



C138 - LIVERPOOL STREET STATION

ADDENDUM TO WSI: TRIAL TRENCH EVALUATION – BROADGATE TICKET HALL (XSM10)

Document Number : C138-MMD-T1-RST-C101-00004

Document History:

Version:	Date:	Prepared by:	Checked by:	Approved by:	Reason for Issue:
1.0	19 08 2010	[REDACTED]	[REDACTED]	[REDACTED]	For PDP Approval
2.0	04 03 2011	[REDACTED]	[REDACTED]	[REDACTED]	For inclusion in SS-WSI
3.0	17 08 2011	[REDACTED]	[REDACTED]	[REDACTED]	Mitigation design
		[REDACTED]	[REDACTED]	[REDACTED]	

CROSSRAIL REVIEW AND ACCEPTANCE STATUS	
This decal is to be used for submitted documents requiring acceptance by CRL.	
<input checked="" type="checkbox"/>	Code 1. Accepted. Work May Proceed
<input type="checkbox"/>	Code 2. Not Accepted. Revise and resubmit. Work may proceed subject to incorporation of changes indicated
<input type="checkbox"/>	Code 3. Not Accepted. Revise and resubmit. Work may not proceed
<input type="checkbox"/>	Code 4. Received for information only. Receipt is confirmed
Reviewed/Accepted by:(signature)	[REDACTED]
Print Name:	[REDACTED] Date: 26.08.11
Acceptance by CRL does not relieve the designer/supplier from full compliance with their contractual obligations and does not constitute CRL approval of design, details, calculations, analyses, test methods or materials developed or selected by the designer/supplier.	

This document contains proprietary information. No part of this document may be reproduced without prior written consent from the chief executive of Crossrail Ltd.



Mott MacDonald Issue and Revision Record

Document Title: C138 – Liverpool Street Station Addendum to WSI: Trial Trench Evaluation – Broadgate Ticket Hall

Document number: C138-MMD-T1-RST-C101-00004

Document History Continued:

Revision:	Date:	Prepared by:	Checked by:	Approved by:	Reason for Issue:
1.0	19 08 2010	[REDACTED]	[REDACTED]	[REDACTED]	For PDP Approval
2.0	04 03 2011	[REDACTED]	[REDACTED]	[REDACTED]	For inclusion in SS-WSI
3.0	17 08 2011	[REDACTED]	[REDACTED]	[REDACTED]	Mitigation design
		[REDACTED]	[REDACTED]	[REDACTED]	

Subject to the terms of the contract between Crossrail and Mott MacDonald Limited:

This document is issued for the party which commissioned it and for specific purposes connected with the Crossrail project only;

It should not be relied upon by any other party, unless the contrary intention is expressly stated in the contract, or used for any other purpose;

We accept no responsibility for the consequences of this document being relied upon by any other party, or being used for any other purpose;

This document contains confidential information and proprietary intellectual property. It should not be shown to other parties without consent from either Mott MacDonald Limited or from the party which commissioned it, Crossrail Limited or Crossrail Central.



Contents

1 Introduction	4
2 Scope of Works	4
2.1 Aims of the proposed investigation	4
2.2 Site Specific Aims and Objectives	5
2.3 Summary of trial trench evaluation results	5
3 Requirements for all Principal Contractors	8
3.2 Interfaces	9
4 Specific Requirements for C503	10
4.1 C503 Procedure for archaeological excavation	10
4.2 C503 Procedure for archaeological general watching brief and targeted watching brief	11
5 Specific Requirements for C502	14
5.1 C502 Procedure for archaeological excavation	14
6 Instructions to the Exhumation Contractor	16
7 Instructions to Archaeological Contractor and Specification	18
7.1 Archaeological Watching Brief and Excavation	18
7.2 Deliverables	19
7.3 Site Archives	19
7.4 Post-excavation	19
8 Provisional Timetable	20
Appendix A – Archaeological Mapping Information	22
Table 1 Summary of archaeological events at the Liverpool Street worksite	4
Table 2 Burial ground data	7
Table 3 Depths of archaeological deposits	7
Table 4 Deliverables required for each fieldwork event	19
Figure 1 Archaeological sequence – facing east	7



1 Introduction

- 1.1.1 This document provides details of the scope, specification and programme of archaeological investigation required to mitigate the impact of construction of the Broadgate Ticket Hall and Utilities Corridor on archaeological deposits.
- 1.1.2 It sets out the location and recording activities required at the Liverpool Street worksite during the enabling works and main works phases following completion of archaeological evaluation works (at Liverpool Street between February and July 2011 by C257.
- 1.1.3 This document is an addendum to the Written Scheme of Investigation (C138-MMD-T1-RST-C101-00001) and should be read in conjunction with that document).
- 1.1.4 This document outlines the requirements for Principal Contractors (C503; C502) that will be undertaking civils works on the site in liaison with the Employer's archaeologist and C257 Archaeology Contractor MOLA and sets out the scope for an Exhumation Contractor (to be appointed as a sub-contractor by C503 and C502 as required).

2 Scope of Works

2.1 Aims of the proposed investigation

- 2.1.1 The aim is to investigate and report on surviving archaeological deposits within the footprint of the Crossrail works in Liverpool Street, including those relating to a post medieval burial ground (BG208), which survives within the worksite footprint, and also deposits relating to the medieval and Roman periods that have been positively identified. This will be achieved through a programme of archaeological investigation to be conducted in parallel with the main civils enabling works package C503, and the main station box construction package C502. A summary of the scope is set out in Table 1 below.

Table 1 Summary of archaeological events at the Liverpool Street worksite

Event Type	Event Code	Progress	Principal Contractor	Addendum Specific Requirements Section
General watching brief (Test pit and core in basement of Railway Tavern)		Complete	JB Riney	Previous version
General & Targeted Watching Brief (secondary utilities diversions, including 2 sewer shafts)		Not started	C503	4.2
AREA 1: Sample excavation by the C257 Archaeology Contractor and rapid removal by a licensed burial contractor, followed by archaeological excavation to 6m BGL.		Not started	C503	4.1
AREA 2: Sample excavation by the C257 Archaeology Contractor and rapid removal by a licensed burial contractor, followed by archaeological excavation to 6m BGL.		Not started	C503/C502 to be agreed	4.1/5.1



AREA 3: Sample excavation by the C257 Archaeology Contractor and rapid removal by a licensed burial contractor, followed by archaeological excavation to 6m BGL.		Not started	C503/C502 to be agreed	4.1/5.1
AREA 4: Archaeological excavation of the utilities corridor by the C257 Archaeology Contractor		Not started	C503	4.1
AREA 5: Sample excavation by the C257 Archaeology Contractor and rapid removal by a licensed burial contractor, followed by archaeological excavation to 6m BGL (5m zone around the Queen Victoria Tunnel and former Broad Street Station Ticket Hall).		Not started	C502/C503 to be agreed	4.1/5.1
General watching brief on mini-pile arisings		Not started	C503	4.2.13
English Heritage Level 2 survey of the Broad Street Station Ticket Hall and the Queen Victoria Tunnel	XSB10	Not started	n/a	n/a

2.1.2 Areas 1 to 5 are shown on Drawing CRL1-XRL-U-DDA-C101-00169. Areas of trial trenches previously excavated will be provided separately.

