with the timescale for production. The report shall not duplicate effort to be utilised at a later date and shall draw on the data gathered during the initial assessment undertaken during fieldwork.



A site plan indicating all as-dug investigations shall be provided. Key stratigraphic profiles and topographic templates of the major stratigraphic units shall be provided.

The Interim Statement including illustrations shall be submitted as a single PDF file to the Project Archaeologist. CAD drawing files shall also be submitted.

The Interim Statement text shall be submitted in hard copy and as an MS Word \*.document in accordance with the Employer's information management standards and procedures.

The Interim Statement shall include an approved report title sheet and QA page (to be supplied by the Employer).

The following shall appear in the footer or header of each Interim Statement:

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Copies of the Interim Statement shall be provided by the Project Archaeologist to Rob Whytehead (English Heritage), Regional Archaeological Advisor, and Adam Single (GLAAS), Archaeological Advisor to the London Borough of Tower Hamlets, for comment.

## 8.5 Survey Report

The Archaeology Contractor shall provide a written and graphic survey report for the works upon completion of fieldwork. Evidence shall be provided for check measurements and results of levelling for establishment of TBMs. The survey report shall be submitted by the Archaeology Contractor to the Project Archaeologist within 2 weeks of the completion of fieldwork.

The Archaeology Contractor shall prepare and submit 'as excavated' site area outlines and levels in accordance with Crossrail standard CRS-SDT-05. Each drawing shall identify the relevant event code and sub-site division, if applicable.

## 8.6 Fieldwork Report

The watching brief reports shall be prepared by the Archaeology Contractor within 6 weeks of the completion of the fieldwork (unless this is varied by the Project Archaeologist). The evaluation report will be prepared either as soon as is practicable if significant find requiring mitigation are uncovered, or within 6 weeks of completion of fieldwork if no archaeological finds are uncovered. The Fieldwork Report shall follow the standard structure set out in City of London Planning Advice Note 3 and IFA standards i.e.:

### Contents list

#### Non technical summary

1. Introduction
2. Planning background
3. Previous work(s) relevant to archaeology of site (DBA, DDBA, surveys etc)
4. Geology and topography of site
5. Research objectives and aims
6. Methodology of site-based and off-site work
7. Results and observations including quantitative report, stratigraphic report(including any constraints on site).

8. Assessment of results against original expectations (using criteria for assessing national importance i.e. period, relative completeness, condition, rarity, and group value) and review of evaluation strategy
9. Statement of potential of archaeology
10. Conclusions and recommendations for appropriate mitigation strategy
11. Publication and dissemination proposals (in addition to fieldwork report)
12. Archive deposition
13. Bibliography
14. Acknowledgements
15. Sites & Monuments Record form
16. A3 plans

The Fieldwork Reports shall provide an illustrated factual statement and statement of importance with associated assessment of potential for further fieldwork and/or analysis of the archive. The Fieldwork Reports shall utilise information collected during archaeological fieldwork and from any other appropriate sources agreed with the Project Archaeologist.

The Fieldwork Reports shall include sections detailing the background to the project, any previous relevant research and investigation, location and topography/geology, a description of the methodology employed and the techniques adopted. Where relevant, these sections shall include location plans with scale and grid co-ordinates.

Each component of the works (e.g. stratigraphic/structural, artefactual and environmental/economic) shall be supported by a statement setting out:

- A quantification of the resource (tabulated and cross referenced as appropriate);
- Provisional dating and evidence for residuality and intrusiveness;
- The range of material, including sampling and/or taphonomic biases; and,
- The condition of the material, including preservation bias.

The stratigraphic statement shall include: a description of the geomorphology and sedimentation record of the survey area; a description of the fieldwork results (brief context descriptions supported by plans and sections as necessary, with levels related to Ordnance Datum); a trench summary table indicating depths of all major stratigraphic units, and their boundaries. Photographs shall be included where appropriate.

The Archaeology Contractor shall produce a subsurface model(s) and profiles to illustrate the extent, character and depth of the major stratigraphic topology identified. The model shall be correlated with previous works within the survey area in order to inform the mitigation design. The processing software and presentation format of the data shall be included in the Archaeology Contractor's Method Statement for approval by the Project Archaeologist.

