



DESIGN PACKAGE C138  
LIVERPOOL STREET STATION

ADDENDUM TO WSI: DETAILED EXCAVATION &  
WATCHING BRIEF - MOORGATE WORKSITE  
(XSJ10)

Document Number: C138-MMD-T1-TCP-C101-00001

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## Introduction

- 1.1.1 This document provides details of the programme of archaeological investigation required to mitigate the impact of construction on archaeological deposits at the Moorgate worksite and at utility diversions and protective works in the vicinity.
- 1.1.2 It sets out the location and recording activities required at the Moorgate worksite during the advanced and main works phases.
- 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 (C501; and C502) that will be undertaking civils works on the site in liaison with the Employer's Archaeologist and the C257 Archaeological Contractor (Museum of London Archaeology - MoLA).

## 2 Scope of Works

### 2.1 Aims of the proposed investigation

- 2.1.1 The aim of archaeological mitigation is to investigate and report on surviving Roman and medieval archaeological deposits within the footprint of the Moorgate shaft and wider worksite which have been positively identified by recent archaeological evaluation work.
- 2.1.2 Mitigation works will be achieved through a programme of archaeological investigation to be conducted in parallel with Principal Contractors C501 and C502.
- 2.1.3 A summary of the scope is set out in Table 1 below.

**Table 1 Summary of archaeological events at the Moorgate worksite**

Event Type	Event Code	Progress	Principal Contractor	Addendum Specific Requirements Section
<i>Trial trench evaluation (3 trenches).</i>	<i>XSJ10</i>	<i>Complete</i>	<i>C501</i>	<i>4.2</i>
General and targeted watching brief during excavation of Moorgate Station Sewer diversion and manholes	XSJ10	Not started	C501	4.3.3 - 4.3.10
General watching brief at ground reduction to 110m ATD in Moorfields	XSJ10	Not started	C501	4.3.7 - 4.3.10
General and targeted watching brief at OSD excavations in Moorfields.	XSJ10	Not started	C501	4.3.11 – 4.3.16
General watching brief on guide trenches for diaphragm wall installation	XSJ10	Not started	C501	4.3.17 – 4.3.21
Archaeological excavation within Diaphragm Walled Shaft	XSJ10	Not started	C501	4.4



Power auger survey with shaft and ground reduction footprint	XSJ40	Removed from scope	C504	
Targeted watching brief at ground reduction to 107.5m ATD in Moorgate worksite (outside diaphragm walled shaft)	XSJ10	Not started	C502	5

## 2.2 Site Specific Objectives

2.2.1 The objective of archaeological investigation is to mitigate the impact of Crossrail construction through a programme of archaeological works comprising 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 results from Trial Trench Evaluation

- 2.3.1 The trial trench evaluation for the Moorgate shaft was completed in September 2011.
- 2.3.2 Four trial trenches (trenches 1; 4; 5; and 6) were excavated in the former basement of 91 to 109 Moorgate. Of these, one trench (trench 1) in the northern half of the site was abandoned due to deep concrete truncation. Refer to figure 1 for trench locations.
- 2.3.3 Three geotechnical boreholes (BH1; 2; and 3) in the former basement of 91 to 109 Moorgate were monitored by the *Archaeological Contractor*. Refer to figure 1 for borehole locations.
- 2.3.4 The three boreholes provided the same information as the trial trenches and are reported in full in the *Archaeology Contractor's* interim report, *Interim Statement, Archaeological Evaluation & Boreholes 91 to 109 Moorgate – XSP10* (document number: C257-MLA-X-RGN-CRG02-50028).
- 2.3.5 Modern truncation was between 0.6m and 1.4m below the surface of the slab. The northern area of the site was more truncated vertically and horizontally.
- 2.3.6 Natural brickearth was identified at 108.87m (trench 4); 108.81m (trench 5); and at 108.65m ATD (trench 6).
- 2.3.7 The stratigraphic sequence identified from the trial trenches is set out in table 2.
- 2.3.8 The evaluation demonstrated that Roman and medieval deposits survive at the Moorgate worksite from approximately 109.35m to 108.65m ATD.
- 2.3.9 Table 2 sets out the depths of deposits within the footprint of the shaft, as identified in the trial trench evaluation. Table 3 provides a conceptual archaeological model of general levels within the Moorgate worksite.
- 2.3.10 The original scope for trial trenching at the Moorgate Shaft comprised 6 trenches at 91-109 Moorgate and 2 trenches in 17-31 Moorfields. The scope was reduced to 4 trenches, all of which were located at 91-109 Moorfields.
- 2.3.11 The 2 trenches were de-scoped from 17-31 Moorfields basement because the depth of the basement (slab surface 109.2mATD) and the thickness of the existing slab (900-

1000mm) truncated to a greater depth than archaeological deposits are expected to survive (base of archaeology at approximately 108.78mATD in 91-109 Moorgate).