2.2 Site Specific Aims and Objectives

2.2.1 The objective of the archaeological investigation is set out below.

- Mitigation in the form of archaeological excavation and general and targeted watching brief to excavate and record archaeological deposits for analysis and dissemination in accordance with the Crossrail Generic WSI (document number CR-PN-LWS-EN-SY-00001) and the standards listed therein.

2.3 Summary of trial trench evaluation results

2.3.1 See Figure 1 for a graphic presentation of the deposit model described below.

2.3.2 In situ human burials survive across the majority of the site beneath a significant number of existing utilities. Burials are present between 111.52m and 109.45mATD, but the upper level of the burials varies across the site.

2.3.3 The cemetery deposits are on average 1.3m thick.

2.3.4 There is an average of 3.77 burials per m³, which equates to between 3250 - 3500 burials within the site footprint.

2.3.5 The made ground layer above the cemetery deposits contains a significant quantity of disarticulated human remains. These are burials which have been disturbed by the later phases of burial, incremental construction, modern and historic road construction and utilities works in the 19th and 20th centuries.

2.3.6 It is apparent from ground investigation data that undisturbed burials do not survive in the footprint of the utilities corridor due to truncation by the cellars of former buildings that fronted the south side of Liverpool Street and by a set of electric cables that have been inserted from the surface and excavated to c. 109.45m ATD.

2.3.7 Underlying the cemetery level is a series of post-Roman dumped layers and marsh deposits. Beneath this is a layer of Roman archaeology dated to the 1st to 3rd



centuries AD. Evidence for structures, ditches and road or yard surfaces has been identified between 109.74m and 107.97mATD.

2.3.8 Taplow Terrace gravel, laid down approximately 128-280,000 BP (Before Present) was identified at 106.90m ATD in Trench 13 beneath a thin layer of alluvium. The archaeological potential of the Terrace Gravel deposits is considered to be very low.

2.3.9 Table 2 provides the burial ground levels and extrapolated estimates and Table 3 the full archaeological sequence as it is currently understood.

Table 2 Burial ground data

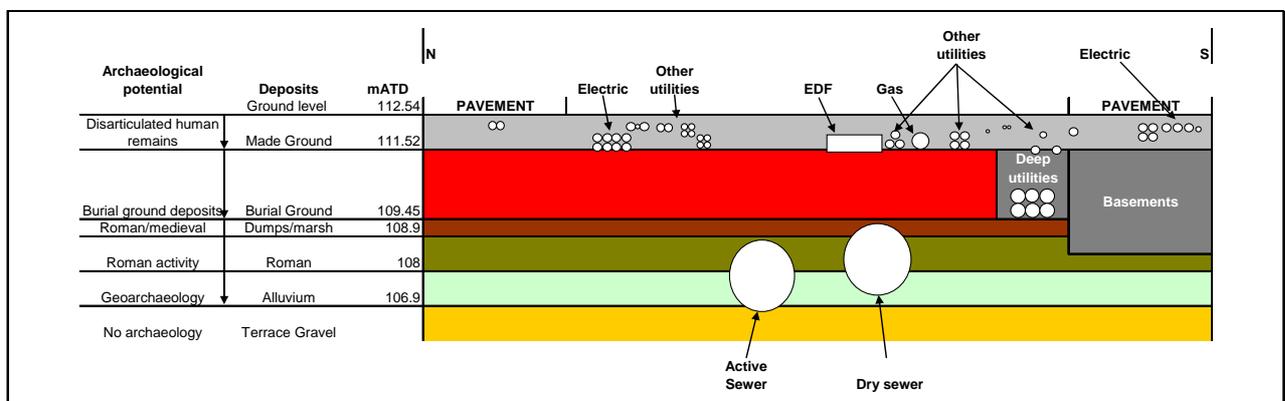
Trench	Length (m)	Width (m)	Surface area (m2)	Ground level (mATD)	Trench base level (mATD)	Trench depth (m)	Surface of burials (mATD)	Base of burials (mATD)	Cemetery thickness (m)	Burials excavated	Volume of spoil in burial layer (m3)	Burials per m3
9	2.26	2.22	5.00	112.71	110.90	1.81	111.12	-	-	-	-	-
6	4.24	2.26	9.59	112.57	111.16	1.41	111.52	-	-	-	-	-
7	3.98	2.45	9.74	112.63	107.69	4.94	111.22	110.09	1.13	62	11.01	5.63
5	3.41	2.33	7.94	112.52	107.62	4.90	-	-	-	-	-	-
13	2.10	2.53	5.30	112.76	106.90	5.86	111.46	110.02	1.44	22	7.63	2.88
1	4.31	2.96	12.75	112.28	107.32	4.96	110.7	109.45	1.25	62	15.94	3.89
2	6.45	2.83	18.28	112.29	106.66	5.63	111.19	109.83	1.36	66	24.85	2.66
14	tba	tba	tba	tba	tba	tba	tba	tba	tba	tba	tba	tba
Totals	-	-	68.59	-	-	-	-	-	-	212	59.43	-
Averages	-	-	-	112.537	-	-	111.20	109.85	1.30	-	-	3.77

 Full sequence excavated

Table 3 Depths of archaeological deposits

Layer	Average surface elevation (mATD)	Average base elevation (mATD)	Archaeological potential
Street level	112.64 to 112.28		n/a
Basement level (within utilities corridor)	111.5	109.5	n/a
Made ground	Ground level	111.52	Disarticulated human remains
Burial ground	111.52	109.45	in situ burials
Dumping levels	110.83	109.74	Yes
Marsh deposits	110.11	107.62	Geoarchaeology
Roman deposits	109.74	107.97	Roman archaeology
Alluvium	107.97	106.9	Geoarchaeology
Terrace gravel	106.9		None

Figure 1 Archaeological sequence – facing east



nb. The above diagram is intended to be a simplified visual reference of the archaeological sequence. The diagram is not to scale and the locations of deposits, obstructions, and utilities are approximate.



