



C502 Liverpool Street Station SS-WSI Addendum for Archaeological Excavation and Watching Brief at the Broadgate Ticket Hall (XSM10)

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Executive summary

This document (SS-SWI addendum) provides details of the scope, specification and programme for archaeological investigation required to mitigate the impact of Crossrail construction works at the Broad gate Ticket Hall (Liverpool Street).

Archaeological remains requiring investigation and removal from the site broadly comprise:

- Cemetery deposits and human remains associated with the 16th and 17th century Bedlam Burial Ground (aka The New Churchyard)
- Post-Roman and Medieval deposits
- Roman period deposits overlying the natural river terrace gravels

The Principal Contractor is C502 (Laing O'Rourke) who will undertake the civil engineering works and enable the archaeology investigations. The Employers' Archaeology Contractor is C257 (MOLA) who shall provide the specialist resources for the investigations. C502 shall appoint an Exhumation Contractor (to be appointed) as a sub-contractor to remove a proportion of previously disturbed human remains and human remains within the pile lines, and receive human remains excavated by C257 for reburial.

The overall framework within which archaeological work will be undertaken is set out in the Environmental Minimum Requirements (EMR) for Crossrail. Accordingly the nominated undertaker or any contractors will be required to implement certain control measures in relation to archaeology before construction work begins.

The strategy for archaeological works is set out in the Crossrail Generic Written Scheme of Investigation (WSI) (Document No. CR-PN-LWS-EN-SY-00001). The Generic WSI presents the strategy for archaeology design, evaluation, mitigation, analysis, dissemination and archive deposition that will be adopted for the design and construction of Crossrail and provides a general statement of objectives, standards, and structure for the planning and implementation of archaeological works.

This document has been prepared as an *addendum* to the Site-Specific Written Scheme of Investigation (Document No. C138-MMD-T1-RST-C101-00001 Rev. 3.0) that has been provided previously to the Principal Contractor and Employers archaeology contractor. The addendum specifically addresses the revised construction programme and revised phasing of archaeological works resulting from a series of construction review meetings held in 2013 and 2014. This document supersedes previous SS-WSI addendums relating to the Broadgate Ticket Hall.

The addendum is also informed by the result of archaeological mitigation that has recently been completed for enabling works undertaken by C503 and others in the vicinity (C257-MLA-T1-RGN-CRG03-50014; C257-MLA-X-XCS-CRG02-50015, Rev. 2 and C257-MLA-X-RGN-CRG02-50064, Rev. 2).



1 Background

1.1 Construction impacts

1.1.1 Construction of the Broadgate Ticket Hall will require the creation of a secant piled station box and access to Crossrail platforms within the carriageway of Liverpool Street. All archaeological remains within the footprint of the station box shall be completely removed. Archaeological deposits within areas required for urban realm works and higher level station entrance works maybe partially removed.

1.1.2 Specific construction impacts on the archaeological resource include:

- Demolition of the existing LU sub-station and part of the Queen Victoria Tunnel may disturb archaeological deposits (potentially including re-deposited human remains) and features of non-listed built heritage interest. Built Heritage recording of these features has been completed (Doc. No. C257-MLA-T1-RGN-C101-50001).
- Excavation for piling guide walls (c. 2.0m width and 1.5m in depth from ground level) for the Broadgate Ticket Hall box will remove disarticulated human remains (to be recovered by C502 Exhumation Contractor).
- Prior to drilling of construction piles within the area of the New Churchyard/ Bedlam burial Ground the area shall be cleared of human remains by the C502 Exhumation Contractor.
- Drilling of 1.25m and 0.75m diameter construction piles (screw auger method) shall remove Post-Roman and Medieval deposits and Roman period deposits. Any significant artefacts that are observed in the pile arising soils will be retained by C502, a note made of the location of the find, and finds and location data handed over to C257 MOLA.
- Bulk Excavation for construction of the Broadgate Ticket Hall will completely remove archaeological deposits within its footprint of Roman, medieval and post-medieval date including human remains within the New Churchyard/ Bedlam burial ground (BG208).
- Ground reduction for urban realm works to a depth of 1.5m below existing ground level outside of the Broadgate Ticket Hall will partially remove archaeological deposits including post-medieval deposits post-dating closure of the New Churchyard/ Bedlam burial ground in the mid. 18th century.

1.2 Summary of previous archaeological investigations

1.2.1 In 1985, archaeological excavations for the Broadgate Centre (Museum of London code: LSS85) immediately north of the Crossrail site recorded burials which had survived the construction of Broad Street railway Station in the 1860s. The excavation trench was located under what had been the taxi cab ramp immediately in front of the station building itself.

1.2.2 Within the main excavation trench over 400 partial or complete burials were investigated at a density of up to 8 No. per m³ of ground. 200 more came from further test-pits in the area.



- 1.2.3 More recent excavations for local utility works have continued to confirm the presence of human remains within the Broadgate Ticket Hall site (Museum of London codes: LVB06 and XRF09).
- 1.2.4 An archaeological site evaluation for the Crossrail works in Liverpool Street commenced in early 2011. Those investigations confirmed the presence of a sequence of archaeological deposits comprising significant Roman period extra-mural activity, post Roman and medieval deposits, and the well preserved deposits of the post-medieval New Churchyard/ Bedlam burial Ground.
- 1.2.5 Mitigation works and watching briefs have been completed during the C503 Enabling Works contract during 2012 and 2013 reconfirming the evaluation results during excavation for utility diversions and creation of a new utility corridor structure on the south side of Liverpool Street.
- 1.2.6 Table 1 summarises the archaeological investigations completed to date and relevant report references. The results of these investigations are summarised in Section 1.3 and the locations of the previous works and surviving archaeology are shown on drawing CRL1-XRL-U-DDA-C101-00181 at Appendix A.

Event	Date of Event	Archaeological Report Doc. No.
General Watching Brief on trial pits at Railway Tavern	07/03/11	C257-MLA-X-RGN-CRG02-50064, Rev. 2
Evaluation Trenches 5, 6 and 9 within Liverpool Street	20/02/10 to 14/03/11	
Evaluation Trenches 1, 2, 7 and 13.	07/03/11 to 27/07/11	
Evaluation Pit 4, along the utilities corridor northern pile line	13/10/11 to 26/10/11	C257-MLA-X-XCS-CRG02-50015, Rev. 2
General Watching Brief utilities corridor northern pile line, including Pits 1, 2, 3, 4a, 5, 6, 7, 8, 9, 9a and 10 (preliminary ground reduction, clearance of human remains by exhumation contractor)	26/10/11 to 07/02/12	
General Watching Brief on Trench 15 within the pavement south of the UBS building (ground works trial pit)	11/01/12 to 20/01/12	
General Watching Brief SSET/UKPN utility diversions (installation of new utility ducts)	11/01/12 to 03/02/12	
Evaluation Trench 14, in the N pavement of Liverpool Street	10/02/12 to 01/03/12	
Targeted Watching Brief on utilities corridor northern pile line Pit 11, along the utilities corridor northern pile line (ground works trial pit)	08/02/12 to 19/03/12	
Excavation [and associated watching briefs], the Utilities Corridor GL1 to GL8 and GL8 to QVT	19/03/13 to 25/04/13 and 14/08/13 to	C257-MLA-T1-RGN-CRG03-50014



Event	Date of Event	Archaeological Report Doc. No.
	16/09/13	
General and Targeted Watching Brief, Area around Sewer Shaft MHS1	15/07/13 to 18/10/13	
General and Targeted Watching Brief, Sewer Shaft MHS2-100 (at the western end of the Open Cut Sewer Trench)	05/08/13 to 30/08/13	
General and Targeted Watching Brief, Open Cut Sewer	15/07/13 to 18/10/13	
General and Targeted Watching Brief, Sewer Shaft MHS2-100 (at the western end of the Open Cut Sewer Trench)	05/08/13 to 30/08/13	
General and Targeted Watching Brief, Open Cut Sewer	12/04/13 to 09/05/13	
General Watching Brief, Heading from MHS2-100 to Blomfield Street sewer	10/09/13 to 03/10/13	
General Watching Brief, demolition of Manhole X	09/12/13 to 13/12/13	
Targeted Watching Brief, Manhole MHS2	20/01/14 to 03/02/14	
Built Heritage Recording of the former Broad Street Ticket Hall and Queen Victoria Tunnel	02/12/2013 to 12/01/2014	C257-MLA-T1-RGN-C101-50001

Table 1 Previous Crossrail Archaeological Investigations at the Broadgate Ticket Hall

1.3 Site deposit model derived from previous investigations

- 1.3.1 See Figure 1 for a graphic presentation of the deposit model described below.
- 1.3.2 The sequence of deposits within the Broadgate Ticket Hall is capped by a layer of modern street surface and a made ground layer which extends to depth of 1.0 to 1.50m below the current ground surface. The depth of the made ground is variable across the site with the incremental construction, modern and historic road construction and utilities works in the 19th and 20th centuries disturbing the underlying burials.
- 1.3.3 The made ground seals 18th and 19th century dump deposits which lie between level 111.60m and 111.12m ATD with an average depth of 0.30m. This deposit may represent attempts to seal the burial ground a raise ground levels when the cemetery went out of use. A significant assemblage of worked ivory and bone was recovered from this deposit.
- 1.3.4 Significant quantities of disarticulated human remains were present in both the made ground and post-cemetery dump deposits.
- 1.3.5 The cemetery deposits are on average 1.32m thick.
- 1.3.6 Cemetery deposits including articulated human burials, occasional poorly preserved coffin evidence, and the foundations of 16th and 17th century walls and buildings, survive across the majority of the site beneath sealed by the 18th and 19th century dumping and made ground. Burials are present between level 111.52m and 109.45m



- ATD, but the upper level of the burials varies across the site. To date the surface of the burial ground has been recorded between level 111.52 and 110.50 m ATD.
- 1.3.7 In MHS2-100 an anomalous group of early burials were recorded between level 109.03 and 108.87m ATD. This was the only occurrence of burials interred at such a depth.
 - 1.3.8 There is an average of 3.65 burials per m³, which equates to an estimated 3141 burials surviving within the footprint of the Broadgate Ticket Hall (Areas 1, 2, 3 and 5 see Appendix A Drawing No. BTH-SKE-004).
 - 1.3.9 Underlying the cemetery level is a layer of dumped soil which has been interpreted as a foundation deposit laid down to level the area for the new burial ground in the mid-16th century. This deposit has been recorded across the site between an average level of 110.42m and 110.22m ATD.
 - 1.3.10 A successive sequence of Post-Roman dumping and medieval marsh deposits are recorded between 110.22m and 109.13m ATD.
 - 1.3.11 Beneath this are a layers of Roman archaeology dated to the 1st to 4th centuries AD. Evidence for structures, drainage ditches, refuse pits, dump deposits, an extra-mural road and activity along the east bank of the Walbrook Channel which flowed beneath the current Blomfield Street has been identified between 109.74m and 107.41mATD.
 - 1.3.12 Taplow Terrace gravel, laid down approximately 128-280,000 BP (Before Present) was identified at 106.90m ATD in Trench 13 beneath a layer of alluvium. On the southern side of the Ticket Hall within the utilities corridor Terrace gravels were recorded sloping east to west into the Walbrook Valley from 108.50m ATD to 106.42m ATD. The archaeological potential of the Terrace Gravel deposits is considered to be very low.
 - 1.3.13 Table 2 provides the burial ground levels and extrapolated estimates and Table 3 the average depths of the full archaeological sequence as it is currently understood.
 - 1.3.14 When using the height information presented in Table 3 it should be noted that the post-medieval burials cut the surface of earlier deposits e.g. the pre-cemetery consolidation layer (surface at 110.42m ATD) to a depth of up to 108.87m ATD.