2.3.12 2 trenches were de-scoped from 91-109 Moorgate. The existing slab in the northern area of the Moorgate site was considerably thicker than expected and it was not possible to excavate the planned trenches at that location. Consequently the survival of archaeological deposits in the north of the site will be partially/completely truncated. It was considered that the data from trenches 1; 4; 5; and 6 were sufficient to evaluate the archaeological potential of the site.

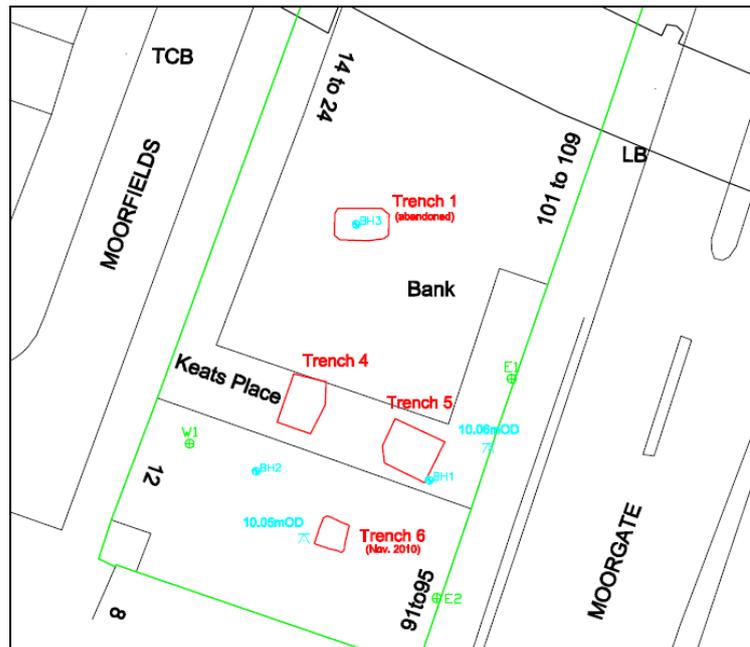


Figure 1 Trial trench and borehole locations (drawing from MoLA Interim Statement)

	Trench 4 (mATD)	Trench 5 (mATD)	Trench 6 (mATD)	Average depth (mATD)
Slab surface	110	110	110.05	110.02
Moorfields Marsh/medieval deposits (surface)	109.27	109.35	109.25	109.29
Proto-march/Roman dumping/Roman archaeology (surface)	109.05	108.99	108.85	108.96
Natural brickearth and gravel (surface)	108.87	108.81	108.65	108.78