3 Requirements for all Principal Contractors

- 3.1.1 In addition to the Specific Requirements for each *Principal Contractor* set out in sections 4 to 6, the *Principal Contractor* must provide and maintain the following attendances and facilities at all times (including additional working hours if necessary) for the duration of and in relation to the specialist archaeological works in Liverpool Street.
- 3.1.2 Identify all live underground services that exist in area of excavation. For excavations on and near to utilities the *Principal Contractor* will safely protect and support utilities prior to allowing the *C257 Archaeology Contractor* and/or the *Exhumation Contractor* access into the excavation. The *Principal Contractor's* methodology for the support and protection of utilities will be approved by Crossrail and the relevant utilities companies prior to the start of site works.
- 3.1.3 The *Principal Contractor* will carry out works adjacent to the Queen Victoria Tunnel and the former Broad Street Station Ticket Hall (currently used as a LU sub-station) in accordance with relevant LU permissions and in liaison with the Crossrail team.
- 3.1.4 Use of excavators or other plant within the area shall only be undertaken with the agreement and under the observation of the *C257 Archaeology Contractor*.
- 3.1.5 Allow safe access for archaeological operatives into the site compound and provide any required temporary works to facilitate this.
- 3.1.6 Allow suitable access from ground level to the bottom of excavated areas for archaeologists to work.
- 3.1.7 Design and provide temporary works to support excavations for personnel access to the investigation by all operatives, e.g. sheet piling and shoring.
- 3.1.8 Provide appropriate plant and trained operatives to remove hand excavated spoil from trenches (e.g. a hoist, conveyor or other appropriate method) and ensure that all equipment is regularly inspected.
- 3.1.9 Provide drainage in excavations where required.
- 3.1.10 Where works involve the exposure or exhumation of human remains, provide covering for the exposed area to prevent public observation of the works, these should be:
- large enough to allow safe working;
 - waterproof;
 - translucent (to provide sufficient light); and
 - be of a type that can be quickly erected and removed to facilitate access for plant when required.



- 3.1.11 Provide appropriate material to compensate for reduction in volumes when reinstating.
- 3.1.12 Provide the lighting as required (in deep excavations and if night working is required);
- 3.1.13 Small plant and tools, as required to complete the works.
- 3.1.14 Provide technical advice to the *C257 Archaeology Contractor* as maybe required to safely complete the works.
- 3.1.15 Manage safety and inter alia provide regular toolbox talks all site staff.
- 3.1.16 Provide traffic management measures that may be required for the works.
- 3.1.17 Provide site security in accordance with the works information.
- 3.1.18 Allow for up to 20 archaeologists to be on site.
- 3.1.19 Unless otherwise arranged, the *Principal Contractor* shall provide the following site accommodation and welfare facilities for the use of archaeological operatives, inclusive of any hardstanding and services required:
 - Toilets, with drying and washing facilities;
 - First Aid;
 - Temporary office for the use of archaeologists, including 2 desks and of a size adequate for up to 20 site staff; and
 - Secure storage.

3.2 Interfaces

- 3.2.1 The *Principal Contractor* will have the following [additional] interfaces for the specialist archaeological works:

C257 Archaeology Contractor: Museum of London Archaeology (MoLA)

Elaine Eastbury - Contract Manager

M: 07730 646063 | E: eeastbury@museumoflondon.org.uk

Nick Elsdon - Assistant Contract Manager

M: 07872 127296 | E: nelsden@museumoflondon.org.uk

Site based Project Officer - tbc

Exhumation Contractor to be appointed as sub-contractor by Principal Contractor

Employer's Archaeologist:

Jay Carver – Crossrail Project Archaeologist

M: 07870 191705 | E: jaycarver@crossrail.co.uk

Mike Court – Crossrail Assistant Project Archaeologist

M: 07870 567433 | E: mikecourt@crossrail.co.uk



4 Specific Requirements for C503

4.1 C503 Procedure for archaeological excavation

4.1.1 The *Principal Contractor* will break out the zones shown on drawing CRL1-XRL-U-DDA-C101-00170, facilitating the archaeological investigations to be undertaken by the *C257 Archaeology Contractor* and the removal of human remains by the *Exhumation Contractor*. Refer to section 3 of this document for general attendances and facilities to be provided by the *Principal Contractor* to achieve these objectives.

Ground level (112.76m to 112.28m ATD) to surface of burial ground (111.52m to 110.70m ATD)

4.1.2 Remove, under supervision of the *C257 Archaeology Contractor* the road surface and modern overburden at each location, to the predicted level of cemetery deposits. The surface of cemetery deposits are present at an average depth of 1.34m below ground level (highest level identified in trial trench evaluation: 111.52mATD).

4.1.3 If disarticulated human remains are identified in the made ground they will be removed by the *C257 Archaeology Contractor*, stored securely on site and provided to the *Exhumation Contractor* for processing off-site.

The burial ground (from 111.52m to 109.45m ATD)

4.1.4 The *Principal Contractor* will facilitate the excavation of the burial ground (present from 111.52m to 109.45m ATD) by the *C257 Archaeology Contractor* and the *Exhumation Contractor*.

4.1.5 40% of the site, comprising zones 2; 3; 9; 10; 11A; 12; 14; and 15 on drawing CRL1-XRL-U-DDA-C101-00170 is to be excavated by the *C257 Archaeology Contractor* to the base of the burial ground (approximately 109.45m ATD) to their approved Method Statement.

4.1.6 60% of the site, comprising zones 1; 4; 5; 6; 7; 8; 11B; 11C; 13; 16; 17; and 18 on drawing CRL1-XRL-U-DDA-C101-00170 is to be excavated by the *Exhumation Contractor* to the base of the burial ground (approximately 109.45m ATD) to their approved Method Statement.

4.1.7 The *C257 Archaeology Contractor* will monitor the works carried out by the *Exhumation Contractor*. The *Principal Contractor* will facilitate the recording and removal of the following features by the *C257 Archaeology Contractor* should they be identified during monitoring:

- Structural evidence for tombs, vaults, or cemetery infrastructure.
- Evidence for the boundaries of the cemetery.

Deeper archaeological deposits (110.64m ATD to 106.90m ATD)

4.1.8 Following the removal of cemetery deposits by the *C257 Archaeology Contractor* and the *Exhumation Contractor*, the *Principal Contractor* will facilitate the further excavation of archaeological deposits by the *C257 Archaeology Contractor* until the full sequence of deposits has been excavated (Zones 1-17 on drawing CRL1-XRL-U-DDA-C101-



00170) in accordance with the Method Statement. Archaeological deposits are expected to a depth of approximately 6m below ground level.