The assessment of results and statement of potential shall include the Archaeology Contractor's conclusions based on the recorded data, e.g. the monument/site class represented, site/feature function and relevant parallels. The statement shall also comment on the potential of the data to address the projects' research themes. As appropriate, comment shall be made on the site as a whole and the individual components (e.g. artefactual, palaeo-environmental, economic). The



statement shall utilise the criteria laid down by the Secretary of State for Culture, Media and Sport Criteria for Scheduling, to establish importance.

In reporting the results of the works, the accuracy of the original expectations and the appropriateness of the methods adopted shall be assessed by the Archaeology Contractor in order to illustrate what level of confidence can be placed on the information. The Project Archaeologist will use that information as the basis for developing any further mitigation strategy and/or further analysis and publication.

The report shall be illustrated with a site location plan, survey location plans as appropriate (to include archaeological interpretation of results), and individual trench and area plans identifying archaeological features exposed and investigated.

When submitted at evaluation stage, the report shall set out an outline recommendation for mitigation. This may include preservation in situ and/or further investigation and recording of the remains and/or watching brief. The development of a detailed mitigation strategy shall be progressed by the Project Archaeologist in liaison with the Project Manager's engineering design team, the Archaeology Contractor, and the English Heritage Regional Science Advisor (and other statutory authority), as appropriate.

Copies of the Fieldwork Report shall be provided by the Project Archaeologist to the GLAAS advisor for the LB of Tower Hamlets, to Robert Whytehead (English Heritage) and the London Borough of Newham for comment.

The following shall appear in the footer or header of each Fieldwork Report:

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## **8.7 OASIS Summary Sheet**

The Archaeology Contractor shall complete an OASIS Summary Sheet for the works (i.e. one per fieldwork event) for submission both to OASIS and the Greater London Historic Environment Record (GLHER). The Summary Sheet shall be included in the Fieldwork Report.

## **8.8 Summary Report**

A short summary report of no more than 500 words (the Summary Report) for the works shall be prepared by the Archaeology Contractor for submission to the Project Archaeologist for subsequent publication within London Archaeologist or another local (county) journal or publication outlet specified by the Project Archaeologist.

The Archaeology Contractor shall submit the draft Summary Report to the Project Archaeologist for approval within 8 weeks of the completion date of the fieldwork event. The Archaeology Contractor shall allow two weeks in the programme of works for the Project Archaeologist to provide comments. The Archaeology Contractor shall include any amendments required by the Project Archaeologist in the final Summary Report which shall be submitted within one week of receiving the Project Archaeologist's comments on the draft report.

The Summary Report shall be submitted as an MS Word \*.document in accordance with the Employer's information management standards and procedures.



## **8.9 Post excavation assessment**

If instructed by the Project Archaeologist, the Archaeology Contractor shall undertake a post-excavation assessment of the site archive and submit a report of their findings to the Project Archaeologist for approval. Assessment of potential for analysis shall be undertaken in accordance with English Heritage guidelines.

The Archaeology Contractor shall provide details of their current post excavation assessment procedures with their Method Statement.





## **9 Site Monitoring & Progress Reports**

Prior to commencing the works the Archaeology Contractor shall agree a programme of weekly written progress reports and periodic progress meetings with the Project Archaeologist an/or Project Manager and shall be represented at such meetings to the satisfaction of the Project Archaeologist. The Archaeology Contractor shall provide information describing progress on-site to date, the processing of samples and artefacts and feedback from any initial assessment.

The LB of Tower Hamlets, the GLAAS advisor and Robert Whytehead (English Heritage) shall be informed in writing at least one week in advance of commencement of fieldwork by the Project Archaeologist.

Periodic updates on the progress of the Crossrail archaeology programme shall be submitted to the external consultees by the Project Archaeologist. The Archaeology Contractor shall provide information to the Project Archaeologist as requested to inform this reporting.

The Project Archaeologist shall arrange and convene monitoring site visits by the external consultees, as appropriate. There shall be no unauthorised access to the works in any other circumstances. Any visits to the works shall be in accordance with the Main contractor's health and safety, site access and security requirements.

The Archaeology Contractor may propose that archaeological excavation be carried out as an extension to evaluation works, if the scope of such work is readily incorporated into the SS-WSI. The detailed method for this work shall be agreed between the Archaeology Contractor and the Project Archaeologist at a site meeting and subsequently in writing between the Project Archaeologist and the relevant external consultees.



## **10 Personnel requirements**

The Archaeology Contractor shall provide project personnel of experience as described below. The personnel shall be approved by the Project Archaeologist. Approval may be withdrawn by the Employer at their discretion and in accordance with the contract conditions.