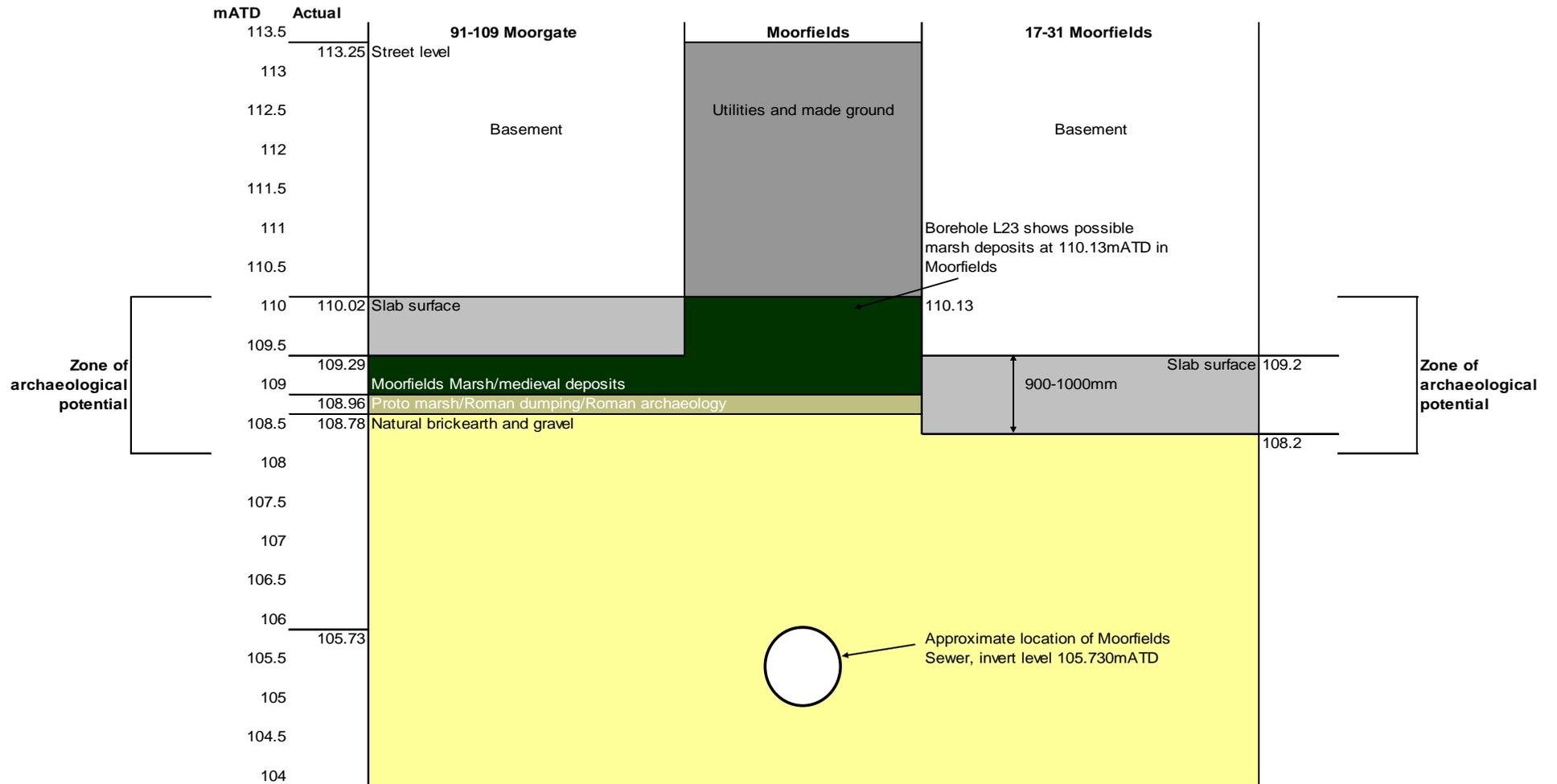
Table 2 Deposit levels (mATD) in the shaft footprint (from trial trench evaluation)



Layer	Estimated surface elevation (m ATD)	Estimated base elevation (m ATD)	Archaeological potential
Street level	113.25		No
91-109 Moorgate basement slab	110.00	109.30	No
87 Moorgate/8 Moorfields basement level	111.00		No
17-31 Moorfields basement slab	109.20	108.20	No
Made ground (in street)	113.00	109.5	Yes
Surviving Moorfield Marsh deposits	110.13	108.85	Yes
Redeposited brickearth/proto-marsh (Roman)	109.05	108.65	Yes
Natural brickearth and terrace gravel	108.87	101.00	Yes (cut into upper layers)

**Table 3 Conceptual archaeological model**

Figure 2 Archaeological sequence, facing south



nb. The above diagram is intended to be a simplified visual reference of the archaeological sequence based on the average levels taken from the trial trench evaluation. The diagram is not to scale and the locations of deposits, obstructions, and utilities are approximated.



