Package C130 - Paddington Station

Archaeology Site-Specific Written Scheme of Investigation

Document Number: C130-SWN-Z-RSI-B071-00001

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1.1.1 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.

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

1.1.3 This site specific WSI addresses the archaeological works required for C130 Paddington Station. The archaeological specification for the C131 Paddington Integrated Project (hereafter referred to as PIP) is set out in the site specific WSI Document No. C131-MMD-T1-RGN-B071-00002. All work site areas are depicted on Figure 1.

Paddington Station

1.1.4 The Crossrail Paddington station box will be situated to the southwest of the existing Paddington Station between ch 1250 – 1580. The Paddington Crossrail Station will be located within the City of Westminster and is the most westerly of the seven new Central Stations on Crossrail Line 1. The new station will comprise a large underground box situated beneath Eastbourne Terrace and Departures Road, between Praed Street to the southeast and Bishop's Bridge Road to the northwest (see Figure 1). It will be integrated with the current railway station, receiving passengers from mainline rail services including Heathrow Express and providing interchange with two of the London Underground lines as well as with vehicular transport. The station will comprise two platforms, ticket hall, concourse areas and all associated plant and operations rooms. Passenger interchange links will connect to Paddington mainline station, LUL Bakerloo Line and Circle & District Line.

1.1.5 Enabling works comprise the construction of a temporary service area at the Platform 1A worksite west of Bishop's Bridge Road. Relocation of taxi facilities at the London Street Deck is being undertaken by the Paddington Integrated Project (PIP). These works will require demolition and dismantling of existing built structures in these locations.

1.1.6 At Paddington Station a programme of archaeological evaluation and mitigation will be required.

1.1.7 During the advanced works this will comprise Targeted Watching Brief (TWB) and General Watching Brief (GWB) during the C251 Utility Diversions on Departures Road and Eastbourne Terrace.

1.1.8 Targeted and General Watching Briefs will also be required during the C405 Main Works Contract. Construction activities requiring Targeted Watching Brief are:

- utilities diversions within Departures Road;
- the excavation of sheet pile foundation trenches;
- the excavation of diaphragm wall guide wall trenches within Departures Road;
- 52m long MacMillan House basement clash trench excavated within the pedestrian pavement or highway of Departures Road; and
- general ground reduction along the length of Departures Road to enable the construction of the station box roof slab.

1.1.9 The provision of a General Watching Brief will be required during the following construction activities:

- removal of the canopy over Departures Road;
- excavation of any intrusive trial pits prior to the removal of the listed railings and coping stones of the retaining wall;
- demolition of the Departures Road/Eastbourne Terrace retaining wall; and
- excavations within Departures Road where it has been proved that wood block paving is not present and in those areas where wood block paving has been recorded and removed and Targeted Watching Brief has been downgraded e.g. during excavations for the Macmillan House basement clash.

1.1.10 An archaeological investigation in the form of a trial trench evaluation will also be required immediately prior to or during the C405 works, following the closure of Eastbourne Terrace in order to evaluate the archaeological potential within the area of the Crossrail Paddington Station box.

1.1.11 This WSI addresses the scope, specification, timing and order of works and the deliverables required to successfully integrate the archaeological aspects of the works into the project phasing.

1.1.12 The archaeological mitigation defined in this site specific WSI has bee prepared with the design and programme information available at the time of writing. It is anticipated that the mitigation strategy will be subject to further review by the Crossrail Project Archaeologist prior to the start of the C405 Main Works contract. Any change to the archaeological design will be issued either in a future revision of, or addendum to this site specific WSI.

2 Project Background

2.1 Introduction

2.1.1 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.

2.1.2 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.

2.1.3 This site specific WSI addresses the works required for C130 Paddington Station.

2.2 Purpose and Objectives of the WSI

2.2.1 The purpose of this site-specific WSI is to describe the Crossrail worksites at Paddington Station and proposed construction impacts; to summarise the local baseline archaeological conditions and specify in detail the archaeological mitigation measures required for the site, including the priority, order and timing of the archaeological works within the overall construction programme.

2.2.2 The specific objectives for the WSI are set out in the *Archaeology Specification for Site-Specific WSIs*. Document Number: CR-PN-PRW-EN-PD-00009 (Crossrail, 2008h) and restated below:

- To define the specification for the archaeological work, the recording that is required, and the collection and disposal strategy for finds;
- To set out the scope of archaeological work in sufficient detail for it to be quantified, implemented and monitored;
- To reflect the nature of archaeological remains likely to be found and the nature of the development impact, whilst allowing sufficient flexibility for variable site conditions;
- To comply with the controls set out in the Environmental Minimum Requirements (EMR) for Crossrail, including the requirement on the nominated undertaker to use reasonable endeavours to adopt mitigation measures that will further reduce any adverse environmental impacts caused by Crossrail, insofar as these mitigation measures do not add unreasonable costs to the project or unreasonable delays to the construction programme.

2.2.3 In accordance with Crossrail Policy, ‘archaeology’ is taken to include resources below-ground (including remains of archaeological, palaeo-environmental and quaternary geological importance) and above-ground non-listed built heritage structures (Crossrail, 2008h).

2.3 Site Description

2.3.1 The Crossrail Paddington station box will be situated to the southwest of the existing Paddington Station between ch.1250 – 1580. The proposed Paddington Station will be located within the City of Westminster and is the most westerly of seven new Crossrail Central Stations on Crossrail Line 1. It will be constructed in a large underground box situated beneath Eastbourne Terrace and Departures Road, between Praed Street to the southeast and Bishop's Bridge Road to the northwest (see Figure 1). It will be integrated with the current railway station, receiving passengers from mainline rail services including Heathrow Express and providing interchange with two of the London Underground lines as well as with vehicular transport. The station will comprise two platforms, a ticket hall, concourse areas and all associated plant and operations rooms. Passenger interchange links will connect to Paddington mainline station, and the Bakerloo and Circle & District London Underground Lines.

2.3.2 Enabling works comprise the construction of a temporary area at the Platform 1A worksite west of Bishop's Bridge Road. Relocation of taxi facilities at the London Street Deck is being undertaken by the Paddington Integrated Project (PIP). These works will require demolition and dismantling of existing built structures in these locations.

2.3.3 The location of the Crossrail works for Paddington Station are shown in Figure 1.

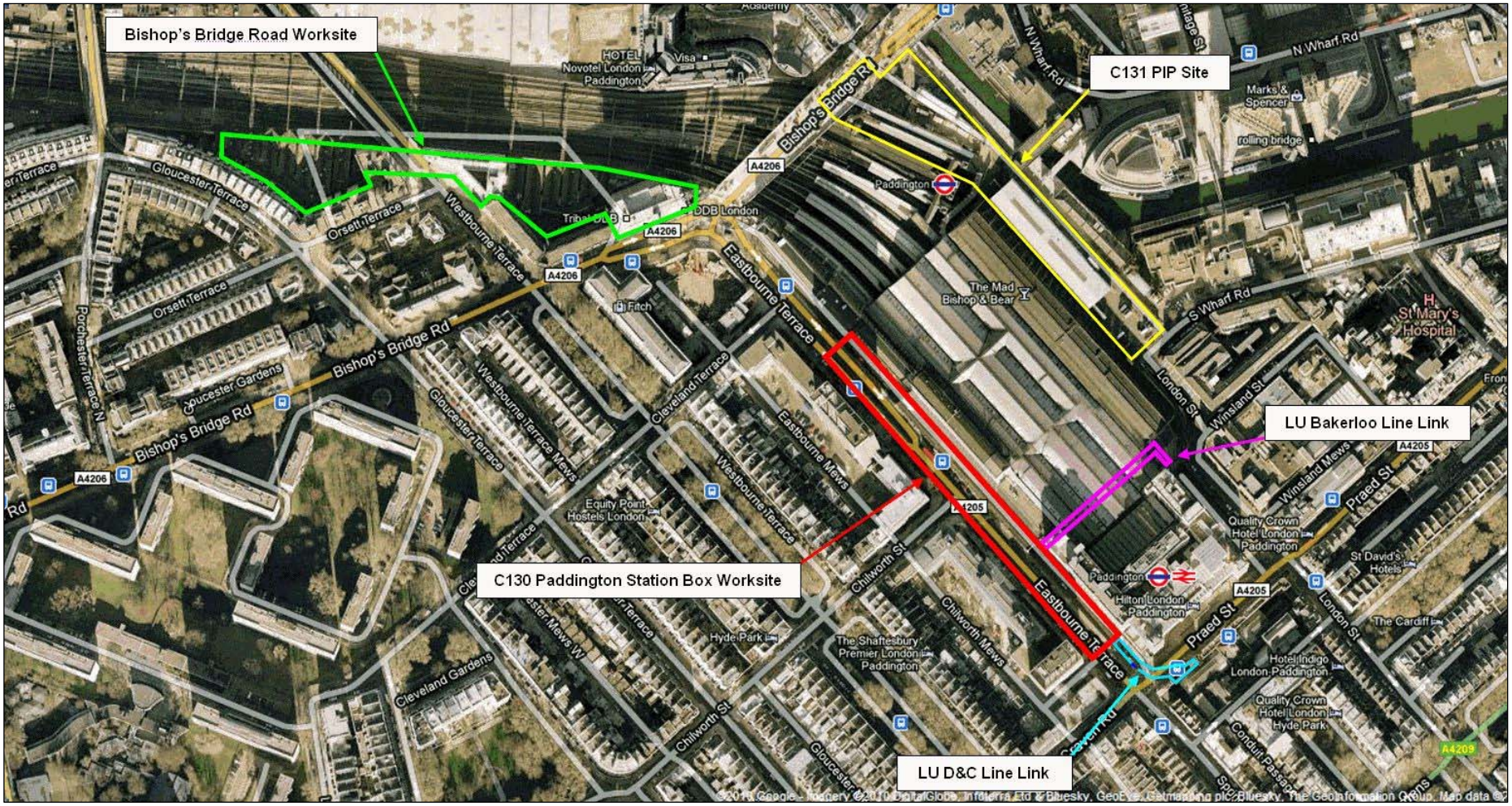

Figure 1 Worksite Locations

2.4 Summary of Previous Crossrail Studies

Desk Based Work

2.4.1 The general archaeological potential in the area of the Crossrail worksites for Paddington Station is described in the Crossrail Archaeological Impact Assessment and the Specialist Technical Reports: Assessment of Archaeological impacts (Part 1-6), published in February 2005 in support of the Crossrail Environmental Statement. In 2006 an Archaeology Programming Assessment outlined the scope and approximate timings of potential archaeological works across the entire Crossrail route. This has been superseded by a Detailed Desk Based Assessment (DDBA) of the site (Crossrail 2008a), which informed this WSI.

Ground investigation works

2.4.2 The results of the following ground investigations has been incorporated into sections 2.4 and 2.5 below and the mitigation strategy updated as required. The information gained through an understanding of sub-surface ground conditions has informed the assessment as to truncation and likely depths of archaeology.

Package 16 Watching Brief

2.4.3 An archaeological watching brief has been carried out by MoLA of the Package 16 geotechnical ground investigation works undertaken by Geotechnical Consulting Group (GCG) on behalf of Crossrail. Further details of the trenches are given in Table 3.

Package 17a Watching Brief

2.4.4 Archaeological monitoring of Ground Investigation works, Package 17a, has been carried out at 4-18 Bishops Bridge Road. The results have been reported in the MoLA document and incorporated into the WSI as required. The full results of this investigation are reported in:

MDC2 Archaeological Monitoring of Ground Investigations, Package 17a, Test Pit 208, January 2009.

Utilities Trial Trench Watching Brief

2.4.5 Archaeological monitoring of utilities trial trenches near Paddington Station has been carried out. The results have been reported in the following MoLA document and incorporated into the WSI as required. The full results of this investigation are reported in:

Crossrail, Archaeological Monitoring of Ground Investigations, Utilities Trial Trenches, near Paddington, Bonds Street and Tottenham Court Road Stations, September 2009.

Enabling Works Departures Road Watching Brief

2.4.6 Archaeological monitoring and recording was undertaken during the excavation of three geotechnical trial pits in Departures Road outside Paddington Station. The results of the watching brief have been reported in by MoLA in the document below and incorporated into the WSI as required. The full results of this investigation are reported in:

Crossrail. Archaeological Monitoring of Ground Investigations. Enabling Works, Departures Road, Paddington Station, PAD-0122. Report on the watching brief. March 2010.

Enabling Works EDF Utility Diversion Watching Brief

2.4.7 The diversion of buried EDF cabling has been undertaken as part of the enabling works package C251 along the northern side of Eastbourne Terrace. A programme of archaeological monitoring and recording was completed by archaeologist from C254 during these works. The results of the watching brief are yet to be formally reported, but interim results have been incorporated in to this SS-WSI where appropriate.

2.5 Geology and Topography

2.5.1 A total of 11 boreholes (P1-P9, P1A and P11), 4 trial pits (TP6, TP7, TP9 and TP10) and 1 self boring pressuremeter (SBP1) were carried out around the main Paddington Station site as part of the 1992 Crossrail Investigation. CRL provided additional information from CPTs (CPTu3-CPTu8 are relevant) and trial pits (TP78-TP84, TP76A, TP77A and TP82A) carried out by Soil Mechanics in 1993 and boreholes for the Telstar House Development (BH1) for the Geotechnical Summary note September 2006 (Document Reference CR-DV-PAD-X-RT-00021). Refer to Figure 4 for the geological longitudinal section. Furthermore, archaeological monitoring of geotechnical package 17a provides deposit survival information for the area around Bishops Bridge Road.

Stratum	Elevation at top, mATD	Thickness, m
Made Ground	127.1 to 123.7	1.7 to 4.45
Terrace Gravel	123.8 to 119.8	1.45 to 4.45
London Clay	122.85 to 118.35	55.2 [1]
Lambeth Group	66.35 [2]	Proven for 14.5 [2]

Note: 1 Only boreholes P1, P1A, P2-P9 and P11 within the Paddington Station chainage considered.
2 Based on borehole P3. The thickness of London Clay and thus top of Lambeth Group was proven in this borehole only.

Table 1 Paddington Box design stratigraphy summary from Scheme Design Note (Crossrail 2008e)

Stratum	Elevation at top, mATD	Thickness, m
Made Ground	124.7 to 125.7	1.5 to 2.75
Terrace Gravel	122.95 to 123.2	4.45 to 4.7
London Clay	118.5 [2]	> 24.45 to 32.8
Lambeth Group	N/A	N/A

Table 2 District & Circle Line design summary, stratigraphy summary from Scheme Design Note (Crossrail 2008e)

2.5.2 Lynch Hill Terrace Gravels overlie much of the Paddington area. These were recorded at a height of c.123mATD to 123.5mATD in Eastbourne Terrace and Praed Street, respectively. The superficial River Terrace Deposits vary in thickness across the site. The Gravel Deposits appear to be thickest in the east of the main Paddington Box site becoming progressively thinner towards the west.

2.5.3 The site has a south trending slope towards the River Thames. There is a local south-west trend towards the shallow valley of the Westbourne. The north-south Thames slope is reflected in the drop along Eastbourne Terrace from 128mATD in the north-west, to c.125.4mATD in the south-east. Within the area of the Lawn Concourse, station construction appears to have caused truncation into the natural geology. The basements of Macmillan House in this area have been predicted to be located on top of the London Clay between 118 and 120m ATD (Crossrail 2008e).

2.5.4 A watching brief was carried out on trench evaluations in the location of proposed utility diversions, which provided further information regarding archaeological survival (see Section 2.5 below).

2.5.5 Package 17a test pit 208 (Drawing Number 1D0101-G0G00-G00-P-01012, Annex 1) encountered a layer of dark grey alluvial clay at a height of 122.21 mATD, probably relating to either a tributary of the Westbourne channel or an adjacent pond. Overlying the alluvial layer at a height of 122.26m ATD was gravelly clay containing chalk and flint that could represent medieval dumping (Crossrail 2009a).

2.5.6 A ground design model based on boreholes and previous archaeological works was carried out by MoLA as part of background research to this WSI and is discussed below in Section 2.6 (see table 3 below).