- 4.1.9 Upon completion of each Zone the *C257 Archaeology Contractor* will issue a signed completion form countersigned by the *Employers Archaeologist* to the *Principal Contractor*.

Archaeological Excavation during construction of the utilities corridor

- 4.1.10 In the utilities corridor footprint, archaeological deposits, including the burial ground, have been removed to approximately 2.75m-3m below ground level by deep running earthenware services and 3m to 4m below ground level by the basements of former buildings. However, earlier archaeological deposits (e.g. Roman) probably survive beneath the services and basements (approximately 3m/4m to 6m below ground level).
- 4.1.11 After, or concurrent with (in phases) the installation of the mini-piles and 1250mm piles the *Principal Contractor* will integrate archaeological excavation into the excavation of the utilities corridor (Zone 18 on drawing CRL1-XRL-U-DDA-C101-00170).
- 4.1.12 Modern overburden will be removed by the *Principal Contractor* under archaeological observation until the surface of undisturbed archaeological deposits is reached - estimated to be 3m below ground level in areas where no basements survive; and immediately beneath basements where they do survive.
- 4.1.13 Material excavated by the *Principal Contractor* during this initial phase containing disarticulated human remains (to be determined by the *Exhumation Contractor* in liaison with the *Employers Archaeologist*) will be provided to the *Exhumation Contractor* for processing off site.
- 4.1.14 The *Principal Contractor* will facilitate the further excavation of archaeological deposits within the utilities corridor by the *C257 Archaeology Contractor* until the full sequence of deposits has been excavated in accordance with the Method Statement down to approximately 6m below ground level.
- 4.1.15 Upon completion of each Zone the *C257 Archaeology Contractor* will issue a signed completion form countersigned by the *Employers Archaeologist* to the *Principal Contractor*.
- 4.1.16 When the full archaeological sequence has been excavated by the *C257 Archaeology Contractor* the utilities corridor can be excavated by the *Principal Contractor* without further archaeological investigation.

4.2 C503 Procedure for archaeological general watching brief and targeted watching brief

- 4.2.1 Where the site has not been cleared of archaeology prior to the start of the secondary utility diversions in Liverpool Street, general watching brief and targeted watching brief are required during these works.
- 4.2.2 Targeted watching brief will also be required at the excavation of the sewer shafts located to the east and west of the utilities corridor (drawing CRL1-XRL-U-DDA-C101-00170).



Secondary utility diversions

- 4.2.3 The removal of made ground by the *Principal Contractor* will be carried out under archaeological observation (general watching brief) by the *C257 Archaeology Contractor*, anticipated to be up approximately 1.3m below ground level.
- 4.2.4 For excavations deeper than 1.3m the *Principal Contractor* will allow for archaeological deposits to be excavated in stages (targeted watching brief) by the *C257 Archaeology Contractor* to the maximum depth of impact. The *C257 Archaeology Contractor* will advise the *Principal Contractor* if and when archaeological deposits are encountered, triggering the targeted watching brief (It is estimated that the trigger point will be at approximately 1.3-1.5m below ground level). NB. Human remains may be present.
- 4.2.5 Any in situ human remains which have been uncovered but which have been left in situ (as directed by the *C257 Archaeology Contractor*) will be covered with an appropriate Terram geotextile and layer of clean sand (e.g. 0.2m in thickness) as directed by the *C257 Archaeology Contractor*.
- 4.2.6 Material excavated by the *Principal Contractor* which contains disarticulated human remains (to be determined by the *Exhumation Contractor* in liaison with the *Employers Archaeologist*) will be provided to the *Exhumation Contractor* for processing off site.

Sewer shaft excavations

- 4.2.7 The removal of made ground by the *Principal Contractor* will be carried out under archaeological observation by the *C257 Archaeology Contractor*, anticipated to be up approximately 1.3m below ground level.
- 4.2.8 For excavations deeper than 1.3m the *Principal Contractor* will allow for archaeological deposits to be excavated in stages (targeted watching brief) by the *C257 Archaeology Contractor* to the maximum depth of impact caused by the sewer shafts or until the bottom of archaeological deposits are reached. Archaeological deposits relating to the former Walbrook channel in the western sewer shaft could be 6-8m below ground level.
- 4.2.9 The *C257 Archaeology Contractor* will advise the *Principal Contractor* if and when archaeological deposits are encountered, triggering the targeted watching brief (It is estimated that the trigger point will be at approximately 1.3-1.5m below ground level). NB. Human remains may be present.
- 4.2.10 Material excavated by the *Principal Contractor* containing disarticulated human remains (to be determined by the *Exhumation Contractor* in liaison with the *Employers Archaeologist*) will be provided to the *Exhumation Contractor* for processing off site.
- 4.2.11 Upon completion of archaeological works the *C257 Archaeology Contractor* will issue a signed completion form countersigned by the *Employers Archaeologist* to the *Principal Contractor*.
- 4.2.12 When the full archaeological sequence has been excavated by the *C257 Archaeology Contractor* the sewer shafts can be excavated by the *Principal Contractor* without further archaeological investigation.



Piling

- 4.2.13 During mini-piling works the *Principal Contractor (C503)* shall enable access to piling arisings for one *C257 Archaeologist* to observe and record (general watching brief) archaeological remains that may be present.



5 Specific Requirements for C502

5.1 C502 Procedure for archaeological excavation

- 5.1.1 Please note that some or all of the archaeological mitigation works set out in this section may have been completed prior to the C502 contract start date. However, it is assumed for the purposes of this document that C502 are required to carry out the mitigation works set out below.
- 5.1.2 The *Principal Contractor* will break out Zones 1; 2; 3; 4; 5; 6; 7; 8 ;9; 10; 11a; 11b shown on drawing CRL1-XRL-U-DDA-C101-00170, facilitating the archaeological investigations to be undertaken by the *C257 Archaeology Contractor* and the removal of human remains by the *Exhumation Contractor*. Refer to section 3 of this document for general attendances and facilities to be provided by the *Principal Contractor* to achieve these objectives.
- 5.1.3 The area to be investigated comprises the footprint of the piled box including a 500mm buffer extending from the outside of the eastern and northern 1250mm piled wall to mitigate the impact of guide wall excavation. Guide walls are anticipated to extend 300mm from the outside edge of the piles and 2m below existing ground level.