### 3 Requirements for all Principal Contractors

- 3.1.1 In addition to the specific requirements for each *Principal Contractor* set out in sections 4 and 5, the *Principal Contractor* must provide and maintain the following attendances and facilities at all times (including extended working hours if necessary) for the duration of and in relation to the specialist archaeological works at Moorgate.
- 3.1.2 Identify live underground services in areas of excavation. For excavations on and near to utilities the *Principal Contractor* will safely protect and support utilities prior to allowing the *Archaeological Contractor* access. 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 works.
- 3.1.3 Use of excavators or other plant where archaeological deposits may be affected shall only be undertaken under supervision by the *Archaeological Contractor*.
- 3.1.4 Design and provide temporary works to support excavations for personnel access to the investigation by all operatives, e.g. sheet piling and shoring.
- 3.1.5 Provide appropriate plant and trained operatives to remove hand excavated spoil from trenches (e.g. a hoist, conveyor or other appropriate method to be determined by the *Principal Contractor*) and ensure that all equipment is regularly inspected.
- 3.1.6 Provide drainage in excavation where required.
- 3.1.7 In the event of the unexpected discovery 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.
- 3.1.8 Provide appropriate material to compensate for reduction in volume when reinstating.
- 3.1.9 Provide lighting as required (e.g. in deep excavations and if extended working hours are required).
- 3.1.10 Provide small plant and tools, as required to complete the works.
- 3.1.11 Provide technical advice to the *Archaeological Contractor* as maybe required to safely complete the works.
- 3.1.12 Manage safety and inter alia provide regular toolbox talks all site staff
- 3.1.13 Provide site security in accordance with the works information.
- 3.1.14 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. The *Principal Contractor* will liaise with the



*Archaeological Contractor* regarding the specific accommodation and welfare requirements for each fieldwork event.

- Toilets, with drying and washing facilities;
- First Aid;
- Temporary office for the use of archaeologists, including 2 desks and of a size adequate to accommodate staff for each fieldwork event; 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*

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## 4 Specific Requirements for C501

4.1.1 The C501 *Principal Contractor* will be responsible for facilitating the following archaeological works at the Moorgate worksite:

- General and targeted watching brief during the excavation of the Moorgate sewer diversion trenches and manholes.
- General watching brief during excavation to 110m ATD in Moorfields.
- General and targeted watching brief during OSD foundation excavations in Moorfields.
- General watching brief on guide trench excavation for diaphragm wall installation.
- Archaeological excavation within the diaphragm walled shaft.

4.1.2 Refer to section 3 for general attendances and facilities to be provided by the *Principal Contractor* to achieve the above objectives.

### 4.2 C501 procedure for general and targeted watching brief

4.2.1 Should archaeological deposits at any of the field work events set out in this section be completely truncated by modern activity no further archaeological work will be required at that location.

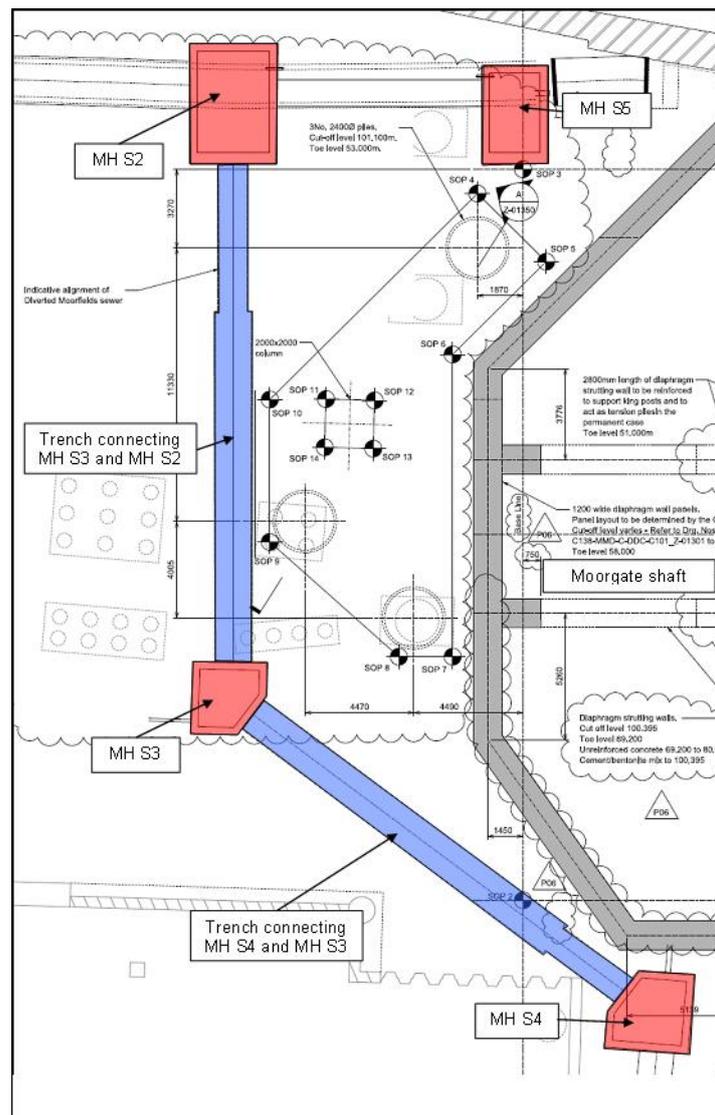
4.2.2 Please note that the depths provided in this section are inferred from the results of ground investigations and that levels may vary across the site.