The Archaeology Contractor shall submit CVs of all proposed personnel including any specialists, but excluding site technician grades, to the Project Archaeologist for approval if this has not already been done as part of the pre-qualification process.

The works shall be managed, directed and staffed by appropriately qualified and experienced personnel. The Archaeology Contractor's Key Person shall possess at least ten years relevant experience.

The excavation, sampling and recording of the works shall be directed in the field by a Fieldwork Director who is a Member of the Institute of Field Archaeologists (MIFA) The Fieldwork Director shall be on site throughout the fieldwork stages.

The Archaeology Contractor's project team shall include an environmental archaeologist suitably qualified in archaeological science and geo-archaeological sediment description methods, and on site sample processing and assessment techniques.

The Archaeology Contractor's project team shall be staffed by technician grades with minimum six months experience in appropriate aspects of excavation and recording.

Specialist staff employed on any aspect of the works, including post-excavation assessment or analysis of any kind including the writing of reports, shall be suitably qualified and shall be supervised by personnel with a minimum of ten years of relevant experience in their field (this may be inclusive of post-graduate studies).

Specialist staff shall be available, normally at 24 hours notice, for the duration of the works to provide advice on any specialist tasks to be undertaken.



## **11 References and Glossary of Terms**

**Brown, Duncan H 2007.** Archaeological Archives: A guide to best practice in creation, compilation, transfer and curation, Archaeological Archives Forum, ISBN 0948393912.

**Crossrail, 2005a.** Assessment of Archaeological Impacts, Technical Reports. Part 2 of 6, Central Route Section, (doc no. 1E0318-C1E00-00001).

**Crossrail, 2008a,** Archaeology Generic Written Scheme of Investigation, (CR-PN-LWS-EN-SY-00001).

**Crossrail, 2008b,** Procedure for non-listed built heritage recording (CR-PN-LWS-EN-PD-00010).

**Crossrail 2008c,** Archaeology Specification for Evaluation and Mitigation. (CR-PN-LWS-EN-SP-00001).

**Crossrail 2008d,** Detailed Desk Based Assessments (DDBA) for Ham & Wick Sewer (CR-SD-PML-EN-SR-00001).

**Crossrail 2010a,** C156 – Central project: Archaeological Monitoring of Ground Investigations, borehole Package 19 (C156-CSY-T1-RGN-CR146\_PT004-00004).

**Nixon T, McAdam, E, Tomber, R and Swain H, 2003.** A Research Framework for London Archaeology 2002, Museum of London Archaeology Service.

## Annex 1 Archaeological Research Agenda

### Generic Research Aims

The following generic research objectives, with reference to the Greater London Archaeology Research Framework Agenda (MoLAS 2002) have been identified for Zone D: West India Dock to Dartford Tunnel (appropriate to individual worksites (or groups of worksites) within ES Route window C11)

- Understanding the significance of geomorphology, ecology, ecosystems and climate, hydrology, and vegetational and faunal development, on human lives. (79).
- Understanding London's hydrology and river systems and tributaries and, in particular, understanding the role of the river Thames (as boundary, communication route, resource, ritual focus, barrier, link, etc) in shaping London's history, and the relationships between rivers and floodplains. (79).
- Understanding the relationship between landscape, river and settlement, and the influences of the Thames in particular on communications and social interaction. (79).
- Understanding the origins of the prehistoric metalwork sequence from the Thames, and examining the links between the metalwork hoards deposited at the headwaters of river tributaries and other activities. (79).
- Studying the correlation between sites associated with watercourses and meander bends, so as to understand the origin of settlements. (80).
- Understanding the relationship between the Bronze Age wooden trackways and the settlements to which they presumably led, and what the trackways represent in terms of woodcraft and woodland management. (81).
- Understanding the development of London's Docklands and Waterways. (82).



## **Annex 2 Site Information**

### **Annex 2.1 Services and Utilities**

Yet to be determined, please refer to Crossrail Project Archaeologist

### **Annex 2.2 Extinguishments of Rights of Way**

Yet to be determined, please refer to Crossrail Project Archaeologist

### **Annex 2.3 Surface Water Control**

Yet to be determined, please refer to Crossrail Project Archaeologist

### **Annex 2.4 Protective Fencing**

Yet to be determined, please refer to Crossrail Project Archaeologist

### **Annex 2.5 Credit Boards**

Yet to be determined, please refer to Crossrail Project Archaeologist

### **Annex 2.6 Care in Executing the Site Operations**

Yet to be determined, please refer to Crossrail Project Archaeologist

### **Annex 2.7 Parking of Vehicles**

Yet to be determined, please refer to Crossrail Project Archaeologist



### **Annex 3 Plans and Other Illustrations**

Please refer to Figure 1 (drawing number C305-DSJ-T-DDA-CR094\_WS115\_Z-60005)





## Annex 4 Health and Safety requirements:

### Annex 4.1 Designers Risk Assessment and CDM requirements

Key construction risks relating to working constraints are provided in the RIBA F constructability report.