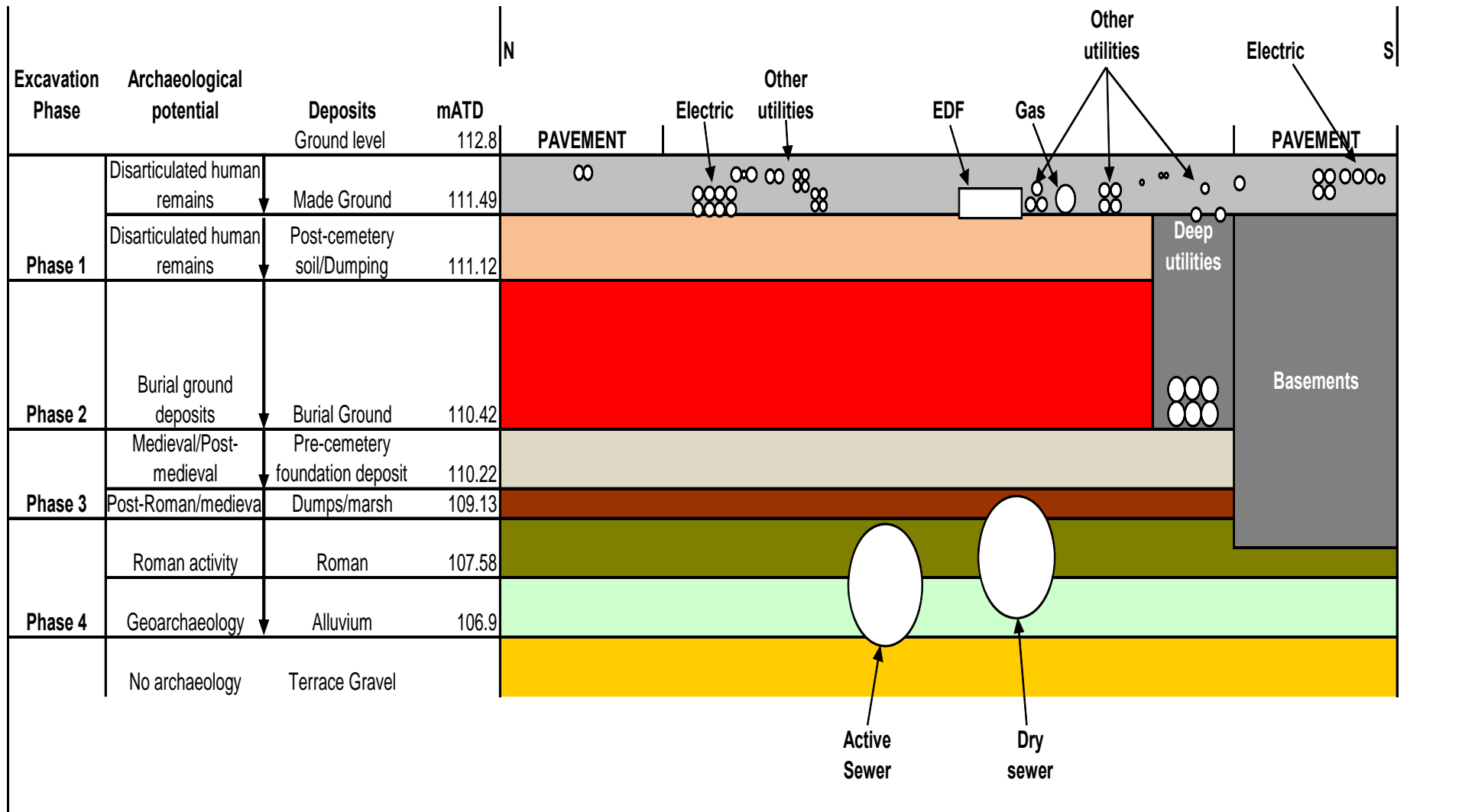
Trench/Excavated area	Length (m)	Width (m)	Surface area (m2)	Ground level (mATD)	Trench base level (mATD)	Trench depth (m)	Surface of burials (mATD)	Base of burials (mATD)	Cemetery thickness (m)	No. Burials excavated	Volume of spoil in burial layer (m3)	Burials per m3
1	4.31	2.96	12.75	112.28	107.32	4.96	110.7	109.45	1.25	64	15.94	4.02
2	6.45	2.83	18.28	112.29	106.66	5.63	111.19	109.83	1.36	66	24.85	2.66
5	3.41	2.33	7.94	112.52	107.62	4.90	-	-	-	-	-	-
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	63	11.01	5.72
9	2.26	2.22	5.00	112.71	110.90	1.81	111.12	-	-	-	-	-
13	2.10	2.53	5.30	112.76	106.90	5.86	111.46	110.02	1.44	22	7.63	2.88
14	1.90	1.80	3.42	113.30	110.10	3.20	111.3	110.00	1.30	24	4.45	5.40
Pit 4	6.00	2.00	12.00	112.32	109.62	2.70	111.07	109.66	1.41	62	16.92	3.66
Pit 10	2.30	1.75	4.03	112.91	106.30	6.61	111.11	109.71	1.40	-	5.64	-
MHS1	11.20	8.60	96.32	112.32	106.25	6.07	110.5	108.87	1.63	17	157.00	0.11
MHS2-100	3.50	3.50	12.25	113.00	107.35	5.65	111.15	110.20	0.95	55	11.64	4.73
Totals	-	-	196.61	-	-	-	-	-	-	373	255.07	-
Averages	-	-	-	112.63	-	-	111.12	109.76	1.32	-	-	3.65

Full sequence excavated

Table 2 Burial Ground Data

Layer	Average surface elevation (mATD)	Average base elevation (mATD)	Archaeological potential
Street level	112.64 to 112.28 (113 to 112.28)		n/a
Basement level (within utilities corridor)	111.5	109.5	n/a
Made ground	Ground level	111.49	Disarticulated human remains
Post-cemetery dumping & disturbed cemetery deposits	111.49	111.12	Disarticulated human remains
Burial ground (Av. thickness 1.32m)	111.12	109.74	In situ burials
Pre-cemetery consolidation layer	110.42	110.22	Yes
Marsh deposits	110.22	109.13	Geoarchaeology
Roman deposits	109.13	107.58	Roman archaeology
Alluvium	107.58	106.9	Geoarchaeology
Terrace gravel	106.9		None

Table 3 Depths of Archaeological Deposits



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.

Figure 1 Archaeological sequence – facing east

2 Aims and Objectives

2.1.1 The objective of the archaeological investigation is to mitigate the impact of constructing the new Crossrail Broadgate Ticket hall on the archaeological resource through a programme of archaeological investigation, recording, analysis and dissemination in accordance with the Crossrail Generic WSI (document number CR-PN-LWS-EN-SY-00001) and the standards listed therein. The programme of archaeological investigation will comprise archaeological excavation and general watching brief.

2.2 General aims of the archaeological investigation

2.2.1 Previous archaeological investigation has confirmed that the following archaeological sequence survives within the Broadgate Ticket Hall site:

- Roman remains associated with extra-mural land-use including a roadway, water channel management and occupation activity
- Post-Roman and medieval alluvial deposit accumulation associated with the Moorfields Marsh (devoid of structures and other specific occupation evidence)
- Post-medieval cemetery deposits of the New Churchyard/ Bedlam burial ground
- Post-medieval remains associated with the development and urbanisation of the area following the closure of the cemetery including structural evidence and fly tipping

2.2.2 The programme of archaeological work aims to achieve a detailed recording and sampling of all phases of natural and manmade activity sufficient to understand the extent, form, date, character, historical significance and regional and international context of the remains.

2.2.3 The fieldwork shall be followed by a phase of post-excavation assessment and analysis leading to an updated project design for publication, dissemination and archiving of the results in a range of formats.

2.2.4 The post-excavation assessment for the current archaeological excavation should reassess the results arising from the 1985 Broadgate Centre excavation (LSS85). The records of the earlier LSS85 excavation may provide further insights into the development, use and spatial management of the Newchurch Yard/Bedlam burial ground or highlight methodological advances made since the 1985 excavation.

2.3 Site specific research objectives

2.3.1 The general archaeological research objectives for the Broadgate Ticket Hall are set out in Section 4.1 of the SS-WSI (Crossrail 2011; Document No. C138-MMD-T1-RST-C101-00001). The results of previous phases of archaeological investigation have enabled the original aims and research objectives to be reviewed and updated. This is not an exclusive list and further objectives may be added to the Archaeology Contractors fieldwork method statement and/or be identified during the works.

Roman and medieval

2.3.2 RM 1 Investigate the natural topography and geomorphic development of the site prior to human intervention

- 2.3.3 RM2 Investigate the form of the River Walbrook in its various phases, any crossing points, including any waterlaid deposits with potential for organic preservation and palaeo-environmental remains.
- 2.3.4 RM3 Determine if the ditch found in Pit 11/Trench 1 is the canalised eastern edge of the Blomfield Street Walbrook channel, and whether this feature was open into the post-Roman period.
- 2.3.5 RM4 Characterise and understand the nature, form, and dating of the different phases of Roman extra-mural activity and land use, including potential settlement occupation and date of any building remains and the function and date of drainage features and how they relate to the Walbrook and Moorfields Marsh.
- 2.3.6 RM5 Determine the structure, form, phasing and dates of use of the probably Roman road alignment continues across the site and, if so, how it relates to other Roman activity within the area.
- 2.3.7 RM6 Are there any further primary Roman burials within the site area? How do apparently primary context deposits of human skulls and cremation deposits recovered from the west of the site relate to re-deposited human remains recovered from parts of the site? What can the human remains tell us of the lives of individual Londoners in the Roman period?
- 2.3.8 RM7 Investigate the character, extent and date of the Moorfields Marsh deposits in this area. Do the marsh deposits represent a continual process of flood inundation from the post Roman period through the medieval period? Can this process be accurately dated? What evidence is there for land stabilisation and agricultural use/refuse disposal in the medieval period?
- 2.3.9 RM8 What evidence is there for reclamation of the area in the medieval or post medieval period?