#### ***Sewer diversion***

4.2.3 General and targeted watching brief is required during the excavation of:

- Manholes MH S2; MH S3; MH S4; and MH S5 (fig 3).
- Trenches connecting MH S4 and MH S3; and connecting MH S3 and MH S2 (fig 3).

- 4.2.4 The *Principal Contractor* will remove the basement floor slab/road surface and modern material – this can be carried out without archaeological observation.
- 4.2.5 The *Principal Contractor* will remove Moorfield Marsh deposits under archaeological observation (general watching brief) until the deposits sealed by the marsh are exposed at an estimated level of 109.05m ATD. Moorfield Marsh deposits are anticipated to survive from approximately 109.76mATD (borehole L24) in Moorfields.
- 4.2.6 The *Principal Contractor* will facilitate the excavation of pre-marsh archaeological deposits (approximately 109.05mATD to 108.65mATD.) in stages (targeted watching brief) by the *Archaeological Contractor* until the full sequence of archaeological deposits is recorded.



**Figure 3 Sewer diversion watching brief locations**

**Moorfields Excavation**

- 4.2.7 General watching brief is required during the excavation of:
- The Moorfields ‘plug’ between the 17-31 Moorfields and 91-109 Moorgate basement.



- 4.2.8 The *Principal Contractor* will remove the existing pavement construction and modern material – this can be carried out without archaeological observation.
- 4.2.9 The *Principal Contractor* will remove Moorfield Marsh deposits under archaeological observation (general watching brief) to the maximum depth of excavation – 109mATD. Moorfield Marsh deposits are anticipated to survive from approximately 109.76mATD (borehole L24) in Moorfields.

#### **OSD Foundation Excavation**

- 4.2.10 General and targeted watching brief is required during the excavation of:
- The OSD foundation excavation area (fig 4).
- 4.2.11 Excavation is required to remove four existing 610mm diameter piles and will be carried out in sequential stages to safely enable the concrete demolition. The archaeological watching brief will be carried out during the first stage of excavation.
- 4.2.12 The *Principal Contractor* will remove the existing basement floor slab, any pile caps and modern material. This can be carried out without archaeological observation.
- 4.2.13 The *Principal Contractor* will remove Moorfield Marsh deposits under archaeological observation (general watching brief) until the deposits sealed by the marsh are exposed at an estimated level of 109.05m ATD. Moorfield Marsh deposits are anticipated to survive from approximately 109.76mATD (borehole L24) in Moorfields.
- 4.2.14 It is unlikely that Moorfield Marsh deposits will be encountered where the excavation extends into the footprint of the basement of 17-31 Moorfields.
- 4.2.15 The *Principal Contractor* will facilitate the excavation of pre-marsh archaeological deposits (approximately 109.05mATD to 108.65mATD.) in stages (targeted watching brief) by the *Archaeological Contractor* until the full sequence of archaeological deposits is recorded.