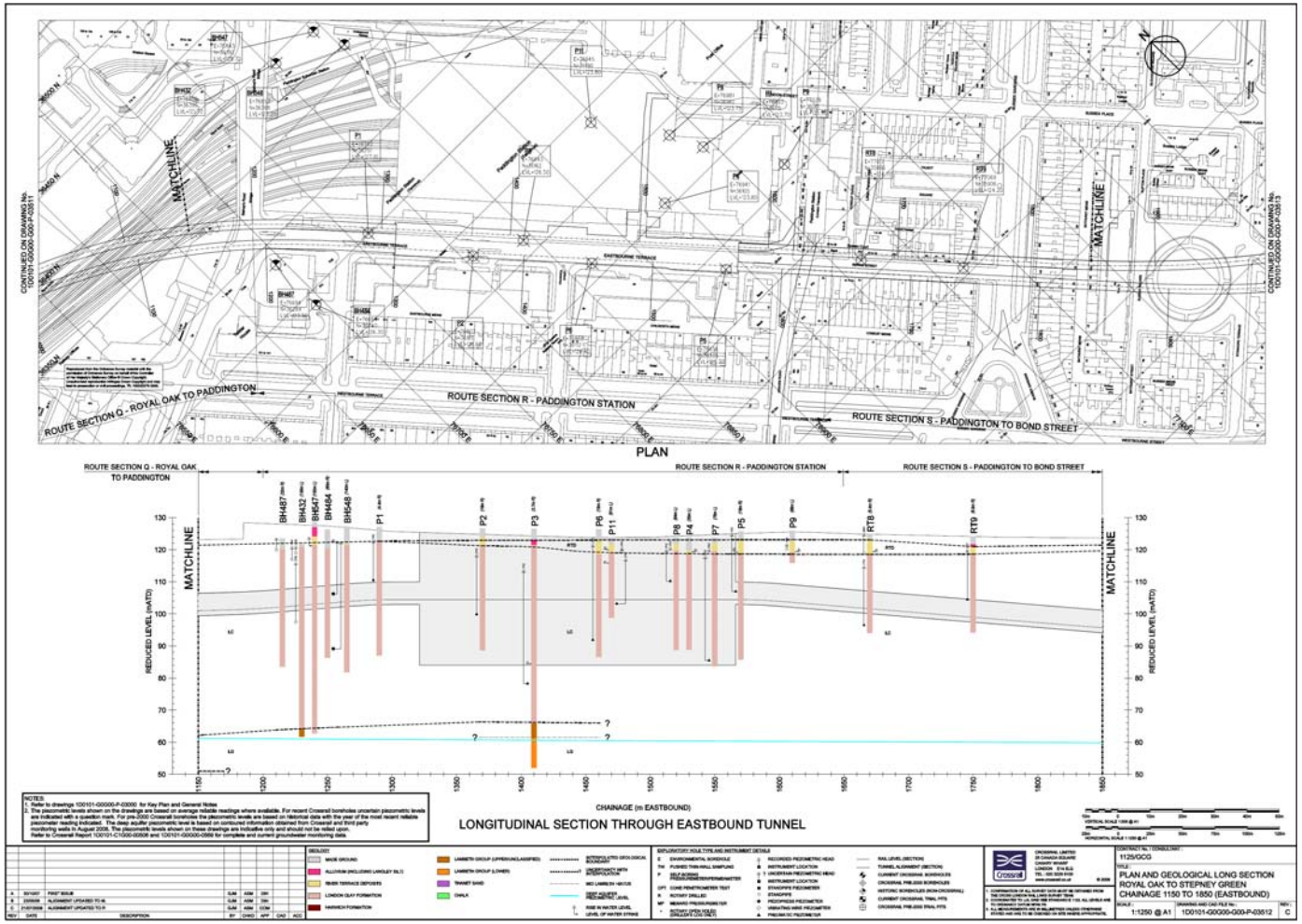

Figure 2 Plan and geological section for Eastbound Track

2.6 Archaeological and Historical Development of the Site

Paddington Station

2.6.1 There has been no evidence of prehistoric or Roman deposits recovered to date within the vicinity of Paddington Station.

2.6.2 Paddington evolved from a medieval village into a suburb within central London, situated on the junction of Roman Watling Street and the road to Harrow. During the 16th and 17th centuries it was still a small settlement centred around a village green. In 1756 Marylebone Road was constructed to connect Islington to Paddington and this gave rise to increased housing, commercialism and industrialisation of the area, particularly with the construction of the Grand Union Canal in 1801. A water conduit is located in Westbourne Terrace and is associated with the diversion and culverting of the Westbourne River.

2.6.3 The construction of Brunel's great Western Railway (GWR) and the opening to the public of the first Paddington Station in 1838 completed the industrialisation of the area. The site chosen for Paddington Station was a natural shallow depression or bowl immediately adjacent to the Paddington basin of the Grand Junction Canal (Brindle 2004).

2.6.4 Work commenced in April 1837 for the excavation of the station cutting and embankments and construction of the retaining walls, bridges, drains and roadways. Work continued until 1845 when the first temporary terminus was completed. Access ramps from London Street and Conduit Street led to a large irregular shaped yard and goods depot on the site occupied by the current passenger station. At the north-western end of the cutting Bishop's Road Bridge formed the station façade through which twenty-six arches allowed access for tracks to the goods yard and head shunt and also housed the booking hall, waiting rooms, parcel office and carriage entrances to the station. West of the bridge lay simple timber departures and arrivals platforms, turntables, carriage sheds, an engine shed and workshops (Brindle 2004).

2.6.5 The first station was demolished in 1853 as a result of the increasing demand for rail travel and the lack of capacity offered by the original station. The following year in 1854 the new GWR Paddington Terminus was opened. Designed by I K Brunel with Matthew Digby Wyatt, the new Paddington station comprised the triple span shed constructed by Fox Henderson and Co. The Lawn and Great Western Hotel formed its eastern end, the western end being open to the railway and goods yard beyond Bishops Bridge Road. To the south of the triple span lay the departures side access by ramps from Conduit Street (now Praed Street) and Bishops Bridge Road. The offices for the Great Western Railway Company were located on the departures side in a two story building (now part of MacMillan House) with the open central section of the Clock Arch and Paxton style glazed canopy. To the north of the triple span lay the arrivals side accessed by a ramp from London Street and again covered by a Paxton Style canopy.

2.6.6 The station has been altered and extended on a number of occasions since 1854. The departures side offices were extended and heightened between 1878- 1880. Between 1908 and 1912 driven by the need to provide additional track capacity the station was extended northwards into the arrivals side with the construction of a fourth shed and new track beds beneath London Street.

2.6.7 The World's first underground railway opened in 1863, running from Bishop's Road to the north of Paddington Station and then extended to Praed Street Station in the following year. This was constructed using a cut and cover method resulting in the removal of considerable areas of deposits. Further sub-surface construction work had included the construction of basements and connections to the underground tube platforms.

2.6.8 The DDBA contains a map regression demonstrating the key stages through the development of the area. The highlights are:

- The Rocque 1746 map shows the site as lying in open fields. The valley associated with the line of the Westbourne Valley is depicted to the east.
- The Greenwood 1824 map shows that nearly 100 years later this area has undergone considerable development with the construction of the Grand Union Canal to the north of the site. Other than Bishop's Lane and field boundaries which cross the site, no structures are illustrated within the Crossrail works area.
- Lucas's 1842 plan of the Paddington parish shows the area was developed in the 1820s. The map shows the large area set aside for the rail line and all the major road links. The area shown here is that acquired for the construction of the original Great Western Station built in 1838. Brunel's building was not built until 1854.
- Less than 40 years after Lucas, Stanford's 1862 map shows extensive development across the entire Paddington Station area, with road construction and housing surrounding the site. The railway station, its tracks and goods yard have been constructed between Eastbourne Terrace and the Grand Union Canal.
- The 1872 Ordnance Survey map shows dense housing surrounding Paddington Station. Across the Station area the 'greyed out' expanses indicate perhaps an overhead structure or canopy.

2.7 Deposit Survival

Deposit Model

2.7.1 Table 3 below lists the deposit model for the Paddington Station construction sites. The data indicates that there has been a great deal of truncation across the site due to previous transport related construction. Where deposits survive they are mainly dated to the post-medieval period.

Data ID	Easting	Northing	Data Location	Natural surface mATD	Description	Ground Level mATD	Notes
PYD 00	526331	181600	London Street, Paddington Goods Yard	122.0	London Clay	127.0 - 129.0	London Clay truncated by railway cutting. No archaeology survived; localised truncation of natural geology by concrete slab to c 120.0mATD
PGY 90	526336	181613	London Street, Paddington Goods Yard	122.0	London Clay	129.0	London Clay truncated by railway cutting. Wooden pile (probably from Brunel's 1838 GWR terminus), and mid-late 19th-century brick foundation, cut into the London Clay
PAG 97	526800	181800	Paddington Green, Children's Hospital	131.6	Brickearth	133.1	17th to 19th-century deposits and features truncated the natural brickearth (which overlay Lynch Hill Terrace Gravels)
PRT 93	526450	181750	1-14 Porteus Road	130.0	London Clay	130.2 - 130.8	19th-century garden deposits at 129.7 - 130.6mATD; Localised truncation of London Clay by late Victorian cellars and modern drains down to 129.5mATD
PRA 98	527000	181550	12-20 Praed Street, Paddington Basin	129.0 - 129.1	Lynch Hill Terrace Gravels	130.0	

Table 3 Deposit Survival data from previous archaeological investigations

Results of utility trench monitoring

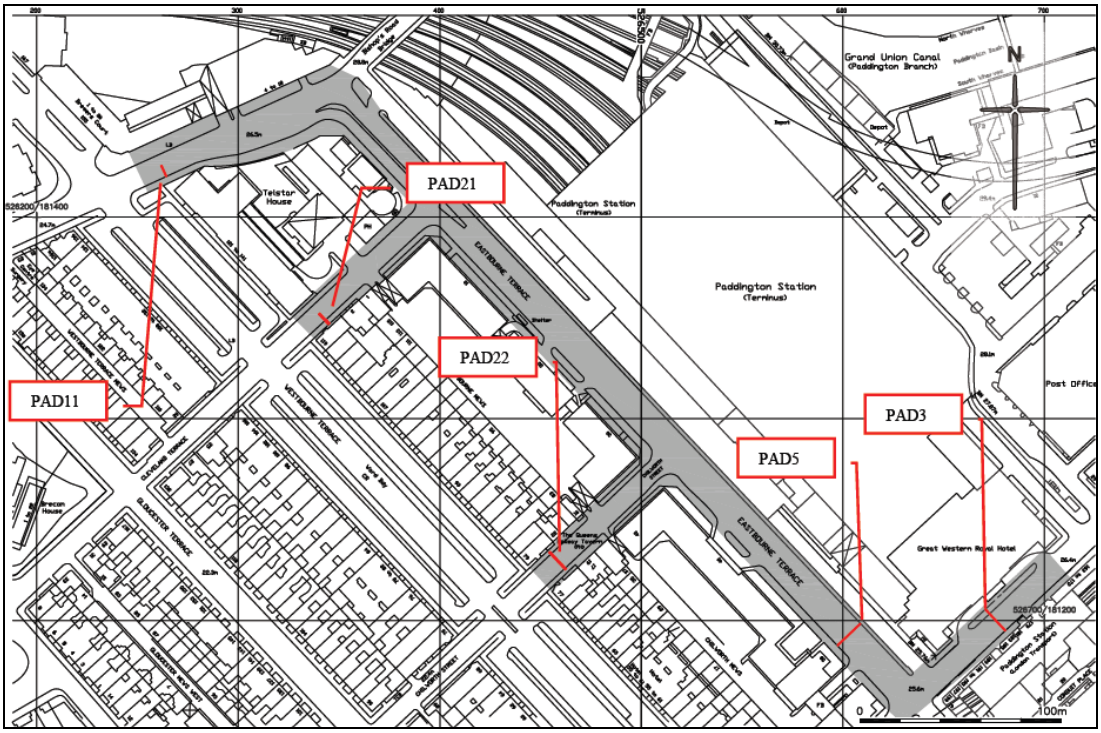

Figure 3 Utility trench locations

2.7.2 Archaeological observation of trenches opened to observe proposed utility locations has been carried out. The results are summarised in Table 4 below. The information provided by this monitoring has been incorporated as necessary into the mitigation strategy.

Trenches	Results	
3		Below tarmac and concrete (150mm thick) modern disturbance and reworked material extended to 580mm bgl. Below this geology comprised clean, firm silty, clayey, sand which has been mapped as Langley Silt Complex Brickearth by the British Geological Survey. There are sedimentary characteristics that distinguish this from Langley Silts in the central – City of London – area but together they form a group of deposits laid down at the end of the last Ice Age
11	No image	In the base of the trench layer of compact, dark brown, green silty clay with very occasional 19th century pottery fragments, was recorded. Overlying deposit was a layer of hard silty sand with moderate red bricks fragments.
21 & 22	No image	Brick arched coal cellars extend <1m into the road. Their base >3m from surface. Cut through post-med fills over coal ash at 1.1m bgl. Stiff brown clay at 1.2m bgl (London Clay? Alluvium?) indicate natural weathered surface of London Clay is the Stiff brown clay exposed at 1.1m bgl (PAD22) to 1.2m bgl (west) and 1.4m bgl (east PAD22). They appear to expose a natural slope from east down to west, reflecting the valley of the Westbourne River (in a culvert in this area).

Table 4 Results of archaeological monitoring of utility trenches

2.7.3 The findings from the archaeological watching brief provide more detailed information about the likely archaeology to be located in the Paddington Station worksites. For the most part natural surfaces appeared to have been truncated by activity in the post-medieval period. Trenches 21 and 22 in Cleveland Terrace and Chilworth Street respectively exposed what appeared to be a natural slope of the Westbourne River Valley.

2.7.4 An archaeological watching brief (XRK09) during EWMA ground investigation surveys in Departures Road under package PAD-0122 identified a possible Pleistocene horizon 0.10m thick, comprising silty sand and gravel at c.120.58m ATD in a single trial pit (Trial Pit 1). This deposit has been identified as having a low potential to contain Palaeolithic remains, although no Palaeolithic material was recovered during the watching brief. The horizon was sealed by a layer of colluvium or made ground *c.*1m thick of probable post-medieval date which was in turn overlain by *c.*2.0m of post-medieval and modern made ground (Crossrail 2010).

2.7.5 Interim results from the archaeological watching brief undertaken during the EDF utility diversion works on Eastbourne Terrace (XSD10) identified a sequence of modern and

post-medieval deposits to a depth of approximately 1m below the existing road surface. A uniform and consistent stratigraphy comprising 0.50m modern tarmac surfacing and road make up, overlying by 0.50m of redeposited clay natural. This deposit has been interpreted as upcast and landscaping material associated with Brunel's cutting for the GWR Paddington terminus (C254 Weekly Progress Report No. 011).

Archaeological Potential at Paddington Station

2.7.6 There is **low potential** for Palaeolithic remains in the area. If located, any features or artefacts will have a **low importance** if they are redeposited; this may become **high importance** if significant in situ remains were present (although on current evidence this is considered to have a low probability).

2.7.7 There is a **low to medium potential** for Roman or medieval remains to be located although these would have a **moderate** to **high importance** were they to be identified. NB. Possible medieval dumping was identified in TP208 at Bishops Bridge Road.

2.7.8 The assessment has found that there is a **high potential** for post-medieval archaeology relating to the construction of Brunel's Railway to be located within the construction area, and of earlier railway works in general. Where this can be positively dated to be part of Brunel's construction these remains are likely to be of **moderate** to **high importance**.

3 Construction Impacts and Mitigation

3.1.1 The new Crossrail station at Paddington will comprise a cut and cover station box and connection to the Paddington Network Rail station. Connection tunnels to the London Underground Bakerloo Line and District & Circle Line Station at Praed may also be constructed. At the time of writing a decision as to whether these two elements of the station design will be undertaken is being made. The requirement for archaeological mitigation for these works should they be required is set out in this WSI.

3.1.2 The relocation of taxi facilities to the London Street Deck and service area at the Platform 1A worksite west of Bishop's Bridge Road are being undertaken as part of the C131 Paddington Integrated Project (PIP).

3.1.3 Construction activities will take place at three principal locations:

- Bishop's Bridge Road worksite;
- Departures Road and Eastbourne Terrace (Departures Road Scheme);
- Praed Street.

3.1.4 Additional works activities will take place within the listed structure of the Paddington Network Rail Station associated with the C122 tunnel bore for the London Underground Bakerloo Line connection tunnel and related works to prevent settlement of structural elements of Brunel's station itself.

Bishops Bridge Road Worksite

3.1.5 The Platform 1A worksite (Figure 8) is situated to the west of Bishop's Bridge Road and south of the mainline railway tracks into Paddington Station. The area is currently used by Network Rail as a car park and for waste transfer activities. The area will be used to provide car parking and support for C405 construction activities.

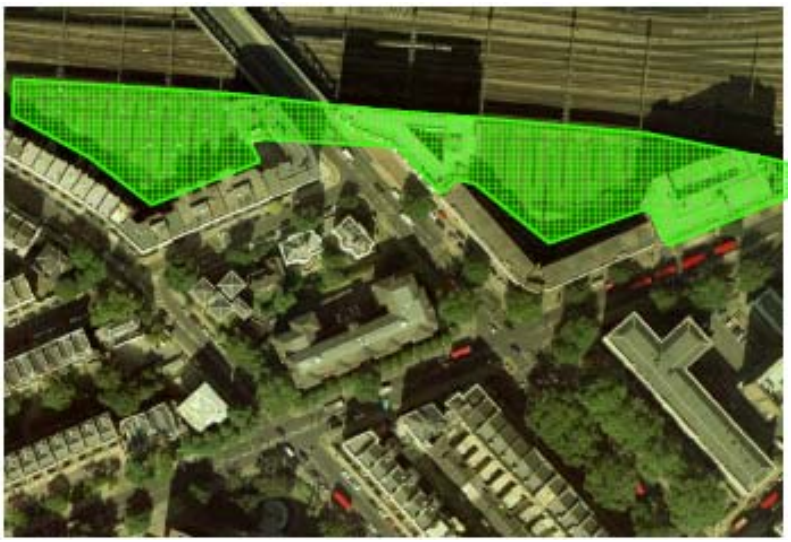

Figure 4 Platform 1a Worksite

3.1.6 Intrusive groundworks within the area of the Platform 1A worksite will be limited to shallow ground reduction and resurfacing works in Car Park 1.

Departures Road Scheme

3.1.7 The Departures Road Scheme (DRS) comprises the construction of the new Paddington Crossrail Station under Eastbourne Terrace and Departures Road. The scheme will comprise a cut and cover station box 267m long with an internal width of 23.0m and general excavation depth of approximately 23m. Connections will link the new Crossrail station to the existing Paddington Network Rail Station, LUL Bakerloo Line and LUL District & Circle Lines.

3.1.8 The perimeter walls of the station box will be constructed from reinforced concrete diaphragm walls on all four sides of the box with the end walls stepped around the east and west bound running tunnels. Soft cement-bentonite secant pile walls will be provided at the end walls where the tunnel bore machines will break through into the station box. The station box will be covered by a reinforced concrete roof, and will be constructed on three levels with intermediate, concourse and base level slabs.

3.1.9 A full description of the Departures Road Scheme can be found in Volume 1 of the Departures Road RIBA D Report (Document No. C130-SWN-Z-RSR-B071-00003) and the C130 Paddington Station Constructability Report (Option A), (Document No. C130-SWN-C-RGN-B071-00001).