New Churchyard/ Bedlam burial ground

- 2.3.10 BB1 Characterise and date the sequence of late medieval and early post-medieval dumping and reclamation associated with the establishment of the cemetery. What evidence is there for the original boundary of the burial ground, its subsequent rebuilding and any intra site spatial organisation?
- 2.3.11 BB2 Characterise and refine the sequence and dating of burials. How was the cemetery filled up? Is there evidence for intermittent import of other soils and hiatus referred to in historic documents? Does structural evidence for the alleged pulpit survive?
- 2.3.12 BB3 Can different burial practices be defined? Use of shrouds, coffins, mass burial pits? How does it change spatially and chronologically? What indication is there for formal organisation/management and zoning? Can burial episodes be related to historic events such as documented plagues?
- 2.3.13 BB4 Is there a zone of multiple or pit burials in the northern part of the site around Trenches 13 and 14, and the 1985 excavations?
- 2.3.14 BB5 What date did the cemetery go out of use and how was the site prepared for subsequent re-use as gardens and then development? Can the gradual encroachment of Georgian buildings and plots in the 18th century be phased and dated?

- 2.3.15 BB6 Can gravestones or marker/ledger slabs provide evidence which will identify individuals, and can these be correlated with documentary sources?
- 2.3.16 BB7 What evidence is there for coffin use, construction type, furniture and coffin plates? Although preservation of these has been shown to be poor what use of specialist recovery methods and scientific testing could be applied?
- 2.3.17 BB8 How can osteology studies be used to describe the population of the burial ground and what scientific samples should be taken to determine the role of various pathogens particularly in relation to potential plague victims?
- 2.3.18 Can scientific sampling of soil samples be used to illuminate any of the other research objectives?
- 2.3.19 BB9 Can skeletal evidence, injury, or other indicators be correlated with biographic details derived from burial records?
- 2.3.20 BB10 Can the skeletal evidence be correlated with burial records found during the Bedlam Burial Record Project to build a picture of the population of the cemetery as a whole and establish chronological trends during the use of the cemetery relating to parish origin, age and cause of death, gender, social, occupation, and religious belief profiles etc.?

Other post-medieval

- 2.3.21 PM1 What is the date and taphonomy of deposition of the important worked bone assemblage? For example, do these fly tipping deposits post date the cemetery deposits, or do they represent intermittent deposition during and after the use of the cemetery?
- 2.3.22 PM2 Can any spatial and chronological patterns of the different types of bone artefact be identified in different parts of the site?
- 2.3.23 PM3 Can documentary research identify evidence for activities and industries in the surrounding area that are likely represented by waste materials dumped in the cemetery?
- 2.3.24 PM4 How was the burial ground location treated in the Georgian and Victorian eras with reference to the character and date of structural remains relating to 18th and 19th-century urbanisation and development?



3 Scope of Works

3.1 Outline sequence

- 3.1.1 The scope of exhumation and archaeological works required to deliver the C502 Main Works Contract is summarised in Table 4 and on drawing BTH-SKE-004 (Appendix A).
- 3.1.2 **Pile lines A-F and G** shall be cleared of human remains by the C502 Exhumation Contractor in accordance with the conditions of an exhumation license issued by the UK Government Ministry of Justice. This work shall be monitored by archaeology contractor C257 under a general watching brief. In the event that artefacts are recovered or evidence for structures, burial vaults or particularly well preserved coffin parts, these will be retained and recorded by C257.
- 3.1.3 The secant piled Broadgate Ticket Hall box is split into four areas for further exhumation works and archaeological excavation.
- 3.1.4 C502 Exhumation Contractor shall remove all disarticulated human remains from **Areas 1, 2, 3, 5 and 6** in accordance with the conditions of an exhumation license issued by the UK Government Ministry of Justice. This work shall be monitored by archaeology contractor C257 under a general watching brief. In the event that artefacts are recovered or evidence for structures, burial vaults or particularly well preserved coffin parts, these will be retained and recorded by C257. The remaining sequence of archaeological deposits in Areas 1, 2, 3, and 5 between the New Churchyard/ Bedlam burial ground and the Taplow Terrace gravels will then be subject to detailed excavation by the C257 Archaeological Contractor supported by the C502 Principal Contractor.
- 3.1.5 The archaeological excavation of Area 5 will be completed to two different depths. The western two thirds of the area will be excavated to a depth of 3.0m below ground level (BGL), with archaeological remains below this depth being preserved in situ. The eastern third of the area will be excavated to the base of the archaeological sequence at a depth of c. 6.0m BGL.
- 3.1.6 The phasing of works for Area 5 and Areas 1 to 3 will be as follows:
- Phase 1: Excavation of upper 1.10m of tarmac, concrete and made ground by the C502 Principal Contractor and Exhumation Contractor, followed by excavation of c.0.30m of post-cemetery deposits containing disarticulated human remains by the C502 Principal Contractor and Exhumation Contractor to the surface of in situ burials under a GWB by the C257 Archaeological Contractor
 - Phase 2: Archaeological excavation of cemetery deposits by the C257 Archaeological Contractor between c.111.52 and 108.87m ATD (40% of each area using Method 1 detailed excavation and retention of human remains by C257 Archaeological Contractor, 60% of each area Method 2 archaeological excavation and assessment of in situ burials prior to transfer of human remains to the Exhumation Contractor for reburial)
 - Phase 3: Archaeological excavation (machine aided using plant provided by the C502 Principal Contractor) of post-Roman deposits between an average depth of c.110.42 and 109.13m ATD
 - Phase 4: Archaeological excavation by the C257 Archaeological Contractor of Roman and pre-Roman (Walbrook) deposits between an average depth of c.109.13m ATD and the surface of underlying terrace gravels at c.106.90m ATD



- 3.1.7 A summary of the phasing and contractor responsibilities for the Broadgate Ticket Hall works is provided in Figure 2 below.
- 3.1.8 Two further areas of the Liverpool Street worksite have been defined and will be subject to archaeological works:
- Area 4 located outside of the Broadgate Ticket Hall box comprises an area in which hard landscaping and utilities works will be undertaken (to maximum of 1.5m BGL) to complete the public realm works. Removal of disarticulated human remains during these works shall be undertaken by the C502 Exhumation Contractor in accordance with the conditions of an exhumation license, under a GWB by the C257 Archaeological Contractor
 - Area 6 (part station entrance escalator box) comprises the former LSS85 archaeological Trench 7 which was backfilled with a mix of disarticulated human bone and concrete. This will be broken out by the C502 Principal Contractor and human remains removed by the Exhumation Contractor in accordance with the conditions of an exhumation license, under a GWB by the C257 Archaeological Contractor



GROUND LEVEL (c.113.5 – 112.25m ATD) ▽

	Depth of Excavation	Activity and Contractor Responsibility	Archaeology
Phase 1	≈ 1.100m	C502 LOR EXCAVATE WITH MACHINE C502 EXHUMATION CONTRACTOR RECOVER REMAINS C257 MOLA WATCHING BRIEF	Disarticulated Human Remains
	≈ 0.300m	C502 LOR EXCAVATE WITH MACHINE C502 EXHUMATION CONTRACTOR – REMOVE HUMAN REMAINS C257 MOLA - WATCHING BRIEF	
	UNDULATING AREA (IF REQUIRED TO BE HAND EXCAVATED UNDER C257 MOLA DIRECTION. C257 MOLA TO INSTRUCT WHEN THE TOP OF CEMETERY AND IN SITU BURIALS IS REACHED)		
Phase 2	≈ 1.500m	C257 MOLA – HAND EXCAVATE TO EXPOSE/REMOVE IN SITU BURIALS C502 EXHUMATION CONTRACTOR – SCREEN MATERIAL REMOVED AND REMOVE HUMAN REMAINS FROM SITE	In Situ Burials (Cemetery Layer)
Phase 3	≈ 1.000m	C257 MOLA –SUPERVISED EXCAVATION WITH MACHINE/SOME HAND EXCAVATION C502 LOR TO PROVIDE MACHINE PLANT	Archaeology Layers Post-Roman and Roman Deposits
Phase 4	≈ 2.000m	C257 MOLA – HAND EXCAVATION TO REMOVE ROMAN REMAINS C502 SUPPORT AS REQUIRED	

Figure 2 Broadgate Ticket Hall Exhumation and Archaeology Works Summary – Approximate Excavation Depths and Contractor Responsibility from Ground Level



Site Area	C502 Construction Activity	C257 Archaeological Investigation	Provisional Start Date
Pile lines A-F and G	Mechanical excavation of Ticket Hall box pile lines (A-F) and I&M pit for TW Sewer (G). Exhumation contractor to remove human remains.	<ul style="list-style-type: none"> General Watching Brief (GWB) during clearance of the pile lines by the C502 Exhumation Contractor. To a depth of 3.0m BGL. 	July 2014
Area 5	Excavation of station escalator box. Depth of excavation required for construction limited to 3.0m below ground level on western side of this area.	<ul style="list-style-type: none"> GWB during excavation of post-cemetery deposits containing disarticulated human remains by the C502 Principal Contractor and Exhumation Contractor to the surface of in situ burials. Archaeological excavation of cemetery deposits, post-Roman marsh deposits and Roman deposits. 	September 2014
Area 6	Break-out and Mechanical excavation of bone and concrete mix filling former LSS85 TP-7.	<ul style="list-style-type: none"> GWB during clearance by C502 Exhumation Contractor. 	September 2014
Areas 1, 2 and 3	Excavation of main ticket hall box.	<ul style="list-style-type: none"> GWB during excavation of post-cemetery deposits containing disarticulated human remains by the C502 Principal Contractor and Exhumation Contractor to the surface of in situ burials. Archaeological excavation of cemetery deposits, post-Roman marsh deposits and Roman deposits. 	5th January 2015
Area 4	Mechanical excavation and ground reduction of the area to northwest of ticket hall to a depth of 1.5m below existing ground level.	<ul style="list-style-type: none"> GWB during ground reduction and clearance by the C502 Exhumation Contractor. 	2016

Table 4 Scope of Archaeological Works

3.2 Event Code

3.2.1 The existing Site Code **XSM10**, allocated by the Museum of London for Crossrail archaeological works at the Broadgate Ticket hall will be used for all stages of the archaeological works. Sub areas defined in the contract drawings shall be used as appropriate in the excavation records.