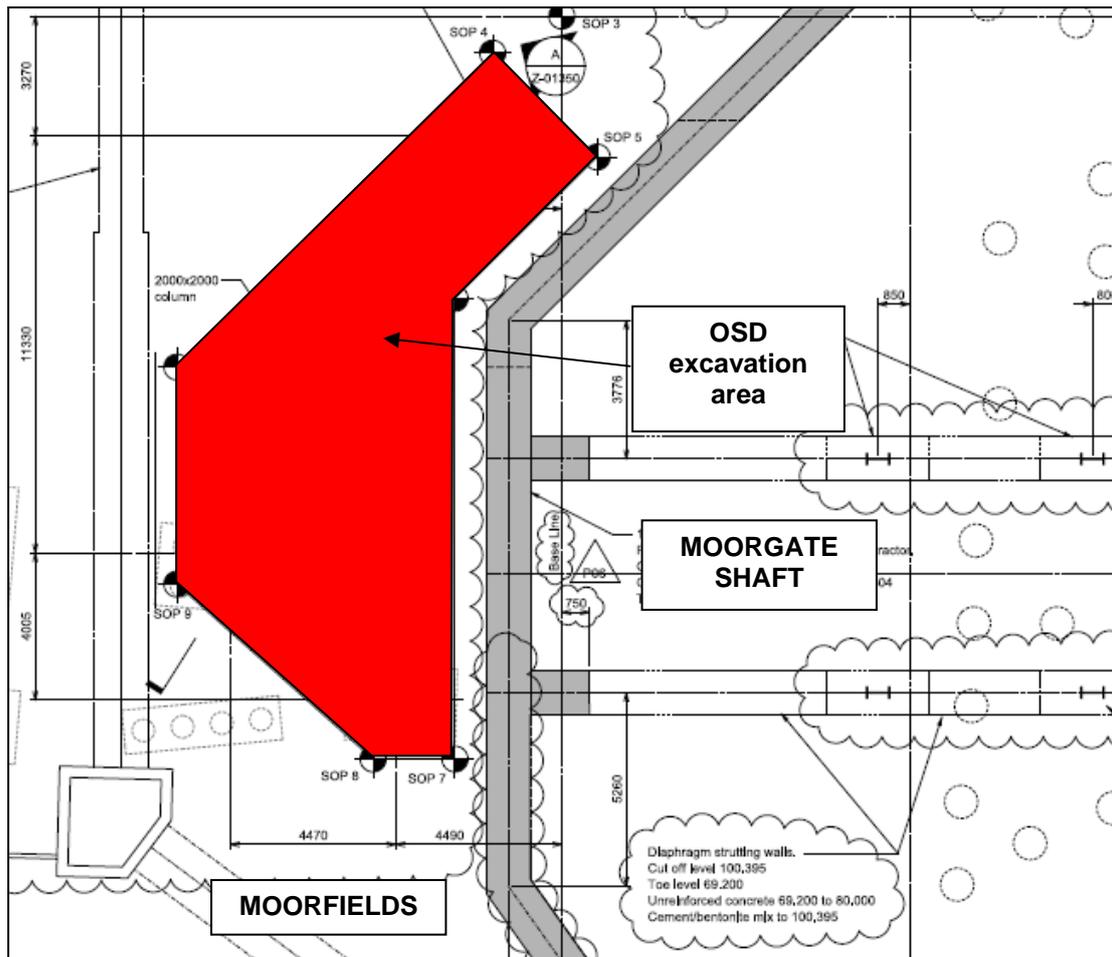


Figure 4 OSD foundation excavation area

### Guide wall excavation

4.2.16 General watching brief is required during the excavation of:

- Two central guide walls during phase 1 (Appendix 1 - sketch ARCH-02) after pile removal in the basement of 91-109 Moorgate.
- Western guide walls during phase 2 (Appendix 1 - sketch ARCH-03) after the sewer diversion and the removal of OSD cofferdam sheet piles.

4.2.17 The perimeter guide walls at the northern and eastern sides of the shaft do not require archaeological watching brief as they are located within the footprint of the foundations of 91-109 Moorgate and no archaeology survives.

4.2.18 The *Principal Contractor* will remove the basement floor slab and modern material – this can be carried out without archaeological observation.

4.2.19 The *Principal Contractor* will remove Moorfield Marsh deposits under archaeological observation (general watching brief) to the maximum depth of excavation – 109mATD. Moorfield Marsh deposits are anticipated to survive from approximately 110.13mATD (borehole L23) to 108.85mATD.