### Annex 4.2 Archaeological Contractors risk assessments and Health and Safety Plans

Yet to be determined, please refer to Crossrail Project Archaeologist

### Annex 4.3 Archaeological Contractor’s Safety Audits, Safety Inspections, Reporting of Accidents

Yet to be determined, please refer to Crossrail Project Archaeologist

### Annex 4.4 Personal Protective Equipment (PPE)

Minimum personal PPE will consist of:

- Hi Visibility Vest (in the appropriate colour for the nature for the Worksite);
- Hard Hat;
- Gloves;
- Safety glasses;
- Laced boots with ankle support, steel insoles and toe caps (rigger boots are not permitted on Crossrail Sites);

### Annex 4.5 Labelling of Hazardous Substances, Contaminated Land

Yet to be determined, please refer to Crossrail Project Archaeologist

### Annex 4.6 CRL Health and Safety Management System, CRL Drugs and Alcohol Policy

Yet to be determined, please refer to Crossrail Project Archaeologist

### Annex 4.7 CRL and work on Network Rail Land

Yet to be determined, please refer to Crossrail Project Archaeologist

Below is the Designers Risk Control Log Summary

Activity	Health Risk	ERIC	Possible Control Measure	Responsibility
General Site Working	All following	E	Site Specific Induction, toolbox talks etc.	<i>Main Contractor</i>



Activity	Health Risk	ERIC	Possible Control Measure	Responsibility
		R	Contractors' Method Statements and Risk Assessments to be approved in writing prior to working. All site staff to confirm that they have read and understood MS and RA	<i>Designer</i> <i>Main Contractor</i> <i>Archaeological Contractor</i>
		I	Zoning of site activities to prevent unnecessary overlap of working areas	<i>Designer</i> <i>Main Contractor</i> <i>Archaeological Contractor</i>
		C	Ensure all site staff are competent and aware of risks (e.g. CSCS cards)	<i>Main Contractor</i> <i>Archaeological Contractor</i>
Contact with plant/machinery, trips, falls,		E	Zoning of site activities to prevent unnecessary overlap of working areas	<i>Designer</i> <i>Main Contractor</i> <i>Archaeological Contractor</i>
		R	Minimum PPE to be worn at all times to include Hi-Visibility clothing, Hard Hats, site safety boots, safety glasses, gloves.	<i>Main Contractor</i> <i>Archaeological Contractor</i>
		I	Zoning of site activities to prevent unnecessary overlap of working areas	<i>Designer</i> <i>Main Contractor</i> <i>Archaeological Contractor</i>
		C	Minimum PPE to be worn at all times to include Hi-Visibility clothing, Hard Hats, site safety boots, safety glasses, gloves.	<i>Main Contractor</i> <i>Archaeological Contractor</i>
		E	Geotechnical reports indicate risk of contamination due to previous site use as railway.	<i>Main Contractor</i>

Activity	Health Risk	ERIC	Possible Control Measure	Responsibility
		R	Geotechnical reports indicate risk of contamination due to previous site use as railway. Appropriate PPE to be provided by <i>Archaeological Contractor</i> as required.	<i>Archaeological Contractor</i>
		I	Any areas of contamination identified during excavation are to be reported and remedial measures put in place prior to further excavation.	<i>Main Contractor</i> <i>Archaeological Contractor</i>
		C	Staff required to wash hands before ingestion of food/drink etc.	<i>Main Contractor</i> <i>Archaeological Contractor</i>
			Welfare for hygiene etc. is to be provided by Main contractor at Archaeologist site office. To include washing facilities	<i>Main Contractor</i>
Deep excavation	Falls from height, tripping etc. Objects falling from height.	E	n/a	
		R	Dedicated Egress – ramping with edge guard is preferred option.  Edge Guards/Heras fencing to be specified to provide barrier to deep excavation and prevent falls from objects into trench.	<i>Main contractor</i>
		I	n/a	
		C	Deep excavation signs	
Plant and Machinery	Proposed Archaeological contractor's working route towards proposed location of plant. Risk of contact with excavating machine arm,	E	n/a	
		R	Appropriate PPE to be provided	<i>Archaeological Contractor</i>
		I	Ensure dedicated pedestrian routes away from arc of machine working	<i>Main Contractor</i>