3.3 Interfaces

3.3.1 The Principal Contractor will have the following key interfaces for the specialist archaeological works:

C257 Archaeology Contractor: Museum of London Archaeology (MOLA)

Contract Manager: Nick Elsdon

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

Site based Project Officer – tbc



C502 Exhumation Contractor – TCS Exhumations Ltd Contractor

Contract Manager - Stephen Randall

T. 0208 709 1877 M: 07836 312405

Site based Foreman - Jason Lyons

Employer's Archaeologist:

Jay Carver – Crossrail Project Archaeologist

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

Iain Williamson – Crossrail Assistant Project Archaeologist

M: 07770 825565 | E: iainwilliamson@crossrail.co.uk



4 Instructions to C502 Principal Contractor and Specification

- 4.1.1 Prior to the start of the programme of archaeological works the C502 Principal Contractor will undertake the review and acceptance of the C257 Archaeological Contractor's Method Statement.

4.2 Excavation of pile lines (Areas A – F and Area G)

- 4.2.1 The area to be investigated comprises the footprint of the piled lines as shown on drawing BTH-SKE-004 at Appendix A. This includes a 500mm buffer extending from the outside of the eastern and northern pile wall to mitigate the impact of guide wall excavation. The pile lines will be cleared to a depth of c.3.0m below ground level.
- 4.2.2 Guide walls are anticipated to extend 500mm from the outside edge of the piles and maximum 1.5m below existing ground level.
- 4.2.3 In order to enable the exhumation of disarticulated human remains and in situ burials from the pile lines the C502 Principal Contractor will breakout and machine excavate the current tarmac and concrete road surface prior to the start of works.
- 4.2.4 During the excavation of the pile lines the C502 Principal Contractor will also facilitate the archaeological GWB to be undertaken by the C257 Archaeology Contractor.
- 4.2.5 Upon completion of the GWB the C257 Archaeology Contractor will issue a signed completion form countersigned by the Employers Archaeologist to the C502 Principal Contractor.
- 4.2.6 The specification, general attendances and facilities to be provided by the C502 Principal Contractor during these works are set out below.

4.3 Excavation of the Ticket Hall Box (Areas 1-3 and 5)

- 4.3.1 As set out in Section 3 of this SS-WSI Addendum the Ticket Hall box will be excavated in phases using a top down method. The Ticket Hall box has been split into four areas (Areas 1, 2, 3 and 5) as set out on drawing BTH-SKE-004 at Appendix A and detailed below.
- 4.3.2 With the exception of Phase 1 the archaeological excavation will be undertaken in two 8hr shifts per day (7am – 3pm Shift 1 and 3pm-11pm Shift 2) Monday to Saturday.
- 4.3.3 The sequence of the archaeological excavation areas will begin with Area 5 in advance of Areas 1, 2 and 3. After the completion of Area 5 the excavation will prioritize Areas 2 and 3 together followed by Area 1. The excavation of Area 1 may have a slight overlap with Areas 2 and 3 or be undertaken independently.
- 4.3.4 It is anticipated that excavation can proceed to the base of cemetery deposits at a depth of c.3.0m below ground level without a requirement for propping to be installed. The depth at which it is anticipated propping will be installed in each area is:
- Area 1 – excavation to c.110.30m ATD (c.3.0m bgl) at which point propping will be installed
 - Area 2 and 3 – excavation to 106.30m ATD (c.6m bgl) without propping
 - Area 5 - excavation to c.110.30m ATD (c.3.0m bgl) without propping. Excavation below this depth will require temporary works to be installed

- 4.3.5 Details of the temporary works to be supplied will be confirmed by the C502 Principal Contractor.

Phase 1 exhumation and archaeological GWB

- 4.3.6 The C502 Principal Contractor will remove the current tarmac and concrete road surfacing and recent made ground to a depth of approximately 1.10m under a watching brief by their Exhumation Contractor.
- 4.3.7 The C502 Principal Contractor will then facilitate the removal of post-cemetery dump deposits by the Exhumation Contractor and under a GWB by the C257 Archaeological Contractor from each excavation area to the predicted surface of cemetery deposits.
- 4.3.8 The post-cemetery dump deposits vary in depth but are on average c. 0.30m thick. The surface of the cemetery deposit is present at an average height of 111.12m ATD (average depth of 1.5m below ground level). The surface of the cemetery does vary with the highest level identified as being 111.52m ATD. As a result it may be necessary for the C502 Principal Contractor and Exhumation Contractor to hand excavate under the supervision of the C257 Archaeologist the final 50mm of loose disarticulated material to expose in situ burials.
- 4.3.9 Disarticulated human remains identified in the recent made ground and post-cemetery dump deposits will be removed, stored securely and transported from the site by the Exhumation Contractor.
- 4.3.10 The surface of the cemetery deposits will be identified by the C257 Archaeologist and exhumation works will cease at this level or if in situ burials are observed.
- 4.3.11 Once the surface of the cemetery deposits is reached the C502 Principal Contractor will ensure that the Exhumation Contractor has completed their works across the entire footprint of each area prior to approving handover to the C257 Archaeological Contractor for the Phase 2-4 archaeological excavation.

Phase 2 archaeological excavation of burial ground deposits

- 4.3.12 In each of the areas defined (Areas 1, 2, 3 and 5) the C502 Principal Contractor will facilitate the archaeological excavation of the cemetery deposits (present from c.111.52m to a maximum recorded depth of depth of 108.87m ATD) by the C257 Archaeology Contractor supported by the Exhumation Contractor.
- 4.3.13 The C257 Archaeological Contractor will employ two methods of archaeological excavation. Within in each area 40% of the cemetery deposits will be subject to detailed excavation (Method 1) to the base of the burial ground (at an average depth of c. 109.76m ATD) to specification set out in this document and the approved C257 Method Statement (forthcoming). Method 1 will provide the required archaeological sample with burials removed from site for further analysis by the C257 Archaeological Contractor.



- 4.3.14 The remaining 60% of each area will be excavated by the C257 Archaeology Contractor to the base of the burial ground (approximately 109.03m ATD) using excavation Method 2 as detailed in this addendum and the approved C257 Method Statement (forthcoming). During the 60% Method 2 excavation the C257 Archaeology Contractor will assess on site which burials will be retained for further study. Those burials not selected will be bagged, securely stored and transferred to the Exhumation Contractor for transport from the site to the place of reburial in accordance with the conditions of MOJ Licence No. 11-0110.
- 4.3.15 During the excavation of the burial ground the C502 Principal Contractor will provide technical support, plant, spoil removal, sight screens, welfare and attendances set out in the specification below and will facilitate the recording and removal of the burial ground deposits and following features by the C257 Archaeology Contractor should they be identified:
- the remains of the pulpit that stood within the burial ground and mentioned in documentary sources
 - in situ remains of surface structures within and associated with the use of the burial, this may include boundary walls, monuments, grave stone and statuary, or ancillary buildings and cemetery infrastructure
 - further below ground structures such as crypts or vaults such as the Jenkes family vault recorded during the 1985 excavation of LSS85 Trench 7

Phase 3 and 4 archaeological excavation

- 4.3.16 Following the removal of cemetery deposits from each excavation area by the C257 Archaeology Contractor, the C502 Principal Contractor will facilitate the further excavation of post-Roman and Roman archaeological deposits by the C257 Archaeology Contractor to the surface of the underlying Taplow Terrace gravels at approximately 106.90m ATD. The maximum level of Phase 4 excavation without propping is 106.40m ATD.
- 4.3.17 The excavation of the post-Roman deposits between approximately 110.42m and 109.13m ATD will be aided by mechanical excavator as required/requested by the C257 supervising archaeologist.
- 4.3.18 The post-Roman and Roman deposits pre-date the establishment of the New Churchyard/Bethlehem burial ground so attendances by the Exhumation Contractor are not anticipated to be required during this phase of the excavation.
- 4.3.19 During Phases 3 and 4 of the archaeological excavation the C502 Principal Contractor will provide technical support, plant and spoil removal. The specification, general attendances and facilities to be provided by the C502 Principal Contractor during these works are set out below.
- 4.3.20 Upon completion of each excavation area the C257 Archaeology Contractor will issue a signed completion form countersigned by the Employers Archaeologist to the C502 Principal Contractor.

Ground reduction outside the Ticket Hall Box and escalator shaft (Area 4)

- 4.3.21 The C502 Principal Contractor will undertake hard landscaping and utilities works within Area 4 located outside of Ticket Hall box (see drawing BTH-SKE-004 at Appendix A) to a maximum depth of 1.50m below the existing ground level.

- 4.3.22 Works in this area may require the removal of the extant tarmac and concrete road surface prior to the removal of the underlying made ground and post-cemetery dump deposits by the Exhumation Contractor. These deposits are likely to contain disarticulated human remains and the C502 Principal Contractor will facilitate a GWB by the C257 Archaeological Contractor during their removal. The GWB will enable the investigation and recording of any archaeological remains associated with the burial ground or post-cemetery development which survive within the area.
- 4.3.23 Upon completion of the GWB the C257 Archaeology Contractor will issue a signed completion form countersigned by the Employers Archaeologist to the C502 Principal Contractor.
- 4.3.24 The specification, general attendances and facilities to be provided by the C502 Principal Contractor during these works are set out below but will be confirmed in the forthcoming Archaeological Method Statement prepared by the C257 Archaeological Contractor.

4.4 Specification

- 4.4.1 For all stages of the exhumation and archaeological works the C502 Principal Contractor will develop with the Exhumation Contractor a method of working in accordance with the conditions of Exhumation Licence 11-0110 issued by the Ministry of Justice and the requirements of the local Environmental Health Officer (EHO). The methodology will ensure that human remains are treated with all due care and respect throughout and make provision for:
- the on-site screening of soil arising from excavations the safe and secure on-site storage of human remains screened from public view until their removal from site
 - the recording the minimum number of individuals removed, chain of custody/transfer and proof of receipt by the Exhumation Contractor during transportation of human remains from the site to the final place of reburial

4.5 Excavation of pile lines (Areas A – F and Area G) and Area 4

- 4.5.1 Archaeological investigation by General Watching Brief is defined in the Generic WSI (Crossrail 2008b; Document No. CR-PN-LWS-EN-SY-00001).
- 4.5.2 The C502 Principal Contractor will work with the Exhumation Contractor and C257 Archaeological Contractor to ensure that the necessary controls are implemented in order to allow archaeological recording to take place to the required standard.
- 4.5.3 The method of working for the C502 Principal Contractor and Exhumation Contractor during those activities requiring GWB and TWB shall allow for:
- the issuing of all required permits to dig
 - safe access/egress for C257 archaeological operatives into the site compound and provide any required temporary works and safe viewing area to facilitate this
 - the design and provision of temporary works to support excavations for personnel access to the investigation by all operatives, e.g. sheet piling and shoring
 - the use of excavators or other plant within the area shall only be undertaken with the agreement of and under the observation of the C257 Archaeology Contractor