### 4.3 C501 procedure for archaeological excavation – Moorgate Shaft

- 4.3.1 A phased archaeological excavation is required at the first dig stage of the shaft construction. The phasing of the archaeological works has been integrated into the construction programme by C501 to prevent delay to critical construction activities.
- 4.3.2 The phasing (prepared by C501) is set out on sketches ARCH-04-A; ARCH-04-B; ARCH-05-A; ARCH-05-B; ARCH-06-A; and ARCH-06-B in Appendix A.
- 4.3.3 As set out in the C501 Archaeological Management Plan (C501-BNK-C-STP-C101-50067) in order to facilitate archaeological excavation of the shaft, its footprint will be divided into two areas. The areas are defined by the level of the proposed diaphragm wall cut off and capping beam level: north, south and east section will comprise phases 1 and 3 (sketch ARCH-06-A); and the west section will comprise phase 2 (sketch ARCH-04-A). The archaeological works will be carried out in one area as the capping beam works are carried out to the other, refer to sketches ARCH-04-A & B to ARCH-06-A & B inclusive (Appendix A).
- 4.3.4 Upon completion of each phase the *Archaeological Contractor* will issue a signed completion form countersigned by the *Employers Archaeologist* to the *Principal Contractor*.
- 4.3.5 The archaeological excavation works will be carried out during both normal and extended hours.

#### **Phase 1 (sketches ARCH-04-A & B)**

- 4.3.6 Archaeological excavation will be carried out to the west and central areas whilst the capping beam is constructed on the north, south and east walls. The cut off level for these walls is at existing ground level and therefore no archaeological works are required for their construction.
- 4.3.7 The *Principal Contractor* will remove the existing basement floor slab. This can be carried out without archaeological observation.
- 4.3.8 Modern made ground will be removed by the *Principal Contractor* under archaeological observation until the surface of undisturbed archaeological deposits is reached – Moorfield Marsh deposits are expected from approximately 109.35mATD.
- 4.3.9 The *Principal Contractor* will remove Moorfield Marsh deposits under archaeological observation until the deposits sealed by the marsh are exposed at an estimated level of 109.05m ATD.
- 4.3.10 The *Principal Contractor* will facilitate the further excavation of archaeological deposits until the full sequence of deposits has been excavated in accordance with the method statement. The base of archaeological deposits was observed at between 108.87m and 108.65mATD during the trial trench evaluation.



4.3.11 It may be possible to excavate the full sequence in this area during phase 1. The trial trench evaluation showed that the full archaeological sequence goes no deeper than 1.35m below the surface of the existing slab.

4.3.12 If the full sequence of archaeological deposits cannot be excavated during phase 1, the remaining archaeological deposits in this area will be excavated during phase 3.

**Phase 2 (sketches ARCH-06-A & B)**

4.3.13 Archaeological excavation will be carried out in the north, south and east area, following on behind the capping beam construction works.

4.3.14 The *Principal Contractor* will remove the existing basement floor slab. This can be carried out without archaeological observation.

4.3.15 Modern made ground will be removed by the *Principal Contractor* under archaeological observation until the surface of undisturbed archaeological deposits is reached – Moorfield Marsh deposits are expected from approximately 109.35mATD.

4.3.16 The *Principal Contractor* will remove Moorfield Marsh deposits under archaeological supervision until the deposits sealed by the marsh are exposed at an estimated level of 109.05m ATD.

4.3.17 The *Principal Contractor* will facilitate the further excavation of archaeological deposits until the full sequence of deposits has been excavated in accordance with the method statement. The base of archaeological deposits was observed at between 108.87m and 108.65mATD during the trial trench evaluation.

**Phase 3 (sketches ARCH-05-A & B)**

4.3.18 Phase 3 represents the continuation of archaeological excavation at the area started in Phase 1.

4.3.19 Should all archaeology be excavated during Phase 1, no further archaeological excavation will be required during Phase 3.

4.3.20 Should archaeological excavation be required in Phase 3, the *Principal Contractor* will facilitate the further excavation of archaeological deposits until the full sequence of deposits has been excavated in accordance with the method statement. The base of archaeological deposits was observed at between 108.87m and 108.65mATD during the trial trench evaluation.



## 5 Specific Requirements for C502 Contractor

5.1.1 The C502 *Principal Contractor* will be responsible for facilitating the following archaeological works at the Moorgate worksite:

- Targeted watching brief during main works ground reduction in the wider Moorgate Shaft worksite (Moorfields, Fore Street Avenue and the basement of 17-31 Moorfields).

5.1.2 Refer to section 3 for general attendances and facilities to be provided by the *Principal Contractor* to achieve the above objectives.

### 5.2 C502 procedure for targeted watching brief – ground reduction in Moorfields

5.2.1 The area will have been reduced to approximately 109mATD during works carried out by C501, see section 4.3.7 to 4.3.10.