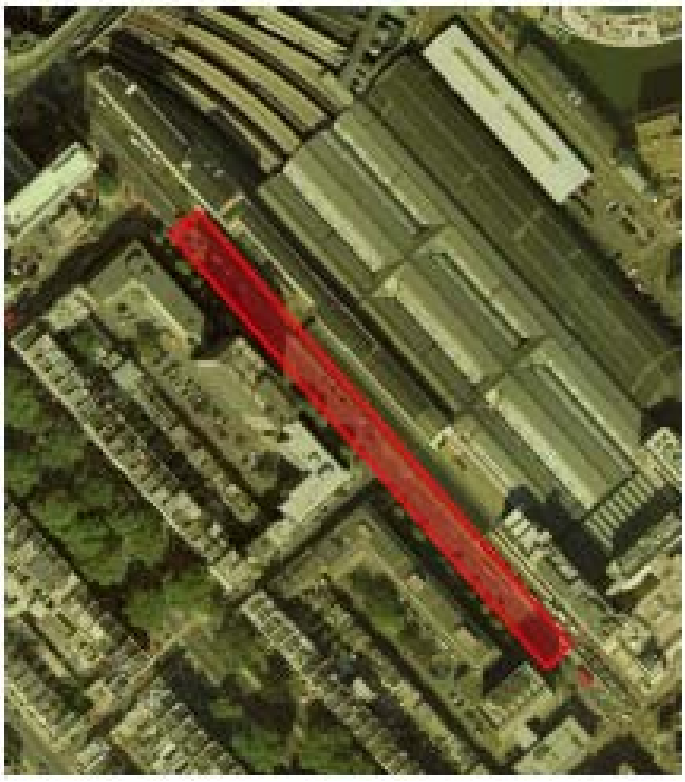

Figure 5 Eastbourne Terrace/Departures Road

3.1.10 General construction sequence for the DRS is divided into two stages:

- Enabling Works; and
- C405 Main Works.

Enabling Works

3.1.11 The enabling works will also take place prior to the closure of Departures Road and Eastbourne Terrace and will include site set up works such as:

- The Consolidated Intrusive Surveys at Departures Road and MacMillan House (Contract Package C2097) will comprise elements of survey packages PAD-0208, PAD-0227, PAD-0259, PAD-0263 & PAD-0264 and PAD-0265 (completed in February 2011);
- EWMA utility diversions within Eastbourne Terrace (Contract Package C251) and the construction of a new utilities corridor on the south side of Eastbourne Terrace (currently ongoing).
- Diversion of gas mains serving MacMillan House within Departures Road (Contract Package C251);
- Erection of hoardings and temporary lighting to protect pedestrian access to Paddington Station;
- The removal and disconnection of all services located within chambers below the Departures Road/Eastbourne Terrace retaining wall;
- The erection of an access scaffold deck to allow the inspection of the MacMillan House façade; and
- The erection of hoardings and temporary lighting to protect pedestrian access along the southern side of Eastbourne Terrace.

3.1.12 Archaeological mitigation measures to reduce the impact of and the intrusive elements of the Enabling Works on the archaeological resource will include a combination of Targeted and General Watching Brief (See section 5 below).

3.1.13 The excavation of the new utilities corridor on the south side of Eastbourne Terrace under C251 has the potential to penetrate 19th and 20th century made ground deposits and either reveal or truncate archaeological deposits that predate the construction of the GWR terminus at Paddington. This potential impact will be mitigated by a programme of archaeological monitoring and recording in the form of a General Watching Brief.

3.1.14 Two gas main diversions are planned within Departures Road to be undertaken as part of C251. The first will go under the Departures Road/Eastbourne Terrace retaining wall and cross Departures Road before entering MacMillan House. The diversion of the gas main across Departures Road has the potential to encounter and the listed disturb creosote soaked wooden setts laid along Departures Road and will require a Targeted Watching Brief as set out in Section 5 of this SS-WSI and paragraph 3.1.17 and Appendix

3 Drawing No. C130-SWN-T-DDB-M171_Z-01520 of the Heritage Method Statement, Utilities Works within Basement of Macmillan House WES/4/5/H1 (Document No. C130-SWN-T-GMS-B071-50001).

3.1.15 A second gas main and BT cabling will be diverted through the Osbourne Tunnel, crossing Departures Road before entering the MacMillan House Block B basement. The service trench carrying the gas main and BT cabling will measure approximately 1000mm wide and 600mm deep, and will follow the a course as shown on Drawing C130-SWN-T-DDL-M171_Z01533, in Appendix 2 of the Heritage Method Statement, Utilities Works Within Basement Of Macmillan House WES/4/5/H25 (Document No. C130-SWN-T-GMS-B071-00010 Ver. 1). This utilities trench has the potential to remove part of the listed wooden setts which survive beneath the existing road surface. In order to mitigate this impact excavation of the trench would be monitored and recorded under a programme of archaeological Targeted Watching Brief as set out in the Section 5.1.10 of the Heritage Method Statement (Document No. C130-SWN-T-GMS-B071-00010 Ver. 1).

3.1.16 The C251utility diversion works in Departures Road have the potential to remove or disturb creosote soaked wooden setts laid to form a wooden roadway surviving approximately 300-500mm beneath the existing road surface. The wooden setts may either be associated with the Departures side approach to Brunel's station of 1854 or a later road surface laid by the Improved Block Pavement Company after 1870. These intrusive impacts would be mitigated by a programme of archaeological Targeted Watching Brief.

3.1.17 Trial pits excavated in Departures Road may penetrate the19th and 20th century made ground deposits and truncate the possible Pleistocene horizon recorded at c.120.58m ATD during the archaeological monitoring of trial pits during the earlier ground investigation PAD-122. Such works will also expose structural elements of the Grade I listed structure of the Paddington Network Rail Station. Where wood blocks are not present the impact of intrusive works will be mitigated by a programme of archaeological monitoring and recording in the form of a General Watching Brief.

C405 Main Works

3.1.18 The Main Works contract (C405) will commence after the completion of the advanced works and the full closure of Eastbourne Terrace scheduled for November 2011. The construction sequence for the new Paddington Station Box will be undertaken in 18 stages as shown on Drawing Nos. C130-SWN-S-DDB-M171_Z54510 to Z54512 in Appendix 3 of the C130 Paddington Station Constructability Report (Option A), (Document No. C130-SWN-C-RGN-B071-00001).

3.1.19 Construction Impacts on the archaeological and heritage resource are anticipated during Stages 2 to 5 and are summarised below:

Stage 2

- Divert utilities in Departures Road;
- Removal of the Canopy over Departures Road and protection of the Paxton canopy (see 3.1. 23 below);

- Removal of listed railing and coping stones from Departures Road/Eastbourne Terrace retaining wall (see 3.1. 24 below); and
- Demolition of the listed central Departures Road/ Eastbourne Terrace retaining wall from the junction of MacMillan House Blocks C and E to Praed Street.

Stage 3

- Install sheet piles along North side of Departures Road in front of MacMillan House. Sheet piles will typically be installed within a foundation trench c 0.6m wide and up to c.1.0m deep. Excavation of the foundation trench has the potential to remove the wood block paving where it survives within Departures Road approximately 300-500mm beneath the existing road surface ;
- Excavate and construct guide walls along north side of Departures Road, working from centre of the site towards both ends. Guide wall trenches will be c. 650mm wide by 1.20m deep and have the potential to remove the wood block paving where it survives within Departures Road approximately 300-500mm beneath the existing road surface; and
- Excavation of a 52m long access trench and diamond cutting to remove the face of the MacMillan House Block E basement wall, seal and backfill prior to diaphragm wall construction (MacMillan House Basement Clash; see below).

Stage 4

- As southern diaphragm wall is completed, demolish remaining section of central retaining wall between Departures Road/Eastbourne Terrace;
- Concurrently reduce Eastbourne Terrace and Departures Road to 124.0m ATD; and
- Continue to construct guide walls for northern section of Departures Road diaphragm walls, guide wall trenches will be c. 650mm wide by 1.20m deep and have the potential to remove the wood block paving where it survives within Departures Road approximately 300-500mm beneath the existing road surface.

Stage 5

- Excavation to soffit level (c.121.5m ATD) of capping beams and roof slab. Cutting down the diaphragm wall were required. In Departures Road there is the potential to remove the wood block paving where it survives approximately 300-500mm beneath the existing road surface.

3.1.20 Stages 6 to 18 of the construction sequence detail the excavation of the station box through the Lynch Hill terrace gravels and London Clay to form the intermediate and lower levels of the station, followed by the construction and fit out of the station structure.

3.1.21 There will be no requirement for archaeological mitigation during the Stage 2 and 3 construction of guide walls for the southern diaphragm wall or Stage 4 excavation of Eastbourne Terrace to 124m ATD. The deposit model and recent archaeological monitoring data for the area indicates that these activities will be undertaken solely within made ground deposits which are recorded extending to approximately 123.3m ATD.

3.1.22 The Departures Road/Eastbourne Terrace retaining wall has been fully recorded under an English Heritage Level III survey standard. A General Watching Brief will be required during demolition of the retaining wall in order to identify and record any structural elements such as supporting buttresses, small rooms or chambers currently hidden from view behind the existing face of the retaining wall.

3.1.23 Archaeological monitoring and recording during the Stage 2 removal of the Canopy over Departures Road will be required. In accordance with Schedule 1, Part 2, Section 2 of the Heritage Deed for Paddington Station a detailed record and analysis of the canopy has already been undertaken (CR-DV-PAA-X-RT-00047, 'Paddington Station: Building Recording at Departures Road' Feb 2009). A General Watching Brief during removal of the canopy is necessary to investigate how the canopy is attached to the fabric of MacMillan House.

3.1.24 The requirement for archaeological mitigation during the Stage 2 removal of the listed railings and coping stone on the Departures Road/Eastbourne Terrace retaining wall is guided by the Heritage Method Statement, Departures Road Canopies and Eastbourne Terrace Retaining Wall and Railings WES/4/5/H4 (Document No. C130-SWN-T-GMS-B071-00002 Rev. 5.0). The method statement notes that:

*Prior to commencement of operations it will be necessary to determine by means of intrusive survey the means of fixing both the coping to the brick wall and the means by which the posts are founded. The most appropriate location for such intrusive survey would be within the pedestrian gap at the west end of Eastbourne Terrace. Such intrusive survey should be undertaken by means of a hand dug excavation (under archaeological conditions) to reveal footings (*Para. 3.2.7*).*

3.1.25 The excavation of any intrusive trial pits prior to the removal of the railings are therefore required to be monitored by an archaeologist and the construction of the fixings and footing recorded under a General Watching Brief. The method for the removal of the railings is set out in the Heritage Method Statement (Document No. C130-SWN-T-GMS-B071-00002 Rev. 5.0).

Stage 3 - MMH Foundation Clash

3.1.26 Trial pits excavated to investigate the depth and extent of the basement foundations of Macmillan House have identified that there is a clash between the existing basement wall and the proposed diaphragm wall of the station box. The clash will affect a 52m length of the basement wall and its supporting foundation.

3.1.27 A detailed design review at RIBA D identified that it is not possible to reduce relocate or reduce the size of the station box. It is therefore necessary to remove the external face of the basement wall and its foundation to allow construction of the diaphragm walls.

3.1.28 The face of the basement wall and foundations will be removed in 2m wide sections by diamond plunge wire cutting along the 52m length of the foundation clash.

3.1.29 The construction sequence for these works is programmed to take place in six stages following the closure of Departures Road as set out in Drawing C130-SWN-S-DDB-M171_Z-54522 Rev. P05.1 (Annex 1).

3.1.30 There is potential for intrusive impacts on buried archaeological remains during the following works activities:

Stage 1

- Divert utilities in Departures Road.
- Pre-trench excavation measuring 0.60m wide and 1.2m deep below the existing level of Departures Road, along the line of sheet pile protection for the main excavation. This activity has the potential to remove surviving elements of the historic wooden block paving identified during earlier trial pit investigations.

Stage 2

- Excavate a trench 2.7m wide between the MacMillan House basement wall and sheet piles to expose the top of the basement wall to a level of 750mm below existing road level. Again there is the potential to remove the historic wooden block paving. An archaeological record of the face of the listed basement wall will also be required once exposed.

Stage 3

- Excavation of the trench to a depth of 2.5m and erection of scaffold working platform. Further archaeological recording of the face of the listed basement wall will be required once exposed and a photographic record taken to document during its removal.

Stage 3a

- Remove scaffolding and excavate trench to full depth of brick basement wall and expose foundation underside at c.119m to 120m ATD. Archaeological recording of the face of the listed basement wall will be required as above.

3.1.31 Trench excavation during Stages 4-6 of the MacMillan House basement works, below a depth of approximately 120m ATD will progress through Lynch Hill gravels and London Clay and will not require archaeological monitoring.

3.1.32 The MacMillan House basement clash works have the potential to remove wood block paving previously recorded at a depth of up to 500mm below existing ground level. Excavation works to this depth will require archaeological monitoring in the form of a Targeted Watching Brief. If no wood block paving is present or for excavation below a depth of 500mm archaeological monitoring will be down graded to a General Watching

Brief with the purpose of recording the foundations of the Grade I listed structure and to investigate the potential for archaeological remains associated with the Pleistocene deposit of low Palaeolithic potential identified at c.120m ATD during the PAD-0122 watching brief.

Main works not currently included in C405 Main Works Package

London Underground District & Circle Line Link

3.1.33 At the time of writing the proposed the District and Circle Line connection tunnel and Praed Street underground station access has been deleted from the Crossrail scheme, this represents a change from earlier versions of this SS-WSI.

Paddington Network Rail Station Protection Works

3.1.34 The proposed connection tunnel linking the Paddington Crossrail Station box to the London Underground Bakerloo Line has also been removed from the C405 scope of work and may be subject to redesign if undertaken at a future date.

3.1.35 The current proposed tunnel alignment designed by C122 runs in close proximity to the existing foundations of six columns of the Brunel train shed roof. The RIBA stage D report (Document No. C130-SWN-Z-RSR-B071-00003) for the Departures Road Scheme identified that without protective measures “significant settlement and rotation of these foundations is anticipated”.

3.1.36 Should the current proposed design or any future designs require intrusive works within the cartilage of Paddington’s Grade I listed station structure that would expose or disturb elements of the listed structure then those works would require archaeological monitoring and recording. Any proposed designs should be reviewed by the Crossrail Project Archaeologist in order to determine the exact archaeological requirements. Those requirements would then be communicated to the Main Contractor and Archaeological Contractor by the Crossrail Project Archaeologist on behalf of the Project Delivery Partnership.

4 Archaeological Aims and Objectives

4.1 Research Aims

4.1.1 Selected research themes derived from A Research Framework for London Archaeology 2002 (Nixon et al, 2003) are included in the Assessment of Archaeology Impacts Technical Report (Crossrail 2005). Archaeological investigation and mitigation in the Crossrail worksites at Paddington Station have the potential to contribute to the major themes set out below:

- Understanding London's hydrology and river systems and tributaries and the relationships between rivers and floodplains;
- Understanding the evolving character of development in central London between Westminster and the City, and Southwark;
- Examining the concept of core/periphery for different periods in London's past, as a means of understanding a settlement and its environs, a city and its hinterland;
- Contributing to our understanding of the creation of the London suburbs; and
- Understanding the reasons for evolution of the road systems, street layouts, river crossings and ferries, and their importance as engines of development and change.

4.1.2 The archaeological investigations at Paddington Station will also directly contribute to the following research priority for understanding the development of London after AD1500:

- Identifying the consequences of infrastructural development at a local level.

4.2 Objectives of the Investigation

4.2.1 The fieldwork priorities for the works will be to recover data that addresses the following research objectives of importance to this landscape. These are:

- To record the landscape development (i.e. land construction) through assessment of the soil stratigraphy, including the definition of any survival Brickearth or Pleistocene deposits;
- To identify the location, extent and depth of post-medieval and modern truncation of archaeological and natural deposits, particularly in relation to the construction of the GWR and Paddington Station;
- To define levels of landscape change due either to environment and climate or human interaction;
- To identify and record any surviving elements of Brunel's 1845 and 1854 Paddington Station and to define and record the development of Brunel's railway and associated GWR works; and
- To define and record surviving elements of Victorian vernacular architecture both above and below ground.

5 Scope of the Investigation

5.1 Archaeology - Paddington Station

5.1.1 The historic development of the Paddington Station Site is summarised in Section 2.5 of this SS-WSI and in the Paddington Station Site Specific Archaeological Detailed Desk-Based Assessment (Document No. CR-SD-PAD-EN-SR-00002). The potential for the survival of archaeological remains is described in section 2.6.5 above.

General Requirements for Main Contractors

Site Accommodation and Facilities

5.1.2 For each works package the *Main Contractor* shall provide the following site accommodation facilities for the use of archaeological operatives, inclusive of any hardstanding and services required:

- Welfare and mess facilities (including power, water and lighting);
- Toilets, with drying and washing facilities;
- First Aid;
- Storage for small plant and tools; and
- Temporary office including 1 No. desk space for the use of the C254 lead archaeologist complete with furniture.

Specific Requirements for Main Contractors

C251 Eastbourne Terrace Utilities Diversions

5.1.3 General Watching Brief is required during the excavation of the Utilities Corridor on the south side of Eastbourne Terrace. Archaeological investigation by General Watching Brief is defined in the Generic WSI (CR-PN-LWS-EN-SY-00001).

5.1.4 At Eastbourne Terrace this will comprise a programme of observation, investigation and the recording of archaeological remains during the excavation of the Utilities Corridor trench. The *C251 Main Contractor* will work with the C254 Archaeologist to ensure that the necessary controls are implemented in order to allow archaeological recording to take place to the required standard.

5.1.5 It is understood that excavation of a trench c. 400m (L) x 4.0m (W) and 1.5 to 3.0m (D) will be undertaken within the pavement and highway along the length of the southern side of Eastbourne Terrace. Additional trenches will be excavated across the width of Eastbourne Terrace and Departures Road at the Bishops Bridge Road and Praed Street end to facilitate 'tie ins' with existing utilities and service infrastructure.

5.1.6 Modern overburden will be removed in stages by the *C251 Main Contractor* using either a vacuum excavation method or 360^{o} tracked mini-excavator fitted with a toothless grading bucket. Excavation will proceed where possible in level spits of a maximum thickness of 500mm at the discretion of the C254 archaeologist. Excavation will proceed until the first

archaeological horizon or the required base of the Utilities Corridor trench which ever is encountered first.