- provide safe access where appropriate to the C257 archaeologist to rapidly hand clean, record and take samples if necessary, of the stratigraphic sequence of deposits visible in soil profiles, if it can be made safe to do so
- for all works involving the exposure or exhumation of human remains provide appropriate hoardings/sight screens that prevent public observation of the works
- where works involve the exposure of or exhumation of human remains, an all-weather roof or covering for the exposed area to prevent public observation of the works should be provided that is:
 - large enough to allow safe working
 - waterproof
 - translucent (to provide sufficient light)
 - be of a type that can be quickly erected and removed/retracted to facilitate access for plant when required
- in the event that archaeological remains are encountered and these require hand excavation and recording, the area surrounding the remains should be demarcated by a safe barrier (e.g temporary fencing) in order to provide a safe working area for the C257 archaeologists and control plant tracking over any exposed archaeology
- allow adequate time for any surviving archaeological remains to be investigated and recorded. The duration of any archaeological investigation and recording required may vary dependant on the density and complexity of archaeological remains present. This will be instructed by the Project Manager following discussion with the Employers archaeologist, C502 Principal Contractor, C257 Archaeologist and Exhumation Contractor
- provide further technical advice to C257 Archaeological Contractor and Exhumation Contractor as maybe required to safely complete the works
- manage safety and inter alia provide regular toolbox talks, task briefings for all site staff
- provide traffic management measures that may be required for the works
- provide site security in accordance with the works information

4.6 Excavation of the Ticket Hall Box (Areas 1-3 and 5)

4.6.1 During the programme of archaeological excavation the C502 Principal Contractor shall:

- clearly set out and mark each individual excavation area
- provide safe access/egress for C257 archaeological operatives into the site compound and provide any required temporary works to facilitate this
- design and provide temporary works to support excavations for personnel access to the investigation by all operatives, e.g. sheet piling and shoring
- allow suitable access/egress from ground level to the bottom of excavated areas for archaeologists to work

- the use of excavators or other plant within the area shall only be undertaken with the agreement of and under the observation of the C257 Archaeology Contractor
- design and provide appropriate plant and trained operatives to remove hand excavated spoil from excavation area (e.g. a hoist, conveyor or other appropriate method) and ensure that all equipment is regularly inspected
- provide 6 No. labourers per area per shift to assist in the removal of hand excavated spoil from each excavation area
- provide small plant and tools e.g. wheel barrows as required to complete the works
- during the **Phase 2 excavation** of the burial ground provide appropriate covering/sight screens 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)
 - be of a type that can be quickly erected and removed to facilitate access for plant when required
- provide the lighting as required (in deep excavations and if night working is required)
- provide drainage in excavations where required
- provide technical advice to the C257 Archaeological Contractor as maybe required to safely complete the works
- manage safety and inter alia provide regular toolbox talks and task briefings for all site staff and the issuing of all required permits to dig
- provide traffic management measures that may be required for the works
- provide site security in accordance with the works information
- allow for up to 40 No. archaeologists to be on site per shift

4.7 General requirements, site accommodation and facilities

General watching brief

- 4.7.1 The C502 Principal Contractor will provide and maintain the following attendances and facilities at all times (including extended working hours if necessary):
- Tool store and sample store within Liverpool Street worksite (size/No. to be confirmed in MOLA method statement)
 - Welfare, drying facilities, and canteen access for a team of up to 5 No. archaeologists
 - 2 No. desks for the duration of the archaeological excavation
 - Health and safety services for C257 and Exhumation Contractor staff

Archaeological excavation

4.7.2 During the archaeological excavation of Areas 1, 2, 3 and 5 the C502 Principal Contractor will provide and maintain the following attendances and facilities for each shift:

- Tool store and sample store within Liverpool Street worksite (to be confirmed in MOLA method statement)
- Welfare, drying facilities, and canteen access for a team of up to 40 No. archaeologists
- 4 No. desks for the duration of the archaeological excavation
- Health and safety services for C257 and Exhumation Contractor staff

Supervision and Monitoring

4.7.3 The C502 Principal Contractor will work with Crossrail to develop and implement a method for monitoring the progress of the programme of archaeological works. This may include:

- the use of daily sign in/out sheets for all C257 archaeologists and exhumation contractor staff working within the BTH worksite
- record keeping e.g. start/finish dates, staff numbers, target depths of excavation vs. actual progress, volume of estimated material vs. actual excavated material, No. of loads of spoil removed from site
- attendance of weekly progress meetings
- the provision of site inductions safe access/egress to the archaeological works for Crossrail's archaeologists
- the provision of site inductions and safe access/egress to the archaeological works for visits (to be arranged by Crossrail archaeologist) by Crossrail's stakeholders such as the City of London Historic Environment Officers and officers from English Heritage GLAAS

Media and Public Access

4.7.4 It is anticipated that the archaeological works at Liverpool Street will generate both media and public interest. In order to successfully meet the public engagement and media commitments of the Crossrail scheme during the course of the main burial ground excavation the C502 Principal Contractor will make provision for:

- a safe public viewing platform and opportunity to view works through windows in the hoardings (to be agreed with Crossrail)
- present display boards or information panels at location to be agreed (in coordination with Crossrail)
- the possible use of time lapse or delayed digital or CCTV recording and display of the archaeological excavation

- 2-3 No. media events/access days are anticipated to be arranged in liaison with CRL External Affairs Team. These may require the provision of site inductions, PPE, safe site access/egress to a viewing platform or the excavation area, staff to assist with and coordinate the event and welfare facilities for the public as appropriate to the nature of the events
- one or more archaeology public open days. These will require access/egress to a suitable viewing platform, staff to assist with and coordinate the event and welfare facilities for the public as appropriate to the nature of the event

4.8 Deliverables

4.8.1 During the programme of archaeological works the C502 Principal Contractor will be required to provide the C502 Exhumation Contractor and C257 Archaeological Contractor with the following, as and when required:

- C257 attendance records and progress reports
- survey data for Crossrail survey control points or permanent ground markers
- engineering plans and drawing which clearly illustrate the individual work areas, temporary works and relevant health and safety information

5 Instructions to C502 Exhumation Contractor and Specification

5.1 Scope

5.1.1 As set out in Table 4 the C502 Exhumation Contractor is required to undertake the exhumation and clearance of pile lines and disarticulated human remains from across the Broadgate Ticket Hall site and support the C257 Archaeological Contractor in the excavation of in situ burials from the New Churchyard/ Bedlam burial ground corresponding to the areas shown on Drawing No. BTH-SKE-004 at Appendix A.

5.2 Excavation of pile lines (Areas A – F and Area G)

5.2.1 The C502 Exhumation Contractor with work with the Principal Contractor to excavate the pile lines (A to F and Instrumentation and Monitoring Pit G) in order to remove all cemetery deposits to a depth of c.3.0m below ground level (on average to c. 109.60m ATD) in advance of piling. Table 5 summarises the estimated volume of material to be excavated.

5.2.2 During excavation of the pile lines the C502 Exhumation Contractor will also work with the C257 Archaeological Contractor enabling them to observe and record archaeological remains present under a general watching brief. This may include:

- the recording of post-medieval structures and features relating to land-use of the site following closure of the burial ground
- the recovery of worked bone and ivory known to exist within the 18th and 19th century dumped deposits.

C502 Site Area	Size (m ²)	Depth of Excavation Made Ground and Cemetery deposits (m)	Total Estimated Volume (m ³)
Pile Line A	86.0	3.0	258
Pile Line B	26.5	3.0	79.5
Pile Line C	22.2	3.0	66.6
Pile Line D	22.2	3.0	66.6
Pile Line E	7.5	3.0	22.5
Pile Line F	12.5	3.0	37.5
Area G	9.6	3.0	28.8
TOTAL	186.5	-	559.5

Table 5 Estimated Size and Volume Required for Pile Line Excavation

5.3 Excavation of the Ticket Hall Box (Areas 1-3 and 5 and 6)

5.3.1 Undertake the Phase 1 removal of made ground and post-cemetery dumped soil deposits containing disarticulated human remains prior to the Phase 2 archaeological excavation of the cemetery deposits by the C257 Archaeological Contractor. The made ground and post-cemetery dumped soils and disarticulated human remains, lie between the existing ground level and the surface of in-situ burials at an average level of 111.12m ATD. Table 6 below summarises the estimated size and volume of material to be removed in Phase 1.

C502 Site Area	Size (m ²)	Estimated Average Depth of Phase 1 soils (m)	Estimated Volume (m ³)
Area 1	146	1.5	219
Area 2	121	1.5	181.5
Area 3	307	1.5	460.5
Area 4	117	1.5	175.5
Area 5	78	1.5	117
Area 6	20	1.5	30
TOTAL	789	-	1,183.5

Table 6 Estimated Size and Volume of Made Ground and Post-Cemetery Deposits

5.3.2 Collect bagged remains (see 5.7) arising from the Phase 2 archaeological excavation of the cemetery deposits by the C257 Archaeological Contractor for transportation and safe storage prior to reburial. Screen soil arisings as required.

5.3.3 Recover, transport, and store human remains from the 1985 concrete backfill of Area 6 (see drawing BTH-SKE-004) prior to reburial.

5.4 Ground reduction outside the Ticket Hall Box (Area 4)

5.4.1 Recover, transport and rebury disarticulated human remains within made ground and post-cemetery dumped soil deposits to a depth of 1.50m below existing ground level within Area 4.

5.5 General Specification

5.5.1 An Exhumation Licence will be obtained from the Ministry of Justice by C257 Archaeological Contractor and will cover all works within the burial ground.

5.5.2 For exhumation and archaeological works the C502 Exhumation Contractor will work with the C257 Archaeological Contractor to ensure that the Exhumation Licence conditions are adhered to for the excavation, processing and reburial of human remains.

5.5.3 Prior to the start of exhumation and archaeological works the Exhumation Contractor shall design and develop with the C502 Principal Contractor a method statement that is in accordance with the conditions of Exhumation Licence and the requirements of the local Environmental Health Officer (EHO). The methodology will ensure that human remains are treated with all due care and respect throughout and make provision for interalia:

- the on-site screening of soil and separation of human remains, arising from excavation of the pile lines, Area 4 and the archaeological excavation areas shown on drawing BTH-SKE-004
- keep a record of the minimum number of individuals removed
- collection of bagged remains excavated by the C257 Archaeological Contractor during the excavation of the burial ground deposits. A method of confirming quantity received shall be included
- the safe and secure storage of human remains screened from public view until their removal from site
- the transportation of human remains from the Liverpool Street Worksite to the final place of reburial including chain of custody/transfer records and reburial proposals (for example separate plot for any named individuals or groups)
- ensure that all mechanical excavation is carried out by machine plant fitted with a smooth bladed (toothless) bucket
- ensure that the use of plant in the working area is only undertaken with the agreement of, and under the supervision the Archaeology Contractor
- in the event that intact coffins are encountered ensure that they are to be excavated, lifted, transported and stored intact and unopened
- Provide section completion certificate to C502 on completion of each Phase



- 5.5.4 Nominate a lead person for the project. The lead person will be the point of contact for and liaise with C257 MoLA for the duration of the works. The contact details of the nominated person will be supplied to C257 Contract Manager, the C502 Principal Contractor and Crossrail Project Manager.
- 5.5.5 Agree with Crossrail an appropriate burial monument marking the location of the New Churchyard/ Bedlam cemetery remains at the reburial site.
- 5.5.6 Agree with Crossrail an appropriate ceremony for the reburial of the human remains at the place of reburial.
- 5.5.7 Allow access for monitoring by Crossrail staff at all stages of the exhumation, storage and reburial process in order to ensure the remains are being afforded all due care and respect as required by the Exhumation Licence, professional standards and guidance.