5.2.2 Should archaeology survive below 109mATD the *Principal Contractor* will facilitate the excavation of pre-marsh archaeological deposits in stages by the *Archaeological Contractor* until the full sequence of archaeological deposits is recorded. Pre-marsh deposits could be present from approximately 109.05mATD to 108.65mATD.



## 6 Instructions to Archaeological Contractor and Specification

### 6.1 Archaeological watching brief and excavation

- 6.1.1 A programme of archaeological investigation comprising general and targeted watching brief and archaeological excavation will be carried out at the Moorgate worksite.
- 6.1.2 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.
- 6.1.3 The *Archaeological 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 geoarchaeologist will be required.
- 6.1.4 The *Archaeological 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 *Employer's Archaeologist*.
- 6.1.5 During excavation and targeted watching brief, following the initial overall strip and clean, individual features are to be hand cleaned and defined by the *Archaeological 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.
- 6.1.6 The *Archaeological 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.
- 6.1.7 The *Archaeological Contractor* will provide staff for extended hours working, comprising a seven day week (07:00 to 24:00).
- 6.1.8 The *Archaeological Contractor* will ensure that all appropriate staff attend the *Principal Contractor's* site induction a suitable period of time prior to the start of site works.

## 6.2 Deliverables

Table 4 summarises the Deliverables required per fieldwork event:

**Table 4 Deliverables for each fieldwork event**

Fieldwork Event	Deliverables Required		
	Weekly Progress Report	Interim Report	Fieldwork Report
XSJ10 General and targeted watching brief during excavation of Moorgate Station Sewer diversion and manholes	XSJ10	YES	YES
XSJ10 General watching brief at ground reduction to 110m ATD in Moorgate worksite (outside diaphragm walled shaft in Moorfields)	XSJ10		
XSJ10 General and targeted watching brief at OSD excavations in Moorfields.	XSJ10		
XSJ10 General watching brief on guide trenches for diaphragm wall installation	XSJ10		
XSJ10 General watching brief on ground reduction by 0.3m in the basement of 8 Moorfields	XSJ10		
XSJ10 Archaeological excavation within diaphragm walled shaft	XSJ10	YES	
XSJ10 Targeted watching brief at ground reduction to 107.5m ATD in Moorgate worksite (outside diaphragm walled shaft)	XSJ10	YES	

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 10;
- Interim report – 7 days after completion of fieldwork – WSI section 9.4; and
- Watching brief and excavation (fieldwork) reports – WSI section 9.6.

## 6.3 Site Archives

Refer to section 8.2 in the Site Specific Written Scheme of Investigation, document reference number: C138-MMD-T1-RST-C101-00001.

## 6.4 Post-excavation

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



## 7 Provisional Timetable

Table 5 archaeology programme outside of C501 scope

Activity	Principal Contractor	Construction Phase
XSJ10 Targeted watching brief at ground reduction to 107.5m ATD in Moorfields	C502	tbc

Table 6 C501 archaeology programme

Task	Estimated start date	Estimated end date	Task duration
Trial trench evaluation	Works complete		
Sewer diversion - MHS4 (GWB & TWB)	28-Nov-11	07-Dec-11	7 days
Sewer diversion - Southern link (GWB & TWB)	07-Dec-11	15-Dec-11	7 days
Guidewall general watching brief - Phase 1	23-Jan-12		15 days
Sewer diversion - North-south link (GWB & TWB)	16-Feb-12	06-Mar-12	14 days
Sewer diversion - MHS3 (GWB & TWB)	07-Mar-12	14-Mar-12	6 days
Sewer diversion - MHS2 (GWB & TWB)	14-Mar-12	19-Mar-12	4 days
Sewer diversion - Northern link (GWB & TWB)	04-May-12	11-May-12	4 days
Sewer diversion - MHS5 (GWB & TWB)	11-May-12	22-May-12	8 days
Guidewall general watching brief - Phase 2	16-May-12		15 days
Ground reduction to 110m ATD in Moorfields (GWB)	Late Nov 2011/early Dec 2011	Tbc	
OSD excavations in Moorfields (GWB & TWB)	Late Nov 2011/early Dec 2011	Tbc	
Shaft archaeological excavation - Phase 1	26-Feb-13		10 days
Shaft archaeological excavation - Phase 2	13-Mar-13		14 days
Shaft archaeological excavation - Phase 3	04-Apr-13		16 days

 Extended Hours working required C257.



## **Appendix A – Archaeological Mapping Information**