Ground level (112.76m to 112.28m ATD) to surface of burial ground (111.52m to 110.70m ATD)

- 5.1.4 Remove, under supervision of the *C257 Archaeology Contractor* the road surface and modern overburden at each location, to the predicted level of cemetery deposits. The surface of cemetery deposits are present at an average depth of 1.34m below ground level (highest level identified in trial trench evaluation: 111.52mATD).
- 5.1.5 If disarticulated human remains are identified in the made ground they will be removed by the *C257 Archaeology Contractor*, stored securely on site and provided to the *Exhumation Contractor* for processing off-site.

The burial ground (from 111.52m to 109.45m ATD)

- 5.1.6 The *Principal Contractor* will facilitate the excavation of the burial ground (present from 111.52m to 109.45m ATD) by the *C257 Archaeology Contractor* and the *Exhumation Contractor*.
- 5.1.7 40% of the site, comprising Zones 2; 3; 9; 10; and 11A on drawing CRL1-XRL-U-DDA-C101-00170 is to be excavated by the *C257 Archaeology Contractor* to the base of the burial ground (approximately 109.45m ATD) to their approved Method Statement.
- 5.1.8 60% of the site, comprising Zones 1; 4; 5; 6; 7; 8; and 11B on drawing CRL1-XRL-U-DDA-C101-00170 is to be excavated by the *Exhumation Contractor* to the base of the burial ground (approximately 109.45m ATD) to their approved Method Statement.
- 5.1.9 The *C257 Archaeology Contractor* will monitor the works carried out by the *Exhumation Contractor*. The *Principal Contractor* will facilitate the recording and removal of the following features by the *C257 Archaeology Contractor* should they be identified during monitoring:



- Structural evidence for tombs, vaults, or cemetery infrastructure.
- Evidence for the boundaries of the cemetery.

Deeper archaeological deposits (110.64m ATD to 106.90m ATD)

5.1.10 Following the removal of cemetery deposits by the *C257 Archaeology Contractor* and the *Exhumation Contractor*, the *Principal Contractor* will facilitate the further excavation of archaeological deposits by the *C257 Archaeology Contractor* until the full sequence of deposits has been excavated in accordance with the Method Statement (Zones 1-11b on drawing CRL1-XRL-U-DDA-C101-00170). Archaeological deposits are expected to a depth of approximately 6m below ground level.

5.1.11 Upon completion of each Zone the *C257 Archaeology Contractor* will issue a signed completion form countersigned by the *Employers Archaeologist* to the *Principal Contractor*.



6 Instructions to the Exhumation Contractor

- 6.1.1 Results from the recent (XSM10) trial trench evaluation in Liverpool Street have identified the in-situ human skeletal remains at most locations from at an average surface depth of 1.34m below ground level. Currently the average known thickness of cemetery soil is 1.30m and the density of burials is 3.77 per m³. Refer to Tables 2 and 3, and Figure 1 for further detail on depths.
- 6.1.2 Disarticulated human remains are present in Made Ground from ground level to approximately 111.52mATD (the average surface of in situ burials across the site).
- 6.1.3 The *Exhumation Contractor* will inspect the site and be aware of the site constraints including below ground utilities that are to be worked around.
- 6.1.4 The burial ground shall be cleared through a combination of detailed archaeological excavation by the *C257 Archaeology Contractor* (MoLA) and by the *Exhumation Contractor*. The total area of surviving cemetery to be cleared for the Crossrail Project is c.1000m².
- 6.1.5 The Exhumation Contractor excavates and removes up to 600m³ of soil from 60% of the locations shown on drawing CRL1-XRL-U-DDA-C101-00170 (Zones 1; 4; 5; 6; 7; 8; 13; 16; 17; and 18). The remaining 40% of the cemetery area is archaeologically excavated by the *C257 Archaeology Contractor*.
- 6.1.6 The *Exhumation Contractor* screens and disposes of all soil containing human remains, including that which arises from the *C257 Archaeology Contractors* archaeological excavation activities and, after the *C257 Archaeology Contractor* has completed the analysis, shall reinter all human remains in accordance with the license from MOJ.
- 6.1.7 All works to set up the site, break the ground, provide steel sheet shoring, protect utilities, and provide welfare facilities to the *C257 Archaeology Contractor* and *Exhumation Contractor* shall be managed and undertaken by the Crossrail *Principal Contractor*.
- 6.1.8 The Exhumation Contractor is responsible for:
- Obtaining necessary consents from Ministry Of Justice (MOJ) and relevant Environmental Health Officer (EHO) for excavation, processing and reburial of human remains;
 - Provision of labour and supervision to excavate all cemetery soils in the locations indicated on drawing CRL1-XRL-U-DDA-C101-00170.
 - Proposing the methodologies for acceptance by the *Project Manager* for the following activities:
 1. excavation,
 2. soil removal from trenches,
 3. soil screening and sorting off site
 - Providing the specification and method for screening of soils to the satisfaction of EHO and MOJ license conditions.



- Providing the specification and, method for disposal of screened soils in accordance with best environmental practice and legal requirements.
- Providing the methodology and proposed location for reburial of human remains in accordance with EHO and MOJ license conditions.
- Providing the methodology and proposed location for reburial of human remains excavated by the *C257 Archaeology Contractor* as part of this investigation following their scientific recording and analysis.



7 Instructions to Archaeological Contractor and Specification

7.1 Archaeological Watching Brief and Excavation

- 7.1.1 It is proposed that a programme of archaeological investigation comprising general and targeted watching brief and excavation be carried out at the Liverpool Street worksite.
- 7.1.2 Further details on the requirements of the Archaeological Contractor are to be found in the Site Specific Written Scheme of Investigation, document reference number: C138-MMD-T1-RST-C101-00001.
- 7.1.3 The *C257 Archaeology Contractor* will obtain a burial license for archaeological works a suitable time prior to the works and ensure that the license is updated as required.
- 7.1.4 The *C257 Archaeology Contractor* will provide a team of suitably qualified archaeologists, experienced in archaeological site investigation and the nature of archaeological deposits which are expected on this site. A geo-archaeologist and osteologist will be required.
- 7.1.5 The *C257 Archaeology Contractor* will provide a suitably qualified buildings archaeologist.
- 7.1.6 The *C257 Archaeology Contractor* will provide a Method Statement inclusive of risk assessment and safe method of working, prepared in liaison with the *Principal Contractor* and approved by the *Employers Archaeologist*.
- 7.1.7 During excavation and targeted watching brief, following the initial overall strip and clean, individual features are to be hand cleaned and defined by the *C257 Archaeology Contractor*, sufficient to determine type, plan form and relationships (e.g. for structures and rebuilds); and recorded. Sufficient archaeological features/structures are to be sample excavated either using a smaller machine with graded digging bucket (by the *Principal Contractor* under archaeological supervision) or hand dug if appropriate.
- 7.1.8 The *C257 Archaeology Contractor* will archaeologically excavate 40% of the area of the burial ground, comprising Zones 2; 3; 9; 10; 12; 14; and 15 on drawing CRL1-XRL-U-DDA-C101-00170.
- 7.1.9 The *C257 Archaeology Contractor* will monitor works carried out by the *Exhumation Contractor* on 60% of burial ground area, comprising Zones 1; 4; 5; 6; 7; 8; 11a; 11b; 13; 16; 17; and 18 on drawing CRL1-XRL-U-DDA-C101-00170.
- 7.1.10 When monitoring works carried out by the *Exhumation Contractor* the *C257 Archaeology Contractor* will also record and remove any of the following features:
- Structural evidence for tombs, vaults, or cemetery infrastructure.
 - Evidence for the boundaries of the cemetery.
 - Well preserved coffins.
 - Any other significant change in the organisation of the cemetery.