5.6 Excavation of pile lines (Areas A – F and Area G)

- 5.6.1 Excavation of the pile lines by the C502 Exhumation Contractor will be carried out under a GWB undertaken by the C257 Archaeological Contractor. During the GWB the C502 Exhumation Contractor shall:
 - undertake the excavation of the pile lines from the existing ground surface to a depth of c.3m below ground level removing both disarticulated human remains and in situ burials for re-interment at an appropriate location off-site as per Exhumation Licence conditions
 - provide the C257 Archaeological Contractor a safe position from which to observe and record the excavation and exhumation works to successfully complete the GWB in accordance with the methodology defined in this SS-WSI addendum

5.7 Excavation of the Ticket Hall Box (Areas 1-3 and 5)

Phase 1 excavation of disarticulated remains

- 5.7.1 For each excavation area the C502 Exhumation Contractor will undertake the Phase 1 excavation of recent made ground and post-medieval dump deposits containing disarticulated human remains as set out Section 3 and Table 4 above. The excavation will be monitored by the C257 Archaeological Contractor.
- 5.7.2 The surface of in situ burials is variable across the site (see Table 4 above) between 111.52 and 110.50 m ATD. In order ensure in situ burials are not removed during machine excavation the removal of the final 200mm shall be undertaken only with direct supervision of C257 archaeologist. The estimated surface of the in situ cemetery deposits is summarised in Table 7 below.

Area	Surface of In Situ Burials – previously recorded (m ATD)
Area 1	111.11 to 111.46
Area 2	111.12 to 111.46
Area 3	110.50 to 111.52
Area 5	111.30

Table 7 Estimated level of in situ burials



- 5.7.3 The exhumation contractor should be aware that C257 Archaeological Contractor will only accept the handover of fully excavated and complete excavation areas reduced to the surface of the cemetery deposits between c. 111.52m and 110.50m ATD.

Phase 2 excavation of in situ burial ground deposits

- 5.7.4 The Phase 2 excavation of in situ burials and cemetery soils that comprise the New Churchyard/ Bedlam burial ground within Areas 1, 2, 3, and 5 will be undertaken by the C257 Archaeological Contractor.
- 5.7.5 60% of the surviving burial ground will be completed using excavation Method 2 by the C257 Archaeological Contractor. The bagged remains shall be handed to the C502 Exhumation Contractor for reburial in accordance with the conditions of Exhumation Licence.
- 5.7.6 Provide the C257 Archaeological Contractor with appropriate plastic bags in which to place excavated human remains. The plastic bags should be clearly distinguishable (either coloured or marked) from the clear, transparent bags used by C257 Archaeological Contractor. It is estimated that approximately 1900 bags will be required during the excavation.
- 5.7.7 Following C257 Archaeology Contractor completion of off-site analysis, the C502 Exhumation Contractor shall collect for reburial all human remains held by C257 (Quantity to be confirmed).

5.8 Excavation of Area 4

- 5.8.1 Excavation work within Area 4 will be carried out by the C502 Exhumation Contractor under a GWB undertaken by the C257 Archaeological Contractor.

5.9 Deliverables

- 5.9.1 The C502 exhumation contractor will provide a Crossrail and C257 Archaeological Contractor with a weekly report detailing the Minimum Number of Individuals recovered throughout the duration of exhumation activities at the Broadgate Ticket Hall site. This will be calculated from the number of skulls recovered.

6 Instructions to C257 Archaeological Contractor and Specification

6.1 Excavation of pile lines (Areas A – F and Area G)

- 6.1.1 Pile lines A-F and Area G (monitoring and instrumentation pit) will be excavated by the C502 Exhumation Contractor from the existing ground surface to a depth of 3.0m below ground level (on average c. 109.60m ATD). Both disarticulated human remains and in situ burials will be removed by the C502 Exhumation Contractor for reburial in accordance with the conditions of the Exhumation Licence.
- 6.1.2 The C257 Archaeological Contractor will undertake a GWB during these works in order to provide an appropriate written and photographic record of the exhumation works and surviving deposit sequence and archaeological remains known to exist across the site. This may include:
- the remains of post-medieval buildings that occupy the site after the burial ground goes out of use
 - possible cemetery structures including boundary walls, monuments or ancillary buildings
 - a record of the number and condition of any burials (e.g. named individuals), headstones, coffin plates or artefacts encountered by the C502 Exhumation Contractor requiring removal from site by the C257 Archaeological Contractor for further analysis
 - where safe and practical the excavation, recording and removal from site of burials of clearly named individuals
 - a general record of the exhumation works during clearance of the pile lines and Area G

6.2 Excavation of the Ticket Hall Box (Areas 1-3 and 5)

- 6.2.1 The main Ticket Hall box has been divided into four excavation areas (Areas 1-3 and 5 as shown on Drawing BTH-SKE-004). The excavation of the Ticket Hall box will be undertaken by the C257 Archaeological Contractor in liaison with the C502 Exhumation Contractor. Each area will be excavated in four phases as summarised in Table 4.
- 6.2.2 The C257 Archaeological Contractor will enable the excavation of the cemetery deposits and underlying archaeological deposits to be completed on programme by operating 2 No. fully staffed eight hour shifts Monday-Saturday; 7am to 3pm and 3pm to 11pm.
- 6.2.3 Area 5 will be the first to be excavated. Due to the design of the escalator shaft the excavation of some of this area will be limited to a depth of 3.0m below the existing ground level (c. 110m ATD). An area measuring c. 4.5 x 6.9m (totalling 31.05m²) requires full excavation to the underlying Taplow Terrace gravels.
- 6.2.4 Areas 2 and 3 will then be excavated concurrently. Area 1 will be the last to be excavated following completion of Areas 2 and 3.
- Phase 1 watching brief on excavation of post-cemetery deposits*
- 6.2.5 Within each area the C502 Exhumation Contractor will excavate recent made ground and post-cemetery dump deposits containing disarticulated human remains. C257

shall closely monitor this work and directly supervise the removal of the final 200mm thickness to reveal the top of in situ burials.

- 6.2.6 The anticipated average height of the surface of in situ burials by excavation area is: 111.23m ATD in Area 1, 111.25m ATD in Area 2, 111.27m ATD in Area 3 and 111.30m ATD in Area 5. See section 5 above for detailed table.
- 6.2.7 The C257 Archaeological Contractor will undertake the GWB during these works. Objectives are as per 6.1.2.

Phase 2 archaeological excavation of Bedlam burial ground

- 6.2.8 Once the excavation of recent made ground and post-cemetery deposits to the surface of in situ burials has been completed by the C502 Exhumation Contractor, excavation of in situ burials will be undertaken by the C257 Archaeological Contractor.
- 6.2.9 The cemetery soils and in situ burials have been recorded between c. 111.52m and a maximum depth of 108.87m ATD with the surface of the upper level of surviving in situ burials varying across the site between 111.52 and 110.50 m ATD.
- 6.2.10 At the start of the excavation the C257 Archaeological Contractor will ensure that the surface of the cemetery deposits is suitably clean and cleared of loose material and that the layout and distribution of the upper layer of burials is visible. This will enable the excavation strategy for the cemetery deposits to be finalised.
- 6.2.11 Excavation of each of the areas will be undertaken by two different methods (split 40-60%) in order to provide a statistically valid sample of the cemetery population and investigate key research questions whilst ensuring Crossrail's programme constraints are met.
- 6.2.12 The sub-division of each area into the composite 40% using excavation Method 1 and the 60% using excavation Method 2 will be determined following cleaning of the horizon. This will allow key features of the individual burials, the burial ground and its spatial layout and management to be identified including:
- evidence for mass grave or group burials – the LSS85 Trench 7 excavation (Area 6) and Crossrail TT9 and TT 13 suggest pit burials may be grouped along the northern side of the Ticket Hall box;
 - the remains of the pulpit that stood within the burial ground and mentioned in documentary sources;
 - in situ remains of surface structures within and associated with the use of the burial ground, this may include boundary walls, monuments, grave stone and statuary, a chapel or ancillary buildings and cemetery infrastructure;
 - the identification and recording of well-preserved coffins and named individuals;
 - the identification and recording of individuals with unusual pathologies;
 - the identification and recording of individuals buried with grave goods; and
 - further below ground structures such as crypts or vaults such as the Jenkes family vault recorded during the excavation of LSS85 Trench 7.

- 6.2.13 The C257 Archaeological Contractor will excavate 40% of the area of the Ticket Hall box using a detailed excavation methodology (Method 1) following standard techniques for the Christian post-medieval burials. All burials excavated in these areas will be retained for further off-site analysis.
- 6.2.14 Within the remaining 60% of each excavation area the C257 Archaeological Contractor will undertake the excavation of the in situ burials using Method 2. The use of Method 2 will allow standard burial information to be recorded for all the excavated burial population. An osteologist will assess each burial in situ for:
- a determination of age, sex and any visible pathologies
 - whether there is justification to retain the skeleton for further off-site recording, assessment and analysis
- 6.2.15 Those burials selected for retention will be retained and stored and assessed separately from the statistical assemblage recovered from the 40% excavation Method 1. Those burials not selected for retention and further assessment will be carefully bagged and transferred to the C502 Exhumation Contractor on site, for off-site reburial in accordance with the conditions of the exhumation licence.

Phase 3 Archaeological Excavation of Post-Roman Deposits

- 6.2.16 Once the burial ground deposits have been excavated the C257 Archaeological Contractor will excavate the post-Roman deposits comprising pre-cemetery foundation or consolidation layers, marsh deposits and evidence for medieval reclamation of the area.
- 6.2.17 Post-Roman deposits are anticipated between a height of c. 110.42 and 109.13m ATD.
- 6.2.18 The excavation of these deposits will be assisted by the use of a mechanical excavator and will ensure that where safe a practical a continuous east-west section through the stratigraphic sequence is recorded across Area 1, 2 and 3.

Phase 4 archaeological excavation of Roman deposits

- 6.2.19 Roman deposits have been recorded between c. 109.13m ATD and the surface of the Taplow Terrace gravels at c. 106.9m ATD. The maximum level of Phase 4 excavation without propping is 106.40m ATD.
- 6.2.20 The C257 Archaeological Contractor will undertake detailed excavation of the deposit sequence within each area in order to record the chronological phasing, spatial distribution and land use of Roman extra-mural occupation within the site.
- 6.2.21 Where bulk deposits are encountered the use of a mechanical excavator may be appropriate. The decision to use plant to aid the excavation of the Roman deposits will be made in consultation with the Project Archaeologist.