Activity	Health Risk	ERIC	Possible Control Measure	Responsibility
	crushing etc.	C	Employ banksman	Main Contractor
Site Traffic	Risk of injury or death from contact with moving vehicles	E	Proposed working and storage area for Archaeological Contractor to be located away from site traffic routes	Designer Main Contractor Archaeological Contractor
		R	n/a	
		I	Controlled crossing points and separation of pedestrian/site traffic routes	Main Contractor
		C	n/a	
Use of hand tools	Possible injury resulting from use of hand tools, e.g. mattocks, trowels, spades	E	n/a	
		R	Appropriate training and PPE to be provided	Archaeological Contractor
		I	n/a	
		C	n/a	
Adverse Weather	Changeable ground conditions leading to trips and falls etc.	E	n/a	Archaeological Contractor
		R	Use of Youngmans boards or similar is to be specified for the transportation of spoil where appropriate	Main Contractor
		I	Appropriate finishing to egress ramps (e.g. compacted hardcore/rubble to provide sufficient purchase, edge guard etc.)	Main Contractor
		C	Appropriate PPE to be provided for adverse weather working	Archaeological Contractor



Activity	Health Risk	ERIC	Possible Control Measure	Responsibility
	Adverse weather conditions may require use of electrical equipment powered by generators (e.g. pumps, temporary lighting etc), with accompanying associated risks for electrocution etc.	E	n/a	
		R	Energy Supply methods and risk assessment to be detailed in Contractor's method statements	Main Contractor
		I	n/a	
		C	Only staff with appropriate training are to operate generators and other electrically operated equipment (for example pumps)	Archaeological Contractor
Buried utilities/services	Hazardous contact with buried services e.g. electrical shock, gas leakage/explosion, contamination through contact with sewage etc.	E	Main Contractor to confirm that appropriate action has been taken to decommission services prior to archaeological investigation.  Main Contractor to identify location of utilities/services in Method Statement and on plan.	Designer  Main Contractor
		R	n/a	
		I	Surface sweep (e.g. CAT scan) to be undertaken prior to excavation by Main Contractor.	Main Contractor
		C	Banksman to be employed to watch for possible buried services/utilities	Main Contractor
			Appropriate PPE measures as outlined above for contamination	Main Contractor Archaeological Contractor
Unexploded ordnances (UXO)	Records show there is a low risk	E	Main Contractor to employ UXO specialist to undertake site survey and probe for UXO	Main Contractor



Activity	Health Risk	ERIC	Possible Control Measure	Responsibility
		R	Briefing by UXO specialist to site staff where appropriate.	<i>Main Contractor</i>
		I	Potential UXO to be reported immediately to site manager and isolated. Any works halted.	<i>Main Contractor</i>
		C	Following identification Authorities to be informed. Procedures for remediation as set out in Main Contractor's method statement to be enacted	<i>Main Contractor</i>





## **Annex 5 Environmental protection requirements**

Yet to be determined, please refer to Crossrail Project Archaeologist

## Annex 6 Programme and order of work for implementation of works and integration with other activities

Task ID	Task	Archaeological phase	Construction programme	Start date
1	Site set up		Site Set Up	July 2012
2	Watching brief	Main Works		
3	Interim Statement			
4	Reporting			
5	Reporting			
6	Interim Statement			
7	Archaeological Fieldwork Report			
8	HER Summary Sheet			
9	Summary Report			



## **Annex 7 Enabling and temporary works design requirements, attendances and implementation**

Yet to be determined, please refer to Crossrail Project Archaeologist

## **Annex 8 Security requirements**

Yet to be determined

## **Annex 9 Need for screening or other protective works**

To be determined

## **Annex 10 Procedure for notification of the Discovery of Human Remains**

Please refer to Chapter 7.3 in this document.

## **Annex 11 Procedure for notification of the Discovery material falling under the Treasure Act 1996**

Please refer to Chapter 7.4 in this document

## **Annex12 Procedure for notification of major unexpected discoveries**

Please refer to Chapter 7.2 in this document