5.1.7 Any archaeological horizons encountered will be hand cleaned as necessary to achieve clear definition of any archaeological features which will then be rapidly investigated, sampled and recorded by the C254 archaeologists. Sections through the stratigraphic sequence will also be cleaned, sampled and recorded.

5.1.8 Following the investigation and recording of any archaeological horizons present excavation of the Utilities Corridor trench will continue through the sequence of made ground and Thames Terrace gravels until the required depth is reached.

5.1.9 Excavation of the Utilities Corridor trench in this manner will allow the full sequence of deposits to be examined and recorded.

5.1.10 For further information regarding Utilities Corridor works refer to Paddington Station Utilities Diversions, Volume 2a – Site Specific Works Information (Document Number CRL1-PD-V3-XWI-B071_WS079_A-00001).

Archaeological General Watching Brief Procedure

5.1.11 The method of working for the C251 Main Contractor during utility diversion works shall allow for:

- Identify the location all known services and utilities prior to excavation and brief the C254 archaeologist as to their location;
- The removal of modern material, made ground and Thames Terrace gravels will be carried out under archaeological observation, to the base of the trench between 1.5m and 3.0m below ground level (e.g. to c.124.5m to 123m ATD);
- Allow suitable access from ground level to bottom of the excavated trench for C254 archaeologists to rapidly clean and record the stratigraphic sequence of deposits visible in trench sections and any significant archaeological deposits which may be encountered.
- In the event that archaeological remains are identified the C251 *Main Contractor* should allow an estimated 1-2 days per 50m section of utility trench excavation 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 Archaeologist following discussion with the *C251 Main Contractor*, and C254 Archaeologist;
- Allow suitable secure access, shoring and edge protection where required from ground level to bottom of excavated area for archaeologists to work;
- Remove, as directed by the C254 archaeologist, materials once they have been recorded by the C254 archaeologists until the required level is reached.
- Use of excavators or other plant within the area shall only be undertaken with the agreement of the Project Manager and under the observation of C254 Archaeologist.
- Allow for up to 2 archaeologists to be on site during groundworks.

- Provide further technical advice to C254 as maybe required to safely complete the works.

Targeted Watching Brief

5.1.12 Targeted Watching Brief will be required during the diversion of the two gas mains within the pedestrian pavement or highway of Departures Road to identify record and remove any wooden setts present. The wooden setts have typically been found at a depth of between 200 –500mm below the existing ground surface. Below this depth where it has been proved that wood block paving is not present Targeted Watching Brief may be downgraded to General Watching Brief. The decision to down grade the Targeted Watching Brief will be made by Crossrail's Project Archaeologist following discussion with the C254 Archaeologist and C251 Main Contractor. Archaeological investigation by Targeted and General Watching Brief is defined in the Generic WSI (CR-PN-LWS-EN-SY-00001).

5.1.13 A specific methodology for the recording, removal and reinstatement of the wooden block paving in Departures Road is provided for reference below in section 7.4.17 of this WSI.

5.1.14 Excavation of the trial pits in this manner will allow the full sequence of deposits and elements of the listed station structure to be examined and recorded.

5.1.15 When undertaking the Targeted Watching Brief the C251 Main Contractor's methodology should allow provision for the following procedure:

Archaeological Targeted Watching Brief Procedure

- Identify the location of all known services and utilities prior to excavation and brief the C254 archaeologist as to their location;
- Machine or hand excavate in stages (as directed by the C254 Archaeologist), under supervision of C254 Archaeologist modern overburden and post-medieval made ground to the surface of the wood block paving, at approximately 200-500mm below the existing ground surface;
- Provide as clean a excavated surface at the top of the wood block paving as is possible and allow the C254 archaeologist up to 1 day per 10m section of pipe trench excavated to clean, record and log the wooden setts prior to removal;
- In the event that archaeological remains are identified the C251 *Main Contractor* should allow an estimated up to 1 day per 10m section of pipe trench excavated to 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 Archaeologist following discussion with the *C251 Main Contractor*, and C254 Archaeologist;
- Allow suitable secure access, shoring and edge protection where required from ground level to bottom of excavated area for archaeologists to work;
- Remove, as directed by the C254 archaeologist, materials once they have been recorded by the C254 archaeologists until the required base of each trial pit is reached;
- Reinstatement as directed by the C254 archaeologist and following the specification provided at section 7.4.17 of this WSI.
- Allow for up to 2 archaeologists to be on site during groundworks;

- Following partial backfilling of each trial pit and at the correct height in metres ATD, allow 0.5 -1 day per 10m section of pipe trench excavated for the replacement and reinstatement of the wood block paving; and
- Provide further technical advice to C254 as maybe required to safely complete the works.

C405 Main Works

5.1.16 As identified in section 3.1.8 above archaeological mitigation during the C405 currently comprises a combination of Targeted and General Watching Brief.

Targeted Watching Brief

5.1.17 Targeted Watching Brief will be required during excavation works within Departures Road where there is the potential to remove surviving elements of the wooden block paving thought to be associated with the departures side approach to Brunel's 1854 GWR station or the post 1870 road surface laid by the Improved Block Pavement Company.

5.1.18 Construction activities within Departures Road requiring a Targeted Watching Brief will include:

- the excavation of sheet pile foundation trenches;
- the excavation of diaphragm wall guide wall trenches;
- the 52m long MacMillan House basement clash trench excavated within the pedestrian pavement or highway of Departures Road; and
- General ground reduction along the length of Departures Road to enable the construction of the station box roof slab.

5.1.19 Previously wood block paving has been encountered at depth no greater than 200 –500mm below the existing ground surface. Consequently the Targeted Watching Brief will be limited to a depth of 500mm below the existing road surface. Below this depth or where it has been proved that wood block paving is not present Targeted Watching Brief may be downgraded to General Watching Brief (see methodology at Section 7.4 below). The decision to down grade the Targeted Watching Brief will be made by the Project Archaeologist following discussion with the Crossrail Central Project Archaeologist, C254 Archaeologist and C405 Main Contractor.

5.1.20 Under the Targeted Watching Brief modern overburden will be removed in stages by the C405 Main Contractor using a 360^{o} tracked excavator or 180^{o} back-actor excavator as appropriate fitted with a toothless grading bucket. Excavation will proceed in level spits of a maximum thickness of 100mm at the discretion of and supervised by the C254 archaeologist. Machine excavation will proceed until the surface wood block paving (but will not disturb or remove any wooden setts), the first archaeological horizon, or a depth of 500mm below the existing road surface, which ever is encountered first.

5.1.21 Any wood block paving or archaeological horizons encountered will be hand cleaned as necessary to achieve clear definition including any archaeological features which will then be

rapidly investigated, sampled and recorded by the C254 archaeologists. Sections through the stratigraphic sequence will also be cleaned, sampled and recorded.

5.1.22 Following the investigation and recording of the wood block paving or any archaeological horizons present, the archaeological monitoring will following consultation with the Project Archaeologist revert to a General Watching Brief. At this point excavation will continue through the sequence of made ground and Thames Terrace gravels until the required depth is reached.

5.1.23 Excavation in this manner will allow the full sequence of deposits to be examined and recorded.

Archaeological Targeted Watching Brief Procedure

5.1.24 During intrusive construction works within Departures Road the following procedure is to be incorporated into the C405 Main Contractor's method of working:

- All known live services and utilities to be diverted prior to the start of excavation activities. The Main Contractor should confirm that there are no live services within the excavated area and brief the C254 archaeologist;
- Machine excavate in level spits, under supervision of C254 Archaeologist modern overburden and post-medieval made ground to the surface of the wood block paving, at approximately 200-500mm below the existing ground surface;
- Provide as clean a excavated surface at the top of the wood block paving as is possible and allow the C254 archaeologist adequate time clean, and record the wooden setts prior to their removal;
- 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 Archaeologist following discussion with the *C251 Main Contractor*, and C254 Archaeologist;
- Allow suitable secure access, shoring and edge protection where required from ground level to bottom of excavated areas for the archaeologists to work;
- Remove, as directed by the C254 archaeologist, materials once they have been recorded by the C254 archaeologists until the required depth of excavation is reached;
- Use of excavators or other plant within the excavation area shall only be undertaken with the agreement of the Project Manager and under the supervision of C254 Archaeologist;
- Allow for up to 2 archaeologists to be on site during groundworks; and
- Provide further technical advice to C254 as maybe required to safely complete the works.

Archaeological General Watching Brief Procedure

5.1.25 General Watching Brief will be required during the following works activities Stage 2 and 3 identified on the C405 construction sequence:

- Stage 2 removal of the canopy over Departures Road;

- Stage 2 excavation of any intrusive trial pits prior to the removal of the listed railings and coping stones of the retaining wall; and
- Stage 2 and 3 demolition of the Departures Road/Eastbourne Terrace retaining wall.

5.1.26 As described above for excavations within Departures Road where it has been proved that wood block paving is not present and in those areas where wood block paving has been recorded and removed Targeted Watching Brief may be downgraded to General Watching Brief. The decision to down grade the Targeted Watching Brief will be made by the Project Archaeologist following discussion with the Crossrail Central Project Archaeologist, C254 Archaeologist and C405 Main Contractor.

5.1.27 The purpose of the General Watching Brief in Departures Road will be to allow archaeological observation and where necessary investigation and recording of previously unknown archaeological remains associated with Brunel's GWR Paddington Terminus and where construction activities impact to a depth of at c.120m ATD to investigate the potential for archaeological remains associated with the Pleistocene deposit of low Palaeolithic potential identified during the PAD-0122 watching brief.

5.1.28 The method of working for the C405 Main Contractor during excavation works shall allow for:

- All known live services and utilities to be diverted prior to the start of excavation activities. The Main Contractor should confirm that there are no live services within the excavated area and brief the C254 archaeologist;
- The removal of modern material, made ground and Thames Terrace gravels will be carried out under archaeological observation, to the required base of excavation;
- Allow suitable access from ground level to bottom of each excavation for C254 archaeologists to rapidly clean and record the stratigraphic sequence of deposits visible in trench sections and any significant archaeological deposits which may be encountered.
- 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 Archaeologist following discussion with the *C251 Main Contractor*, and C254 Archaeologist;
- Allow suitable secure access, shoring and edge protection where required from ground level to bottom of excavated area for archaeologists to work;
- Remove, as directed by the C254 archaeologist, materials once they have been recorded by the C254 archaeologists until the required level is reached;
- Allow for up to 2 archaeologists to be on site during groundworks; and
- Provide further technical advice to C254 as maybe required to safely complete the works.

C405 Archaeological Design not Currently Programmed

Trial Trench Evaluation

5.1.29 The archaeological trial trench evaluation within the area of the Crossrail Paddington Station box is proposed in order to confirm the archaeological potential and stratigraphic sequence of

Eastbourne Terrace. The final location and programming of the trial trenching will be confirmed by the Crossrail Project Archaeologist at the relevant time, this is due to a number of factors:

- It is intended to use the results from the C251 Utility Corridor archaeological watching brief to inform the requirement for and design of the trial trench evaluation;
- It is not possible to undertake the trial trench evaluation until after the C251 utility diversions in Eastbourne Terrace have been completed and Eastbourne Terrace has been closed; and
- The archaeological design will also be dependant on the C405 Main Contractor's Method of working and programme to determine when the trenching can take place and also to what depth Eastbourne Terrace will have been reduced when the evaluation can take place. This will determine the final number, size, depth and location of the trial trenches.

5.1.30 The purpose of the trial trenches would be to evaluate the archaeological potential of the Crossrail Paddington Station box. This would comprise the excavation of archaeological evaluation trenches and the examination, recording and sampling of the archaeological and geo-archaeological deposits.

5.1.31 A review of the archaeological and geotechnical information has identified alluvial deposits possibly Langley Silts of unknown archaeological potential under Eastbourne Terrace and a possible late Pleistocene deposit of low Palaeolithic potential in the adjacent area of Departures Road. It is unknown if these deposits extend across Eastbourne Terrace. The potential for Palaeolithic remains associated with the Lynch Hill gravels underlying Eastbourne Terrace are also unknown.

5.1.32 A review of the PCS04 programme has indicated that it will not be possible to undertake the trial trench evaluation until after the diversion of all live services currently located within Eastbourne Terrace. Provision for an archaeological evaluation may be required within the C405 construction programme following the closure of Eastbourne Terrace. It may be favourable to programme the archaeological evaluation within Stage 3 of the construction sequence following the reduction of Eastbourne Terrace to 124m ATD.

5.1.33 At present 2 No. 10(L) x 5(W) trenches are proposed, located within the area of Eastbourne Terrace. The depth of the trenches would be dependant the level at which the trial trenches are excavated from but would range from 4-5m shored trenches excavated from the existing road level to 1.5-2m deep if excavated from 124m ATD.

5.1.34 Prior to the closure of Eastbourne Terrace the results of the archaeological watching brief for the C251 Utilities Corridor will be available to inform both the necessity for and design of the programme of trial trenching evaluation.

5.1.35 Should archaeological layers or features be located, further archaeological works may be required, which will need designing and incorporating into the programme. Both the design of

the trial trench evaluation itself and any subsequent mitigation measures would be submitted as addendums to this SS-WSI.

Specific Requirements for C405 Main Contractor - Archaeological Trial Trench Evaluation

5.1.36 The archaeological evaluation will comprise 2 No. sheet piled trial trenches measuring 10m (L) x 5m (W) and up to 4-5m in depth. The trenches would be excavated on Eastbourne Terrace within the area of the Paddington Crossrail Station Box.

5.1.37 Trial trench evaluation is defined in the Generic WSI (CR-PN-LWS-EN-SY-00001).

5.1.38 The C405 Main Contractor shall undertake site clearance of an area measuring 10m x 5m for each trial trench and adequate areas for spoil storage and for safe access/egress to the trench. These investigation areas are required to facilitate the safe completion of the archaeological investigation of the deposit sequence within Eastbourne Terrace.

5.1.39 Modern overburden will be removed by the Main Contractor by machine in level spits under the supervision of the C254 archaeologist to the first archaeological horizon or the surface of the Langley Silts (if present) which ever is encountered first. Any archaeological horizons encountered or the surface of the Langley Silts will be hand cleaned as necessary to achieve clear definition of any archaeological features which will then be investigated, sampled and recorded by the C254 archaeologists to identify their survival, extent, depth, date and significance.

5.1.40 Following the investigation and recording of any archaeological horizons present machine excavation of the trench will continue through the sequence of Langley Silts and into the surface of the underlying Lynch Hill terrace gravels.

5.1.41 Excavation of the evaluation trenches in this manner will allow the full sequence of deposits to be examined and will determine if any palaeo-landsurfaces or geoarchaeological deposits survive within the Langley Silts or at the surface of the Lynch Hill gravels. If present these horizons/deposits will be again cleaned, planned, recorded and sampled in order to establish extent, depth, character, and date.

Archaeological Trial Trench Evaluation Procedure

5.1.42 The C405 Main Contractor shall after site clearance:

- Ensure no live underground services exist in area;
- Provide all sheet piling and support works for excavation of the trench to a maximum depth of 5.0m below the existing ground level (approximately 127 to 124m ATD) dependant on the depth of the deposit sequence;
- Remove, under supervision of C254 Archaeologist modern overburden, to the archaeological horizon or the surface of the Langley Silts (as established during geotechnical investigation), at approximately 123m ATD;
- Place excavated material in spoil heaps at an agreed safe distance from the site of the trench;

- Allow suitable secure access/egress from ground level to bottom of excavated area for archaeologists to work;
- Allow for further localised machine or hand excavation within the trial trench to remove materials once they have been recorded by the C254 archaeologists until the full sequence of archaeological deposits is identified. The surface of the Lynch Hill terrace gravels is estimated to be at approximately 123.80 to 119.80m ATD;
- Use of excavators or other plant within the excavation area shall only be undertaken with the agreement and under the supervision of C254 Archaeologist;
- Allow safe access for archaeological operatives into the site and any required temp works;
- Allow for up to 8 archaeologists to be on site; and
- Provide further technical advice to C254 as maybe required to safely complete the works.

Specific Requirements for the C254 Archaeological Contractor

5.1.43 The programme of archaeological investigation for the C405 Paddington Station works will comprise targeted and General Watching Brief and trial trench evaluation.

Archaeological Targeted and General Watching Brief

5.1.44 Targeted and General Watching Brief will required during the following advanced works packages as detailed in section 3 above:

- C251 Eastbourne Terrace Utilities Diversions; and
- C2097 Consolidated C122 & C130 Intrusive Surveys.

5.1.45 Targeted and General Watching Briefs will also be require during the C405 Main Works Contract. Construction activities requiring Targeted Watching Brief are:

- Stage 2 utilities diversions within Departures Road;
- Stage 2 the excavation of sheet pile foundation trenches;
- Stage 3 the excavation of diaphragm wall guide wall trenches within Departures Road;
- Stage 3 52m long MacMillan House basement clash trench excavated within the pedestrian pavement or highway of Departures Road; and
- Stage 4 to 5 general ground reduction along the length of Departures Road to enable the construction of the station box roof slab.

5.1.46 The provision of a General Watching Brief will be required during the following construction activities:

- Stage 2 removal of the canopy over Departures Road;
- Stage 2 excavation of any intrusive trial pits prior to the removal of the listed railings and coping stones of the retaining wall;
- Stage 2 and 3 demolition of the Departures Road/Eastbourne Terrace retaining wall; and

- Stage 2 to 5 excavations within Departures Road where it has been proved that wood block paving is not present and in those areas where wood block paving has been recorded and removed and Targeted Watching Brief has been downgraded e.g. during excavations for the Macmillan House basement clash.

5.1.47 For each contract package and the specific construction activities set out in Section 3 the Archaeological Contractor shall:

- Provide an archaeological method statement inclusive of risk assessment and safe method of working;
- Provide a suitably qualified archaeologist, experienced in archaeological monitoring and recording and the nature of archaeological deposits (including railway heritage) which are expected on this site;
- Provide a suitable qualified geo-archaeologist experienced in archaeological monitoring and recording and the nature of archaeological deposits which are expected on this site;
- Ensure that during the targeted and General Watching Briefs individual features/structures are to be hand cleaned, defined and sample excavated: sufficient to determine type, plan form and relationships (e.g. for structures and rebuilds) and recorded.