6.3 Ground Reduction Outside the Ticket Hall Box (Area 4)

- 6.3.1 In Area 4 the C502 Exhumation Contractor will undertake localised ground reduction within the area defined on Drawing BTH-SKE-004, between the current road surface and a depth of 1.5m below ground level (on average to c.111.10m ATD). Both disarticulated human remains and in situ burials will be removed by the C502 Exhumation Contractor for reburial in accordance with the conditions of the Exhumation Licence.
- 6.3.2 The C257 Archaeological Contractor will undertake a GWB during these works.

6.4 Specification

- 6.4.1 Prior to the start of the archaeological works the C257 Archaeological Contractor will:
- during preparation the Method Statement, arrange a meeting the City of London Historic Environment Officer and English Heritage GLAAS Science Advisor to discuss the excavation methodology and the environmental/scientific sampling strategy;
 - provide a Method Statement inclusive of risk assessment and safe method of working, prepared in liaison with the C502 Principal Contractor and approved by the Employers Archaeologist
 - provide an Exhumation License issue by the MOJ for archaeological works a suitable time prior to the works and ensure that the license is updated as required;
 - ensure all staff working on the project are suitably qualified and competent and valid CSCS cards
 - ensure all staff working on the project have received a site specific induction by the C502 Principal Contractor
 - provide an experienced metal detectorist to undertake metal detecting of the excavated surfaces and spoil arising from the excavation

Excavation of Pile Lines (Areas A – F and Area G) and Area 4

- 6.4.2 During the GWB on the excavation of the pile lines and Area 4 the C257 Archaeological Contractor will:
- provide suitable numbers of qualified and competent staff who have valid CSCS cards and are experienced in the investigation and recording of post-medieval burial grounds and the nature of archaeological deposits which are expected on this site
 - where appropriate provide a suitably qualified osteoarchaeologist, experienced in archaeological investigation, recording of post-medieval burial grounds and the nature of archaeological deposits which are expected on this site
 - ensure that during the GWB the extent of the any surviving archaeological deposits are mapped and that where appropriate any surviving archaeological remains are hand cleaned, defined and sample excavated, sufficient to determine type, plan form and relationships

- take record photographs of the exhumation works and C502 Exhumation Contractor progress for inclusion in the C257 weekly report
- on completion of the recording of any surviving structures provide a suitably qualified and experienced archaeologist to supervise the removal of walls to ensure that any re-used headstones or burial monuments are recorded and where appropriate retained. If earlier archaeological remains are identified beneath these structures they will be hand cleaned and recorded

Excavation of the Ticket Hall Box (Areas 1-3 and 5)

Phase 1 general watching brief

6.4.3 During the GWB the C257 Archaeological Contractor shall:

- provide up to 5 No. suitably qualified and competent staff who have valid CSCS cards and are experienced in the investigation and recording of post-medieval burial grounds and the nature of archaeological deposits which are expected on this site
- where appropriate provide a suitably qualified osteoarchaeologist, experienced in archaeological investigation, recording of post-medieval burial grounds and the nature of archaeological deposits which are expected on this site
- ensure that during the GWB the extent of the any surviving archaeological deposits are mapped and that where appropriate any surviving archaeological remains are hand cleaned, defined and sample excavated, sufficient to determine type, plan form and relationships
- take record photographs of the exhumation works and C502 Exhumation Contractor progress for inclusion in the C257 weekly report
- on completion of the recording of any surviving structures provide a suitably qualified and experienced archaeologist to supervise the removal of walls to ensure that any re-used headstones or burial monuments are recorded and where appropriate retained. If earlier archaeological remains are identified beneath these structures they will be hand cleaned and recorded

Phases 2 to 4 archaeological excavation

6.4.4 For the duration of the Phases 2 to 4 of the excavation archaeological excavation the C257 Archaeological Contractor will **for each shift** provide a team comprising:

- 1 No. suitably qualified project officer experience in directing major urban and cemetery excavations within London and the familiar with nature of archaeological deposits which are expected on this site
- 2 No. suitably qualified senior archaeologists experience in urban and cemetery excavations within London and the familiar with nature of archaeological deposits which are expected on this site
- 2 No. suitably qualified assistant senior archaeologists experience in urban and cemetery excavations within London and the familiar with nature of archaeological deposits which are expected on this site
- A minimum of 24 No. suitably qualified archaeologists for the excavation of Areas 2 and 3 and 12 No. archaeologists for the excavation of Area 1.

- 2 No. suitably qualified osteologists experienced in the excavation of post-medieval burial grounds and familiar with burial types and pathologies which are expected on this site
- a suitably qualified geo-archaeologist experienced in archaeological monitoring and recording and the nature of Walbrook deposits which are expected on this site
- when appropriate will provide a suitably qualified buildings archaeologist familiar with post-medieval and cemetery structures expected on this site

6.4.5 During all phases of the excavation the C257 Archaeological Contractor will:

- develop and implement the innovative use of electronic recording media (e.g. tablet and software) to aid the efficient on-site recording and creation of a database of those burials assessed by the osteologists for retention or reburial during the 60% Method 2 excavation of the cemetery deposits
- ensure that the extent of the any surviving archaeological deposits are mapped and that any surviving archaeological remains are hand cleaned, defined and sample excavated, sufficient to determine type, plan form and relationships
- ensure that a full sequence of environmental samples are recovered through the post-medieval, cemetery, post-Roman, Roman and natural stratigraphy in order to record and inform the further landscape and palaeo-environmental development of the site
- ensure that sufficient archaeological features/structures are sample excavated either using a smaller machine with graded digging bucket (by the C502 Principal Contractor under archaeological supervision) or hand dug if appropriate
- develop a detailed strategy for archaeological science identifying where possible collaboration opportunities with third party researchers to enhance the value of the excavations
- agree the scope of the archaeological science strategy with the English Heritage regional science advisor and Crossrail archaeologist

6.5 Deliverables

6.5.1 The deliverables for this fieldwork event will be:

- a weekly written progress report throughout the duration of the programme of archaeological works
- a Fieldwork Report within 6 weeks of completion of fieldwork
- a Survey Report within 2 weeks of completion of fieldwork
- a Summary Report within 8 weeks of the completion of fieldwork

6.5.2 The fieldwork will be followed by a phase of post-excavation assessment and analysis leading to an updated project design for publication and dissemination of the results as required by post-excavation workstream CRL 11 *Roman and Medieval Broadgate and Blomfield Street*.

6.5.3 Full details of each deliverable are provided in Section 8 of the Liverpool Street Archaeology SS-WSI (Document No. C138-MMD-T1-RST-C101-00001).



6.6 Site Archives

- 6.6.1 The site archive shall be organised to be compatible with other archaeological archives in London.

7 Provisional Programme

- 7.1.1 A provisional programme for the archaeological investigations at the Broadgate Ticket Hall is set out below. The programme makes the following assumptions:
- that the archaeological excavation of Area 5 commences on 2nd February 2015
 - that the archaeological excavation of Areas 2 and 3 commences on 2nd February 2015
 - that the archaeological excavation of Area 1 commences on 25th May 2015
 - that the dates for exhumation works undertaken by the C502 Exhumation Contractor are unconfirmed at the time of writing with estimated dates inserted into the programme.

Table 8 Provisional Programme of Archaeological Works

8 References

- City of London Corporation, 2003. Planning Advice Note 3: Archaeology in the City of London.
- Crossrail 2008. Archaeology Generic Written Scheme of Investigation, Document Number CR-PN-LWS-EN-SY-00001
- Crossrail 2009. Archaeology, Specification for Evaluation & Mitigation (including Watching Brief) (Document No. CR-PN-LWS-ENSP-00001 Ver. 0.3)
- Crossrail/MOLA. 2012a. Central Section Project Fieldwork Report Archaeological Evaluation and Watching Brief Broadgate Ticket Hall (XSM10); (Document No. C257-MLA-X-RGN-CRG02-50064, Rev. 2)
- Crossrail/MOLA. 2012b. C257 Archaeology Central Fieldwork Report and Watching Briefs Pit 4, Pit 11, Trench 14 and 15, Pile Line Pits and SSET/UKPN Utility Diversions, Broadgate Ticket Hall (XSM10); (Document No. C257-MLA-X-XCS-CRG02-50015, Rev. 2)
- Crossrail/MOLA. 2014. C257 Archaeology Central Fieldwork Report Archaeological Excavation and Watching Briefs Broadgate Ticket Hall Utilities Combined Report 2013 (XSM10); DRAFT REPORT (Document No. C257-MLA-T1-RGN-CRG03-50014)
- English Heritage 2009. GLAAS Standards for Archaeological Work, London Region, External Consultation Draft
- Nixon, T, McAdam, E, Tomber, R, and Swain, H, 2003, A Research Framework for London Archaeology 2002, Museum of London Archaeology Service