7.1.11 The C257 Archaeology Contractor will undertake full excavation of deeper archaeological deposits underlying the burial ground in Zones 1-18 on drawing CRL1-XRL-U-DDA-C101-00170 to an estimated depth of 6m below ground level, in accordance with the Method Statement.

7.1.12 The C257 Archaeology Contractor will develop a strategy for archaeological science (refer to Section 7 of the WSI (document number C138-MMD-T1-RST-C101-00001), to be presented in the Method Statement in liaison with the English Heritage regional science advisor and or GLAAS and COL archaeologist as appropriate.

7.2 Deliverables

7.2.1 Table 4 summarises the Deliverables required per fieldwork event:

Table 4 Deliverables required for each fieldwork event

Fieldwork Event	Weekly Progress Report	Interim Report	Fieldwork Report
XSM10 (Trial Trench Evaluation)	✓	✓	✓
XSM10 (GWB/TWB on secondary utility diversions)			
XSM10 Archaeological Excavation (utilities corridor)		✓	
XSM10 Archaeological Excavation (station box)			

7.2.2 Refer to the following sections of the Written Scheme of Investigation (C138-MMD-T1-RST-C101-00001) for further information regarding the following report types:

- Weekly progress reports – WSI section 9;
- Interim report – 7 days after completion of the fieldwork events in Table 4 – WSI section 8.4; and
- Fieldwork report for the events in Table 4 – WSI section 8.6.

7.3 Site Archives

7.3.1 The site archive shall be organised to be compatible with other archaeological archives in London. Refer to section 8.2 in the Site Specific Written Scheme of Investigation, document reference number: C138-MMD-T1-RST-C101-00001.

7.4 Post-excavation

7.4.1 Refer to the detail set out within the CRL/Crossrail Archaeological Contract and the Written Scheme of Investigation for Liverpool Street Station (C138-MMD-T1-RST-C101-00001 Rev 3.0).

8 Provisional Timetable

Activity	Principal Contractor	Construction Phase
<i>C257 Archaeology Contractor</i> to obtain Burial License for archaeological activities and update as required	C257	To be reviewed regularly through the works
<i>Exhumation Contractor</i> to obtain Burial license for excavation activities and update as required	Exhumation Contractor	
Trial trench evaluation Phase 3 (4 trenches in Broadgate Box footprint)	JB Riney	Complete
Trial trench evaluation Phase 4: (4 trenches in utilities corridor footprint)	JB Riney	Complete
General watching brief on exploratory trench T15 to front of 100 Liverpool Street on British Land	JB Riney	July-August 2011
General watching brief on test pit in basement of Railway Tavern	JB Riney	Complete
General and targeted watching brief on secondary utilities diversions including sewer shafts	C503	Enabling Works (Aug 2011 to Mar 2012)
General Watching Brief on piling arisings	C503 & C502	Enabling Works (Oct 2011 to Sept 2013)
AREA 1: Sample excavation by the <i>C257 Archaeology Contractor</i> and rapid removal by <i>Exhumation Contractor</i> , followed by archaeological excavation to 6m BGL (10 weeks – estimated duration)	C503	July 2011 – August 2011
AREA 4: Archaeological excavation of the utilities corridor by the <i>C257 Archaeology Contractor</i> (8 weeks – estimated duration)	C503	October 2011 – December 2011
AREA 2: Sample excavation by the <i>C257 Archaeology Contractor</i> and rapid removal by <i>Exhumation Contractor</i> , followed by archaeological excavation to 6m BGL. (9 weeks – estimated duration)	C503/C502	August 2011 – December 2011
AREA 3: Sample excavation by the <i>C257 Archaeology Contractor</i> and rapid removal by <i>Exhumation Contractor</i> , followed by archaeological excavation to 6m BGL. (9 weeks – estimated duration)	C503/C502	August 2011 – December 2011



AREA 5: Sample excavation by the C257 <i>Archaeology Contractor</i> and rapid removal by <i>Exhumation Contractor</i> , followed by archaeological excavation to 6m BGL (5m zone around the Queen Victoria Tunnel and former Broad Street Station Ticket Hall). (6 weeks – estimated duration)	C503/C502	September 2011 to 2012
---	-----------	------------------------

The above provisional programme is based on information provided by CRL and is indicative only and may differ from the actual programmes followed by Contractors.

An alternative proposal is being re-examined whereby mitigation along the line of 1250 mm piles will in part comprise prior removal of human remains followed by general watching brief on subsequent pile arisings until the Taplow Gravels are encountered. This alternative is not included in the above programme.