5.1.48 For the C2097 Consolidated Intrusive Surveys targeted and General Watching Brief additional provision should be made to:

- Provide a suitably qualified archaeologist, experienced in archaeological monitoring and recording of archaeological deposits and structural remains including railway heritage; and
- Ensure that appropriate photographic and drawn records are made of the Grade I listed structure of the station (e.g. foundations or basement walls of MacMillan House) sufficient to determine type, method and materials of construction and the relationships between different phases of construction.

5.1.49 For the C405 Main Works package Targeted Watching Brief additional provision should be made to:

- Provide a suitably qualified archaeologist, experienced in archaeological monitoring and recording of archaeological deposits and structural remains including railway heritage;
- Provide where required a suitably qualified surveyor or geomatics technician to aid in the geo-rectified photographic recording of large areas of wooden block paving if present or structural elements of the Grade I listed structure of the station (see section 7.4.19 below);
- Ensure that appropriate photographic and drawn records are made of the Grade I listed structure of the station (e.g. foundations or basement walls of MacMillan House) sufficient to determine type, method and materials of construction and the relationships between different phases of construction.

5.1.50 For the C405 Main Works package General Watching Brief on the MacMillan House basement clash works specific provision should be made to:

- Provide a suitably qualified archaeologist, experienced in archaeological monitoring and recording of archaeological deposits and structural remains including railway heritage; and
- Ensure that appropriate photographic and drawn records are made of the Grade I listed structure of the station (e.g. foundations or basement walls of MacMillan House) sufficient to determine type, method and materials of construction and the relationships between different phases of construction.

5.1.51 A specification for the programme of archaeological works is provided at Section 7 below and the deliverables for each works package at Section 8 of this WSI.

Archaeological Trial Trench Evaluation

5.1.52 Archaeological trial trench evaluation will carried out on Eastbourne Terrace within the area of the Crossrail Station box. The final location and programme requirements for the trial trench evaluation at Eastbourne Terrace will be determined by the Crossrail Project Archaeologist and detailed in an addendum to this SS-WSI.

5.1.53 For these works the Archaeological Contractor shall:

- Provide a suitably qualified archaeologist, experienced in archaeological site evaluation and the nature of archaeological deposits which are expected on this site;
- If required provide a suitable qualified geoarchaeologist experienced in archaeological site evaluation and the nature of archaeological deposits which are expected on this site;,
- Provide a method statement for carrying out the works;
- Provide a risk assessment and health and safety plan;
- During the trial trench evaluation individual features/structures are to be hand cleaned, defined and sample excavated: sufficient to determine type, plan form and relationships (e.g. for structures and rebuilds) and recorded; and
- When the initial investigation strip is completed to the surface of the Langely Silts it will be followed by a second strip through the sequence of Langley Silts and into the surface of the underlying Lynch Hill terrace gravels. Any archaeological horizons, palaeo-landsurfaces or geoarchaeological deposits encountered will then be sampled and recorded.

5.2 Non-Listed Built Heritage Assessment and Recording

5.2.1 Non-listed built heritage assessment and recording forms part of the archaeological mitigation strategy for CRL. The definition of non-listed built heritage adopted follows Information Paper D22 Archaeology and encompasses above ground historic features and structural elements of historical interest.

5.2.2 Two main groups are:

- Non-listed buildings proposed for demolition in conservation areas; and

- Historic street furniture and materials falling within a worksite and being temporarily or permanently impacted upon by the works.

5.2.3 The Crossrail Archaeology Generic WSI expands upon the definition for non-listed buildings. The scope for this element of works includes:

- Important non-listed buildings of historic interest proposed for demolition in conservation areas (as set out in Information paper D18, Listed Buildings and Conservation Areas);
- Important non-listed historic street furniture and materials; and
- Other important non-listed buildings and structures of historic interest outside conservation areas (i.e. the standing walls at Stepney Green), locally listed station buildings and railway structures and any industrial and defence archaeology of significance.

5.2.4 The requirement for NLBH recording at Paddington Station has been reassessed as part of the RIBA E design stage. A site walkover survey was undertaken by a NLBH specialist the purpose of which was to identify items of NLBH including historic street furniture and recommend suitable mitigation measures. The survey encompassed Departures Road/Eastbourne Terrace, Praed Street and London Street. No NLBH assets were identified during the survey and no NLBH mitigation is required.

6 Programme

6.1 Paddington Station

C251 Utilities Diversions

6.1.1 Excavation of the main utility corridor trench has been completed. The two trenches for utility connections and gas main diversions that cross laterally across Eastbourne Terrace and Departures Road commenced in August 2011 and due to continue throughout September and October 2011.

C405 Main Works

6.1.2 The programme information provided in Table 6 below has been summarised from the provisional C405 programme prepared by C130 and dated 15th May 2011.

Activity ID.	C405 Programme Activity	Archaeological Mitigation / C254 Activity	Start Date	Finish Date	Duration (Days)
Stage 1					
C0000271	Closure of Departures Road and Full closure of Eastbourne Terrace to Taxis and pedestrians	-	06-Nov-11	-	0
Stage 2					
C0000610	Excavate to roof level and install sheet piles (Departures Rd)	TWB	07-Nov-11	11- Nov -11	10
C0002600	Remove listed railing and coping stone from Departures Road retaining wall	GWB	07-Nov-11	25- Nov -11	15
C0002310	Install protection system for Paxton Canopy	-	07-Nov-11	25- Nov -11	15
C0002500	Divert Utilities within Departures Road (Serving NR)	TWB & GWB	07-Nov-11	02-Dec-11	20
C0002800	Demolish 20% of Departures Road/Eastbourne Terrace retaining wall for MMH basement clash works	GWB	21- Nov -11	02-Dec-11	10
C0002400	Remove Canopy steelwork from MacMillan House	GWB	02-Jan-12	13-Jan-12	10
C0000600	Remove 52m of NR foundations (Obstructing D Wall) by diamond drilling/sawing. Make	TWB & GWB	28-Nov-11	20-Jan-11	30

Activity ID.	C405 Programme Activity	Archaeological Mitigation / C254 Activity	Start Date	Finish Date	Duration (Days)
	good with RC skin wall, remove sheet piles.				
C0002810	Demolish 80% of Departures Road/Eastbourne Terrace retaining wall	GWB	23-Jan-12	10-Feb-12	10
Stage 3					
C0003100	Construct guide walls (Northside)	TWB	05-Dec-11	28-Feb-12	52
Stage 4					
C0003610	Excavate Eastbourne Terrace down to 124.00m ATD	-	08-Mar-12	21-Mar-12	10
Stage 5					
C0004505	Install sheet piles and excavate along MacMillan House frontage for construction of capping beams	TWB/GWB	07-Jun-12	01-Aug-12	40
C0004600	Excavate to soffit of roof slab for Level O for capping beams and cut down D-walls	TWB/GWB	02-Aug-12	30-Aug-12	20
Stage 6					
C0007310	Re-open Eastbourne Terrace -2 lanes only	-			22-Aug-13

Table 5 C405 Main Works Provisional Construction Programme

6.2 Non-Listed Built Heritage

6.2.1 No further Non-listed Built Heritage mitigation is proposed

7 Specification for Evaluation & Mitigation (including Watching Brief)

7.1 Generic Standards

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

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

Potentially nationally important remains

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

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

7.1.4 In the event that archaeological remains of potentially national importance are encountered the C254 Archaeology Contractor will immediately inform the Project Archaeologist and not recommence work at the location until further instruction has been received from the Project Archaeologist. The discovery of archaeological remains of potentially national importance will be confirmed in writing within 24hours of discovery.

7.1.5 The Project Archaeologist will be responsible for informing the relevant statutory consultees (EH GLAAS) and co-ordinate any meetings required between Crossrail Central, the Principal Contractor, the C254 Archaeology Contractor and the relevant statutory consultees.

7.1.6 The Principal Contractor will be responsible for supplying any material required to protect archaeological remains of potentially national importance from possible damage by ongoing construction activities in the vicinity. This may include the provision of barrier fencing, terram and sand.

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

Human Remains

7.1.8 Certain aspects of the normal legal procedure for the removal of human remains (and associated monuments) from burial grounds has been modified by Schedule 15 to the Crossrail Act 2008. However for other aspects, normal legislation applies.

7.1.9 Where human remains are identified, all subsequent works must be undertaken in accordance with relevant legislative and environmental health requirements as set out in the Environmental Requirements (archaeology) section of the relevant package Works Information.

7.1.10 In the event that human remains are encountered the C254 Archaeology Contractor will immediately inform the Project Archaeologist and not recommence work at the location until further instruction has been received from the Project Archaeologist. The discovery of human remains will be confirmed in writing within 24hours of discovery during which time C254 will apply for the relevant Ministry of Justice (Coroner's Division) licence.

7.1.11 The Project Archaeologist will be responsible for informing the relevant statutory consultees (EH GLAAS) and co-ordinate any meetings required between PDP, the Principal Contractor, the C254 Archaeology Contractor and the relevant statutory consultees.

7.1.12 The Archaeology Contractor shall confirm how the requirements set out in the SS-WSI will be implemented as part of their procedure for excavating and recording human remains in the Archaeology Contractor's Method Statement. This should incorporate best practice guidance e.g. Council for the Care of Churches (1999) and English Heritage (2002 and 2002a).

7.1.13 At sites known in advance to have a high risk of encountering human remains, provision shall be made by the Archaeology Contractor for site inspection by a recognised specialist.

7.1.14 Should human remains be discovered, the Archaeology Contractor shall notify the Project Archaeologist immediately so that these procedures can be implemented. This notification may be initially made personally or by telephone but shall be confirmed in writing within 24 hours of discovery.

7.1.15 The Principal Contractor will be required to cease all works at that location until further instruction is provided by the Project Archaeologist. The Archaeology Contractor shall undertake an initial in situ observation and assessment of the remains and shall advise the Project Archaeologist of the course of action required.

7.1.16 Lifting of human skeletal remains shall be kept to the minimum which is compatible with an adequate evaluation or excavation. Notwithstanding this, the Archaeological Contractor shall ensure that all burials are planned/photographed in-situ and that appropriate samples have been recovered prior to any lifting.

7.1.17 Visible grave goods and other obvious artefacts, shall be recorded and lifted before the end of the working day to avoid the risk of vandalism and theft. Where this is not feasible or appropriate, the Archaeology Contractor shall ensure, on liaison with the Project Archaeologist that adequate site security is provided by the Principal Contractor. As a minimum, this will require a 24 hour comprehensive security regime until sensitive remains have been recorded and lifted.

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

Treasure Act

7.1.19 The Treasure Act 1996 defines 'Treasure' as:

- Any object at least 300 years old when found which is: not a coin, but has metallic content of which at least 10% is precious metal; or
- One of at least two coins with at least 10% precious metal content;
- One of at least 10 coins;

- Any object at least 200 years old designated as treasure by the Secretary of State;
- Any object which would have been 'Treasure Trove';
- Any object found with any of the above.

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

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

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

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

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

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

7.2 Health and safety

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

7.2.2 No ground intervention or other survey shall be made without approval of the Archaeology Contractor's Health and Safety Plan, Method Statement and Risk Assessment by the CDM co-ordinator.

7.2.3 Hand excavation or other remote sensing method may be required prior to any mechanical excavation in the first instance to locate any known or suspected below ground hazards. The Archaeology Contractor's Method Statement and Risk Assessment shall take account of any design information (including the Designer's and Principal Contractor's Risk Assessment) pertaining to above ground hazards such as buildings and other structures or public rights of way and below ground hazards such as services, utilities and infrastructure and shall contain a site specific Risk Assessment for unknown below ground hazards such as contaminants including unexploded ordnance. All

appropriate mitigation measures shall be in place prior to commencement of any ground intervention or other survey.

7.2.4 Trial trench excavation method and earthworks support design, shall conform to Health and Safety legislation and safety standards as well as incorporating current engineering best practice, where appropriate.

7.3 Location and ground elevation of interventions and survey grids

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

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

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

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

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

7.4 Specification for watching brief

Scope of Watching Brief

7.4.1 Watching brief, as defined in the Generic WSI, is a programme of archaeological monitoring (i.e. observation, investigation and recording) which is carried out by a suitably

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

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

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

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

- A General Watching Brief shall comprise observation and recording of the Principal Contractor's works without constraint on their working methods.

- A Targeted Watching Brief shall comprise observation and recording of the Principal Contractor's works with specific operations carried out under the supervision of the Archaeology Contractor. Under Targeted Watching Brief, the Archaeology Contractor may impose constraints on, or require changes to, the Principal Contractors' or his sub-contractor's method of working to enable the archaeological investigation to take place alongside construction works.

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

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

7.4.7 The Principal Contractor shall make allowance in their activity programme for the completion of any targeted or General Watching Briefs as set out in the SS-WSIs.

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

Scope of Targeted Watching Brief - Constraints on Principal Contractor's Methodology

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

Specification for watching brief

7.4.10 The Archaeology Contractor shall undertake a Targeted Watching Brief during advanced works during utilities diversions; at the connection to the Paddington mainline station; and at worksite establishment including the set up for enabling works such as the replacement taxi facilities at the London Street Deck.

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

a) Watching brief ('observation') following, and without interruption to, the progress of the Principal Contractor by a core team of archaeologists.

b) Investigation of archaeology and remains of quaternary geological importance undertaken either:

- by the core team, following the progress of the Principal Contractor; or
- by additional archaeologists (the 'support team'), to be deployed to investigate unanticipated archaeological remains, where appropriate.

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

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

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

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

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

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

Specific methodology for C251 Targeted Watching Brief

7.4.17 The specific methodology for the investigation, recording and removal of the block paving in Departures Road during the Targeted Watching Brief for the C251 gas main diversions is as follows:

- Hand excavate under supervision of C254 Archaeologist modern overburden and post-medieval made ground to the surface of the wood block paving, without disturbing the wooden setts;
- If machine excavation is required, modern overburden and post-medieval made will be removed in level spits of 100mm depth under supervision of C254 Archaeologist to the surface of the wood block paving, without disturbing the wooden setts;
- Provide as clean a excavated surface at the top of the wood block paving as is possible and allow the C254 archaeologist adequate time clean, and record the wooden setts prior to their removal;
- The C254 archaeologist will expose and clean the blocks;
- Make a 35mm and digital photographic record;
- Make a written record of the blocks using standard proforma record sheets;
- Produce a scaled plan of the blocks at suitable scale e.g. 1:20;
- Record both Ordnance datum and ATD levels on the surface of the blocks;
- Number each block and record their position on the plan;
- The C251 Main Contractor will under supervision of C254 Archaeologist carefully lift the wooden blocks and safely store them (adjacent to the trial pit) in preparation for replacement; and
- Following partial backfilling the C251 Main Contractor will, under supervision of C254 Archaeologist replace the numbered blocks at the correct position and level during backfilling of the trial pit.

7.4.18 This methodology has been discussed with the Crossrail Heritage Specialist and in consultation with WCC.

Specific methodology for C405 Targeted Watching Brief

7.4.19 The specific methodology for the investigation, recording and removal of wood block paving in Departures Road during the Targeted Watching Brief during C405 Main Works will be as follows:

- Machine excavate under supervision of C254 Archaeologist modern overburden and post-medieval made ground will be removed in level spits of 100mm depth (or to the discretion of the C254 archaeologist) to the surface of the wood block paving, without disturbing the wooden setts;

- Provide as clean a excavated surface at the top of the wood block paving as is possible and allow the C254 archaeologist adequate time clean, and record the wooden setts prior to their removal;
- The C254 archaeologist will expose and clean the blocks;
- Make a 35mm and digital photographic record;
- Make a written record of the blocks using standard proforma record sheets;
- Either produce a scaled plan of the blocks at suitable scale e.g. 1:20. The plan will either be hand drawn or produced using geo-rectified photography and electronic survey to accurately map the location and extent of the wood blocks;
- Record both Ordnance datum and ATD levels on the surface of the blocks;
- Suitable examples of the wood block should be retained particularly examples which display the use of different timber species, size, shape or evidence characteristic construction techniques or ware marks;
- C254 archaeologist will then inform the C405 Main Contractor that the blocks can be removed and excavation proceed.

7.4.20 If a during excavation depth of 500mm is reached and wood block paving is confirmed as not being present the location and extent in which the wood block are absent will also be recorded.

7.4.21 Once recorded the wooden blocks can be discarded in accordance with Crossrail's Environmental Policy or if possible salvaged for use by a suitable amenity group or railway heritage society.

7.4.22 This methodology has been discussed with the Crossrail Heritage Specialist and with Westminster City Council.

Investigation undertaken during watching brief

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

7.4.24 Heights for all deposits shall be related to approved Permanent Ground Markers (PGMs) or approved Ordnance Survey Bench Marks (OSBM), where reasonably accessible. Levelling accuracy between OSBMs/PGMs and site Temporary Bench Marks (TBMs) shall be within 10 mm□k: where 'k' is the total distance levelled in kilometres. Each TBM shall be levelled as part of a closed loop starting and finishing on approved OSBMs or

URL PGMs. Where more than one TBM is required per site, the Archaeology Contractor shall establish the TBMs as part of the same closed loop. The Archaeology Contractor shall prepare a record of their surveying methodology for inclusion in the archive.

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

Recording standards

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

7.4.27 The recording is to include as a minimum:

- The written record of individual context descriptions on appropriate pro-forma.
- The drawn record shall normally include, plans and section drawings of appropriate features, structures and individual contexts (1:50 1:20 or 1:10). Isolated archaeological remains (artefacts) may be spot located in plan and a height provided where possible. Deposits which are regular in plan (pits and ditches) may be located though co-ordinates, annotated with dimensions, and may be recorded digitally.
- Other appropriate drawn and written records shall also be produced (for environmental sampling etc.).
- The photographic record shall consist of monochrome prints/negatives and colour transparencies. A 35mm format (film or digital) SLR camera is acceptable for all site photography. The Archaeology Contractor shall maintain a minimum of two 35mm SLR cameras on site at all times during working hours. The photographic record shall include photographs and transparencies of archaeological features, appropriate groups of features, structures, and quaternary deposits. Each photograph and transparency shall clearly show details of the above. Each photograph and transparency shall include an appropriate graduated scale, a north arrow, and a header board detailing (as a minimum) the event code and context/feature number. In addition, the Archaeology Contractor shall take appropriate record photographs to illustrate work in progress.