Appendix A – Drawings

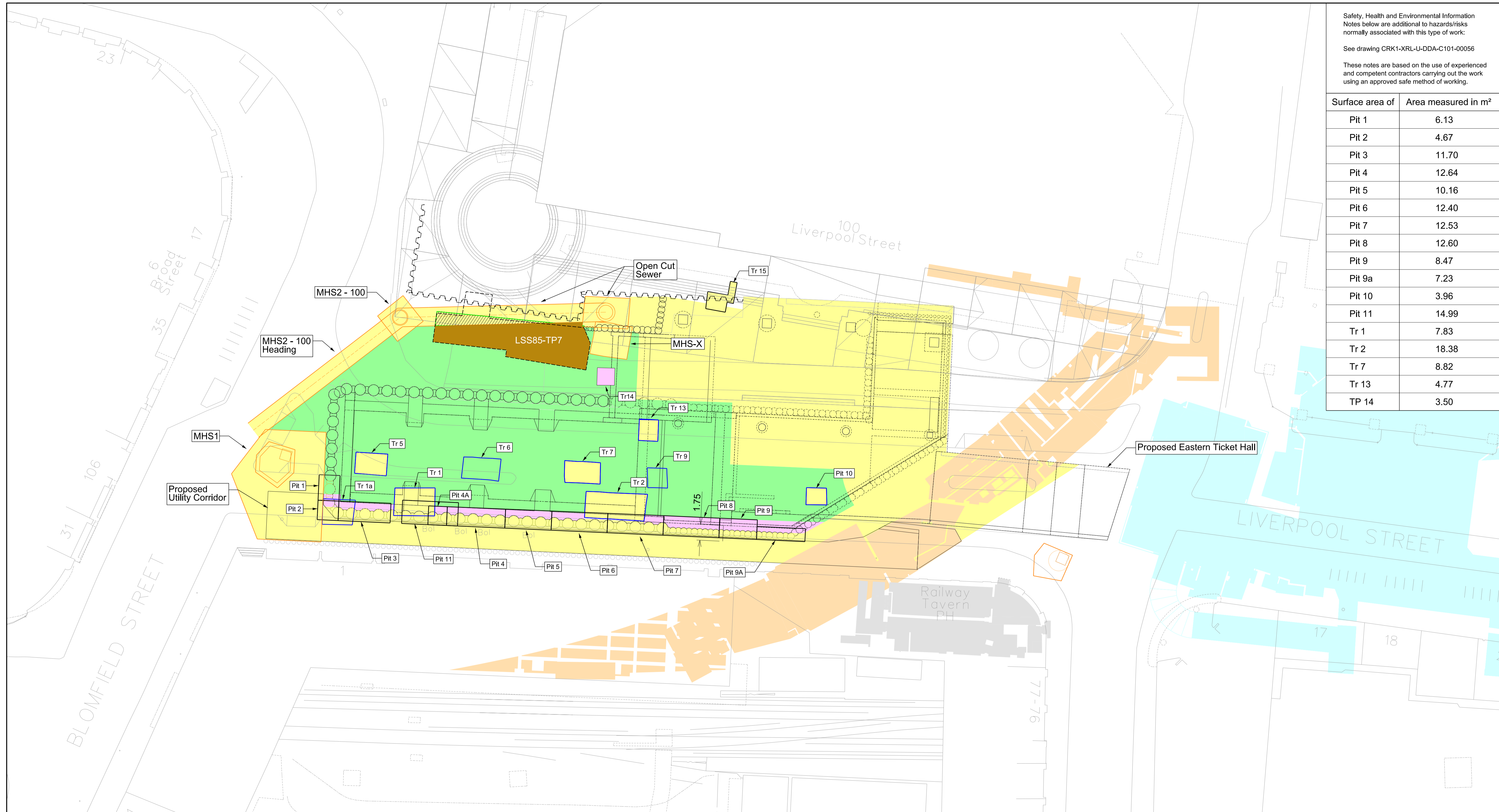
Drawing No.	Drawing Title	Revision
CRL1-XRL-U-DDA-C101-00181	Liverpool Street Eastern Ticket Hall Archaeological Survival at Liverpool Street	P02.1
BTH-SKE-004	Archaeological and Exhumation Sequence of Works	2.0

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.

Surface area of	Area measured in m ²
Pit 1	6.13
Pit 2	4.67
Pit 3	11.70
Pit 4	12.64
Pit 5	10.16
Pit 6	12.40
Pit 7	12.53
Pit 8	12.60
Pit 9	8.47
Pit 9a	7.23
Pit 10	3.96
Pit 11	14.99
Tr 1	7.83
Tr 2	18.38
Tr 7	8.82
Tr 13	4.77
TP 14	3.50

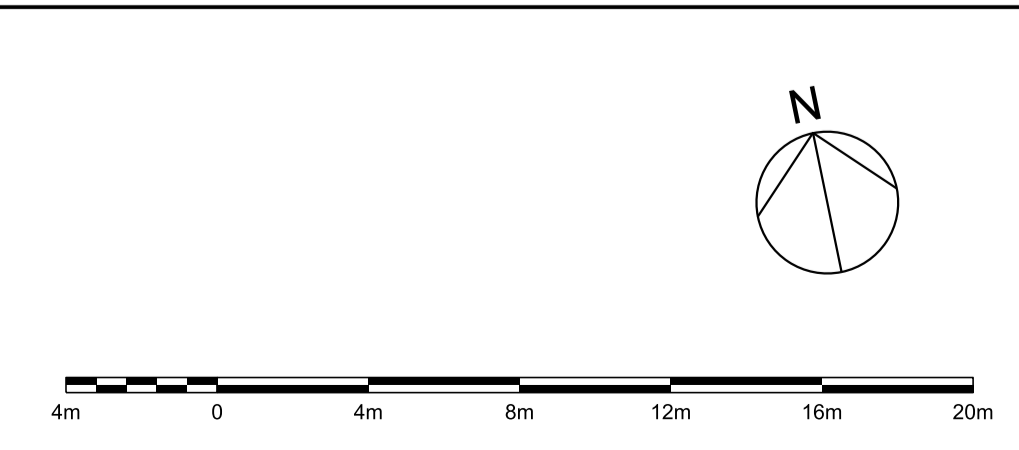


Key

LU structure	Proposed Sewer Shaft (to be completed by others)	Archaeology at approx 1.5m to 6.0m below ground level Human remains and Roman deposits	Bone & Concrete was encountered to at least 6.0m BGL in the open cut sewer trench by C503. That deposit may extend south within the area marked TP7. It is not anticipated that any Roman Deposits will survive within the area of TP7 as the 1985 MOL report indicates they were fully excavated
Queen Victoria Tunnel	Trial Trench location (completed by J P Riney)	Archaeology at approx 3.0m to 6.0m below ground level Roman deposits only	Bone & Concrete confirmed
Railway Tavern Public House	Pit /Trench location (completed by Contract C503)	No archaeology	

Rev.	Date	Description	By	Chkd	App	Auth
P01	28/11/2013	First Issue	HC	GS	GB	-
P02	19/05/2014	New MH added	HC	EN	GB	-

Notes
 1. Confirmation of all survey data must be obtained from the Crossrail survey team.
 2. 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.
 3. All dimensions are in metres unless specified otherwise.

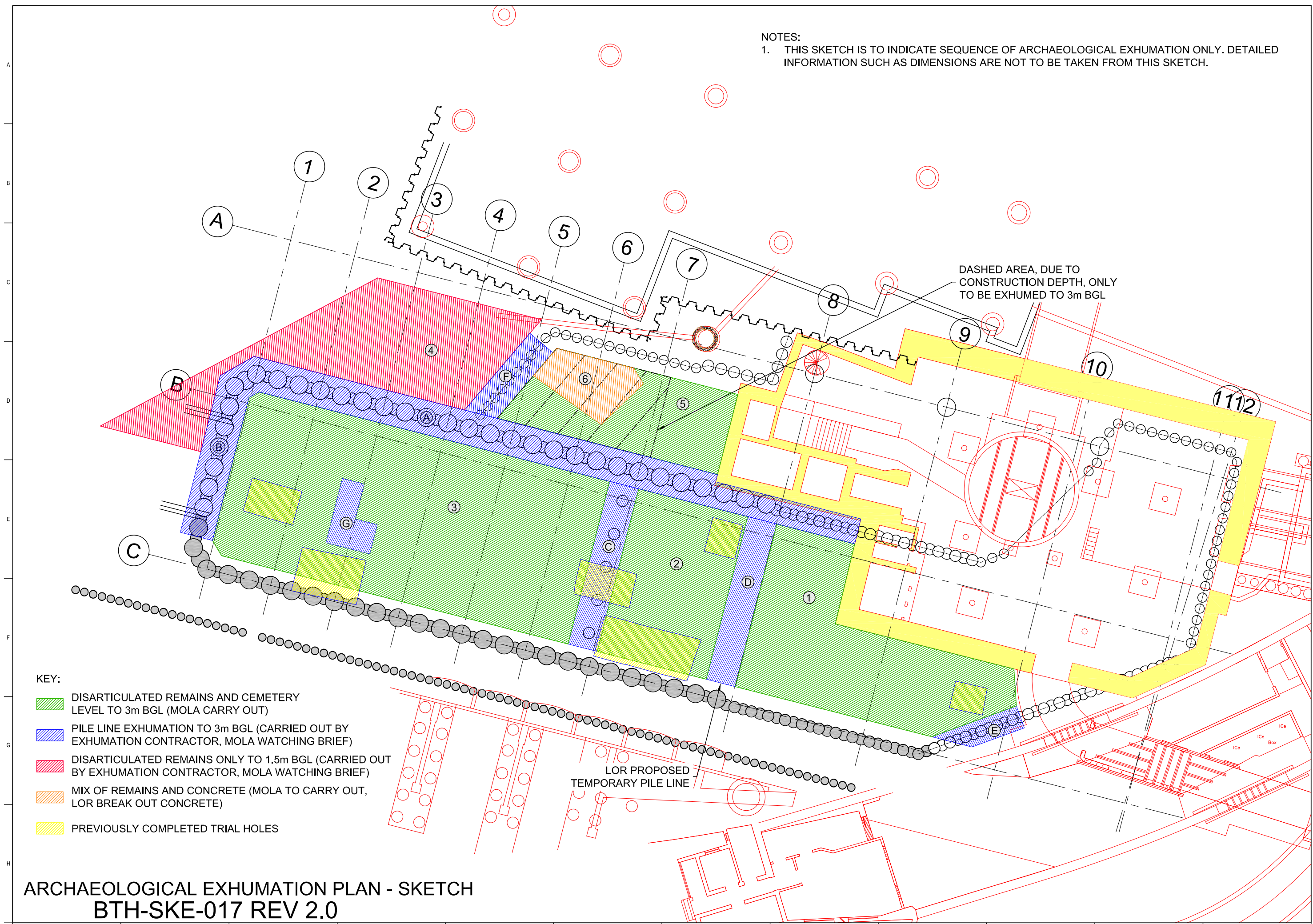


 Crossrail Limited 25 Canada Square Canary Wharf London E14 5LQ www.crossrail.co.uk	Contract: Crossrail Line 1 Programme Originator: Crossrail Ltd Location: Liverpool Street Stn	By: H.CASEY Chk: E.NAVARRO App: G.BRIGIDA Auth: ...
	Title: Liverpool Street - Eastern Ticket Hall Archaeological Survival at Liverpool Street	Scale: 1:200 @ A1 Drawing and CAD file No.: CRL1-XRL-U-DDA-C101-00181 Rev: P02 Suitability: S4

Copy Approved for Design - Created: 20-MAY-2014

RESTRICTED

NOTES:
 1. THIS SKETCH IS TO INDICATE SEQUENCE OF ARCHAEOLOGICAL EXHUMATION ONLY. DETAILED INFORMATION SUCH AS DIMENSIONS ARE NOT TO BE TAKEN FROM THIS SKETCH.



- KEY:
- DISARTICULATED REMAINS AND CEMETERY LEVEL TO 3m BGL (MOLA CARRY OUT)
 - PILE LINE EXHUMATION TO 3m BGL (CARRIED OUT BY EXHUMATION CONTRACTOR, MOLA WATCHING BRIEF)
 - DISARTICULATED REMAINS ONLY TO 1.5m BGL (CARRIED OUT BY EXHUMATION CONTRACTOR, MOLA WATCHING BRIEF)
 - MIX OF REMAINS AND CONCRETE (MOLA TO CARRY OUT, LOR BREAK OUT CONCRETE)
 - PREVIOUSLY COMPLETED TRIAL HOLES

ARCHAEOLOGICAL EXHUMATION PLAN - SKETCH
 BTH-SKE-017 REV 2.0