Appendix A – Archaeological Mapping Information

Drawings

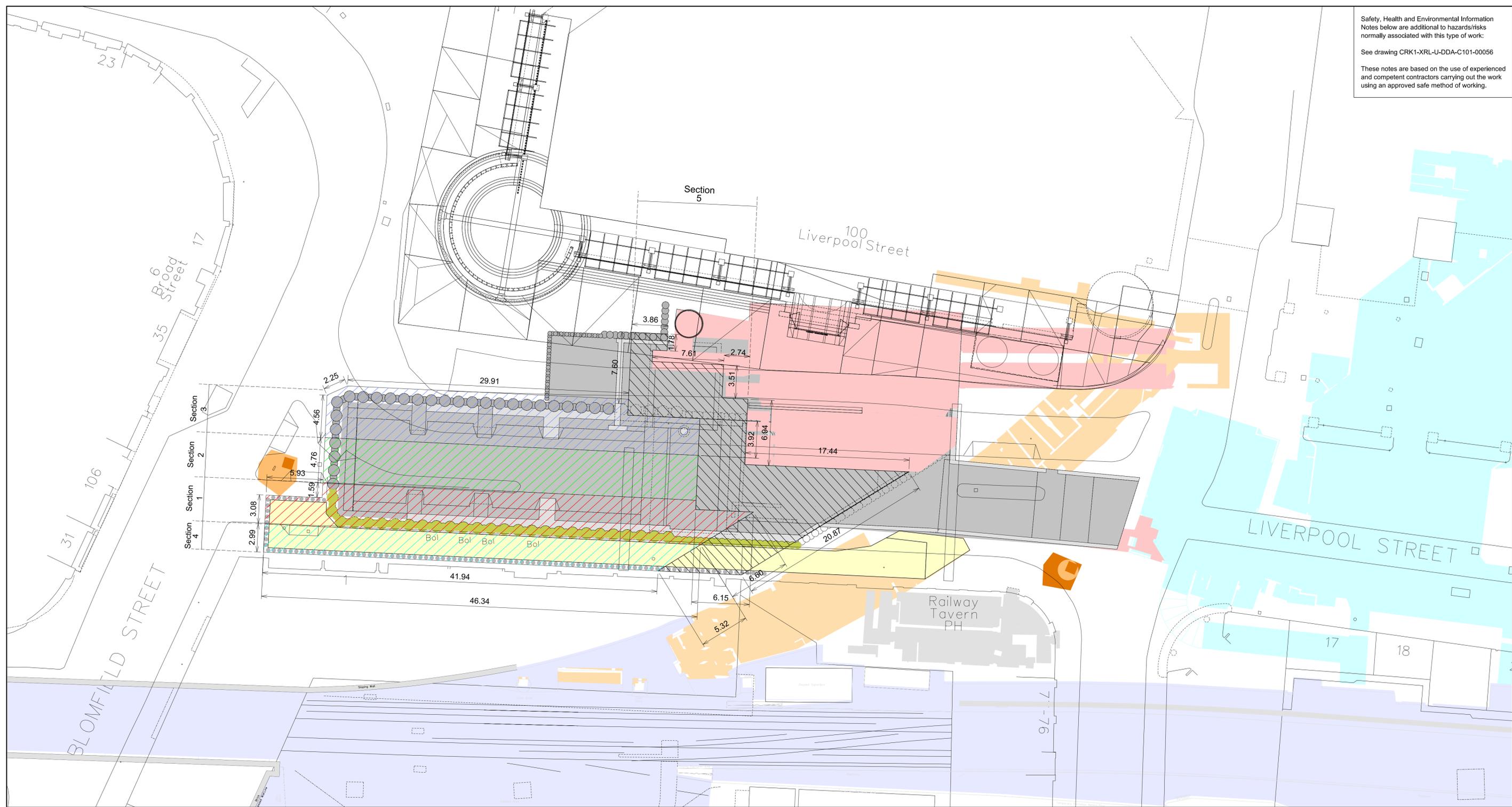
CRL1-XRL-U-DDA-C101-00169 Rev P02 – Liverpool Street- Eastern Ticket Hall
Archaeology
Mitigation Phase Drawing

CRL1-XRL-U-DDA-C101-00170 Rev P02– Liverpool Street- Eastern Ticket Hall
Archaeology
Areas for Exhumation Contractor and C257
Archaeology Contractor

Safety, Health and Environmental Information
Notes below are additional to hazards/risks normally associated with this type of work:

See drawing CRK1-XRL-U-DDA-C101-00056

These notes are based on the use of experienced and competent contractors carrying out the work using an approved safe method of working.



- | | | | |
|---------------------------|-----------------------------|--|---|
| Proposed Ticket Hall | LU Tunnel | Section 1 - For dimensions see above, depth 6m, surface area 216.82 sq m | Section 4 - Utilities corridor - disarticulated remains
For dimensions see above, depth 6m, surface area 132.14 sq m |
| Proposed Utility Corridor | Existing Sub-station | Section 2 - For dimensions see above, depth 6m, surface area 188.86 sq m | Section 5 - 5m buffer zone around below ground assets (QVT & Sub-station)
Final area for investigation
For dimensions see above, depth 6m, surface area 250.27 sq m |
| Queen Victoria Tunnel | Railway Tavern Public House | Section 3 - For dimensions see above, depth 6m, surface area 207.89 sq m | |
| LU structure | Proposed Sewer Shaft | | |

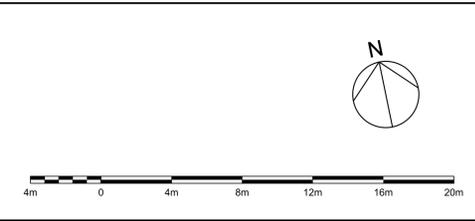
- Phasing**
- Section 1 - Phase 1 to be excavated first
 - Section 2 - Phase 2
 - Section 3 - Phase 2
 - Section 4 - Phase 3 to be excavated during construction of utilities corridor
 - Section 5 - To be confirmed

Copy Approved for Design - Created: 15-JUL-2011

Rev.	Date	Description	By	Chkd	App	Auth
P01	12/07/2011	First Issue		HC	MH	SS
C01	15/07/2011	Issued as Fit for authorisation		HC	MH	SS

Notes

- Confirmation of all survey data must be obtained from the Crossrail survey team.
- Coordinates to the London Survey Grid, heights to the London height datum which is 100 metres below Ordnance Datum Newlyn. See Crossrail standard CR-STD-010.
- All dimensions are in metres unless specified otherwise.