7.5 Specification for archaeological investigation

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

7.5.2 Where modern foundations are likely to be present, the SS-WSI shall identify whether they should be left in-situ for the purposes of the evaluation or removed. Where it is clear that modern foundations have truncated certain archaeological levels they should be

removed to assess lower archaeological levels. The Archaeology Contractor shall take all reasonable care to ensure that any damage is limited as for as practicable. If significant damage is likely to occur the work shall be suspended and the Project Archaeologist informed so that a technical solution can be agreed with the Project Manager.

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

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

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

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

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

7.5.8 All undifferentiated topsoil, or overburden of recent origin, shall be removed down to the first archaeological layer. An exception to this would be where a focused soil-sampling strategy is proposed to record and collect data from reworked soil contexts above recognisable stratified archaeological contexts. If a mechanical excavator is to be used to remove modern overburden, such as floor slabs or recent levelling layers, this shall be undertaken in spits of 0.20m-0.5m depth (dependant on specific site conditions), moving along the length of the trench or area. The Archaeology Contractor's supervising archaeologist shall use their professional judgement to determine the appropriate depth of each spit and will advise the Principal Contractor accordingly. Any variations to the excavation methodology shall be at the discretion of the supervising archaeologist and recorded in writing for inclusion in the final report to the Project Archaeologist.

7.5.9 Each spit shall be examined carefully to assist the recovery of any archaeologically significant artefacts and thus to determine when to cease machining.

7.5.10 The archaeological level shall be cleaned in plan by the Principal Contractor using a wide blade, ditching bucket or similar, with no teeth. If the machine has to re-enter the trench care will need to be taken to ensure that it does not damage underlying remains.

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

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

- The recording of individual contexts on appropriate pro-formas;
- Excavation plans at 1:50 scale; planning and section drawing of appropriate single contexts and features (usually at 1:20 scale for plans and 1:10 scale for inhumations and sections);
- Photographs; and other appropriate drawn and written records; and
- Permanent Ground Markers (PGM's), any temporary benchmarks and approved OS benchmarks shall be indicated on the relevant plans.

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

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

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

7.5.15 The Archaeology Contractor shall identify any temporary works and dewatering requirements associated with the archaeological investigation in the Archaeology Contractor's Method Statement and shall agree the detailed arrangements for such with the Principal Contractor. The Archaeology Contractor will be required to undertake works in accordance with the Principal Contractor's arrangements for matters such as off site-

spoil disposal or storage, on-site facilities and services. Relevant requirements shall be incorporated in the Archaeology Contractor's Method Statement.

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

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

Recording systems

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

7.5.19 The recording is to include, as a minimum:

- At least one representative section at (1:10 or 1:20 scale) of each trial excavation from ground level to the base of the excavation;
- The written record of individual context descriptions on appropriate pro-forma;
- Plans at appropriate scales (1:10 or 1:20);
- Single context planning if appropriate; and
- Photographs and other appropriate drawn and written records.
- Other sections, including the half-sections of individual layers or features shall be drawn as appropriate to 1:10 or 1:20.

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

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

7.5.22 A record of the full extent in plan of all archaeological deposits as revealed in the investigation shall be made; these plans shall be on polyester based drawing film, and be

at a scale of 1:10 or 1:20 unless otherwise agreed with the Project Archaeologist. 'Single context planning' shall be used on deeply stratified sites. Drawing information shall be digitised for eventual CAD applications. The GLSMR will accept Autocad DXF or .DWG format of extent of site and location of major features with the completed Sites and Monuments Report Form.

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

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

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

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

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

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

7.6 Specific Requirements for the excavation of trial trenches or pits

7.6.1 The Archaeology Contractor shall ensure that water is discharged and arisings from archaeological excavations are stored in accordance with the Principal Contractor's

environmental protection requirements (as set out in the package Works Information and their Environmental Management Plan) and any relevant consents for the worksite. The Project Manager shall monitor discharge rates and if necessary conductivity of discharge waters to ensure compliance.

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

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

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

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

7.7 Archaeological science

7.7.1 The strategy for sampling archaeological and palaeo-environmental deposits and structures (which can include soils, timbers, pollen, diatoms, animal bone, human bone etc.) will be developed by the Project Archaeologist in consultation with English Heritage Regional Science Advisor and the Archaeology Consultant. On-site work and off-site analysis of the processed samples and remains will be undertaken by the Archaeology Contractor's environmental archaeologist as specified in the Archaeology Contractor's Method Statement.

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

7.7.3 Where there is evidence for industrial activity, macroscopic technological residues (or a sample of them) shall be collected by hand. Separate samples (c. 10ml) shall be collected

for micro-slags (hammer-scale and spherical droplets). Reference should be made to the Centre for Archaeology Guideline on Archaeometallurgy (English Heritage 2001). Assessment of any technological residues shall be undertaken.

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

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

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

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

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

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

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

the relevant burial licence under the Burial Act 1857 (in all other cases) shall be adhered to.

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

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

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

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

Generic specification for Environmental Sampling

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

7.7.16 The Archaeology Contractor shall use ten litre plastic buckets (with lids and handles), or strong polythene bags (double bagged) secured at the neck, for the recovery of bulk 'disturbed' environmental samples. An adhesive label recording the project event code, context number and sample information shall be securely fixed to a vertical face of the bucket only or attached to the neck of the bag. Labels shall be completed with an indelible ink pen. A duplicate non-adhesive label shall be inserted within the bucket or between the polythene bags.

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

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

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

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

7.7.21 The Archaeology Contractor shall use appropriately sized monolith or kubiena boxes for the recovery of 'undisturbed' monolith samples for geo-archaeological study (pollen, other microfossil and micromorphological studies etc). Care shall be taken to ensure that wherever possible only newly exposed sections are sampled to avoid contamination,

desiccation and decalcification. This sampling shall be undertaken under supervision of the Archaeology Contractor's environmental specialist. Boxes shall be wrapped neatly and tightly in bin-liners or plastic sacks and secured with rubber bands. A label shall be attached to the outside (in duplicate) with site name and code, feature/context number and depths of sample.

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

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

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

8 Deliverables

8.1 C254 Archaeological Contractors Deliverables

8.1.1 The Archaeology Contractor shall provide a detailed Archaeological Method Statement for the archaeological fieldwork events (targeted and General Watching Brief and trial trench excavation) for each works package.

8.1.2 During the execution of each fieldwork event the Archaeology contractor shall submit a weekly progress report to the Project Archaeologist.

8.1.3 On completion of each archaeological fieldwork event the Archaeology Contractor shall provide the post-excavation deliverables summarised in Table 11 below:

	Deliverable		
Fieldwork Event	**Weekly Progress Report**	**Interim Report**	**Fieldwork Report**
C251 Utility Diversions			
General Watching Brief	✓	✓	*1
Targeted Watching Brief	✓	✓	*1
C2097 Consolidated Intrusive Surveys			
Combined Targeted & General Watching Brief	✓	✓	*1
C405 Main Works			
Combined Targeted & General Watching Briefs	✓	✓	✓
Trial Trench Evaluation	✓†	✓†	✓†
Praed Street LU D&C Line Link			
General Watching Brief	TBC	TBC	TBC
Paddington Network Rail Station Protection Works			
General Watching Brief	✓	✓	✓

*1 Due to the size and scope of these watching briefs it is suggested that they are reported together in a single Fieldwork Report.

† TBC when the requirement for and scope of the Trial Trench Evaluation has been agreed.

Table 6 C254 Archaeological Contractor fieldwork event deliverables

8.1.4 The requirement for production of a formal Post-excavation Assessment will be dependant on the significance of the results of the archaeological evaluation and mitigation undertaken during the C130 and C405 Main Works packages.

8.1.5 Details of each deliverable are provided below.

8.2 Archaeological Contractors Method Statement

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

a) A resource plan and programme and CV's;

b) The Archaeology Contractor's IT capability and proposed IT plan (including specific survey methods for on-site recording of stratigraphic profiles and sub-surface topographic modelling;

c) The Archaeology Contractor's approach to Archaeological Science;

d) The methods for survey and setting out works;

e) The methods to address the specific event types required (trial trench, area excavation etc);

f) The safe method of working whilst excavating trenches or pits including any temporary works required;

g) The method for disposing of water from trenches and test pits in waterlogged ground;

h) Site management plan to include details of the method for preparing safe access route to the working areas, the proposed site accommodation, services and welfare;

i) The retention and disposal policies for samples and artefacts recovered during the work;

j) The method for excavating and recording inhumations and cremations in compliance with the generic Crossrail standards for Human Remains (see Section 7.1);

k) The method for preparation of the required reports, archive and all associated deliverables;

l) The procedures for assessment of potential for analysis (post excavation assessment);analysis and publication proposals;

m) The method for preparation of the digital dataset, digital drawings, and digital report deliverables;

n) The Archaeology Contractor's methods and approach for undertaking the site based works and off site processes to completion.

o) The Health and Safety Plan and Site-Specific Risk Assessment (including unexploded ordnance);

p) The Quality Assurance Plan;

q) The procedures for on- and off- site security and emergency response plan (including environmental incidents);

r) The method for complying with project generic and site specific environmental and consent requirements; and

s) The Archaeology Contractor's requirements and specification for services and facilities and attendances required to be supplied by the Principal Contractor or the Employer.

8.3 Site Archives

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

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

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

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

8.4 Digital Data

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

8.4.2 The Archaeology Contractor shall prepare and provide field and laboratory data, evaluation or excavation trench and phasing plans showing archaeological features

recorded, and report text in digital form, as well as in paper form. Consideration should be given to recording electronic plans during fieldwork.

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

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

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

- Confirmation that this check has been carried out (including details of the virus checking programme name and version used) and that the submission is virus free.
- Fieldwork event name and code.

8.4.6 Supplier company name, date and QA details (as a minimum, the name, position and signature of the approver).

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

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

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

8.4.10 Where any changes are made to a data record between digital data submissions, the Archaeology Contractor shall record the date of the change and the name of the person

carrying out the change. The Archaeology Contractor shall ensure that each data amendment is carried out correctly.

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

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

8.5 Interim Statement

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

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

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

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

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

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

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

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8.5.8 Copies of the Interim Statement shall be provided by the Project Archaeologist to the LB Westminster and GLAAS for comment.

8.6 Survey Report

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

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

8.7 Fieldwork Report

8.7.1 The evaluation report and watching brief reports shall be prepared by the Archaeology Contractor within 6 weeks of the completion of the fieldwork (unless this is varied by the Project Archaeologist). The Fieldwork Report shall follow the standard structure set out in City of London Planning Advice Note 3 and IFA standards i.e.:

Contents list

Non technical summary

1. Introduction
2. Planning background
3. Previous work(s) relevant to archaeology of site (DBA, DDBA, surveys etc)
4. Geology and topography of site
5. Research objectives and aims
6. Methodology of site-based and off-site work
7. Results and observations including quantitative report, stratigraphic report(including any constraints on site).
8. Assessment of results against original expectations (using criteria for assessing national importance i.e. period, relative completeness, condition, rarity, and group value) and review of evaluation strategy
9. Statement of potential of archaeology
10. Conclusions and recommendations for appropriate mitigation strategy
11. Publication and dissemination proposals (in addition to fieldwork report)
12. Archive deposition
13. Bibliography
14. Acknowledgements
15. Sites & Monuments Record form
16. A3 plans

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

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

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

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

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

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

8.7.7 The assessment of results and statement of potential shall include the Archaeology Contractor’s conclusions based on the recorded data, e.g. the monument/site class represented, site/feature function and relevant parallels. The statement shall also comment on the potential of the data to address the projects’ research themes. As appropriate, comment shall be made on the site as a whole and the individual components (e.g. artefactual, palaeo-environmental, economic). The statement shall utilise the criteria laid down by the Secretary of State for Culture, Media and Sport Criteria for Scheduling, to establish importance.

8.7.8 In reporting the results of the works, the accuracy of the original expectations and the appropriateness of the methods adopted shall be assessed by the Archaeology Contractor in order to illustrate what level of confidence can be placed on the information.

The Project Archaeologist will use that information as the basis for developing any further mitigation strategy and/or further analysis and publication.

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

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

8.7.11 Copies of the Fieldwork Report shall be provided by the Project Archaeologist to the LB Westminster and GLAAS for comment.

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

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8.8 GLSMR Summary Sheet

8.8.1 The Archaeology Contractor shall complete a GLSMR Summary Sheet for the works (i.e. one per fieldwork event). The Summary Sheet shall be included in the Fieldwork Report.

8.9 Summary Report

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

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

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

8.10 Post excavation assessment

8.10.1 If instructed by the Project Archaeologist, the Archaeology Contractor shall undertake a post-excavation assessment of the site archive and submit a report of their findings to the

Project Archaeologist for approval. Assessment of potential for analysis shall be undertaken in accordance with English Heritage guidelines.

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

9 Site Monitoring & Progress Reports

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

9.1.2 The LB Westminster and GLAAS shall be informed in writing at least one week in advance of commencement of fieldwork by the Project Archaeologist.

9.1.3 Periodic updates on the progress of the Crossrail archaeology programme shall be submitted to the LB Westminster and GLAAS by the Project Archaeologist. The Archaeology Contractor shall provide information to the Project Archaeologist as requested to inform this reporting.

9.1.4 The Project Archaeologist shall arrange and convene monitoring site visits by the LB Westminster and GLAAS, as appropriate. There shall be no unauthorised access to the works in any other circumstances. Any visits to the works shall be in accordance with the Principal Contractor's health and safety, site access and security requirements.

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

10 Personnel Requirements

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

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

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

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

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

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

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

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

11 References and Glossary of Terms

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12 Annexes

Annex 1 Archaeological Research Agenda

The aims, objectives and relevant archaeological research agenda as set out in A Research Framework for London Archaeology 2002 (Nixon et al, 2003) are presented in Section 4 of this site specific WSI and major research themes summarised below:

- Understanding London's hydrology and river systems and tributaries and the relationships between rivers and floodplains;
- Understanding the evolving character of development in central London between Westminster and the City, and Southwark;
- Examining the concept of core/periphery for different periods in London's past, as a means of understanding a settlement and its environs, a city and its hinterland;
- Contributing to our understanding of the creation of the London suburbs; and
- Understanding the reasons for evolution of the road systems, street layouts, river crossings and ferries, and their importance as engines of development and change.

Annex 2 Site Information

Services and Utilities

Known services and utilities are identified on design drawings: C130-SWN-U-DDA-M171_1-6010 to C130-SWN-U-DDA-M171_1-6016.

The C405 Principal Contractor will advise the C254 Archaeological Contractor of the latest works information regarding the location and depth of all known services and utilities prior to the start of the archaeological works.

Initial information is set out in Section 2 of the C130 Paddington Station Constructability Report (Option A). (Document No. C130-SWN-C-RGN-B071-00001).

Extinguishments of Rights of Way

For further information please refer to the Works Package Information for the C254 Archaeological Contract.

Surface Water Control

For further information please refer to the Works Package Information for the C254 Archaeological Contract.

Protective Fencing

Site security and protective fencing is the responsibility of the C405 Principal Contractor. Initial information is set out in Section 3 - Site Set Up of the C130 Paddington Station Constructability Report (Option A). (Document No. C130-SWN-C-RGN-B071-00001).

Credit Boards

For further information please refer to the Works Package Information for the C254 Archaeological Contract.

Care in Executing the Site Operations

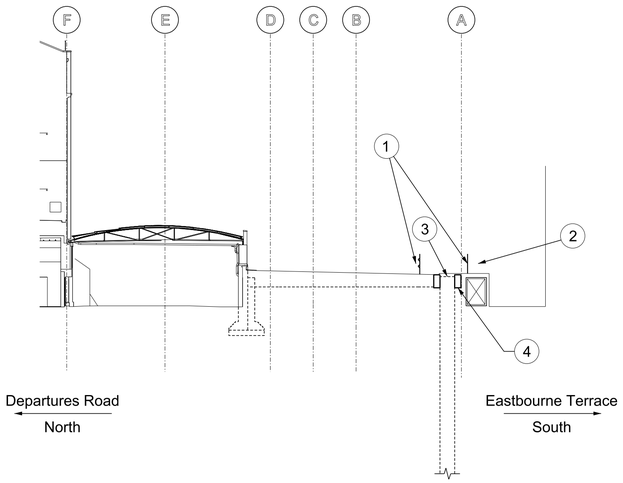
For further information please refer to the Works Package Information for the C254 Archaeological Contract.

Parking of Vehicles

For further information please refer to the Works Package Information for the C254 Archaeological Contract.