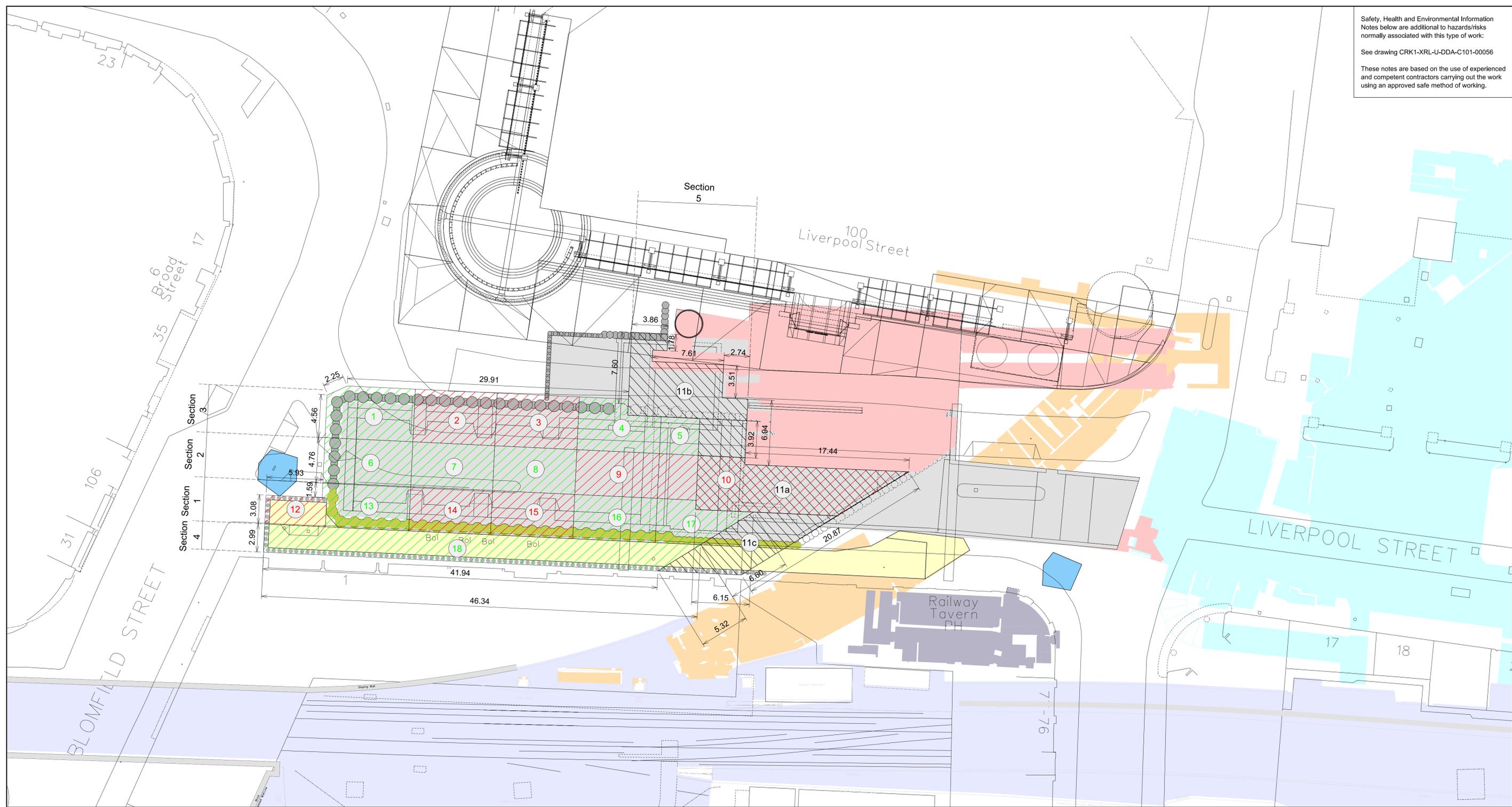
 Crossrail Limited 25 Canada Square Canary Wharf London E14 5LQ © Crossrail www.crossrail.co.uk	Contract: Crossrail Line 1 Programme	By: H.CASEY
	Originator: Crossrail Technical	CHK: M.HOPPER
	Location: Liverpool Street Stn	APP: S.SHEPHERD
	Title: Liverpool Street - Eastern Ticket Hall Archaeology Mitigation Phase Drawing	Auth: K.WHITE
Scale: 1:200@ A1	Drawing and CAD file No: CRL1-XRL-U-DDA-C101-00169	Rev: C01
		Suitability: S4

RESTRICTED
Fit for authorisation

Safety, Health and Environmental Information
Notes below are additional to hazards/risks normally associated with this type of work:

See drawing CRK1-XRL-U-DDA-C101-00056

These notes are based on the use of experienced and competent contractors carrying out the work using an approved safe method of working.



Proposed Ticket Hall	LU Tunnel	Archaeology sample area - burials
Proposed Utility Corridor	Existing Sub-station	Exhumation contractor - in-situ burials
Queen Victoria Tunnel	Railway Tavern Public House	Exhumation contractor - disarticulated remains (whole site)
LU structure	Proposed Sewer Shaft Targeted watching brief	5m buffer zone around below ground assets (QVT & Sub-station) - Final areas for investigation

Size of areas

① 50.03 sq m	⑪ 97.42 sq m
② 48.66 sq m	⑫ 19.78 sq m
③ 48.94 sq m	⑬ 42.25 sq m
④ 43.14 sq m	⑭ 40.74 sq m
⑤ 16.12 sq m	⑮ 40.97 sq m
⑥ 44.52 sq m	⑯ 41.12 sq m
⑦ 41.43 sq m	⑰ 31.96 sq m
⑧ 41.56 sq m	⑱ 132.14 sq m
⑨ 41.74 sq m	
⑩ 117.03 sq m	

Phasing

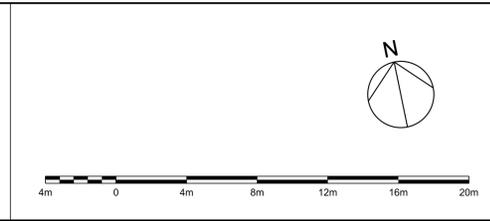
- Section 1 - Phase 1 to be excavated first
- Section 2 - Phase 2
- Section 3 - Phase 2
- Section 4 - Phase 3 to be excavated during construction of utilities corridor
- Section 5 - To be confirmed

Note: These sample areas relate to burials only

Rev.	Date	Description	By	Chkd	App	Auth
P01	12/07/2011	First Issue				
C01	15/07/2011	Issued as Fit for authorisation				

Notes

- Confirmation of all survey data must be obtained from the Crossrail survey team.
- Coordinates to the London Survey Grid, heights to the London height datum which is 100 metres below Ordnance Datum Newlyn. See Crossrail standard CR-STD-010.
- All dimensions are in metres unless specified otherwise.



 Crossrail Limited 25 Canada Square Canary Wharf London E14 5LQ	Contract: Crossrail Line 1 Programme	By: H.CASEY CHK: M.HOPPER App: S.SHEPHERD Auth: K.WHITE
	Originator: Crossrail Technical	Location: Liverpool Street Stn
Title: Liverpool Street - Eastern Ticket Hall Archaeology Areas for Exhumation Contractor and C257 Archaeology Contractor	Scale: 1:200@A1	Drawing and CAD file No: CRL1-XRL-U-DDA-C101-00170
www.crossrail.co.uk	Rev: C01	Suitability: S4

Copy Approved for Design - Created: 15-JUL-2011

RESTRICTED