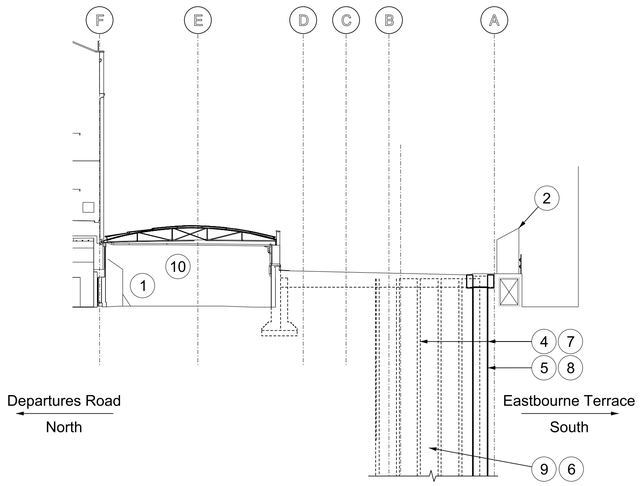
Annex 3 Plans and other Illustrations

Drawing Number	Title	Scale
C130-SWN-S-DDB-M171_Z-54510	Main Box Designer's Assumed Construction Sequence Sheet 1 CC405	NTS @ A1
C130-SWN-S-DDB-M171_Z-54522	MacMillan House Block E Construction Sequence for Partial Removal of Basement Wall CC405	1:100 @ A1



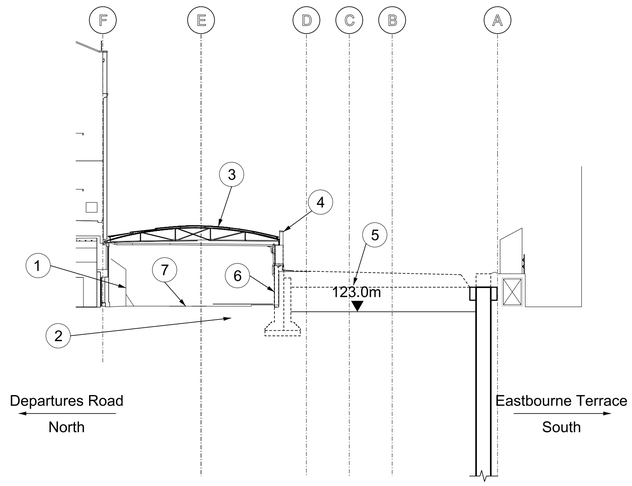
Stage 1

1. Erect Heras Fence and occupy South side of Eastbourne Terrace.(take over from C251) but maintain 2 lanes of traffic on Eastbourne Terrace and access to side roads.
2. Restore public access to footpath on south side of Eastbourne Terrace.
3. Probe and remove obstructions to diaphragm walls along south side of Eastbourne Terrace.
4. Install guide walls along south side of Eastbourne Terrace. It is assumed that the existing EBT road surface will be utilised as the working platform for Diaphragm wall construction on the south side of the station.



Stage 2

1. Divert taxis from Departures Road to PIP and close both Departures Road and Eastbourne Terrace.
2. Erect pedestrian hoarding along south side of Eastbourne Terrace.
3. Mobilise bentonite plant at west end of site.
4. Install soft cement/bentonite walls at west end of the box beneath Eastbourne Terrace.
5. Start construction of southern diaphragm walls (from existing ground level) between gridlines 1 and 12 with Departures Road used as the west to east haul route.
6. Construct diaphragm walls across west end of station box under Eastbourne Terrace.
7. Install soft cement/bentonite walls at east end of the box beneath Eastbourne Terrace.
8. Start construction of southern diaphragm walls (from existing ground level) between gridlines 12 and 24.
9. Construct diaphragm walls across east end of station box under Eastbourne Terrace.
10. Divert haul routes from Departures Road to south side of Eastbourne Terrace.



Stage 3

1. Erect hoarding for NR escape route along MacMillan House facade.
2. Divert utilities in Departures Road.
3. Remove canopy over Departures Road (including concrete column and foundation at west end).
4. Remove railings and coping from brick retaining wall and store for future reuse.
5. Reduce Eastbourne Terrace to approximately level 123.0m ATD between Gridlines 1 and 11 working eastwards.
6. Demolish central brick retaining wall from Gridline 1 to Gridline 11 working eastwards.
7. Reduce Departures Road to approximately level 123.0m ATD and place a 600mm piling mat for diaphragm walling on Departures Road between Gridlines 1 and 11.

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

Ci. Risk of instability of tunnels during bulk excavation of box, Close coordination is required between the Paddington Station contractor (C405) and the running tunnel contractor (C300) to co-ordinate works adjacent to the running tunnels during excavation of the station box. Temporary propping must be installed and preloaded at level 114.5m before excavation below level 113.6m can commence. Running tunnels remain operational until handover by the C300 contractor.

Cii. Excavation below underside of concourse slab can only occur when both running tunnels are handed over to C405 by C300. Both tunnels must be dismantled simultaneously to avoid unsymmetrical load effects. Largest weight of tunnel segment (included grouted annulus) to be handled = 5.5 tonnes.

Ciii. Risk of construction equipment punching through top of tunnels when excavation is close to the soffit of the concourse slab or during excavation below the soffit of the concourse slab.

Operations
Oi. N/A

Maintenance
Mi. N/A

Dismantling/Demolition (Future)
Di. N/A

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

Stage 4

1. Install sheet piles along north side of the site in front of MacMillan House Blocks B & C for diaphragm wall capping beam construction.
2. Excavate and construct guide walls along north side of Departures Road, from Gridlines 1 to 11 working eastwards.
3. Install soft cement/bentonite walls at east end of the box beneath Departures Road.
4. Start construction of northern diaphragm walls (from approximately level 123.6m ATD) between Gridlines 1 and 11.
5. Construct diaphragm walls across west end of station box under Departures Road.
6. Erect hoarding and install sheet piling for the part removal of MacMillan House Block E brick retaining wall.
7. Refer to drawing C130-SWN-S-DDB-M171_Z-54522 for the sequence of work relating to the part removal of the basement wall.
8. Remove sheet piles (see 4.6 above) and construct guide walls in preparation for diaphragm walling in front of basement wall and restore Departures Road (site road) in the vicinity of the basement works.

Stage 5

1. As the southern diaphragm walls are completed on the east side, reduce Eastbourne Terrace to level 123.0m ATD between Gridlines 11 to 24 working westwards.
2. Demolish remaining length of central brick retaining wall between Gridlines 11 to 24.
3. Reduce Departures Road to approximately level 123.0m ATD and place a 600mm piling mat for diaphragm walling on Departures Road between Gridlines 11 and 24.
4. Construct guide walls for Departures Road northern diaphragm walls between Gridlines 11 and 24.
5. Install soft cement/bentonite walls at east end of the box beneath Departures Road.
6. Start construction of northern diaphragm walls (from approximate level 123.6m ATD) between Gridlines 11 and 24.
7. Construct diaphragm walls across east end of station box under Departures Road.
8. Demolise bentonite plant. Mobilise piling equipment.
9. Start installation of plunge piles and plunge columns.
10. C300 TBMs arrive at Paddington Station, W/B drive beneath Eastbourne Terrace followed by E/B drive under Departures Road.
11. Continue and complete the installation of plunge piles and plunge columns along the central axis of the station box. Piling work will be put on hold by passage of C300 TBMs when cutter head is within 20m of pile bore (resulting in a delay to piling of approx. 6 days per TBM passage).

Stage 6

1. Move the haul route from Eastbourne Terrace to Departures Road.
2. Starting at the east end, reduce the level of the southern half of the box to the roof formation level at approximately 120.0m ATD.
3. Expose diaphragm walls and soft secant piles on the south, east and west ends of Eastbourne Terrace.
4. Excavate to soffit level of capping beams and roof slab, cut down and prepare diaphragm walls connections to roof slab.
5. For the parts on Eastbourne Terrace where there is no capping beam, break out 75mm deep inert material on face of diaphragm wall. Interface surface to be high pressure washed to expose the aggregate. Expose embedded couplers.

Rev.	Date	Description	By	Chkd	App	Auth
P02	26/02/2010	Temporary Horizontal propping note removed	SK	MB	GB	
P03	21/05/2010	---	FH	RS	GB	
P04	25/06/2010	---	FH	RS	-	
P05	02/07/2010	---	FH	RS	GB	
P06	27/10/2010	Sequence amended to include concrete infill	MX	RS	GB	
P07	19/11/2010	Scale amended	PF	RS	GB	
P08	08/12/2010	Stage 1A revised	GM	MK	GB	
P09	13/01/2011	Stage 1 Amended	TS	KM	GB	
P10	02/08/2011	Annotation amended in stages 2 - 5	GN	KM	GB	
C01	15/08/2011	Issued as Fit for construction	GN	KM	GB	MT
P11	23/09/2011	Revised to suit contractor's prefered option	NP	JD	GB	-
P12	10/10/2011	Stages added to suit Contractor's prefered Option	FH	JD	GB	-

Notes

1. For General notes refer to drawing number C130-SWN-S-DDL-M171_Z-00501
2. All dimensions are in millimetres unless specified otherwise.
3. All levels are in metres to Above Tunnel Datum
4. For end wall construction sequence refer to drawing number C130-SWN-S-DDB-M171_Z-54015 and C130-SWN-S-DDB-M171_Z-54016
5. Refer to constructability report and programme for further details.

Note:
The construction sequence shown is that assumed by the designer in the development of the design. If the contractor wishes to depart from this sequence, full proposals must be submitted to the Project Manager prior to commencement of works on site. The contarcator must demonstrate that the proposed modification sequenece has no adverse effects on the permanent works or on the settlements of the adjacent buildings.

4m 0 4m 8m 12m 16m 20m

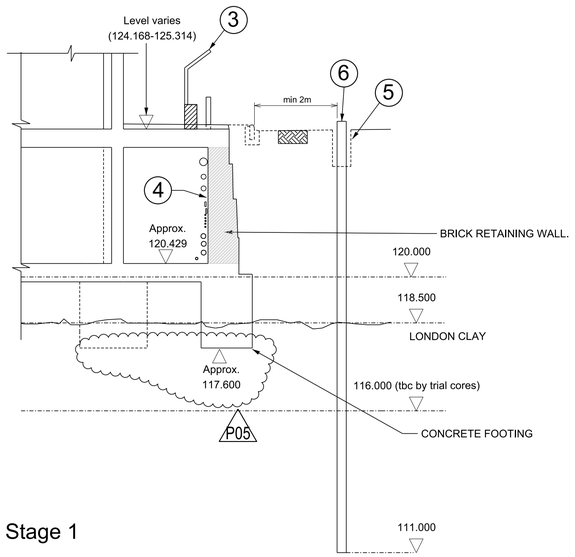
Crossrail Limited
25 Canada Square
Canary Wharf
London
E14 5LQ

www.crossrail.co.uk

Contract : Paddington Station Design
Originator : Scott Wilson Limited
Location : Paddington Stn Met Suburban
Title : Main Box
Designers Assumed Construction Sequence
Sheet 1
CC405
By : F.HOLGUIN
Chk : J.DODD
App : G.BRENNAN
Auth : ---
Scale : NTS@ A1
Drawing and CAD file No : C130-SWN-S-DDB-M171_Z-54510
Rev : P12
Suitability : S4

Fit for authorisation

RESTRICTED



Stage 1

1 Close Departures Road

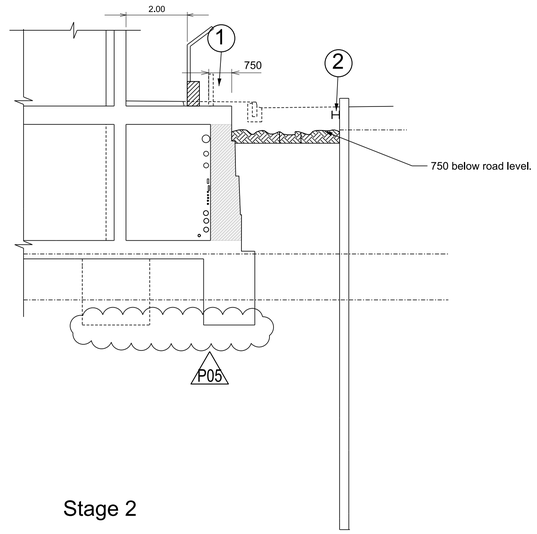
2 Divert utilities in Departures Road.

3. Erect hoarding to provide 2.0m wide emergency egress foot path. Set up site compound.

4. Install electronic monitoring sensors on inside face of basement wall.

5. Pre-trench to a width of 0.6m and depth of 1.2m along the line of the proposed sheet piles

6. Install AZ12 sheet piling from existing carriageway level (varies from 124.0m to 125.0m) at a distance of 2.7m from paved edge to toe level 111.0m ATD.

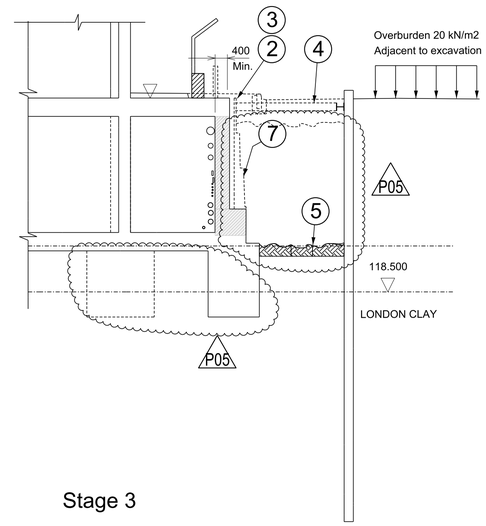


Stage 2

1 Excavate trench and expose top of basement wall to a level of 750mm below road level over the width of existing wall. Expose roof slab over the top of basement wall for a width of 750mm. - Remove existing bollards and divert any utilities beneath the footpath.

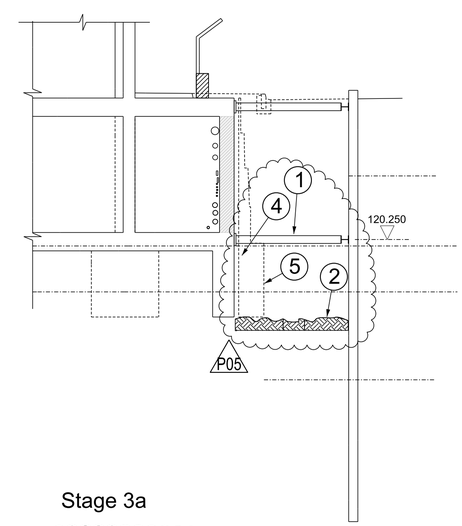
2 Install and fix temporary steel waling beam to sheet piling. Installation level varies to suit the road profile (approx 500mm below road level)

3 Install coring and cutting equipment and water supply and pumps.



Stage 3

1. Mark out holes to be drilled at 2000mm centres. (At 425mm from inside face of wall)
2. Drill Vertical 150mm diameter holes, using diamond core drill, to underside of concrete foundation.
3. Locally cut out top of wall and roof slab at prop positions at 4m centres.
4. Install Temporary steel props at 4m centres between exposed roof slab and waling beam and pack as required.
5. Excavate trench to full depth of brick wall and expose top of concrete foundation. Erect scaffolding in excavated trench to provide working platform at G.L.
6. Install plunge wire with fixing legs into pairs of drilled holes to selected depth between prop positions.
7. Wire cut 2m long panel to selected depth.
8. Move plunge wire cutter to next panel between props and repeat operation.
9. Move props by 2m and repeat stages 6, 7 & 8 until all panels are cut.
10. Remove scaffolding and using hand breakers, break off the cut brickwork.
11. Remove broken brickwork with grab excavator.



Stage 3a

1.Install additional props and waling beams at 4m centres and waling at the level of the building foundation, during trench excavation.

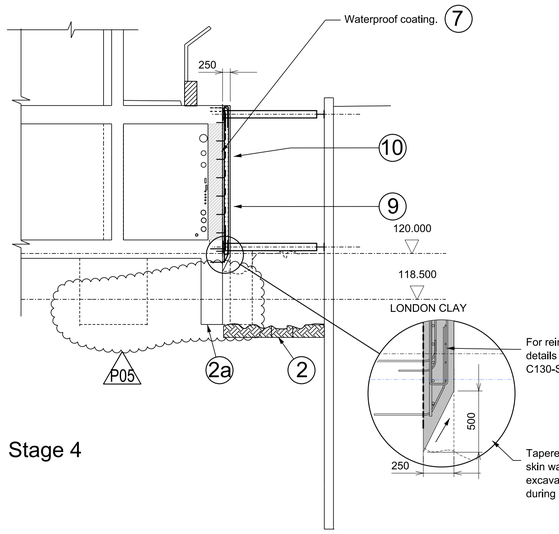
2.Excavate trench to full depth of foundation.

3. Erect scaffolding in excavated trench to provide working platform at G.L.

4. Resume wire cutting (with plant at G.L.) and cut 2m wide panels to full depth of wall and foundation.(between prop positions)

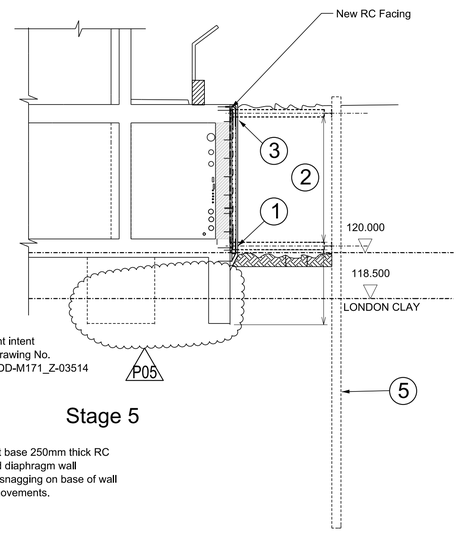
5. Using hand breakers break off brick skin above foundation, remove rubble with excavator.

P05



Stage 4

1. Remove the wire cutting equipment from site.
2 .Remove scaffold from trench, use machine mounted hydraulic breaker to remove the cut section of the concrete foundation, then excavate to the u/s of the foundation.
2a. Geotechnical Engineer to inspect the existing soil below the base of the existing foundation to determine the need for future underpinning.
3. Backfill trench to lower layer of props with a soil/cement mix with a strength of 2-3 MPa.
4. Reinstall the scaffolding.
5. Clean brick work and fill any voids.
6. Apply waterproofing membrane to face of brickwall.
7. Drill 200mm deep holes for 10mm Dia. (with resin grouting) stainless steel dowel bars into basement concrete base and roof slabs.
8. Place reinforcement cage, fix to starter bars.
9 Erect shutter for 250mm thick lining wall. Prop off sheet piling as required. Cast concrete to half height of brickwall. allow 24 hours to cure.
10. Repeat for Upper half of brick wall and pour remaining part of RC wall.



Stage 5

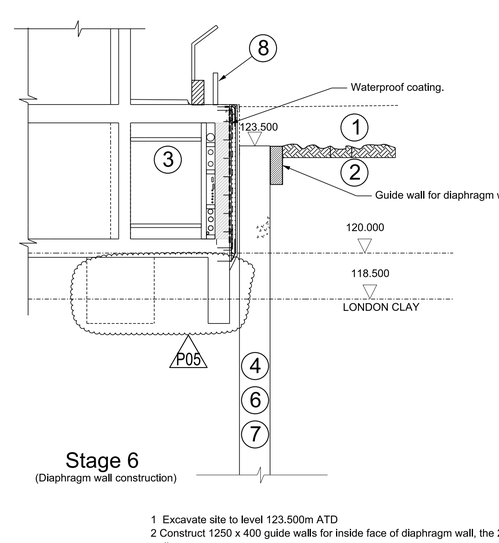
1 Remove lower layer of props. Make good waterproofing and lining wall around lower prop pockets.

2 Backfill trench with soil / cement to next layer of props.
Remove upper temporary steel props and waling beams.

3 Make good wall waterproofing and lining wall where props were located. Complete backfill with Soil/Cement mix (2-3).

4 Make good any damage to the waterproofing on top of the basement roof and concrete the remaining lining wall at the upper prop position. Inspect inside face of basement wall and make good any defects.

5 Remove Sheet piling.



Stage 6
(Diaphragm wall construction)

1 Excavate site to level 123.500m ATD
2 Construct 1250 x 400 guide walls for inside face of diaphragm wall, the 250 lining wall will form the external guide wall for the diaphragm wall.
3 Install 'Propping' to inside face of basement wall at location of first diaphragm wall panel and measure loads / deflections.
4 Excavate diaphragm wall panel in 3m wide panel lengths.
5 Provided that no significant movements are detected, remove the propping for remaining works.
6 Install diaphragm wall reinforcement cage with plastic slip layer and a protective compressible filler board attached to the cage to act as a slip layer between the diaphragm wall and the basement wall.
7 Concrete diaphragm wall panel.
8 New bollards to basement roof to be installed as part of the urban realm to contractors's design.

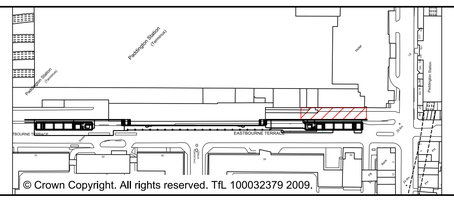
P05

P06

Safety, Health and Environmental Information
Notes below are additional to hazards/risks normally associated with this type of work:
Construction
Ci. Potential Damage to Sensitive Structures Due to Ground Movement Vibration and Demolition Techniques
Cii. The basement roof and walls are not designed for vehicle loading. Vehicle loads are not permited on the basement roof or walls during the construction stage. Live loading on basement roof is limited to 5kN/m2
Ciii. The temporary steel props are required to be shifted in order to cut wall panels in a hit and miss sequence. Additional props will have to be positioned before any prop can be removed so that prop spacing never exceeds 4.0m
Operations
Oi. Live loading on basement roof is limited to 5kN/m2
Maintenance
Mi. N/A
Dismantling/Demolition (Future)
Di.
Dii.
Diii.
These notes are based on the use of experienced and competent contractors carrying out the work using an approved safe method of working.

Rev.	Date	Description	By	Chkd	App	Auth
P01	02/07/2010	First Issue	FH	RS	GB	---
P02	27/10/2010	Escape width and hoardings amended	MX	RS	GB	-
P03	23/11/2010	Construction sequence notes amended.	NP	RS	GB	-
P04	03/12/2010	Title Block Updated	GM	MK	GB	-
P05	21/04/2011	Foundation survey Information added, stages 3 and 3a amended.	FH	JD	GB	-
P06	14/07/2011	SHE box amended	FH	JD	GB	-
C01	15/08/2011	Issued as Fit for construction	FH	JD	GB	MT

Notes
1. For General notes refer to drawing number C130-SWN-S-DDL-M171_Z-00501
2. All dimensions are in millimetres unless specified otherwise.
3. All levels are in metres to Above Tunnel Datum
4. For general arrangement refer to drg C130-SWN-S-DDD-M171_Z-03510 & 03511
5. For waterproofing details refer to drg C130-SWN-S-DDD-M171_Z-03512
6. For temporary works refer to drg C130-SWN-S-DDD-M171_Z-03513
7. The construction sequence shown is that assumed by the designer in the development of the design. If the contractor wishes to depart from this sequence, full proposals must be submitted to the Project Manager prior to commencement of works on site. The contractor must demonstrate that the proposed modified sequence has no adverse effects on the permanent works or on the settlements of the adjacent buildings.



Scale 1:100
2m 0 2m 4m 6m 8m 10m

Crossrail
Crossrail Limited
25 Canada Square
Canary Wharf
London
E14 5LQ

www.crossrail.co.uk

Contract : Paddington Station Design
Originator : Scott Wilson Limited
Location : Paddington Stn Met Suburban
Title : Macmillan House Block E Basement Designers Assumed Construction Sequence For Partial Removal Of Basement Wall CC405
By : F.HOLGUIN
Chk : J.DODD
App : G.BRENNAN
Auth : M.TINGLEY
Scale : 1:100@ A1
Drawing and CAD file No : C130-SWN-S-DDB-M171_Z-54522
Rev : C01
Suitability : A

Fit for construction
RESTRICTED

Annex 4 Health and Safety Requirements

Designers Risk Assessment and CDM requirements

The C130 Designers CDM Residual Hazard and Risk Identification form is provided below.

Archaeological Contractors Risk Assessments and Health and Safety Plans

The C254 Archaeological Contractor will prepare method statements, site-specific risk assessments and a health and safety plan to be approved by the C405 Principal Contractor and Crossrail Central.

Archaeological Contractor's Safety Audits, Safety Inspections, Reporting of Accidents

The Archaeological Contractor's requirements for safety audits, inspections and the reporting of accidents are set out in the Works Package Information for the C254 Archaeological Contract.

Personal Protective Equipment (PPE)

Mandatory PPE to be worm by all C254 personnel will comprise:

- High Visibility Vest (of an appropriate colour for the nature for the Worksite);
- Hard Hat;
- Gloves;
- Light Eye Protection;
- Lace-up boots with ankle support, steel insoles and toe caps (rigger boots are not permitted on Crossrail Sites).

For further information please refer to the Works Package Information for the C254 Archaeological Contract.

Labelling of Hazardous Substances, Contaminated Land

For further information please refer to the Works Package Information for the C254 Archaeological Contract.

Crossrail Health and Safety Management System, Crossrail Drugs and Alcohol Policy

For further information please refer to the Works Package Information for the C254 Archaeological Contract.

Crossrail Policy for work on Network Rail Land

For further information please refer to the Works Package Information for the C254 Archaeological Contract.

CDM RESIDUAL HAZARD AND RISK IDENTIFICATION FORM

Project Data

Project Title	Crossrail C130 Paddington Station Archaeological Design			**Project Group**	PD0405
Project Manager	Darren Brooke			**Project Number**	A014509
Client	Crossrail Ltd			**Date**	20-05-11
Design Stage	RIBA E	**Design Discipline**	Archaeology	**Completed by**	Iain Williamson Checked:

Rev	**A**	**B**	**C**	**D**	**E**
Initial					

Notes on Completion

The following table identifies some areas over which the designer has direct influence. The areas cover construction, as well as future maintenance and cleaning requirements. This is not an exhaustive list, nor is every item relevant on every project.

1 Each section (A to H) identifies areas where Designers should provide information. Taking each option in turn, consider if the types of hazards can be eliminated. If so, state measures in the design to eliminate the hazard. If elimination is not possible, can the hazard be reduced? State measures to reduce or reasons why this is not feasible. Where hazards cannot be reduced, state information that should be passed to the Contractor/Principal Contractor by the CDM Coordinator. Section I allows any further issues to be listed that do not fit in Sections A to H

2 A response is required to all sections, however N/A may be an acceptable response

Hazard to Consider in Design	Scheme Specific Details	Action: Can Hazard be		Notes
A) Position and design of structures to minimise risks from site hazards, including: Buried services, inc gas pipelines; Overhead cables; Traffic movements to/from/around the site Contaminated ground.	Archaeological watching briefs will be required during utility diversion in Eastbourne Terrace and Departures Road.	Eliminated?	Y ☐ N ☒	
		Reduced?	Y ☒ N ☐	• C251 and C405 Main contractors are responsible for design of utility diversions and location and marking of all live services. • Known utilities are identified on design drawings: C130-SWN-U-DDA-M171_1-6010 to C130-SWN-U-DDA-M171_1-6016, which have been used during the design of the archaeological works.
		Information to pass to Contractor / Principal Contractor so as to manage hazard		

Hazard to Consider in Design	Scheme Specific Details	Action: Can Hazard be		Notes
B) Design out health hazards, for example: Specify less hazardous materials; Avoid processes that create hazardous fumes, vapours, dust, noise or vibration; Specify materials that are easy to handle; Design block paved areas to enable mechanical handling/laying.	C254 Archaeology Contractor to comply with Principal Contractor's site safety procedures. Regarding the heavy lifting of spoil and heavy archaeological artefacts – e.g. large items of stone, wood etc – a hoist should be used to remove these items from trenches	Eliminated?	Y ☐ N ☒	
		Reduced?	Y ☒ N ☐	• Works will be undertaken in accordance with Written Scheme of Investigation (Document No: C130-SWN-Z-RSI-B071-00001)
		Information to pass to Contractor / Principal Contractor so as to manage hazard		• Archaeological Written Scheme of Investigation - Package C130 - Paddington Station Archaeology Site-Specific Written Scheme of Investigation Document No: C130-SWN-Z-RSI-B071-00001
C) Design out safety hazards for example: The need for work at height; Fragile roofing materials; Deep or long excavations in public areas or	• Working from height will be required archaeological General Watching Brief during removal and modification of Departures Road canopy.	Eliminated?	Y ☐ N ☒	• No excavation in public areas or highways. Excavation works will take place either within hoarded or fenced worksites or within main C405 Eastbourne Terrace/Departures Road worksite.

Hazard to Consider in Design	Scheme Specific Details	Action: Can Hazard be Reduced?		Notes
on highways; Materials that could create a significant fire risk during construction.	• Deep trenches will be required during archaeological Trial Trench Excavation on Eastbourne Terrace and watching briefs during MacMillan House basement clash works. – Final trench location will be in areas where existing (including redundant) services are not present or have been removed. All trench locations will be CAT scanned before excavation.		Y ☒ N ☐	• Working at height will be required during the removal of the Departures Road canopy. Access will be via a scaffold which will be designed by the C405 Main Contractor. The C254 archaeological contractor should prepare a Site Specific Risk assessment and Method Statement compliant with the Main Contractor's H&S Plan and Method Statement. • Deep trenches will be required for the Trial Trench Evaluation no Eastbourne Terrace and for the MacMillan House Basement Clash. In both instances the support work, edge protection and secure access will designed by the C405 Main Contractor. The C254 archaeological contractor should prepare a Site Specific Risk assessment and Method Statement compliant with the Main Contractor's H&S Plan and Method Statement. • Where sheet piling or trench boxes cannot be used an alternative form of safe excavation such as battering or stepping of the trench edge should be used. For Eastbourne Terrace Trial trenches it may also be possible to programme the evaluation to after the initial phase of ground reduction there-by reducing the required depth of the trial trenches by *c.*1.5m. • All C254 Staff must undergo a C405 H&S site induction and wear mandatory PPE.

Hazard to Consider in Design	Scheme Specific Details	Action: Can Hazard be		Notes
		Information to pass to Contractor / Principal Contractor so as to manage hazard		• Archaeological Written Scheme of Investigation - Package C130 - Paddington Station Archaeology Site-Specific Written Scheme of Investigation Document No: C130-SWN-Z-RSI-B071-00001 • C130 Paddington Station City of Westminster Heritage Agreement, Heritage Method Statement. Departures Road Canopies & Eastbourne Terrace Retaining Wall & Railings WES/4/5/H4 (Document No. C130-SWN-T-GMS-B071-00002 Rev 5.0)
D) Consider prefabrication to minimise hazardous work or allow it to be carried out in more controlled conditions including, for example: Design elements so that sub-assemblies can be erected at ground level and then safely lifted into place; Arrange for cutting to size to be done off-site, under controlled conditions, to reduce the amount of dust released.	N/A	Eliminated?	Y ☐ N ☐	
		Reduced?	Y ☐ N ☐	
		Information to pass to Contractor / Principal Contractor so as to manage hazard		
E) Design in features that reduce the risk of falling/injury where it is not possible to avoid work at height, for example:	• Access into trenches to be provided by the Principal Contractor.	Eliminated?	Y ☐ N ☒	

Hazard to Consider in Design	Scheme Specific Details	Action: Can Hazard be		Notes
Early installation of permanent access; Edge protection or other features that increase the safety of access and construction.	Trench edges to be protected.	Reduced?	Y ☒ N ☐	• Access to the Departures Road canopy will be via a scaffold/platform which will be designed by the C405 Main Contractor who will also be responsible for preparation of an appropriate H&S Plan and Method Statement. • Deep trenches will be required for the Trial Trench Evaluation no Eastbourne Terrace and for the MacMillan House Basement Clash. In both instances the support work, edge protection and secure access will designed by the C405 Main Contractor who will also be responsible for preparation of an appropriate H&S Plan and Method Statement.
		Information to pass to Contractor / Principal Contractor so as to manage hazard		• Archaeological Written Scheme of Investigation - *Package C130 - Paddington Station Archaeology Site-Specific Written Scheme of Investigation Document No: C130-SWN-Z-RSI-B071-00001* • C130 Paddington Station City of Westminster Heritage Agreement, Heritage Method Statement. Departures Road Canopies & Eastbourne Terrace Retaining Wall & Railings WES/4/5/H4 (Document No. C130-SWN-T-GMS-B071-00002 Rev 5.0)
F) Design to simplify safe construction, for example: Provide lifting points and mark the weight, and centre of gravity of heavy or awkward items requiring slinging both on drawings and on the items themselves; Make allowance for temporary works required during construction;	N/A	Eliminated?	Y ☐ N ☐	
		Reduced?	Y ☐ N ☐	

Hazard to Consider in Design	Scheme Specific Details	Action: Can Hazard be	Notes
		Information to pass to Contractor / Principal Contractor so as to manage hazard	
G) Design to simplify future maintenance and cleaning work, for example: Make provision for safe permanent access; Make provision for safe temporary access to allow for painting and maintenance.	N/A	Eliminated? Y ☐ N ☐	
		Reduced? Y ☐ N ☐	
		Information to pass to Contractor / Principal Contractor so as to manage hazard	
H) Identify demolition hazards for inclusion in the health and safety file, for example: Sources of substantial stored energy, including pre- or post tensioned members; Unusual stability concepts; Alterations that have changed the structure.	N/A	Eliminated? Y ☐ N ☐	
		Reduced? Y ☐ N ☐	
		Information to pass to Contractor / Principal Contractor so as to manage hazard	
I) Other Issues as necessary:	N/A	Eliminated? Y ☐ N ☐	
		Reduced? Y ☐ N ☐	

Hazard to Consider in Design	Scheme Specific Details	Action: Can Hazard be Information to pass to Contractor / Principal Contractor so as to manage hazard	Notes

Annex 5 Environmental Protection Requirements

For the environmental protection requirements refer to the Works Package Information for the C254 Archaeological Contract.

Annex 6 Programme and Order of Work for Implementation of Works and Integration with other Activities

The programme and construction sequence for each contract package and the associated archaeological works are set out Section 6 of this site specific WSI.

Annex 7 Enabling and Temporary Works Design Requirements, Attendances and Implementation

The requirements for enabling works are outlined in the C130 Paddington Station Constructability Report (Option A). (Document No. C130-SWN-C-RGN-B071-00001).

The C405 Principal Contractor will be responsible for the design of temporary works and the will establish archaeological trial trench design in line the requirements for site Health & Safety and for the archaeological works set out in this SS-WSI.

The C405 Principal Contractor is also responsible for the excavation activities within the C405 Departures Road/Eastbourne Terrace worksite under supervision of the C254 Archaeological Contractor. A clear, safe working area will be defined for use by C254. For construction activities requiring archaeological mitigation the C405 Principal Contractor will consult the C254 Archaeological Contractor prior to starting work.

For general and site specific security requirements at the Paddington Station Crossrail site please refer to the Works Package Information for the C254 Archaeological Contract.

Annex 8 Security Requirements

For further information please refer to the Works Package Information for the C254 Archaeological Contract.

Annex 9 Need for Screening or Other Protective Works

For further information please refer to the Works Package Information for the C254 Archaeological Contract.

Annex 10 Procedure for Notification of the Discovery of Human Remains

The procedure for notifying the discovery of human remains during the archaeological works are set out in Section 7 of this site specific WSI.

In the event that human remains are encountered the C254 Archaeology Contractor will immediately inform the Project Archaeologist for Paddington and not recommence work at the location until further instruction has been received from the Project Archaeologist. The discovery of human remains will be confirmed in writing within 24hours of discovery during which time C254 will apply for the relevant Ministry of Justice (Coroner's Division) licence.

Annex 11 Procedure for the Notification of the Discovery of Material Falling Under The Treasure Act 1996

The procedure for notifying the discovery of material falling under The Treasure Act 1996 during the archaeological works are set out in Section 7 of this site specific WSI.

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

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

Annex 12 Procedure for Notification of Major Unexpected Discoveries

The procedure for notifying major unexpected discoveries during the course of the archaeological works are set out in Section 7 of this site specific WSI.

In the event that archaeological remains of potentially national importance are encountered the C254 Archaeology Contractor will immediately inform the Project Archaeologist and C405 Principal Contractor. Where the remains cannot be preserved in situ a suitable scheme of investigation and recording (preservation by record) will rapidly be agreed and implemented. The scope of the archaeological recording and sampling will comply with the standard Crossrail mitigation strategy and will be proportionate to the significance of the archaeological remains discovered. The C254 Archaeology Contractor will deploy appropriate resources in order to successfully undertake the archaeological recording and sampling with minimal delay to the C405 Principal Contractor's construction programme.